waste management research Report

News from State University of New York at Buffalo and Stony Brook, and Cornell University

Vol. 4, No. 1 1992

Focus On

The Relevance of Research

Waste Management Research Report

Vol. 4, No. 1 1992

Research news coordinated through:

The New York State Center for Hazardous Waste Management
Dr. Ralph R. Rumer, Executive Director
Jane E. Warfield, Campus Correspondent
State University of New York at Buffalo
207 Jarvis Hall
Buffalo, NY 14260
(716) 636-3446

Dr. William P. Tully, ESF Coordinator
State University of New York
College of Environmental Science
and Forestry
1 Forestry Drive
Syracuse, NY 13210
(315) 470-6606

Waste Management Institute
Dr. R. Lawrence Swanson, Director
Anne West-Valle, Campus Correspondent
Marine Sciences Research Center
State University of New York
at Stony Brook
Discovery Hall
Stony Brook, NY 11794
(516) 632-8704

Cornell Waste Management Institute and the New York State Solid Waste Combustion Institute
Dr. Richard Schuler, Director
Carin A. Rundle, Campus Correspondent
Center for the Environment
Cornell University
468 Hollister Hall
Ithaca, NY 14853
(607) 255-7535

Editorial Office
123 Bray Hall
SUNY College of Environmental
Science and Forestry
1 Forestry Drive
Syracuse, NY 13210
(315) 470-6644
Editor, Louise W. Laughton

Articles in this journal are indexed in
Environmental Periodicals Bibliography

Printed on Recycled Paper

CONTENTS

Commentary

Features

Announcements

About This Newsletter

Waste Management Research Report appears three times a year to share research from the publication's contributing institutions. Each issue focuses on one major area of waste management and highlights the institution where researchers concentrate on the featured topic. The Cornell Waste Management Institute is responsible for this issue which focuses on the relevance of research, a matter of concern to all the contributors and to the public. The Waste Management Institute of the Marine Sciences Research Center at State University of New York at Stony Brook will be responsible for the next issue which will focus on the implications of the Clean Water Act.

On the Covers

Pictured on the front are Dr. Richard E. Schuler, left, director of the Cornell Waste Management Institute, and Dr. Frederick C. Gouldin, director of the Institute's Combustion Simulation Laboratory. Pictured on the back cover is the Cornell University Engineering and Theory Center building. The structure houses the School of Operations Research and Industrial Engineering, parts of the School of Electrical Engineering and the Sibley School of Mechanical and Aerospace Engineering, special programs of the Laboratory of Plasma Studies, and the Cornell Manufacturing Engineering and Productivity Program — all parts of the Cornell University College of Engineering. The building also houses the Cornell Theory Center, one of four centers sponsored by the National Science Foundation to further advanced computational science, and the Cornell Program of Computer Graphics. The latter includes the National Science and Technology Center for Computer Graphics and Scientific Visualization.

Director's Comment

University-based Research Leads to Practical Applications In Field of Waste Management

By Richard E. Schuler

When it comes to public relations, university faculty are probably our own worst enemies as we ramble on and on with ever-heightened enthusiasm over seemingly more obscure minutiae. So, in times of widespread budgetary pressures, intensified by recession, it might appear reasonable to include university research among the less essential items and let funded programs face the axe. Yet, university-based research and development are the seed corn of economic advancement in the United States. New, improved products are essential for economic growth, but, on our finite planet, it is equally important to improve our ability to handle the wastes of producing and consuming these products.

The purpose of the *Waste Management Research Report* is to convey to interested citizens, business and industry, and public officials throughout New York state the variety and nature of efforts at three universities in New York to develop new and improved ways of dealing with society's waste management problems. Most New Yorkers concede that managing wastes intelligently is an important long-term problem confronting the state. In this issue of the *Report*, we highlight the potential practical applications of several research projects undertaken at or sponsored by our institutions. We emphasize how theory may be put into practice.

In fact, a major thrust since the inception of our programs has been to serve an outreach mission to citizens, communities, and businesses throughout the state. Our objective has been to focus the theory (research) on the practical (applications). Our intention is not to compete with existing private designers and vendors. Rather, our role is to step in when others are scratching their heads, searching for solutions, and determine how we might focus new knowledge on the problem. To accomplish that mission, we decided to support additional efforts to learn how and why things burn and rot, not because that's all we know how to do at universities, but because there are enormous gaps in our knowledge about these basic processes. Curiously, society has devoted far more resources to exploring the mysteries of the atom than it has to understanding the basic, everyday sciences of combustion and digestion. There is also much to learn about how to alter our product manufacturing and distribution systems so that fewer, less toxic wastes are generated to begin with, and on how to use advanced technology to detect and alleviate the presence of toxic constituents.

In this environmentally conscious era, if we are to dispose of our wastes sensibly and monitor the consequences effectively, we must step back and learn some fundamental things we probably should have discovered 40 years ago. Bearing in mind, however, the extremely limited resources in New York, we have sought to push the pursuit of knowledge in those highly selective areas that offer the greatest potential waste management payoffs. Those potential practical applications are the focus of this issue.

Richard E. Schuler

Dr. Richard E. Schuler, a professor of economics and civil and environmental engineering, is director of the Waste Management Institute at Cornell University.

NYS Solid Waste Combustion Institute at Cornell

How 'Real' Would the World Be Without Research at Universities?

By Steven W. Kulick

Research plays a critical, but often unrecognized, role in the development of solutions to a wide range of problems. The practical applications derived from research and development programs often follow by many years the original research effort. That lapse in time tends to obscure the fact that the roots of many successful approaches to difficult problems lie in fundamental research. The pipeline that connects basic research to practical, real world applications is a long one that requires constant maintenance. In recognition of the value of the "research-to-applications pipeline," the New York State Solid Waste Combustion Institute (SWCI) has worked since its inception to support and promote research that holds promise for improved waste management practices, especially in the waste combustion field.

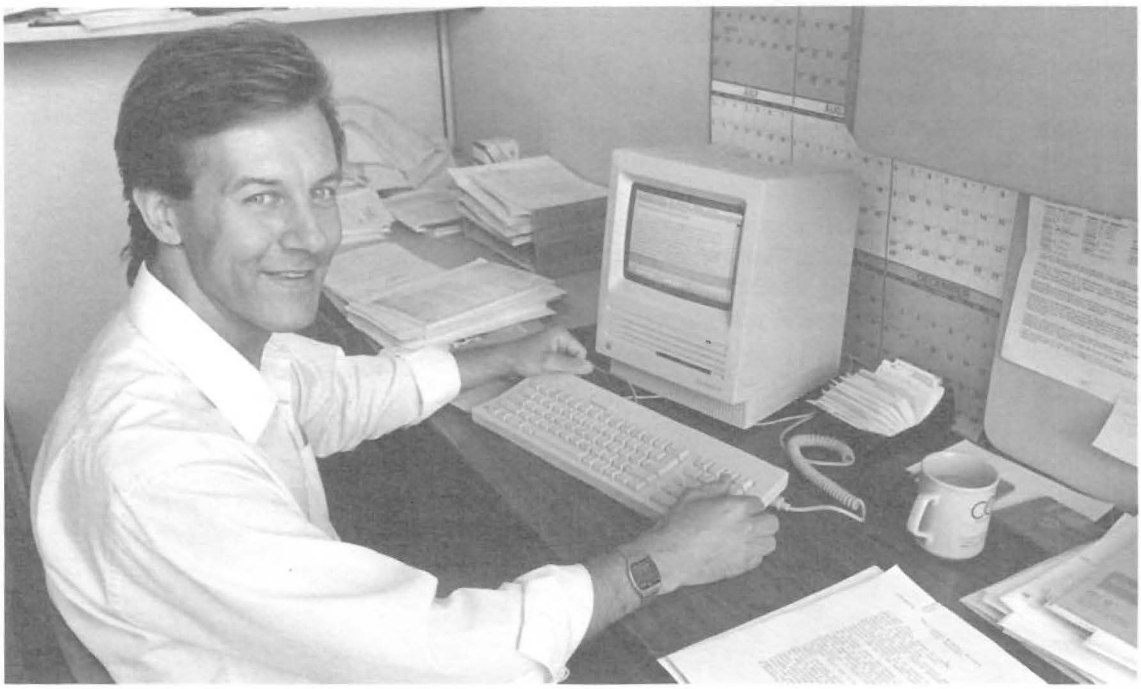
The initiative to foster an environment conducive to waste-related research included several elements. The first step consisted of market research — the identification of a series of problematic combustion and waste issues, public concerns, and gaps in knowledge. The second step was one of process development — assembling a Technical Advisory Committee that included individuals from government, industry, and academic institutions with recognized technical experience in waste combustion and related sciences. With those two elements in place, the Institute launched its Research Awards Program to provide funding for research that addressed perceived public need and that had been identified by the Advisory Committee as technically sound.

Establishment of the Research Awards Program led to two important developments. First, the program focused critical, but limited, resources on the most pressing waste combustion issues. Secondly, the awards program engaged the interest of the research community in New York state, thus attracting talented researchers and university resources to the field of waste combustion. As a result, more than 20 researchers now focus their efforts largely on combustion-related issues. The Solid Waste Combustion Institute also has helped to foster an informal network among the researchers, government laboratories, and industry representatives that fosters information exchange and focuses resources on current problems.

The Institute's research program focuses on key issues of public concern, including the development of better monitoring techniques for incinerator emissions, improved ash management capability, the potential for sludge incineration, and improved knowledge of fundamental combustion processes which, surprisingly, are not well understood.

These issues represent some of the unanswered questions that continue to prove troublesome to communities considering incineration of municipal solid waste. More importantly, each research area selected represents an opportunity to unlock and facilitate the public decision-making process by providing scientific information.

Steven W. Kulick is the former coordinator of research at the Cornell Waste Management Institute.



Monitoring

One stumbling block to public acceptance of incineration as a waste disposal option has been the inability of facility operators (or others) to monitor all emissions in a continuous manner that can reassure the public that its health is not in jeopardy from potentially harmful pollutants. The standard practice has been to take samples of stack emissions periodically, perhaps once a year, and to run those samples through a laboratory process that produces results a day or two later. Although the emissions from modern incinerators are regulated stringently, current monitoring processes do not allow the incinerator operator to adjust operating procedures instantaneously in response to measured output.

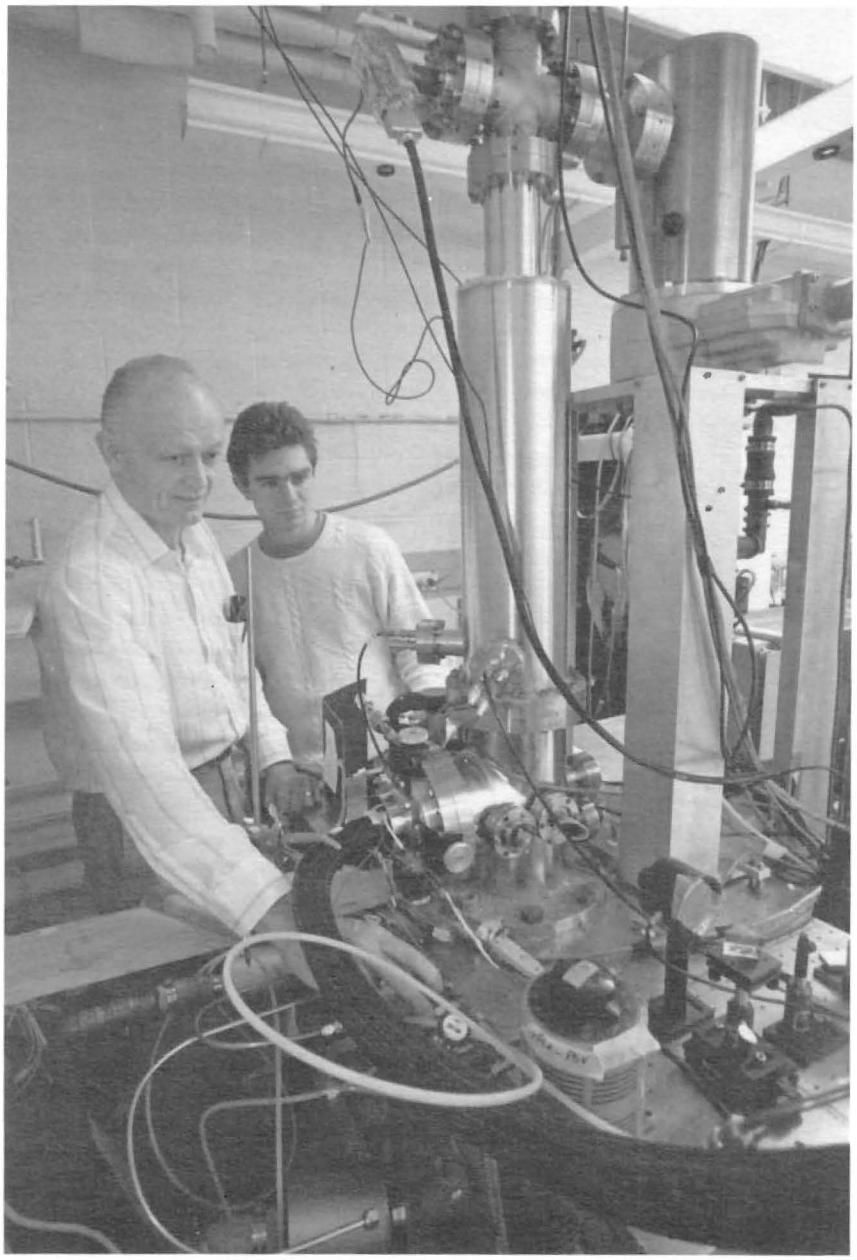
What comes out the stack is a matter of keen interest to the public. Individuals living in host communities place a high priority on monitoring because accurate, continuous monitoring can identify types and levels of exposure to those living near an incinerator. Facility operators have a keen interest in monitoring because of its potential to provide immediate and continuous feedback on performance so that remedial measures can be initiated when emissions standards are not being met.

With funding from the New York State Solid Waste Combustion Institute, steady progress is being made on two projects that hold great promise for altering dramatically the way emissions are monitored at incineration facilities. Precise monitoring can lead to much higher levels of public confidence in combustion technology because the new techniques will provide immediate information about the performance of the incinerator.

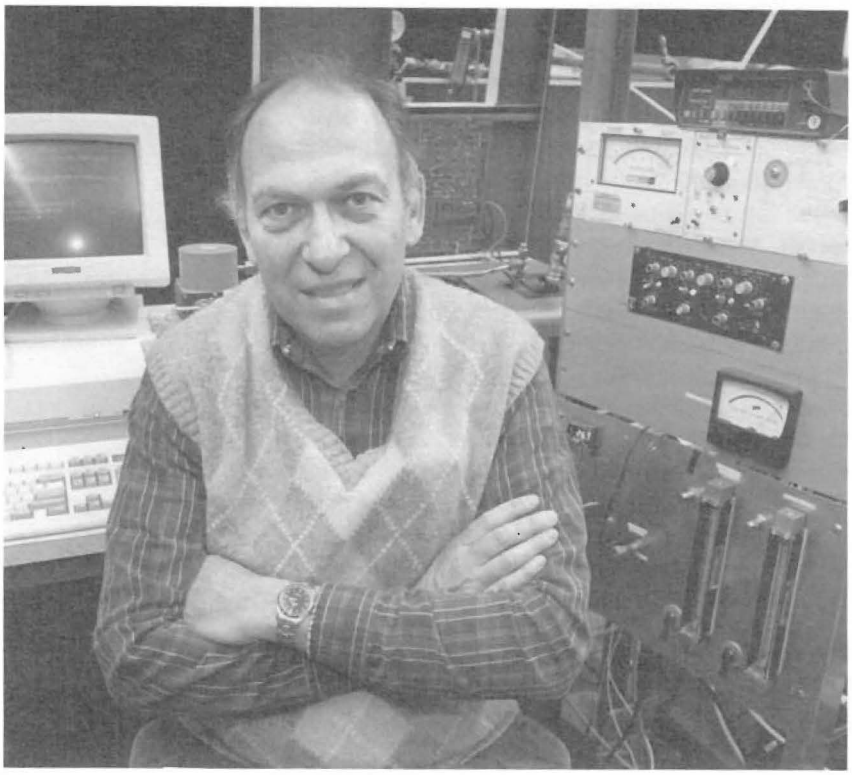
The resonance-enhanced multiphoton ionization (REMPI) project directed by **Dr. Terrill Cool** at Cornell University utilizes the fact that at low temperatures, differences in spectra for different ions are precise. He has established detection schemes and obtained data for monitoring chloroethylene at part-per-billion concentrations. Detection limits this low are not achievable in current practice by methods suitable for day-to-day monitoring. Furthermore, this process' selectivity, its ability to detect these minute concentrations of a specific ion mixed in a "soup" of chemicals, is extremely high.

As a result of its success in developing laser-based monitoring technology, this project has moved us much closer to having continuous monitoring capability. The research has identified tetrachloroethylene as a particularly attractive surrogate for monitoring the presence of numerous other chlorinated hydrocarbon species found in incinerator stack gases. If indeed the sensitivity, selectivity and mobility of this monitoring technique prove to be as promising as the initial research suggests, significant progress will have been realized in addressing a persistent public concern. Monitoring will be possible on a continuous basis, coupled with the ability to make adjustments to the combustion process when the presence of harmful pollutants is detected. Moreover, because of its mobility, this technique has the potential to provide monitoring capability at virtually any site where performance feedback is desired.

Infrared absorption is another approach to continuous monitoring that is being investigated by **Dr. George Wolga** and **Dr. Fred Gouldin** at Cornell University with Combustion Institute support. Their work capitalizes on the fact that most combustion products display unique absorption of infrared spectral energy — an identifying spectral "signature." More importantly, the



Dr. Terrill A. Cool, left, is a professor of applied engineering physics at Cornell University.



Dr. George J. Wolga is a professor of electrical engineering and applied engineering physics at Cornell University.

absorption spectrum from a molecular gas can be correlated quantitatively to the concentration of the molecule in the gas and to the temperature of the gas. Thus, by collecting these absorption spectra, combustion products can be tracked.

Progress on this innovative monitoring technique has been promising. Using mathematical techniques similar to those applied in a CAT scan for medical diagnoses, three-dimensional images of effluent concentrations in an exhaust stream can be prepared continuously.

As the imaged molecules mix, as they do in the real world, the measurement process is complicated by overlapping spectra from different molecules. This research investigates the use of infrared absorption measurements under such conditions and has already identified regions in which the concentrations can be measured without the complications of overlapping spectra.

The project is expected to demonstrate that accurate concentrations of gases can be obtained from measurements within identified spectral regions and thus help determine the minimum resolution required of the measurement apparatus as well as the complexity of the apparatus and the implementation cost.

Potential applications of the analytical absorption spectroscopy technique are promising. It is reasonable to expect that this technique may provide a means for realizing real time monitoring of incinerator flue gas. What is especially attractive is the likelihood that this technique can measure absorption across the entire flue and thus avoid inaccuracies inherent in sampling at specific locations. Once again, research is addressing the need for monitoring techniques that can detect reliably, continuously and accurately the potentially harmful emissions from incinerators.

In summary, both projects are developing monitoring techniques that will make a major contribution toward establishing public confidence in our ability to know if and when what pollutants are being emitted from incinerators. Access to that kind of information is a prerequisite for undertaking remedial action.

Ash Management

The handling and disposal of incinerator ash equals stack emissions as a matter of paramount concern to the public. The concern stems from the fact that ash may contain dangerous materials. If the ash is not properly handled, such materials could contaminate groundwater or other resources. Given the level of public concern regarding the proper management of incinerator ash, the Solid Waste Combustion Institute supports two research projects that address the issues of handling and disposal of incinerator ash.

At Clarkson University **Dr. Thomas Theis** investigates the characterization of leachate from incinerator ash materials and has designed a series of small column experiments to investigate chemical and physical interactions of multiple solutes in the municipal solid waste ash-water environment. These designs are intended to simulate ash behavior in a landfill. Theis tested them using ash from several operating municipal incinerators. This is the first time that small column reactors have been applied specifically to municipal solid waste ash. The project is also developing a method to analyze the data.

The land disposal of incinerator ash constitutes a concern because of the potential for groundwater contamination from ash leachate. The Theis research offers the potential to determine from laboratory tests how and what types of ash leachate are formed in the landfill. Knowing in advance the leachate behavior of certain ash materials, precautions can be taken in the design, construction, and siting of landfills to minimize the risk to groundwater and other resources.

In addition, at the City University of New York, **Dr. Reza Khanbilvardi** is nearing the completion of a comprehensive analysis and interpretation of existing ash data sets. The objective is to establish an ash sampling protocol that can yield toxicity estimates representative of the total ash stream and do so at a reasonable cost.

In actual practice, before appropriate treatment can be determined for incinerator ash, it is important to know the makeup of the ash. Reza Khanbilvardi's research will facilitate the development of a systematic method for obtaining

representative samples of incinerator ash in order to determine accurately its characteristics. Once samples are obtained, analyses can be performed and treatment determined based upon the characteristics of the sample. This research will help us obtain better samples more quickly and at lower cost. The real benefit is that disposal treatment can be selected to correspond appropriately to the characteristics of the ash.

Fundamental Research

One concern associated with solid waste incineration is the possibility that dioxins and furans will be formed during the combustion process and released into the environment. Little is known about the conditions under which these compounds are formed or destroyed during the combustion process. For that reason, the Institute supports research to investigate circumstances in the furnace that might influence the formation and destruction of dioxins and furans, with an emphasis on temperature and residence time. Once the conditions leading to dioxin/furan formation and destruction have been identified, there will exist a sound, scientific basis for making changes in the incineration process to maximize preferred outcomes.

Research to identify the conditions that favor the formation and destruction of dioxins and furans is underway at Rensselaer Polytechnic Institute (RPI) under the direction of **Dr. Elmar Altwicker**. Altwicker has completed experiments comparing the effect of changing temperature in the post combustion regions of an incinerator.

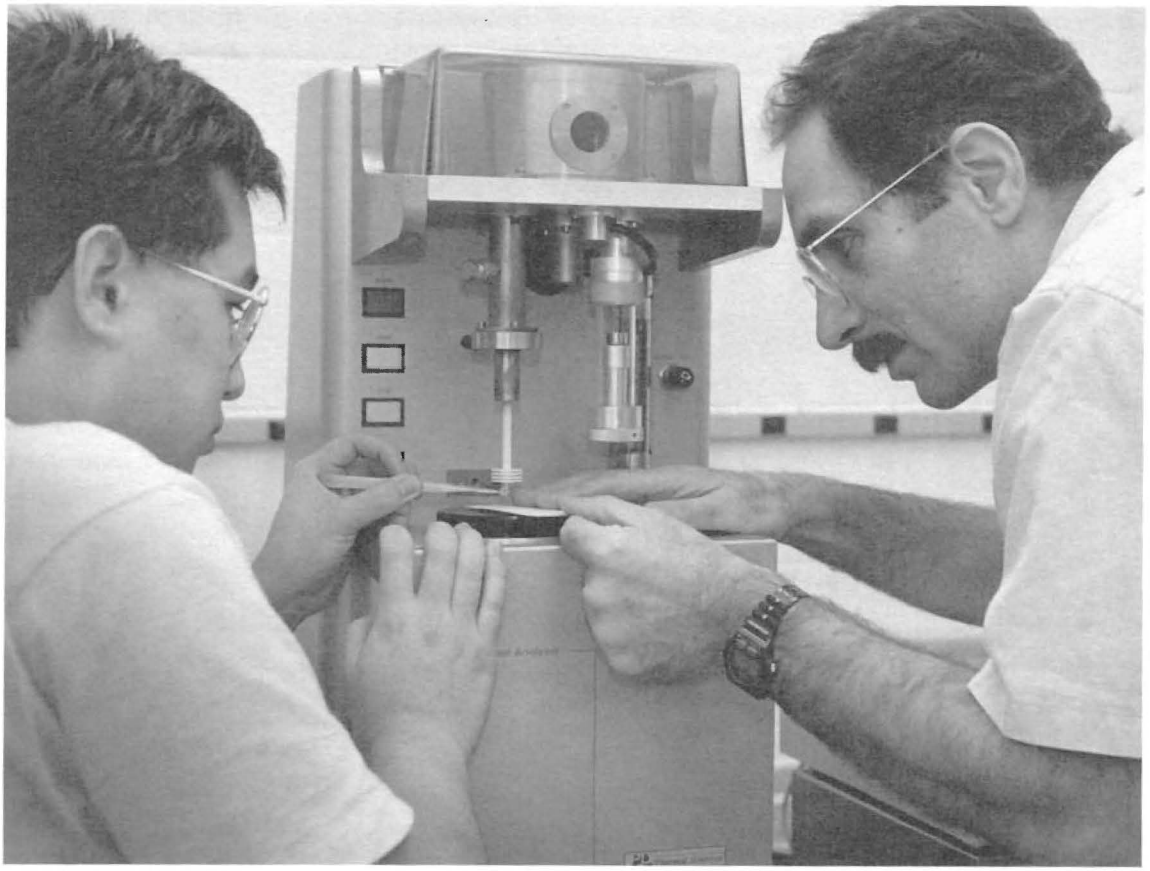
At the same time, another RPI researcher, **Dr. Arthur Fontijn**, has developed a unique technique called high-temperature photochemistry (HTP) to provide chemical kinetics measurements in the temperature range found in solid waste incinerators.

To decrease the formation and increase the destruction of chlorinated hydrocarbons in municipal solid waste, models of the incineration process are needed. These models should be based on realistic chemical kinetic data of the elementary reactions involved but such data are usually not available in the temperature range that is typical for solid waste incinerators.

Since gaseous products that can be produced during the combustion process are a primary environmental focus, the work of **Dr. C. Thomas Avedisian** at Cornell University is directed at expanding knowledge about the fundamental physical nature of the combustion process within an incinerator. Much still is not known about how solid materials burn, to what extent they vaporize and burn as a gas or remain as a solid, and the rate of transformation from one to another. This work could lead to better prediction of the products likely to be produced during the combustion reaction.

This joint research project at Cornell University and at the National Institute of Standards (NIST) has completed analyses of several candidate solid wastes and of fluidized bed combustion of solid particles. Continued research by Avedisian and **Dr. Andrej Macek** at NIST will lead to the development of models of the overall kinetics of the decomposition process that occurs in incinerators.

The incomplete combustion of municipal solid wastes that contain chlorine is also being examined because it creates the potential for forming hazardous materials in the combustion process. Unburned intermediates formed during or after combustion are known to contribute to formation of such highly toxic chemicals as dioxins and



Dr. C. Thomas Avedisian, right, is an associate professor of mechanical and aerospace engineering at Cornell University.

furans. The presence of chlorine in solid waste may hinder its complete combustion. Thus, it is important to understand the conditions under which incineration of chlorine-containing MSW compounds will burn to completion without producing harmful products.

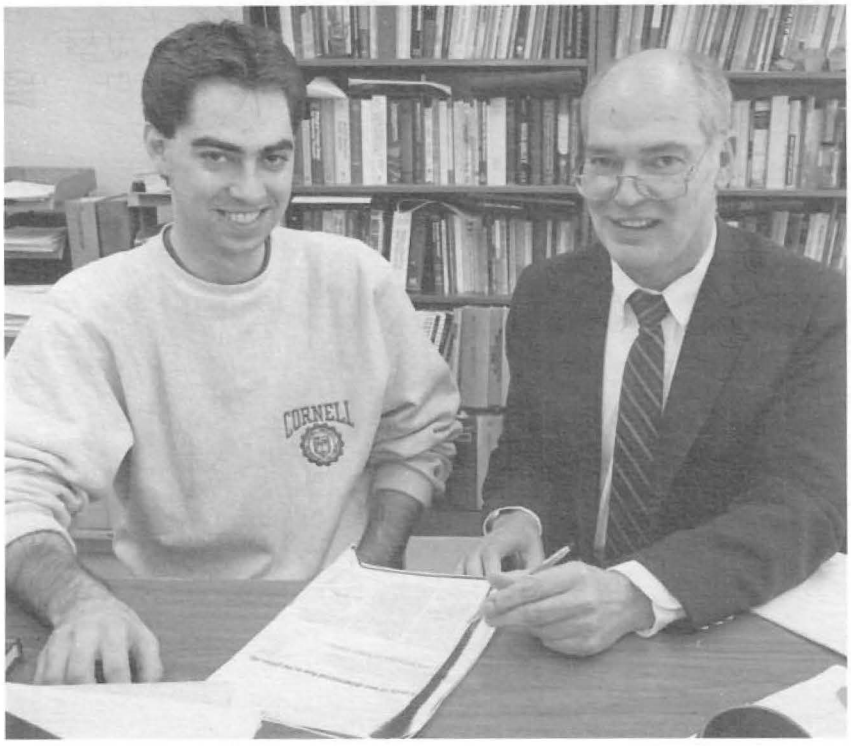
Sludge Management

Finally, a project at Cornell under the direction of **Dr. Richard Dick** is aimed at improving the combustion properties of wastewater sludges from municipal sewage treatment plants. The project has developed and applied techniques to investigate sludge dewatering under conditions that occur in belt filter presses.

A very costly waste management dilemma is likely to benefit from this research that investigates ways to improve the combustion properties of wastewater sludge. Approximately 40 percent of New York state's municipal sludge has been discharged at sea, but that practice was banned beginning in 1992. Alternatives need to be developed to replace the disposal capacity lost as a result of the ban on ocean dumping. Incineration is one possible alternative, but it is expensive and energy-inefficient because sludge contains so much water. By pre-heating the sludge, the water can be vaporized, but the thermal process is energy-inefficient.

If water could be removed economically from municipal sludge, combustion would become a much more attractive disposal option. The belt filter press is one device for removing water from sludge mechanically, a process that requires little energy, but its fundamental mechanisms are not well understood. Dick's research is aimed at identifying the factors that make it difficult to remove water from sludge. As those factors are identified, the process design can be modified to achieve a more economical way to prepare sludge for combustion. The implications are important for sludge management in New York if economical ways can be found to dewater sludge in preparation for combustion.

Dr. Richard I. Dick is Joseph P. Ripley Professor of Engineering and a professor of civil and environmental engineering at Cornell University.



Research: Real Help for Real World Problems

Steady progress is being made in the laboratory on a range of issues that are uppermost in public concern whenever solid waste incineration is discussed. What is the significance of the research for decision-makers, for industry, and for local communities struggling with the ongoing problem of waste management? The work is of considerable significance if the research leads to combustion procedures that are more economical and that the public considers safe. As the costs of all waste management options continue to soar, a waste-to-energy facility may become an even more attractive alternative in many locations.

In summary, the Institute's research program begun four years ago will soon yield results as practical applications begin to emerge from the other end of the pipeline. Sophisticated monitoring technologies, improved ash handling procedures, and better understanding of fundamental combustion processes are the products of that research program. These research results and applications will be the new tools for our waste managers — tools needed to address issues of public health and safety, cost-effectiveness, and efficiency.

Research like that sponsored by the Institute contributes information and, ultimately, new applications to address problems. It can identify risk and reduce uncertainty and anxieties associated with certain technologies or alternatives. It cannot, in and of itself, make better decisions. People still need to do that. But it can put into our hands the data and the tools that we need to help us make the most reasonable and sound decisions possible when we are called upon to act.

Notes and Announcements

Pollution Prevention Topic of Conference Scheduled for June

The fifth annual New York State Pollution Prevention Conference will be June 2 and 3 in the Desmond Americana in Albany, NY.

Sponsors are the New York State Department of Environmental Conservation (NYSDEC) and The Business Council of New York State, Inc.

Limited exhibit space is available. Interested persons should contact:

NYSDEC Bureau of Pollution Prevention
50 Wolf Road
Albany, NY 12233-7253
(518) 457-6072
(800) 462-6553 (New York state only)

Cornell Institute Sponsors Workshops for New York State Journalists

Cornell Cooperative Extension and the Society for Professional Journalists sponsored three regional risk communication workshops for New York state print and broadcast journalists last fall. Cornell faculty members discussed principles of risk communication and their application to specific issues.

Prior to the workshops, a majority of journalists indicated that waste management was a topic of major interest to them. Ellen Harrison, associate director of the Cornell Waste Management Institute, outlined the relative risks of different waste management approaches and stressed that there are no completely risk-free options. Among the questions addressed was why the public perceives certain options, such as incineration, as particularly risky, while remaining unconcerned about uncontrolled backyard burning.

Cornell, Stony Brook Plan Cooperative Research

Researchers at the Cornell Waste Management Institute and the Waste Management Institute at State University of New York at Stony Brook cooperate in an investigation of mixed waste composting.

An interdisciplinary team from Cornell, including engineer Thomas Richard; plant scientists Peter Woodbury, Dr. Leonard Weinstein and Steve Ebbs; toxicologist Dr. James Gillett, and associate director of the Cornell Waste Management Institute, Ellen Harrison, will prepare a series of review papers and fact sheets on municipal solid waste composting.

Collaboration with Dr. Vincent Breslin and Dr. Theodore Goldfarb at the Stony Brook Waste Management Institute, who analyze compost quality, will provide information about the relationship of compost quality tothe raw materials and processing methods used.

Environmental Shopping And Waste Reduction Subjects of Project

The Cornell Waste Management Institute will undertake research and provide technical assistance in the areas of environmental shopping and waste reduction in businesses. The work is funded by the New York State Energy Research and Development Authority in response to two proposals submitted by Cornell and several cooperators.

The Ulster County Resource Recovery Agency, Cornell Cooperative Extension of Ulster County, and Wakefern Food Corporation (familiar as Shoprite supermarkets) will work with the Cornell Waste Management Institute to test approaches to consumer education and determine how best to influence choices consumers make in the supermarket.

A project to help businesses reduce solid waste will take place in Tompkins County. A cooperative effort involving the Tompkins County Division of Solid Waste, Cooperative Extension of Tompkins County, Recourse Systems Inc., and the Cornell Waste Management Institute will make information from a pilot study available throughout New York state.

New Video Available

The Cornell Waste Management Institute recently released "Do You Know Where Your Garbage Is?," a 12-minute video for middle and high school students. The tape explores disposal options for the garbage that remains after reduction, recycling, and reuse. Animated characters explain composting, incineration, and landfilling and the roles of those options in community waste management. The video is available from the Cornell University Resource Center, 7-8 Business and Technology Park, Ithaca, NY 14850; (607) 255-7660.

Waste Management Institute, SUNY Stony Brook

Dumping Ban Provides Time For Research into Possible Role Of Oceans in Waste Management

By R. Lawrence Swanson

Dr. R. Lawrence Swanson is director of the Waste Management Institute, Marine Sciences Research Center, State University of New York at Stony Brook.

Introduction

On 29 August 1988, the Oceanic Society placed a full page advertisement in *The New York Times* using one-inch letters to proclaim, "now you don't have to go into the water to be affected by ocean dumping."

An accompanying picture shows a fish on a platter with a syringe and needle through its mouth and gill. The purpose of the advertisement was to increase the Society's membership, but it did so by exploiting the public's fear of acquiring disease through contact with floatable marine debris (some small fraction of which was medically-related waste). Floatable debris had frequently washed ashore on New York and New Jersey ocean beaches during the summers of 1987 and 1988, and it had been featured in national and international news.

The advertisement skillfully confused marine pollution issues (ocean dumping and floatable waste) and implied that seafood would be contaminated by floatable wastes (totally unsubstantiated). The society played to the public's fears in an attempt to raise money.

The advertisement also calls attention to the public's poor understanding of oceanic processes and how these processes relate to human use of the ocean. As waste products of the world continue to increase, it is evident that the ocean, and particularly the coastal ocean, will play an important role as part of the global waste management strategy. If the ocean is to be used in this way, it is necessary to understand the impacts and consequences of such use and to seek ways to minimize and alleviate adverse effects. Continuing and long-term research into these matters is essential.

Coastal waters have been used for millennia to transport and dilute society's wastes. Squires (1981) points out that efforts to control waste in New York Harbor go back to within 50 years of the European settlement of Manhattan Island when Governor Andros prohibited inhabitants "to cast any dung, dirt, refuse of Ye City or anything to fill up Ye harbor..."

The Way We Protect Coastal Waters

We, in the United States, protect coastal waters through the legislative/regulatory process. Historically, marine pollution laws and regulations have been a reaction to conditions, or perceived conditions, that have been deemed harmful, injurious, or otherwise unacceptable.

Rather than being anticipatory, this system of control is reactionary — preventing a problem from becoming worse and rehabilitating what damage may have been done. In most cases, the legal/regulatory process attempts to balance many conflicting issues in order to provide the greatest public good with the least restriction to access, use, and economic opportunity.

Rarely, if ever, are laws and regulations based on a definitive understanding of the problem or issue. Laws may even be a product of a consensus on political issues that may have nothing to do with an understanding of the problem. Such laws take many different forms but can include prohibiting manufacturing or use of a material, specifying where polluting activities may or may not take place, or specifying permissible concentrations of a contaminant in the waste stream, the environment or in organisms. Jurisdictional limits of laws often dictate "where."

Table 1: Laws and Regulatory Approaches for Solving Marine Pollution Problems

Problem	Pertinent Law	Regulatory Approach
Polychlorinated biphenyls (PCBs) in environment	Toxics Substance Control Act of 1976 (PL94-469)	Ban on production in the United States
PCBs in striped bass in NYS marine waters	Environmental Conservation Law 11-0303, Part 40.1	Geographic restrictions on commercial fishing for striped bass
Ocean disposal of contaminated dredge material	Marine Protection Research and Sanctuaries Act of 1972 (PL92-532)	Disposal site designation
	Regulations and permits	Bioassay and other tests
Sewage treatment effluent	Clean Water Act of 1972 (PL92-500) and amendments	Mandatory secondary treatment
	Regulations and permits	Permissible concentration of specified contaminants in effluent
Ocean dumping of sewage sludge	Marine Protection Research and Sanctuaries Act of 1972, as amended 1977	Permitted ocean disposal of sewage sludge through 1981 at EPA approved sites as long as material did not "unreasonably degrade" marine environment
	Water Resources Development Act of 1986	Limited dumping to the 106-Mile Site east of Cape May, NJ
	Ocean Dumping Ban Act (PL199-688)	Banned ocean dumping of sewage sludge after Dec, 31, 1991
Closure of shellfish beds in New York	Certification of Shellfish Lands 6NYCRR47	Limits or prohibits commercial harvesting of shellfish from certain geographic areas based on surrogate measure for pathogens (coliform)

With regard to the legal/regulatory framework, long-term and continuous research can be beneficial because a system of laws and regulations always creates losers as well as winners. It is important to provide better public health and environmental protection while reducing the numbers of losers, eliminating inequities in the system, and better anticipating future coastal environmental problems.

The issues identified in Table 1 illustrate the complexities of managing problems associated with marine pollution and also identify research questions that must be answered if we are to make the relevant legislative/regulatory framework more effective.

Examples of Issues Requiring Research for Improved Management of Coastal Waters:

Polychlorinated Biphenyls

Polychlorinated biphenyls (PCBs) have been identified as potentially carcinogenic or mutagenic to humans. In addition, they are thought to cause a variety of adverse marine ecosystem effects, including fin erosion and liver cancer in some fishes. Over the long term, the ban on production of PCBs in the United States should reduce the risk of these effects. However, questions remain about how to protect people and resources from the effects of the PCBs that are already in, or inevitably will enter, the marine environment.

New York State issues seafood advisories and restrictions based on U.S. Food and Drug Administration guidelines. But, how reliable are these guidelines? Do they provide adequate protection to people who consume fishes contaminated with PCBs? Or, are the guidelines too protective, unnecessarily alarming those who eat affected fishes and unfairly restricting a commercial/recreational fishing industry? Doubt concerning the advisories exists and will continue until we better

understand how contaminants are passed along the food web and how public health effects can be more accurately estimated based on laboratory experiments extrapolated to people.

In the meantime, debate continues on how to manage the marine sediments known to be contaminated with PCBs. Should such sediments be left alone, allowing them to be gradually dispersed and naturally buried? Should they be covered with clean sediments in hope of isolating the PCBs from the sediment/water interface where their transport or exposure to marine resources is more likely? Perhaps it is best to dredge the PCB-laden sediments and put them in a more acceptable place. Where might that place be, and will resuspension, as part of the dredging process, be more hazardous than leaving the contaminated sediments alone? Answers to these research questions would greatly aid in the management of PCBs.

Contaminated Dredged Material

Many of the questions regarding sediments contaminated with PCBs also apply to contaminated dredged material. The chemicals of concern in the sediments may be numerous, and, prior to dredging and dumping, the sediments may have to pass bioassay and other tests. Questions, however, remain as to the significance of the test procedures and the relevance of the bioassay organisms to the organisms found in the marine ecosystem at the dredging site and at the designated dump site.

Of course, if the dredged material fails the prescribed tests, then what? Does channel maintenance cease? Do we then abandon the harbor because it is unnavigable?

Sewage Treatment Plant Effluent

The Clean Water Act of 1972 specified that Publicly Owned Treatment Works (POTWs) were to attain a level of secondary sewage treatment. This typically is considered 85-90 percent removal of biological oxygen demand and 85-90 percent removal of suspended solids in domestic waste water. Section 301H of the Act allowed municipalities to apply for waivers, but the U.S. Environmental Protection Agency (EPA) essentially approved none of the waiver applications. No provisions were made for interpreting the Act in relation to the special nature of the effluent receiving waters. In the waiver process, EPA did not accept evidence that environmental and ecological impacts from a lower level of treatment (primary) were not adverse. Thus, in a few circumstances, treatment plants were upgraded when there was potentially little environmental benefit to be derived. In some cases, the added expense totaled as much as $1 billion. This situation occurred primarily along the coast of California where effluent was being discharged into very deep water at the edge of the narrow continental shelf.

Mandatory secondary treatment has been a benefit in nearly all cases. However, there are a few instances where the benefit has been, or will be, marginal or doubtful (San Diego, Los Angeles). There are also situations where implementation of secondary treatment may have only translocated negative impacts from primary effluent (near the point of discharge) to locations some 20-30 kilometers downstream.

This situation has been suggested with regard to the impact that some of New York City's secondary POTWs may be having on western Long Island Sound (Parker and O'Reilly, 1991). Specifically, there is concern that the hypoxia observed, perhaps more frequently in recent years, in western Long Island Sound may be attributable in part to the New York City treat-

Trash litters Texas beach in February of 1989. Photo by R. Lawrence Swanson

ment plant upgrading. Locally, at the points of discharge in the East River, improvements in water quality are clearly evident.

With the U.S. Congress mandating a level of sewage treatment, several issues emerge:

❒ Did the law stifle development and implementation of other innovative sewage treatment technologies?

❒ Did implementation nationwide unnecessarily burden the tax payer?

❒ Did we understand sufficiently the consequences of implementing the prescribed treatment in all environmental settings?

Ocean Disposal of Sewage Sludge

The ocean disposal of sewage sludge (the semisolid residual including many concentrated contaminants removed from the influent in the process of sewage treatment) has been a volatile issue since the late 1960s. Many of the associated problems, such as selecting dump site locations and limiting permissible disposal concentrations, are similar to the issues mentioned before. However, there are other interesting and perplexing problems associated with the sewage sludge disposal debate.

The Marine Protection Research and Sanctuaries Act as amended in 1977 permitted ocean dumping of sewage sludge that "did not unreasonably degrade or endanger human health, welfare or amenities or the marine environment, ecological systems or economic potentialities." The provision "unreasonably degrade" was meant to be broader than evaluating measurable effects in the ocean and includes an assessment of the need to dump (Erdheim, 1985). But, it means one thing to an environmentalist and something quite different to the Mayor of New York City, particularly during a time of fiscal crisis.

In the suit filed against the EPA (U.S. District Court, 1981), New York City contended that after having dumped sewage sludge, along with other New York and New Jersey communities, at the 12-Mile Sewage Sludge Dump Site just outside New York Harbor since 1924, the City had not unreasonably degraded the marine environment. As part of the argument, the City stated that EPA had not considered the cost or environmental impacts of alternatives. And this was after the environmental community had labeled the dump site a "dead sea." The City won its case, in part, because neither the scientific community nor EPA could quantify in measurable terms the notion of "unreasonably degrades." Mixing scientific measures with social/political debate is almost impossible.

Perhaps the problem has been solved with the passage of the Ocean Dumping Ban Act of 1988. Ocean dumping of sewage sludge was to have stopped by December 3, 1991. The six New Jersey sewage authorities, Westchester County, and Nassau County have stopped as of this writing. New York City is implementing a phase-out schedule that will take several years.

Of course, the problem of what to do with the sludge now is not quite so clear. Many municipalities around the country are creating a soil conditioner with it. With pretreatment programs in place in some municipalities, the levels of potentially toxic materials in the sewage sludge have been reduced to some degree. It is not so obvious, however, that the continued application of composted sludge will be acceptable after repeated applications to certain lands and as land becomes less available because of continued population growth and development. We may want to reconsider the Ocean Dumping Ban Act in the future. In fact, the Woods Hole Oceanographic Institution has already re-opened the debate concerning use of the ocean for controlled waste dumping (Woods Hole Oceanographic Institution, 1991).

Now is the time, despite the Ocean Dumping Ban Act, to continue to look at the ocean and its appropriate role in the context of the sludge issue. If it is necessary to use the ocean in order to protect the land, groundwater, and species that thrive in the terrestrial environment, we should be undertaking research to determine under what conditions and how such an activity might take place -- safely and economically. We can anticipate this situation with well planned research.

Closure of Shellfish Beds

Coliforms measured in the water column have been used for decades as surrogate measures of pathogen contamination to protect the public from contaminated shellfish. Considering that there has been little evidence of disease outbreaks in the United States since implementation of the coliform test, the test would seem to be a success. However, such is not the case. There is not always a good correlation between contaminated waters as determined from coliform sampling programs and contaminated shellfish. There are numerous questions regarding coliform and contamination that need better resolution. Some are:

❒ Where and when should we sample (*i.e.* where the animals live on the bottom, or in surface water which is most likely to be contaminated; immediately after a storm during worst conditions or during more average conditions)?

❒ Do coliforms adequately reflect viral contamination?

❒ Are the tests the most efficient means of sampling (analysis takes days)?

Baymen around Long Island are concerned that coliforms are too conservative a measure of contamination and that the measure unnecessarily excludes some bay bottom from shellfish harvesting at a great economic loss to the commercial shellfisherman. Work is continuing under the National Shellfish Sanitation Program to look for a better indicator(s).

An acceptable substitute is unlikely to be approved in the near future. With any new indicator, the same questions arise. It is difficult to substitute a new measure when the old measure, despite its shortcomings, has protected the public health so well, based on the limited occurrences of disease outbreaks.

Conclusions

Laws and regulations are designed to protect our coastal waters, their living marine resources, and the health of the people who depend on these waters for food, livelihood and recreation. The effectiveness and equity of the regulatory systems is only as good as our knowledge of the physical, chemical, and biological processes of the ocean and how anthropogenic impacts interact with and modify these processes.

Several examples have been presented to help identify the types and complexities of the issues of marine pollution. Even though the laws and regulations would seemingly close the debate, they actually increase its level and complexity. Long-term continuing research is the only means for resolving most of these issues. While some might argue that marine pollution research is a poor investment, it can readily be seen that research can:

- ❒ Lead to better protection of marine resources,
- ❒ Provide early warnings for unforeseen marine pollution problems,
- ❒ Aid in examining the efficiency and effectiveness of pollution mitigation technologies,
- ❒ Lead to better protection of public health,
- ❒ Balance the need for environmental protection with economic opportunity.

In the context of the marine pollution legal/regulatory framework, long-term, continuing research should be one of the highest priorities — an investment for the future.

References

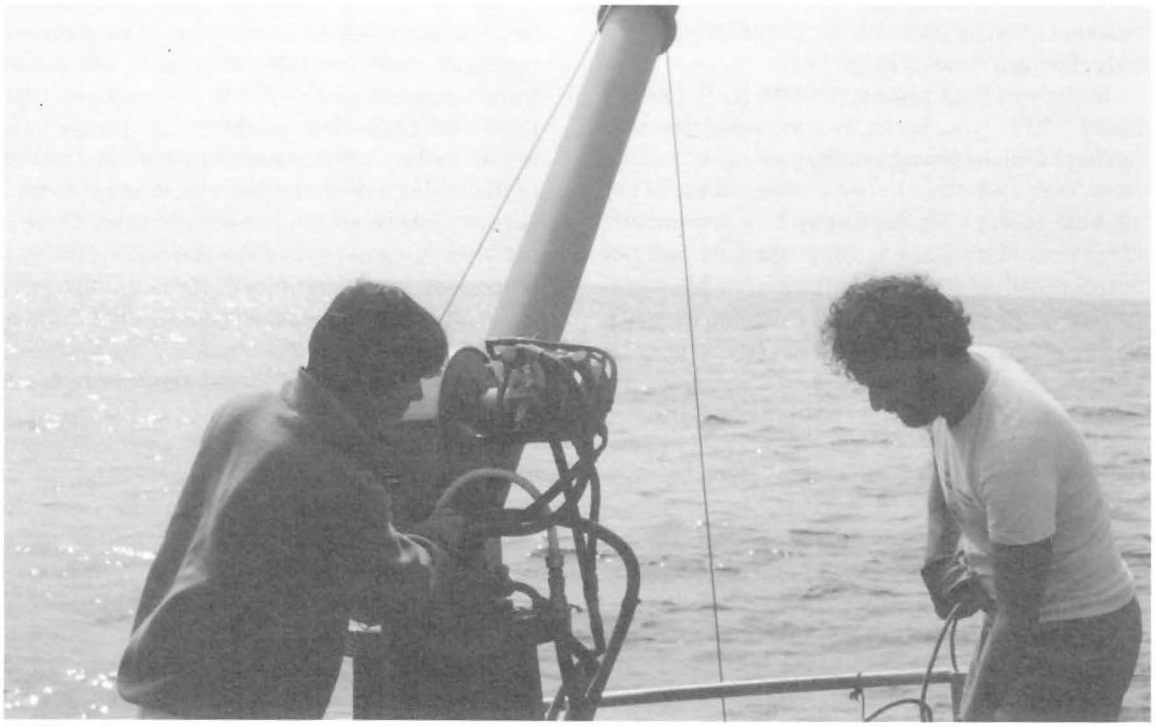
Erdheim, E. 1985. United States marine waste disposal policy. In: Waste in the Ocean, Vol. 6 (B.K. Ketchum, J.M. Capuzzo, W.V. Burt, I.W. Duedall, P.K. Park, and D.F. Kester, Eds) Wiley-Interscience, pp 421-460.

Parker, C.A. and J.E. O'Reilly. 1991. Oxygen depletion in Long Island Sound: A historical perspective. Estuaries, 14(3), 248-264.

Squires, D.F. 1981. The Bight of the Big Apple. New York Sea Grant Institute. Albany NY. 84 pp.

U.S. District Court. 1981. New York City V. United States Environmental Protection Agency. In: Federal Supplement. West Publishing Co. St. Paul, MN. 543, 1084-1115.

Woods Hole Oceanographic Institution. 1991. An Abyssal Ocean Option to Waste Management. Report of a workshop held 7-10 January 1991. Woods Hole, MA. 111 pp.



Graduate students at the Marine Sciences Research Center, SUNY Stony Brook, Vera Agostini and Todd Echelman, participate in a cruise to study hypoxia in the New York Bight.

NYS Center for Hazardous Waste Management

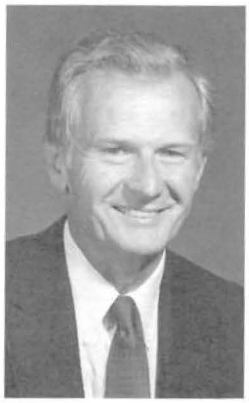
Buffalo Center Supports Research Designed to Lessen the Risks To Health and the Environment Caused by Hazardous Wastes

By Ralph R. Rumer

By design, the research program of the New York State Center for Hazardous Waste Management aims to produce results that will reduce risks to human health and the environment associated with hazardous waste management in New York State. The scope of the hazardous waste management system is very broad, encompassing research needs related to reduction in the generation of hazardous waste, treatment of generated waste, and cleanup of inactive hazardous waste disposal sites. Since the chemical and physical characteristics of hazardous wastes are highly variable, it is understandable that the Center's research program portfolio is quite diversified.

Since its establishment, the Center has funded 27 projects located at 11 educational institutions and one industry in New York State. Most of the projects have industry partners that share in the cost of the research. Each project proposal received by the Center is peer-reviewed by technical specialists from industry, government, and academia. The Center's Technical Advisory Committee, with representatives from industry, government and academia, reviews all proposals and peer reviews and makes final recommendations for project awards. In this way, the Center ensures that funded projects are relevant to New York State's needs and are technically meritorious.

The following four brief project summaries have been selected to reflect the diversity of the Center's research program. Taken together, they involve efforts aimed at hazardous waste reduction, recovery and reuse, treatment and destruction. Summary reports for all completed projects can be obtained by contacting the Center at 207 Jarvis Hall, State University of New York at Buffalo, NY 14260.



Ralph R. Rumer

Combined Chemical/Biological Oxidation For Reduction of Hazardous Waste Toxicity

By James N. Jensen and A. Scott Weber

Introduction

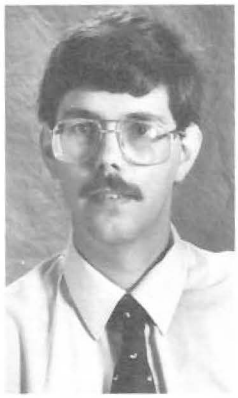
Technologies are needed for reducing or eliminating the toxicity associated with hazardous waste. Detoxification processes can be divided into two classes: physical/chemical (*e.g.*, incineration and ozonation) and biological processes. When possible, biological processes are preferred over physical/chemical processes due to their economical nature. However, many anthropogenic (man-made) organics found in hazardous waste undergo slow rates of biodegradation or are non-biodegradable. Often these traits arise from difficulties associated with converting the anthropogenic material to a substrate for which there are capable enzymes. While chemical processes are more expensive, they are not limited by these constraints and have been used successfully to degrade compounds resistant to biodegradation. Consequently, technologies which are capable of concurrently exploiting the major attributes of both chemical and biological processes need to be researched and developed. In particular, theoretical considerations suggest that a combined chemical oxidation/biodegradation system may outperform either chemical oxidation or biological treatment alone.

The applicability of combined chemical/biological oxidation to hazardous waste toxicity reduction is unproven, but potentially significant. Research is needed to evaluate, develop, and optimize this promising technology.

Objectives

Currently, no rational strategy exists for the evaluation and optimization of the combined chemical/biological oxidation treatment of a spe-

Dr. Ralph R. Rumer is executive director of the New York State Center for Hazardous Waste Management at State University of New York at Buffalo.



James N. Jensen

A. Scott Weber

cific hazardous waste. The two primary goals of our work are to 1) validate the advantages of combined chemical/biological oxidation systems, and 2) apply the complementary oxidation technology to hazardous wastes.

Results to Date

The potential benefits of combined chemical/biological oxidation have been demonstrated with chlorendic acid (a non-biodegradable flame retardant). Previous work in our laboratory has shown that chlorendic acid is essentially non-biodegradable, but capable of being oxidized by the strong chemical oxidant ozone. With ozone, near complete (greater than 98 percent) disappearance of chlorendic acid can be achieved. As chlorendic acid is chemically oxidized, organic by-products are formed.

These by-products appear to be relatively resistant to chemical oxidation and are persistent even at high ozone doses. However, ozonation by-products have proven to be readily degradable when subjected to biological oxidation. Thus, nearly complete destruction of chlorendic acid and its by-products can be achieved with the combined chemical/biological oxidation process. The combined system outperforms biological oxidation alone (where chlorendic acid is not degraded) and chemical oxidation alone (where oxidation by-products are not degraded).

As a general rule, the efficiency of the combined chemical/biological oxidation process is dependent upon 1) the chemical oxidation efficiency of the parent compound, and 2) the biodegradability of chemical oxidation by-products. In recognition of these general criteria, our work to date with chlorophenols has focussed on the identification of chlorophenol-ozone reaction products. We plan to use by-product information to choose chemical and biological oxidation conditions which are optimal for the treatment of chlorophenols.

Relevance of Research

This project illustrates the two important roles that basic research plays in the management of hazardous wastes. Research is being used for both the development and optimization of an innovative management strategy. By studying the chemistry, biology, and physics of the system on a fundamental level, treatment processes may be optimized without the arduous (and often impossible) task of evaluating every possible combination of all treatment parameters.

Dr. James N. Jensen is an assistant professor and Dr. A. Scott Weber an associate professor in the Department of Civil Engineering, State University of New York at Buffalo.

Metal Ion Separation From Hazardous Waste Streams by Impregnated Ceramic Membranes

By Lawrence L. Tavlarides

Waste streams from the electronics, electroplating, catalyst manufacture, and photographic industries are significant industrial problems. Effluent limitations and pretreatment standards under the Clean Water Act require removal of heavy metals from the wastewater discharges. This is commonly accomplished by precipitating the metals out of solution. Usually, the resulting metal-containing sludges must be managed as hazardous wastes.

Our research effort at Syracuse University under the sponsorship of the New York State Center for Hazardous Waste Management is to develop an advanced separation technology to recover toxic and valuable metals from industrial waste streams. In this process, chemically active membranes are used to selectively remove metals from dilute aqueous waste streams. A second approach is to use chemically active beads for achieving very low metal ion levels (PPM to sub-PPM range). The metals are concentrated into a reduced volume stripping solution that can be recycled to the manufacturing process or further treated for metal recovery.

Technology

The inorganic chemically active membranes (ICAMs) and beads (ICABs) consist of a porous ceramic support that contains an organic acid in the pores known as a chelation acid (see Figure 1). The ceramic substrate functions as a support and also immobilizes the acid within the pores. This immobilization is accomplished by chemical binding or capillary forces.

The metal ions are selectively removed from the feed phase (waste stream) and transported through the membrane as a metal-chelation acid complex whereupon it is released into the receiving phase (strip solution). The strip solution also regenerates the chelation agent to be reused as a "shuttle" agent to complex with another metal ion and continue the process. In an industrial process, these ceramic membranes would be in the form of tubes cast into a bundle which would be housed in a shell. The waste stream could flow inside the tubes, the receiving phase over the outside of the tubes, and the metal ions would

permeate through the tube wall from the waste stream to the receiving phase.

The ICAB process is similar, however, the metal ions accumulate in the beads as a complex until the chelation acid in the pores is saturated. The beads can be stripped of the metal ions using mineral acid solutions. The contacting geometry for industrial application would be in the form of a packed bed of the beads through which the wastewater passes. Purified water exits the bed. The bed is regenerated by acid washing for reuse and collection of the recovered metal ions.

The goals at Syracuse University are to develop a series of such membranes and beads which have specific application to waste streams. Selective, modular ICAMs and ICABs could be used in a sequential manner with tubular units and fixed bed units to selectively remove metals from multiple metal ion waste streams as shown in Figure 2. Target metals include lead, chromium, mercury, copper, nickel, platinum, silver and gold. Stripping solutions containing the recovered metals can be returned to the process streams along with safe discharge or recycle of the effluent streams.

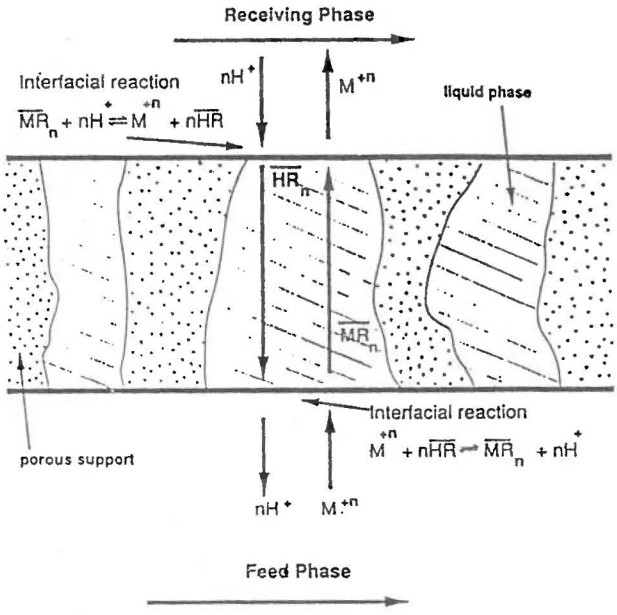
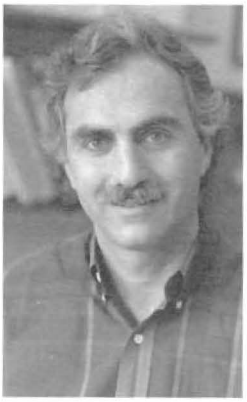


Figure 1. Concept of coupled transport through an immobilized liquid membrane



Lawrence Tavlarides

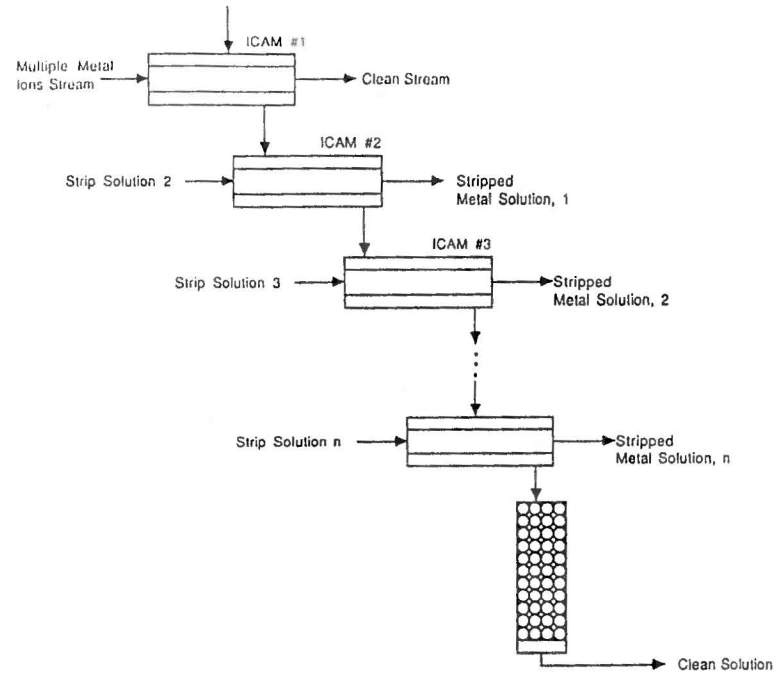


Figure 2. Concept for multistage process using inorganic active membranes (ICAMs) and beads (ICABs)

Dr. Lawrence L. Tavlarides is a professor in the Syracuse University Department of Chemical Engineering.

Landfilling Alternative

Productive Use Of a Hazardous Solid Waste

By Stephen E. Wiberley

Stephen E. Wiberley

The General Electric Silicone Products Division at Waterford, NY generates approximately 25,000 tons per year of a material classified as a hazardous waste. This waste is currently being landfilled in an approved site at a considerable expense to General Electric. From both an environmental standpoint and the landfilling costs involved, an alternate solution to landfilling is needed.

This research involved investigating environmentally sound and commercially attractive uses of the solid waste. The goals of the study were the complete chemical characterization of the waste and the exploration of possible applications of reuse of the material in the manufacture of glass or as a partial replacement for cement in concrete or masonry block. The possibility of recovery of the copper in the waste by bioleaching was also explored.

Plant samples taken at various stages in the industrial process were characterized by chemical and physical methods. Results showed that the major component was amorphous silica. Calcium carbonate and copper were also present in significant amounts.

Copper recovery from the waste by bioleaching with heterotropic bacteria was studied. Although copper could be successfully bioleached in an acidic iron medium, the treatment would be quite expensive, and the reduction in material being landfilled would be less than two percent.

Using the waste and other additives, 34 batches of experimental glasses were prepared and analyzed. Conclusions from this study were that glasses and glass fibers could be made from the solid waste, but production problems might be encountered during glass manufacture because of copper separation in the melting process. The three companies contacted to see if they could use the waste product in the manufacture of fiberglass, glass or glass frits were not interested in utilizing the waste.

The third alternative investigated for reuse was as a partial replacement or as an addition to the cement used in mortar, masonry blocks, or concrete. By modification of the existing plant process, a reasonably uniform material was tested as cement replacement in mortar strength tests by Blue Circle Atlantic, Inc., Ravena, NY. Since higher compressive strengths resulted after 28 days, a 60-pound plant sample was prepared, analyzed and tested as a 10- or 20-percent cement replacement in mortar specimens. Improved compressive strengths resulted in both formulations containing the material.

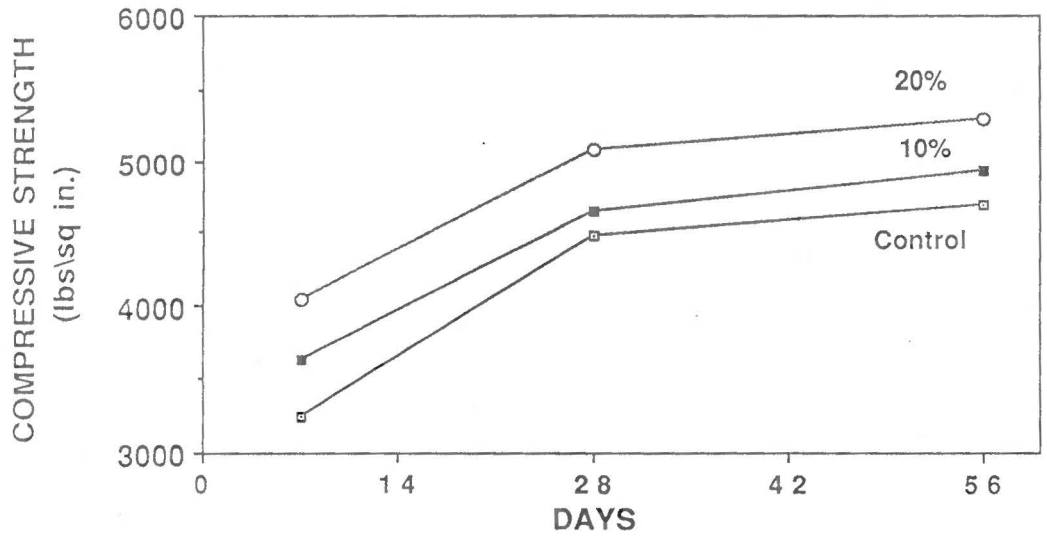


Figure 1. Percent Cement Replacement with General Electric Waste Material in Concrete

Dr. Stephen E. Wiberley is a professor of chemistry at Rensselaer Polytechnic Institute in Troy, NY.

Large testing area installed at the General Electric Silicone Plant allows study of concrete performance in the field.

This material was also successfully used as a 15- and 20-percent cement replacement to prepare acceptable 8" x 8" x 16" masonry blocks at the laboratory of the National Concrete Masonry Association, Herndon, VA.

Concrete specimens were made and tested by Soil and Material Testing, Inc., Castleton, NY with this material as a 10- and 20-percent replacement for cement. Both samples yielded a large improvement in compressive strength compared to the control with the 20-percent sample having the highest values (see Figure 1). Improvement in permeability of the concrete specimens was also largest for the 20-percent sample.

Studies to insure that regulated metals would not leach out of the concrete and pose a hazard to the environment showed the material to be well within specifications.

As shown above, a large concrete area has been installed at the General Electric Silicone Plant to further study the performance of this concrete in the field.

New large-scale application of the material as an additive to or a substitute for cement in concrete will have a beneficial economic and environmental impact. Due to its high compressive strengths and low permeability, this material would be ideal for the construction of roads, bridges or parking garages.

This research was supported by the General Electric Silicone Products Division, Waterford, NY, the New York State Center for Hazardous Waste Management, and the New York State Energy Research and Development Authority.

Carcinogenic Risk
Minimization By Treatment of Hazardous Offgases

By James A. Mueller

Air stripping for the efficient removal of volatile organic chemicals, VOC, from contaminated groundwater is used in drinking water purification and hazardous waste site remediation. The removal of VOC from the water phase to the air phase is a transfer process resulting in no net destruction. As air quality regulations become more stringent, emission controls on the air stripper offgases will be required. Using granular activated carbon, GAC, to treat the offgas requires a consideration of the interactions between the air stripper design and the GAC design. Often these interactions are neglected with the air stripper design and the GAC designed for the resulting offgases leading to significantly higher capital and operating costs.

For proper design of the overall system, a mathematical framework for each process is required. This exists for the air stripping process, allowing the tower efficiency to be determined as a function loading rate. This framework also predicts the offgas concentration and flow rate to be treated by the GAC. To analyze the GAC system, a framework incorporating the interactions among the various chemical components in the offgas is required to accurately predict breakthrough curves and to project carbon capacity.

James A. Mueller

Dr. James A. Mueller is a professor in the Manhattan College Environmental Engineering & Science Program, Riverdale, NY.

This project developed a multicomponent offgas adsorption model used to calculate the carbon breakthrough curves. Due to its generality and ease of application, the Polanyi equilibrium potential theory was used to describe the equilibrium sorption isotherms. The model was calibrated using data from a pilot scale unit treating a contaminated groundwater containing seven chlorinated volatile organic chemicals. Determination of the GAC regeneration frequency can be obtained by considering the carcinogenic impact of the GAC breakthrough curves. Combining the latest data available on carcinogenic risk with GAC breakthrough curves yields the impact of regeneration frequency on the long term cancer potential of GAC effluent gas. Figures 1 and 2 show the actual GAC capacity that can be obtained as a function of the allowable maximum cancer potential at the GAC outlet.

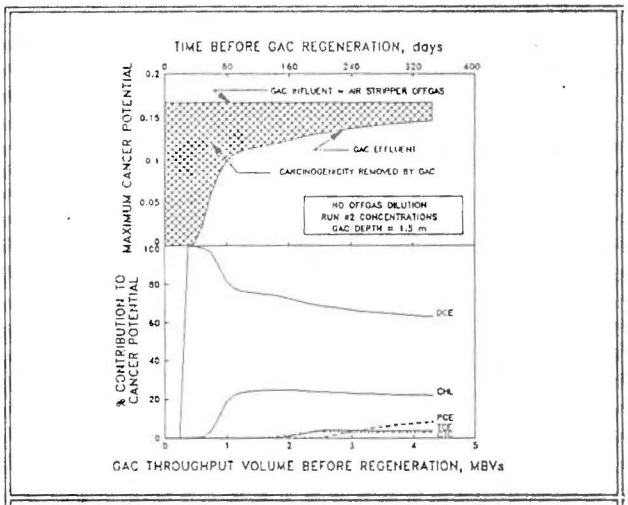


Figure 1. Effect of GAC Regeneration Frequency on Carcinogenic Risk at GAC Discharge

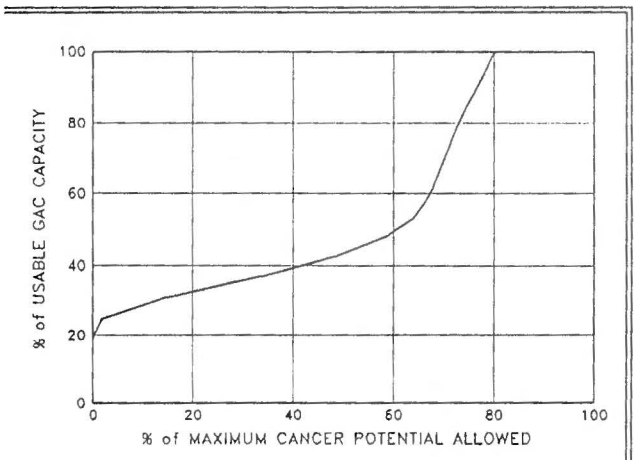


Figure 2. Impact of Allowable Cancer Potential at GAC Discharge on Usable GAC Capacity

The allowable value at the GAC outlet is site specific, a function of the distance to receptor, meteorological conditions, and atmospheric dispersion. Although DCE has a relatively low concentration in the offgas mixture, it has a major impact on the carcinogenicity due to its relatively high risk per unit concentration compared to the other components.

Conclusions

A multicomponent model based on the physical characteristics of the GAC and individual compounds has been successfully developed and calibrated on pilot scale breakthrough curves at two ranges of offgas concentration for a mixture of 7 chlorinated VOC's. Using the multicomponent model for design of GAC air stripper offgas systems provides a rational technique to assess regeneration requirements based on the total cancer potential of the various components as they break through the GAC. This research effort has successfully combined process design with risk assessment to obtain a rational procedure for carbon systems treating hazardous offgases.

Demonstration Protocols For New Biotechnologies Purpose of Project

The New York State Center for Hazardous Waste Management, the New York State Department of Environmental Conservation, and the New Jersey Institute of Technology cooperate in an effort to develop a protocol for pilot-scale treatability demonstrations of biotechnologies at state Superfund sites.

Ralph R. Rumer, executive director of the New York State Center for Hazardous Waste Management, and William Librizzi of the New Jersey Institute of Technology direct the project. The work will be funded, starting June 1, 1992, by a grant from the Environmental Protection Agency Northeast Hazardous Substance Research Center which is headquartered at the New Jersey Institute of Technology.

The project is designed to promote demonstration of promising innovative technologies applicable to the cleanup of soils, sludges, and groundwater contaminated by hazardous substances. Assisting the project directors will be representatives of state and federal agencies, industry, consulting engineering firms, universities, and environmental organizations. Study findings will be used to establish guidelines for pilot-scale treatability tests and for judging the technical merits and performance of the demonstrated technologies.

New Research Reports Available

The New York State Center for Hazardous Waste Management offers reports on two recent research projects funded by the Center:

Mechanisms of Aromatic Pollutant Degradation by Immobilized Cultures of the Ligninolytic Fungus *Phanerochaete Chrysosporium,* Kenneth E. Hammel, SUNY College of Environmental Science and Forestry. (Hammel is now affiliated with the USDA Forest Products Laboratory in Madison, WI.)

White-rot fungus, a common wood-degrading fungus, was investigated for its ability to degrade two common hazardous substances, anthracene and phenanthrene. The findings show that extracellular lignin peroxidases catalyze the first step in the degradation process and that the fungus and other indigenous microorganisms in the environment degrade the intermediate products produced by this catalyzed first step.

Extraction of Organic Pollutants Using Enhanced Surfactant Flushing: Initial Field Test, John C. Fountain and Dennis Hodge, SUNY at Buffalo.

Based on laboratory experiments and field testing, it was found that dilute (two percent) aqueous mixtures of surfactants greatly improved the ability to remove tetrachlorethylene, a common groundwater pollutant, from contaminated aquifers. The success of this initial field test led to a pilot-scale demonstration of the method at a contaminated site.

Copies of these (and earlier) research reports can be obtained for $5 (five dollars) each from the New York State Center for Hazardous Waste Management, State University of New York at Buffalo, 207 Jarvis Hall, Buffalo, NY 14260, (716) 636-3446.

Mid-Atlantic Industrial/Hazardous Waste Conference

West Virginia Sessions Slated July 15-17

The 24th Mid-Atlantic Industrial and Hazardous Waste Conference will be July 15-17 at the Lakeview Resort and Conference Center, Morgantown, WV.

West Virginia University and the State University of New York at Buffalo are conference sponsors, in cooperation with the U.S. Environmental Protection Agency (EPA), the New York State Center for Hazardous Waste Management at SUNY Buffalo, the West Virginia University National Research Center for Coal and Energy, the West Virginia University Office of Academic Affairs and Research, the West Virginia Department of Natural Resources, the West Virginia Water Pollution Control Federation, and the West Virginia Chapter of the American Society of Civil Engineers.

The conference will focus on waste treatment, site remediation, and waste management, and also offer sessions that address sludge treatment, disposal of solids, fluid flow, and waste-to-energy issues. The primarily technical sessions are designed to balance state-of-the-art and state-of-the-practice.

Conference keynote speaker will be Dr. W. Wesley Eckenfelder Jr., a Distinguished Professor at Vanderbilt University and chairman of the board of Eckenfelder, Inc., an environmental consulting firm in Nashville, TN. Topic of the general session will be pollution prevention. Representatives of the EPA, Battelle, Union Carbide, and the Environmental Defense Fund will speak.

The Lakeview Conference Center offers two USGA golf courses, a sports center, indoor and outdoor pools, and other recreational facilities. Nearby Cheat Lake offers additional outdoor activities. Interested persons may call Brian Reed at (304) 293-3031, extension 613; FAX (304) 293-5024.

Banks Leaves NYSDEC Post

Dr. R. Darryl Banks, deputy commissioner of environmental quality for the New York State Department of Environmental Conservation, will leave his position with the department to become director for technology and environment at the World Resources Institute in Washington, DC. Banks served as Environmental Conservation Commissioner Thomas C. Jorling's designee on the executive board of the New York State Center for Hazardous Waste Management at the State University of New York at Buffalo and on the executive committee of the Solid Waste Combustion Institute at Cornell University.

Eco World '92 June 14 - 17 In Washington Convention Center

The American Society of Mechanical Engineers will sponsor Eco World '92 June 14 - 17 in the Washington (DC) Convention Center. Forty business, environmental, and technical organizations from the United States and other countries will participate, among them the United Nations Environment Programme, the World Bank, and the World Health Organization. The conference will be of benefit to legislators, government authorities, investment advisors, engineers and consultants, city planners, industry leaders, defense industry representatives, scientists, manufacturers and distributors, and ethicists.

Technical tracks at Eco World '92 will be:

- ❒ Site Remediation and Cleanup
- ❒ Local Authorities and the Environment
- ❒ Food and the Environment
- ❒ Energy and the Environment
- ❒ Industrial Production and the Environment
- ❒ Transportation and the Environment
- ❒ Technology, Society, and the Environment

Participants from New York include: Edward O. Sullivan, deputy commissioner for environmental remediation, New York State Department of Environmental Conservation (DEC); Edwin Tifft Jr., O'Brien & Gere Engineers, Inc.; Mark P. Brown, Blasland and Bouck Engineers, P.C.; Ralph R. Rumer, executive director of the New York State Center for Hazardous Waste Management; Anthony C. Ying, TreaTek, Inc.; Conrad Simon, U.S. Environmental Protection Agency, Region II; Philip Landrigan and Edith Wise, Mount Sinai School of Medicine; Angelika Forndam, New York City Department of Environmental Protection; Joseph R. Visalli and Parker Mathusa, New York State Energy Research and Development Authority; William D. Cotter, director of the New York State Energy Office; Commissioner Thomas C. Jorling, NYSDEC; Peter A. Bradford, New York State Public Service Commission; Francis J. Murray Jr., deputy secretary to Governor Mario Cuomo; and Faye Duchin, New York University.

The cost for the conference is $295 for ASME members and $360 for others. On-site registration for exhibits only will be $20. To register and receive an advance program:

Call 800-843-2763, extension 814 or 201-882-1167, extension 814
Fax number 201-882-1717

Conference planners recommend that international registrants use the fax.

Write for information to:
ASME/Eco World '92
345 East 47th Street
New York, NY 10017

Guest Comment

University/Industry Collaboration: The Key Word is 'Relevance'

By Theresa A. Walker

Theresa A. Walker

Over the past decade, numerous university/industry alliances have arisen from the belief that university-generated knowledge has significant potential for commercial exploitation. Often, state or federal governments encourage such alliances as part of economic development policy in order to enhance the productivity and competitiveness of existing industries and the development of new commercial enterprises. Collaborative efforts have proven valuable to university and industry alike.

The appropriate and cost-effective management of waste is an increasingly important element in the competitiveness of companies. It also represents an emerging industry. Thus, there is untapped potential for university/industry collaborative research and development in the reduction and management of waste.

Despite very real cultural differences — in motivation, time scale, reward system, for example — which divide the academic and industrial worlds, there is common ground where the research goals of each are complementary and even synergistic. For industry, investment in academic research capitalizes on existing university infrastructure and often is further leveraged by funding from other sources, including other companies. As companies more and more focus in-house research and development on areas with short-term commercial potential, access to university research in areas that will be important for future competitiveness becomes critical. For universities, such collaborative arrangements represent a new source of funding for research.

But, if the university's only objective is to tap a new funding source, the success of the effort will be limited. For optimal effectiveness, industry must have an influence on the research agenda. Sometimes academic researchers, who fear that the mission of the university will be distorted, abhor this idea. However, successful university/industry collaborations show that the right kind of industry influence does not destroy or compromise the university's mission but actually enhances the research and educational enterprise.

The "right" kind of influence can be encapsulated in the word "relevance." The knowledge, experience, viewpoints, and problems of industry are extremely useful in identifying critical research issues that must be addressed in order to achieve technological progress. Academic researchers sometimes justify the relevance of their research by pointing to potential applications. When fundamental research is motivated by a real application or problem in industry, the relevance of the research is clear. Thus, one of the rewards of university/industry collaborative research for the academic researcher is the knowledge that the work is likely to be useful as well as interesting.

University faculty researchers who develop strong interactions with counterparts in industry find that companies are replete with interesting problems that can serve as the basis for unrestricted, publishable, fundamental research suitable for doctoral students. In addition, working on technology problems of actual companies offers undergraduate and master's level students valuable experience and training for the "real world" they will enter upon graduation.

Just as it is not enough for the university to merely accept the financial contributions of industry, it is not enough for industry to merely supply research funds to the university. The key to successful collaborations is person-to-person communication, "early and often." This requires the commitment of company people and time. The research agenda should be developed jointly, informed by the knowledge and expertise of both the academic and industry partners. A two-way dialogue should be maintained throughout the course of the research. Only with concerted effort do the partners gain confidence in one other and mutual understanding of motivations and expectations. And only through substantive research interactions does each partner benefit from the knowledge and expertise of the other. This is true in traditional academic scientific collaborations; it is no different when the collaborator is from industry.

Theresa A. Walker is manager of University — Industry Programs for New York State Science and Technology Foundation.

Waste Management
Research
Report

123 Bray Hall
SUNY College of Environmental Science
and Forestry
1 Forestry Drive
Syracuse, NY 13210
(315) 470-6644

ADDRESS CORRECTION REQUESTED

The Cornell Engineering and
Theory Center Building