TURNING LONG ISLAND'S SENSITIVE ENVIRONMENT AND ITS ENVIRONMENTAL PROBLEMS INTO OPPORTUNITIES FOR ENTREPRENEURS

Results of a Workshop
Held at the
Marine Sciences Research Center
19 June 1992

MARINE SCIENCES RESEARCH CENTER
STATE UNIVERSITY OF NEW YORK

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Co-Sponsors
Long Island Environmental-Economic Roundtable
Long Island Research Institute
Marine Sciences Research Center
The University at Stony Brook's Regional Development Task Force

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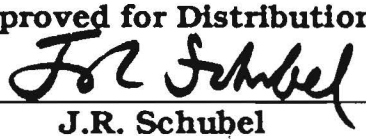

J.R. Schubel
Dean and Director

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PREFACE

This report is a brief summary of the major conclusions and recommendations of the workshop. The workshop prospectus is included as Appendix A, the workshop agenda as Appendix B, and the list of participants as Appendix C.

WELCOME AND INTRODUCTIONS

J.R. Schubel

We are here today to turn problems into opportunities. On Long Island we have lots of environmental problems -- real and perceived -- and therefore we should have lots of opportunities. Pogo once mused that *"Some opportunities are so large, they are insurmountable."* Long Island's environmental opportunities are large, but not insurmountable; not as I look around the room and see the talent that's gathered here today. Our challenge is to harness some of that creative horsepower to exploit these opportunities.

We are looking for ways -- for innovative, creative ways -- to stimulate technology transfer in ways and to degrees that would transform Long Island into the environmental technology transfer "model" for the rest of the U.S.

We are here today to begin a sustained process to look for ways that technology and technology transfer can contribute to strategies for sustainable development on Long Island. We are using the terms technology and technology transfer in the broadest sense -- the use of knowledge to solve problems. And, we take our definition of sustainable development as "social and economic development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Our first speaker today is Provost Tilden G. Edelstein who will welcome all of you officially and set the stage for today's program.

INTRODUCTORY REMARKS

Provost Tilden Edelstein

Welcome to Stony Brook and to this workshop on Environmental Technologies being co-sponsored by our University Task Force on Regional Development. I am delighted to see so many of you here this morning.

The President and I created the Task Force on Regional Development 2-1/2 years ago. It has organized a number of workshops and forums on important topics over its brief history, but none has generated the response this one has -- and I'd like to thank the organizers of the Earth Summit that just ended in Rio for the terrific lead-in. Let me share with you a quote from the report by their principal business adviser that was just published last month, Changing Course: A Global Business Perspective on Development and the Environment. The point is that the consumption of natural resources has accelerated to such a rate that renewable resources are no longer being renewed: *"The bottom line is that the human species is living more off the planet's capital and less off its interest. This is bad business."* Our goal must be sustainable development, which, according to a UN report, *"meets the needs of the present without compromising the ability of future generations to meet their own needs."*

This concept has special meaning for Long Island, where our efforts to build a vibrant 21st century economy must also preserve our fragile island environment. Fortunately we are rich in resources.

Long Island is the high-tech "capital" of New York. Long Island: home of a large number of small to medium sized companies active in a rich diversity of high tech fields: home of several impressive technology parks; home of the new Long Island High Technology Incubator; home of Brookhaven National Laboratory, the Cold Spring Harbor Laboratory, Stony Brook, Polytechnic University, North Shore Hospital and a number of other excellent colleges and universities and, most recently, home of the Long Island Research Institute.

One person who has been a major force in developing the State and the Island's high technology industries and its academic capabilities to nurture those initiatives is Senator Kenneth LaValle. We are indeed fortunate to have him here today.

It's clear that Long Island has a high tech economy. It's just as clear that Long Island has a sensitive environment. Hardly a day goes by that Newsday doesn't remind us of the conflict -- real or perceived -- between the environment and the economy. What isn't clear is why we don't have a concentration of high technology industries which specialize in environmental technologies; in technologies dedicated to protecting, to restoring, to enhancing the Island's environment. That's what sustainable development is... making things better for present and for future generations. Technology has a major role to play in allowing people to live in harmony with their environment. We are here today to search for new opportunities for technological innovation that can benefit Long Island's environment and its economy.

New York State Senator Kenneth P. Lavalle

Today represents a unique opportunity for business leaders in diverse fields to come together and chart a course for the future of Long Island. We are fortunate to live in one of the most beautiful areas of the State. However, because we live on an island we are faced with sensitive environmental challenges and must find ways to balance economic growth with the preservation of our natural resources.

While it is important to attract new industry and stimulate our local economy, we must do so in a way that will enable us to maintain the quality of life that initially brought our families to Long Island. Today's environment is ripe for the exchange of new and creative ideas that will put Long Island on the map as a leader in the field of high technology and clean industry.

This year our efforts to develop an incubator for fledgling companies at Stony Brook University became a reality. As President Marburger and Jerry Schubel will attest this took ten years of hard work to bring to fruition. But working together towards a common goal we were able to ensure a means for new entrepreneurs on Long Island to take their ideas from the development stage in the laboratory into the market place as real products or processes that result in the creation of jobs.

Today's meeting is another link in the chain of events we must continue to encourage if we are to successfully expand upon our new and exisiting resources.

Long Island has one of the most talented and skilled workforce in the nation. As we move away from defense, it is vital that we diversify and move towards areas compatible with the Island's unique natural makeup. Our economic welfare depends on our ability to stimulate industry in harmony with the preservation of our environment.

Dr. Philip Palmedo
President and CEO, Long Island Research Institute

It's a pleasure for the Long Island Research Institute to act as a co-sponsor of this workshop. Despite our enthusiastic support and sponsorship of the workshop, I feel a little like a co-host at a dinner party who didn't do any of the cooking. The Institute is just getting organized and was unable to make any substantial contribution in preparing for this meeting. The cooking, as often the case, fell to the great chef of such meetings, Jerry Schubel.

Nonetheless, there is a strong logic to our sponsorship of this workshop. Let me describe briefly what the Institute is about and you will see why I say that. The Long Island Research Institute was founded by Associated Universities (the managing corporation of Brookhaven National Laboratory), Cold Spring Harbor Laboratory and the State University of New York at Stony Brook. A non-profit organization, LIRI has three specific objectives:

1. To accelerate the flow of research from Long Island research institutions into commercial application.
2. To act as a catalyst for collaborative sponsored research between Long Island research institutions and industry.
3. To contribute to the solution of economic and environmental problems of the Long Island region.

This meeting encompasses both technology commercialization (objective No. 1) and our focus on the economic and environmental issues facing Long Island (objective No. 3).

I believe that it is defeatist - and, in fact, wrong - to consider that there is an inevitable conflict between economic development objectives and the objectives of environmental quality. There is far more complementarity in these objectives than there is conflict. For example, a key drawing card for the entrepreneurs and scientists who will create Long Island's new knowledge-based industry is the region's clean air, water, beaches and open spaces. If these attributes are destroyed the economic prospects of the region are dim.

Maintaining and cleaning Long Island's environment will not be cheap. Reaching the nutrient release targets for Long Island Sound has a price tag of billions of dollars. The preservation of significant amounts of Long Island's natural landscape is becoming more and more expensive. We can afford those costs only if the Island is economically vigorous.

This workshop focuses on another intersection of economic development and the environment: the business opportunities that can emerge from finding solutions to Long Island's environmental needs. The Long Island Research Institute's technology commercialization program can be helpful in this quest. In that program we are creating a capability to evaluate technologies for their technical merit and their market potential. A separate privately capitalized for-profit corporation is being formed to work with the Institute in providing seed money and venture capital to new joint ventures and start-ups. This corporation will also provide management support often needed in technology-based start-ups. Thus, we can now be assured that if commercially viable ideas come out of the research

community on Long Island - or this meeting today - there is a powerful mechanism in place to convert those ideas into businesses and jobs.

I hope that ten years from now we can identify some companies on Long Island that are making a contribution to environmental quality, that are making money for their owners, that are providing fulfilling jobs to their employees and whose origins can be traced to today's meeting.

AN OVERVIEW OF LONG ISLAND'S SPECIAL ENVIRONMENTAL QUALITIES: GRIST FOR THE ENTREPRENEURS' MILL

Harold Berger, Co-chair,
Long Island Environmental-Economic Roundtable

Good morning! I am pleased to have the opportunity to speak to you today on this very important subject -- "How We Can Turn Long Island's Sensitive Environment And Its Environmental Problems Into Opportunities for Entrepreneurs."

When I attended organic chemistry classes some 50 years ago we reacted various chemicals to produce certain end products. We reacted "A" with "B" to get "C" but we also came up with "D" and maybe "E" as by-products. Usually "D" and "E" ended up as waste products for disposal. If our yield of our desired product was 25-50% we were satisfied with the results. And many chemical manufacturing processes were built on the premise that yields of these amounts or even less were adequate and could yield sufficient profits. The 59-75% waste that resulted was easily disposed of at minimal cost.

Today, the cost of disposing of this waste, sometimes as hazardous waste, is enormous and future costs will be even more prohibitive. Companies, in order to remain competitive, find it imperative to reduce or eliminate these wastes. The air, ground or water is no longer available for disposal of these

materials. The POLLUTION PREVENTION PAYS program (3 P's) of the 3M Company is an excellent example that demonstrates that waste reduction increases profits. Other companies such as Dow Chemical and DuPont have similar programs.

Companies of the future will have to strive to operate closed loop systems. They will have to minimize waste by changing formulations and other parameters or their reactions. They will find ways to reuse whatever by-products or waste they cannot prevent and if the waste cannot be reused they will find ways to neutralize the waste so that it can be disposed of in a manner that will not disturb the ecology of our planet.

The technologies necessary to achieve this closed loop concept are within our grasp and should be the goal of our universities and our industries. Long Island's Brookhaven National Laboratory, The University at Stony Brook, the Cold Spring Harbor Laboratory, Polytechnic University, the many other universities and the dynamic industries of Long Island have the capacity to develop these technologies so that we will get a head start in meeting the challenges of this next century.

In order to encourage the development and implementation of these new technologies it is essential that all segments of society work together. Industry, universities, government and environmental groups must develop a climate in which these new technologies can thrive.

On this note, I would like to tell you about the Long Island Environmental-Economic Roundtable.

About two years ago, at a meeting in the office of the former county executive, we were discussing how we could resolve an environmental problem for a new business on Long Island. Bob Coughlan, a developer, suggesting that there ought to be a place where a businessperson could go to discuss his/her environmental problems and perhaps get some direction and help. While the various regulatory agencies, the County and State's Department of Economic Development and various consultants were available, there did not exist a forum that included public environmental interest groups. It was suggested that developers could use input from all of these groups before committing to specific projects.

Dr. Jerry Schubel and I decided to attempt to try to fill this vacuum. Accordingly we called together representatives of these various groups and formed the Long Island Environmental-Economic Roundtable. This is a structured group comprised of ten representatives of government and regulatory agencies, six members from local environmental groups such as the Pine Barrens Society, Audubon Society, Nature Conservancy, Citizens' Campaign for the Environment, L.I. Progressive Coalition and the League of Women Voters. Also on the Roundtable are six representatives from industry and industry organizations. Dr. Schubel is a representative of academia, and I operate as a sort of executive director for want of a better title.

We see the Roundtable as a Forum for Discussion and Debate among these diverse groups, as an Information Resource, as a Problem Solver, as a Coordinator and Facilitator and, we hope, as a Shaper of Policy.

The Roundtable acts as a **forum** where these diverse groups can discuss urgent economic and environmental problems. For example, we have all agreed that industry on Long Island should attempt to develop in areas where the necessary sewage infrastructure exists. We also agree that development should be encouraged in already developed areas rather than in pristine areas. What we are now discussing are the means to accomplish these goals.

We are also discussing what can be done to improve the energy situation on Long Island. Everyone agrees that energy costs are a major factor in preventing the improvement of the Island's economy. How to address this situation is the subject of a lively debate.

Discussing these issues and finding common ground is much healthier than hearing environmentalists and business people calling each other names in the media, or even worse, engaging in expensive lawsuits.

The Roundtable is attempting to act as an Information Resource by preparing a brochure which will supply the names, addresses and phone numbers of all the individuals on Long Island that are part of the environmental regulatory community. It is hoped, that in the not too distant future, a business that wants to come to Long Island, or one that has a particular environmental problem, can look up the subject, i.e., wetlands, solid waste, superfund sites etc. or look up the name of the municipality and find the individuals involved that should be approached to discuss the particular problem.

In addition, the Roundtable plans to develop a database of all environmental regulations, federal, state, county and local municipality so that any individual can enter the database to obtain the information desired.

Also, the Roundtable hopes to build a database of environmental problems that companies have encountered and will describe how they have solved or why they have failed to resolve these problems.

As a Problem Solver and as a Coordinator and Facilitator we will work with companies and regulators to find reasonable solutions that will not compromise our Island's sensitive ecology.

The members of the Roundtable believe that Long Island can have a viable economy without degrading our sensitive environment. In fact this workshop today will attempt to show that we on Long Island can set an example for other areas. The recent Rio conference proclaimed to the world that we can have a viable economy and a sustainable environment.

We, on Long Island, must prove that this can be done.

Before I sit down, I would be remiss if I did not advise you of a short two-day course that will be held at SUNY Stony Brook on September 23 and 24. The subject will be "Doing Business on Long Island." The course instructors will be representatives of the major regulatory agencies on Long Island and the two keynote speakers will be County Executive Gaffney and DEC Regional Director Ray Cowen. The course will include a role playing work session

where attendees will have an opportunity to attempt solution of problems working with county and state regulators. We are very enthusiastic about this course and we expect all participants will find the time well spent.

Thank you for your attention.

**Lee E. Koppelman, Executive Director,
Long Island Regional Planning Board,
Director, Center for Regional Policy Studies**

To address a group of working professionals who are expert in their own areas of particular environmental technologies and opportunities would place a rather gratuitous responsibility on my shoulders. Instead, I'd rather try and put into focus why Long Island should be concerned with this type of program or effort, and why we should be concerned about it at the present time.

In seeking such a focus let me first observe that from a standpoint of the national environment of the United States, four out of five Americans reside in urban areas of the country. In other words, of our quarter of a billion population, 80% of the population not only resides in the urban areas of America, but those urban areas comprise less than 6% of the total real estate of the nation. If we look just to the northeast corridor in terms of the Boston to Washington megalopolis we account for about 20% of the entire American population, or approximately 50 million people living in a rather narrow corridor. If we bring that focus a little closer to the downstate New York area, 80% of the total population of the entire State of New York can be found on approximately one million acres of real estate. In the Adirondack Preserve there are more than 6 times that, or 6 million acres of already dedicated land -- and this doesn't account for the southern tier, the Catskill Preserve, and so on.

When we get specifically to Long Island, this splendid "Emerald Isle" is dead center in the midst of this east coast megalopolitan area. We are

geographically dead center between the Boston-Washington nexus. More to the point, despite the recent geniuses on the Supreme Court of the United States that declared to the contrary, Long Island is an island, and as such is a closed envelope. That makes it an excellent laboratory because there are clearly defined borders. Long Island not only is the center of a major metropolitan area, but is a microcosm of the entire nation. We have every conceivable interface that planners are concerned about. We have the interface between a super-urban area -- the City of New York -- and the suburban communities of Nassau and Western Suffolk counties; and all the problems that relate to this kind of interface. We have the interface between the western suburban areas of Long Island and the rural enclaves that are still extant in eastern Suffolk County. And, then we have the third interface of all of these varieties of human habitation and human activity with the natural regime.

We're a microcosm because the inter-relationships are not merely between the natural regime in terms of human habitation and a limited set of environmental concerns; but, the entire array of environmental concerns including freshwater concerns in terms of groundwater aquifers, and the saline marine environment that has its own peculiarities. And so, with the exception of palm trees and mangrove swamps we could perhaps replicate every environmental problem that would face any type of human settlement anywhere in the United States; and therefore, anywhere on a global scale. While Long Island has the change of seasons and a temperate climate, and therefore no mangroves, we have a parallel in terms of the saline marsh grasses -- the wetlands of Long Island.

We are a magnificent laboratory and this issue of environment and economy is not a new subject. In doing planning for Long Island over the past thirty years the issue of environment and economic development was always part and parcel of the process of developing a balanced growth pattern for the two counties. Were mistakes made? Absolutely! One merely has to read the current newspapers in terms of some of the issues going on in the very town in which we're located, where some developers have received extraordinary benefits from government which certainly were in violation with good planning and good environmental practice. But on balance, Long Island was an exciting laboratory and has produced some very solid results both economically and environmentally.

Let me observe for example, about the issue of wetlands which had been referred to as swamps in the 1960s, and which in some areas of the United States are still attacked as being less than environmentally necessary for a solid environmental community. In fact, the current administration in Washington has taken steps to relax the controls that are already in place in terms of proper management and protection of these most valuable pieces of real estate to be found anywhere on the face of the globe.

Long Island was a pioneer in identifying (building on the work of the Odum Brothers from Georgia) the absolute value and importance to the economy of preserving these wetlands. It was the work of the Regional Planning Board in the sixties that produced a number of results with the support of the State Legislature. One of the most significant was the Tidal Wetlands Act of 1972. This wetlands protection legislation flowed directly from the research carried out here on Long Island.

The creation of the Marine Sciences Research Center which is the host of this program, was again a recommendation of these early efforts. I can cite a host of similar actions. Certainly the issues of groundwater protection which have been of concern to USGS, the Health Departments and the State, since all of the potable supplies that Long Island benefits from come from the ground under our feet is a prime environmental and economic subject. The protection of water quality is obviously very important. Here we are really at the embryonic stage. When I started research on groundwater thirty years ago, the basic measure of water quality was the federal and state standard of nitrate-nitrogen of 10 milligrams per liter. A homeowner using a private well could go to a local laboratory and if the nitrate standard was met, receive a seal of approval that there was no problem with the water. When we did the 208 study sponsored by EPA we were the first in the nation to try and identify organic compounds as a contaminate of this groundwater supply. EPA objected on the grounds that organic testing was research and not "state of the art" and therefore did not comply with the law. We went ahead anyway discovered the ubiquitous nature of organic contamination in the glacial aquifer. The result of that work gave rise to the need for the type of technology needed to adequately measure organics.

Let me just observe that today's Newsday reported the ongoing quest for better measuring techniques because one homeowner on a private well who tested his water annually was given a clean bill of health. The Suffolk Health Department finally achieved additional technical competence and discovered an organic compound that earlier tests failed to discover. It turned out that this individuals' water supply is not up to snuff and for many years the problem was the inability to have the technical equipment to be

able to measure the quality of these aquifers. That is an ongoing problem. Coupled to that is the lack of standards. We do not have a categorical list of what the standard should be in terms of risk assessment, vis-a-vis organic contamination. So, here is an area where we need more science, better science, and the technical equipment to make better, more accurate, more consistent measurements. So there's an economic opportunity right in that field alone.

Let us look at some other aspects of the environment. Since Long Island is a marine environment we have particular concerns with the impact of meteorological events: hurricanes, northeasters, and so on, which have an impact on lives and property protection, and in terms of the marine processes themselves. There are public policy questions that are obviously involved with these issues, but there are also hard scientific issues in terms of the kind of monitoring that has to take place in order to understand what is happening with these coastal processes. And so, the marriage between academia and industry is a most clear one in many areas of concern.

Let me mention another area that is of environmental concern to planners, and that is transportation. It obviously has a spin-off beyond the protection of lives and the expeditious movement of people and goods. It also has environmental consequences in terms of air contamination. We on Long Island are automobile driven. In fact, while Nassau County has been losing population and Suffolk's population has remained stable and the economy is in a depression, the one statistic that still is on the upward curve is automobile registration. Automobile registration is growing at a phenomenal rate, and by the way so is air contamination.

Are there technological solutions that we should be addressing? Here again, Long Island is in the center of such an opportunity. Two of the scientists at the Brookhaven Lab, Dr. Danby and Dr. Powell are the geniuses who have developed and hold the patents on what I believe will be the next century's major ground transportation system. The second generation of magnetic levitation. The reason I believe they have the answer is that the current system is based on attractive magnetic forces, which simply means that the technical equipment has to be built at such close tolerances that one should not exceed the distance between the rail system and the vehicle of more than one-half inch. The "repulsive" system (come to think of it that's a hell of a term for it) that the two doctors have developed would allow a six inch clearance.

From an economic point of view we could develop the technology in the United States that could out-compete the Germans and the Japanese who are the only ones currently developing magnetic levitated trains. In fact, I think it is really objectionable that the United States, who developed the original magnetic levitation devices, now has to buy the equipment from Japan if you want to build such a facility at Disney World in Florida. We could be the center here on Long Island of this technology.

What are the environmental spin-offs? Well, they're obvious. Any opportunity we have to move to clean mass transit in place of what we now have would be an improvement. The economic consequences could be tremendous because we are not talking about a million or billion dollar industry, but ultimately a trillion dollar industry. Long Island could be the center of such production. In effect we're talking about airplane fuselages

without wings, because the carrying compartments have to be lightweight and have to be aerodynamically designed. What better firm to build them than Grumman Corporation? And, in fact, they have already invested millions of dollars of their own money in this field.

Let us look at some other potential technological spin-offs in this area alone. One of the environmental questions that is raised vis-a-vis magnetic levitation is the question of the use of magnets and its impact on the passengers or anyone who would live alongside the guide rails. Thus, the question of magnetic shielding offers a need for new technological development. That is just one area.

We can also talk about solid waste. Once again, being an island we shortly will not even have the luxury of exporting our self-created problems off Long Island. DEC has already informed the towns that this luxury of following the second law of thermodynamics in such a way that we get the benefits and other parts of the United States get the downturn is going to come to an end. That means that we have to solve the solid waste problem right here at home. Here again Long Island has been a pioneer in the nation, in creating a Solid Waste Institute under Dr. Schubel that is the center of solid waste research that hopefully will work with the private sector in developing the technologies to solve Long Island's most serious current environmental and economic problems. One such technology relates to medical wastes. Right now we incinerate it. Are there other technologies? I recently received an inquiry from a firm that claimed to have facilities in several parts of the United States. They use a low temperature solution for the disposal of medical wastes. I do not know if it really works or not. It certainly has to be

looked at and tested. The point is, there may be several technologies that could handle these problems. Here is another area of potential opportunity.

One of the problems we have to face, however, and I'd like to move from the technological to the policy arena, is that we certainly have a conflict between environmental and economic interests. Harold Berger, in talking about the Roundtable, has portrayed these relationships in an optimistic fashion that I wouldn't quite share in terms of my observations. We are dealing at the present time with a coterie of professionals -- be they business people who have technological training or academics, and those who are concerned about the environment but do not necessarily have any academic skills or training or knowledge but have an intuitive concern that the way to protect the environment is to lock it up. He mentioned the Sierra Club among one of the groups. I work with all of these groups. Every study I manage has an independent citizen advisory council, and the paucity of scientific knowledge among them is quite strong, and the unwillingness to recognize the need for economic development is equally strong.

In short, there's a strong movement to use environmental issues as a surrogate for those who wish to stop the world. That is a problem we have to address because we are here today to talk about industrial development. The question is: Can Long Island sustain this? And, my observation is: yes, it can. We have enough existing zoned industrial lands that are outside the environmentally sensitive areas to meet the potential development needs for the next two centuries.

At the heyday of development, Long Island was developing about 200 acres of industrial land a year. That was when Nassau and Suffolk were the two fastest growing counties in the United States. Let me observe most of this development has taken place fortunately in the areas that are not the most environmentally sensitive from a groundwater point of view. And, that is one of the major concerns.

We have 30,000 acres of available vacant land that could be used for these purposes. We are doing a study now, for example, on Calverton airport. Calverton airport has been a facility for forty some-odd years. It is a naval testing device center. It is also an assembly and testing facility for Grumman Aircraft Corporation. For most of that forty years high performance non-noise attenuated military aircraft have been taking-off and landing on a consistent basis. Now that the nation is going into a peace initiative, there is an opportunity to diminish the military, and to increase some of the economic potential that could be a benefit to Long Island. It doesn't necessarily have to mean increased flight operations. At the present time I'm doing a comprehensive study to try and see if there's an economic feasibility for this kind of work. That piece of property has 7,000 acres of land purchased by the United States Government, 3500 acres are within the fence-line of which Grumman occupies approximately 900 acres with their industrial plants with a current employment of about 2500 people.

There are many opportunities in terms of what we are here to talk about today that perhaps could be sited at the Calverton facility. Before I was introduced, I was talking to Phil Palmedo about some of the questions of environmental technical opportunities. He said, *"You know the Calverton*

facility could be used as a center for research and for development that is non-aviation related." The field could be used for that purpose.

However, we have a climate which is not as rosy as I heard depicted. There are those who have a scorched earth policy; namely they are here, burn all the bridges, and anyone who is interested in economic development is obviously the enemy and evil and suspect. I don't think that should be downplayed because that is an issue we have to face, and it also relates to the way government responds. We also have to talk about government regulation.

Let me give a biased point of view which may be echoed by some of you who are in the private sector. Quite often when government regulates it doesn't know what the hell it's doing. It regulates because the politics mandates regulation, or it regulates because of the absence of better knowledge. The politicians and bureaucrats figure "let's play it safe." I have been guilty as well. A special groundwater study that I prepared looked at the question of the carrying capacity of these special groundwater areas vis a vis the aquifer. When I conducted the seminal 208 study, the answer was one acre zoning; because, with one acre zoning you would not exceed 60% of the existing State nitrate standard of ten milligrams per liter. That more than protects the public health. But, what about organics?

Well, we don't know a hell of a lot about organics so we did some USGS modeling and they said, *"If you do the following things you could allow one house per half acre. No problem with organics."* Keith Porter of Cornell University disagreed. If you really want to have zero probability (and there is

not such thing actually) let us go to five acre zoning. On the sixty member advisory committee everyone of the regulators -- the planners including my own staff, DEC, the Health Department -- all said they could not support any recommendation beyond two acres. I fought for five acres. The argument was, *"Look, we really don't know. What happens ten years from now if someone says yes, there is a relationship between the organics in the ground water and various carcinomas."* I do not want the responsibility of having blown the opportunity to be safe rather than sorry. What does that decision mean in terms of development?

Fortunately it's not a negative because most of these special groundwater protection areas are already in five-acre zoning. The additional restrictive zoning affects less than 3% of the real estate. Being safe rather than sorry makes a certain amount of good sense. Does that satisfy some of the so-called environmentalists who go door-to-door huckstering money on the basis of fear? The answer is no. They go and tell people and scare the hell out of them that the drinking water is not being protected.

Drinking water supplied by public purveyors on Long Island is the highest quality of water in the world! That includes Perrier and all the rest. We don't have benzene in our water. We do not artificially carbonate. The public water suppliers are monitoring for organics, and the most they can do in the absence of standards if they discover organics are diminished down to a few parts per billion. We need a better knowledge base in order to deal with some of these concerns. Let us look at another area of regulation.

Solid Waste. It was my 208 study that identified the plumes coming out of the Syosset Landfill. We said let us not continue landfills in the deep recharge areas. It is going to take two centuries before the plume from the Syosset Landfill works its way out into the marine environment. But, at least if it is closed the environment will be on the upturn rather than downturn.

What about the eastern communities that are not in the deep recharge areas and have a limited population, a limited generation of solid waste, and a relatively clean solid waste? We ran tests. Monitoring wells were placed right in the middle of the East Hampton Landfill and no contamination plume beneath the landfill could be detected. The State in its wisdom in writing the Landfill Law as administered by DEC became "holier than the Pope" in terms of the gag about converts to Catholicism winding up holier than the Pope himself. This phenomena applies to solid waste as well. Instead of being able to use logic and reason and say there isn't a real problem, the eastern towns are now facing litigation. Once the law was passed it became a political problem, and the effort to try and amend the law becomes a sizeable political public policy problem.

How do we address solid waste? One way is to incinerate. Incinerators are unpopular because no one wants an incinerator in their backyard. There's a group running around saying we have the answer. A group called NYPIRG. They hire college kids, they run door-to-door, they hustle money. They've got the answer. Recycle everything. That's the Barry Commoner approach. I've got news for Barry and NYPIRG and everyone else, and that is total recycling for a variety of good reasons doesn't work. One of the most basic reasons is economic.

The net result is that the County, which had started a paper recycling program, discovered that they created a mountain of paper almost as big as the Dennison Building and no customers for it, so they stopped the recycling program. Many of the towns who got good public relations out of recycling would take the stuff in the front end so the citizen's thought they were doing a marvelous job -- "*we're doing something for Mother Nature, we're recycling.*" The towns picked up the stuff, segregated it, and then it wound up in the landfill because there was no market for the stuff. And this is true on a national scale.

What does that connote for our concerns here today? One of them is can we develop better technology to handle solid waste. There sure is a need for that. I think most of you are aware of the saga of the Town of Hempstead which was sold a bill of goods by a company that was in the paper pulp business and the paper pulp business was getting a little slow so they determined that they'd go into solid waste since the paper pulp process is sort of an incinerator process itself. The only problem is you have to wet the material when you are making paper pulp. So they built an incinerator in Hempstead. They received no guidelines from DEC except the mandate to close landfills. The town was on its own to pick the technology.

Here is an instance where you have elected officials none of whom were even engineers, let alone specialists in solid waste, who had no one in town government qualified in solid waste. When the entrepreneur said, "*Trust us and we'll build it.*" You don't have to pay for the construction but you'll pay for it in terms of use. The town felt they were off the hook. The town could build this modern new incinerator, and comply with the State law. Did DEC

come in and say here are the technologies you should use? No! No real guidance. They put up the facility and then lo and behold dioxin, furan, and stink right in the middle of Hempstead, the largest town in the State of New York with 800,000 people was the result. What was the technological solution? They blew it up, or rather they blew it down -- they imploded it. They dynamited it. I don't know, a hundred and fifty, two hundred million bucks. What the hell!

These are some of the concerns I have with the way regulations and the absence of knowledge is addressed in these environmental issues. If there is one argument I would raise, and it is a subject that Jerry Schubel and I have been involved in ever since we interviewed him to bring him up from Chesapeake to head the Center here, was the absolute need for the integration of the best possible science into the environmental process and that is the ingredient that has to be in place if any sense is to come out of this conflict between environment and economic development. And the thesis is quite simple. We should not be making intuitive environmental judgements. Environmental policy should be based on the best science possible.

How are we going to get this science? We have a number of universities, colleges beyond the Brookhaven Lab and the Cold Spring Harbor Lab and State University at Stony Brook where excellent undergraduate programs from the technical level to the more advanced level in the basis sciences are taking place. One of the strongest segments of our economy are the 20 institutions of higher learning that are providing the kind of qualified labor

force which also makes this a center for economic development. Out of this science hopefully we could make better environmental decisions.

On solid waste, for example, one of the former heads of the environmental segment of the Suffolk Health Department Dr. Andreoli observed that the State law banning landfills was asinine because some of these landfills which had been in existence for thirty years had already developed the established plume pattern, and merely by closing it down is not changing one single iota of the impact of that landfill on the environment in terms of the subterranean aquifers. Therefore, one might be able to build a better case to say those are precisely the areas that should be maintained as landfills. You write them off particularly if they are not impacting on the groundwater aquifer. Of course that runs in the face of environmental lobbyists.

I am not here to attack environmentalists because I will defer to no one in terms of my credentials, or Jerry's credentials as an environmentalist. What I am arguing for is the best possible science base on which to make these decisions. Nothing is more frustrating than when you even achieve the scientific knowledge and then you find yourself in the position of the naysayers saying well, you know we don't care about the facts. That in part is what we're up against. And so, the question of environmentally-based technologies couldn't be more appropriate because this is the best laboratory in the United States, and the combination of technological firms working to develop the equipment, the methodology, and the measuring skills will move the state-of-the-art forward to the point where we can honestly and more comprehensively address these questions.

In the absence of this base, we are going to continue to guess at what public policy should be and we're going to continue to have this trade off and conflict between economic development and the protection of the environment. In my judgement, at the present time, the environment of Nassau and Suffolk County is at an extremely high order. The water supplied to the public is among the best in the world. Air quality could be improved, but being next to New Jersey and New York City with prevailing winds coming from the west is a problem. Fortunately, New Jersey is beginning to clean up its act. But, in every other aspect, if we improve our transportation nexus, the quality of life for our citizens of Long Island could be a model and a paradigm for the nation, and will enable Long Island to continue to be among the top ten communities in the entire nation.

I certainly compliment you people for participating in this most important conference and I'm anxious to see the results of the panels this afternoon.

J.R. Schubel,
Dean and Director, Marine Sciences Research Center,
Co-chair, Long Island Environmental-Economic Roundtable

Following Lee brings to mind the cartoon of the two deer standing beside each other during deer hunting season, one with a target on his side, bullseye and all. The other turned to him and said, "Bummer of a birthmark." That's what it's like following Lee Koppelman on any program.

We are here today to try to turn some of the environmental problems that Lee has described so eloquently into opportunities. Long Island has many environmental problems -- real and perceived. Both categories can and should become opportunities for us. Today is the first in what we intend to make an ongoing series of meetings and forums in a search to turn Long Island's environmental problems into opportunities. We want to stimulate technology transfer; to transform Long Island into the environmental technology transfer capitol for the rest of the world. That's really what we are trying to do! If you want to be more conservative, you could settle for the rest of the country.

Let me quote from Gus Speth, President of the World Resources Institute. *"Environmental factors should be seen as opportunities, since demands for ecological responsibility are creating markets for new processes, products and services. Yet, despite the enormous possibilities, environmental issues are left out of most discussions of national competitiveness, trade and technology policy."*

Speth is right. We are looking for ways that technology and technology transfer can contribute to sustainable development on Long Island. We are using the terms "technology" and "technology transfer" in the broadest senses -- using the best knowledge we have to solve problems and to create opportunities. That is what technology transfer is.

I mentioned the phrase "sustainable development", as have a number of others. I like the definition that sustainable development is *"social and economic development that meets the needs of the present generation without compromising the ability of future generations to meet their needs."* That's really a good way of putting it and we can make it even more positive than that for Long Island. We can tailor it to Long Island by saying that we should be working to sustain development so that those of us who live here now can meet our social and economic needs and at the same time enhance the ability of future generations of Long Islanders to meet their needs. I think we can. Indeed, I know we can on this Island that is "long on innovation."

Growth doesn't equal development. Growth means to increase in size by assimiliation or accretion of materials. Development means to expand or to realize one's potentialities. When you grow, you get bigger; when you develop, you get quantitatively, or at least qualitatively, better or different. There does not have to be a conflict between development and the environment, if we put development in this context. We have and we need to maintain a clean and healthy environment, but we have to do more than that if we want to have a bright future for present Long Islanders and for those who are going to come after us.

In the new book, "Beyond the Limits" the authors state, *"We see the economy and the environment as one system."* So do we. I think all of us who are here today see Long Island's environment and its economy as one system. So you might ask, what's the role of technology in making the economy and the environment a unified system? Let me quote from a different report: "Transforming Technology: An Agenda for Environmentally Sustainable Growth in the Twenty-First Century." That report states: *"Rapid technological change stands as the key element in reconciling inevitable economic and population growth with a livable environment."* The statement is dead center on target. The only way that the planet's mushrooming population is going to be able to live in harmony with the environment is with a major contribution from technology. It is developing countries where 95% of the population growth is going to occur which face the greatest challenges; countries which have no infrastructure to deal with their wastes. The level of harmony we achieve with the planet will be coupled tightly to the evolution and diffusion of technology.

Let me mention just a few of the important areas of technology.

Biotechnology. Biotechnology is in its infancy, not just on Long Island but everywhere. Biotechnology has enormous potential in the environmental field. In terms of agriculture, biotechnology might conceivably eliminate the need for pesticides and synthetic fertilizers, but this might not represent an unequivocal environmental gain. It would contribute to a further loss of biodiversity and when we lose biodiversity, the vulnerability of crops to being wiped out by disease increases. And, we don't know what the interactions are of bioengineered systems with natural systems.

Materials. Better composite materials typically perform better than conventional materials on a per unit weight basis. No question about it. They require less raw material to manufacture and they produce less waste. On the other hand, they are a "bugger" to recycle. We don't know how to recycle most composite materials. Also, in general composite materials contain more toxic substances than do materials that are made from single, simple components.

Information Technology. An enormous growth has taken place in this field and the potential for further growth is enormous. According to the OTA, two years ago information technology accounted for more than 40% of all the new capital investment in the United States. How does information technology affect the environment and environmental opportunities? In many different ways. For the first time we're able to think about real time monitoring with chemical and biological sensors so that we can actually target and monitor individual sources. Also, perhaps for the first time we can think seriously about converting enviromental data into information that gets used by decision makers in a timely way. The combination of technological advances in effluent monitoring and information processing offers a plethora of opportunities that has yet to be exploited.

Dematerialization. Dematerialization represents a technological shift away from economies that are based upon large and increasing amounts of raw materials. We are seeing a dematerialization movement throughout much of the world. Information is what replaces material. So, again, it's an opportunity.

Toxic and Hazardous Waste Management. It's a growth industry. Recent predictions indicate that by the mid-1990's toxic and hazardous waste management in the United States will be a $30 billion a year industry. In 1991 Dupont announced a new environmental services unit. They predict that by the year 2000 it will be a $1 billion a year business for Dupont alone. Chevron predicts a 10% per year increase in their division concerned with pollution control and prevention. That would make that segment of Chevron the most rapidly growing area for that corporation. When reviewing the opportunities in environmental technologies the Conference Board of Canada made the following statement: *"The task of building an environmental industry is the great enterprise in the 1990s and beyond."*

Energy Conservation. As we all know, Long Island has the highest electrical energy costs anywhere in the country and the delta between our costs and the rest of the country is increasing, not decreasing. Although energy conservation will drive up the costs of electric energy on Long Island, there are compelling reasons for Long Island to take a leadership role in conservation of electric energy.

Nearly 40% of all U.S. energy is used in the commercial sector; 66% of it to heat and cool buildings. Are there enormous gains to be made? Absolutely. There are super-insulated homes that are now in Scandinavian countries and in Minnesota that use anywhere from 10% to 25% of what is used in an average U.S. home in terms of heating and cooling. In this country alone, every year the loss of energy because of poorly designed windows is

equivalent to the energy from a full year's Alaskan North Slope oil production.

Long Island -- The Special Problems and Opportunities. Lee Koppleman has already covered much of this. Let me just highlight a few items. We've got all of the global problems here on this one Island wrapped up in a nice beautiful package. A unique package

- Garbage -- we have the highest per capita production of MSW in the world, >2x the U.S. average.

- MSW Disposal Options -- the number Long Island has is (n-1) where n = the number of options everywhere else in the world has. We eliminated landfilling.

- Recycling -- our location puts us at a disadvantage, a disadvantage that will increase as New York City comes on-line. Am I suggesting we back off from recycling? Absolutely not. I am suggesting that we get out front... in developing markets... in developing uses for secondary materials... in demonstrating leadership in all aspects of recycling. We must develop regional strategies!

- Groundwater -- Long Island has a sole source aquifer; an aquifer that requires protection. It led to the Long Island Landfill Law and to a number of State and County regulations controlling discharges of wastes into the

ground. Those regulations are necessary, but they make it difficult to do business on Long Island.

- Sewage Treatment Plants -- from the standpoint of industry and the environment, we have too little access, particularly in Suffolk County, to sophisticated sewage treatment plants.

- Coastal Waters -- A major problem is eutrophication, over-enrichment by nutrients which leads to depletion of dissolved oxygen. But before hypoxia occurs, it may lead to shifts in phytoplankton assemblages and to losses of submerged aquatic vegetation. The sources of nutrients are many -- point and non-point. They are expensive and complicated to control. There have been no major advances in wastewater treatment technology for decades. The stakes are high for Long Island.

Another major problem of our coastal waters is pathogens -- bacteria and viruses -- that pose a growing public health threat. They lead to the closure of beaches and shellfish beds; to the loss of important resources and to the loss of enormous economic potential for Long Island and the greater New York City metropolitan area. Again, the sources of pathogens are numerous and difficult to control. New York State already has two estuaries in the National Estuary Program: Long Island Sound and the NY-NJ

Harbor estuary. We expect that a third -- the Peconics Estuary -- will be named within a few weeks. This would make New York the only state in the nation with three estuaries in this National Program; three estuaries of "National Significance."

Long Island has a greater diversity of coastal environments than any other area of comparable size in the country, perhaps in the world. And more people make a greater diversity of demands on those resources than on any coastal area of comparable size anywhere in the world. This combination -- the rich diversity of natural environments and the intensity of human uses -- makes Long Island the world's best coastal laboratory. These have been the two themes that have guided the development of the Marine Sciences Research Center for nearly two decades.

- Air Pollution -- a growing concern for the region, particularly the western portion of the region. Not only in terms of pollution of the atmosphere itself but also as a contributor of pollution to our coastal waters. The direct deposition of a number of contaminants from the atmosphere on Long Island Sound may be the dominant source of these materials: Cu, Zn, Pb, PCBs, PAHs. The Clean Water Act takes on added and unusual importance to the Long Island area.

- Environmental Monitoring -- As a nation we spend more than $130 million each year on marine environmental monitoring and another several hundred million per year on compliance monitoring. A recent National Academy of Sciences review of marine environmental monitoring painted an unflattering portrait of the value of most of the present programs. The programs were characterized by large expenditures of money to generate data with relatively little attention being directed at transforming the data into information that is, or could be, used by decision makers.

  We in New York State spend large amounts at the State, regional, county, and town levels on monitoring with only modest benefit. This is an area of enormous opportunity for Long Island; an opportunity enhanced by the regions two (soon to be three) estuaries in the National Estuary Program (NEP). Each participating estuary in the NEP must design and carry out an environmental monitoring program.

Albert Einstein once remarked *"The significant problems we face today cannot be solved at the same level of thinking we were at when we created them."* This statement rings true for Long Island and for the region's, the nation's and the planet's environmental problems. We need new ideas, new concepts, new insights new paradigms. We are here today to begin a

sustained process to turn Long Island's environmental problems into opportunities.

It is now time to break up into working groups.

When we return to plenary, we want each working group to report back to the entire group on its findings.

WORKING GROUP REPORTS

MUNICIPAL SOLID WASTE

R.L. Swanson, Facilitator,
Director, Waste Management Institute,
Marine Sciences Research Center
University at Stony Brook

Jennifer D'Urso, Rapporteur

An assumption was made by the group that the National and State goals were operative to reduce the volume and level of contamination in the waste stream. Some of the highlights of the discussion included:

1. Incineration probably will have to be relied on to a greater degree in the near future because of the over saturation of world markets with recycled materials.

2. Improved systems for up-front separation of recyclable goods and otherwise compatible materials in the waste stream are needed. These include separation for a variety of waste

technologies including MRFs, composing operations and incinerators.

3. Improved incineration technologies are needed. Even existing modern well run incinerators depend on decades-old technologies. "Smart" incinerators are needed that can more effectively target the type of waste passing through the system. These incinerators would more completely combust the wastes, thereby minimizing the level of contamination in ash or air emissions.

   Reconsideration of pyrolysis and waste distillation is worthwhile. Suitable demonstration programs are needed to properly evaluate the effectiveness of these systems.

4. Composting technology for MSW must be improved in order to improve the quality and consistency of the product. Unless this can be achieved, this technology for MSW will probably fail, as sewage sludge and yard waste composts will probably produce a higher quality product.

5. International exportation of MSW should be considered. There are countries that desire this type of material and barriers to international trading of it should not be put in place. Quality control measures would be needed to assure that toxic materials were excluded.

6. Capital and demonstration programs are needed to encourage innovative technologies. This money must come from the federal government as towns, counties and the private sector will not be able or willing to fund these projects. Studies of the environmental effects of these technologies will be needed. The approach of linking private business with universities to carry out these studies as is currently encouraged by the New York State Department of Economic Development (DED), however, may not be appropriate. However, the approach of linking private business with universities may not be appropriate as is currently encouraged by the NYS DED. This is because entrepreneurs often cannot afford to contribute to environmental studies or do not want to have such problems identified.

7. Processes and products directed toward making secondary materials need to be perfected and encouraged. The fledgling plastic lumber industry is an example of an enterprise that has made some positive contributions in this regard.

8. While environmental education is being encouraged in schools, it is not balanced with education concerning economic growth and development. These issues are on a collision course globally and must be more effectively addressed.

SURFACE WATERS

Thomas Wilson, Facilitator,
Director, Division of Ocean Engineering
Marine Sciences Research Center,
University at Stony Brook

Jiong Shen, Rapporteur

Several areas were identified during the group discussion that constitute opportunities for commercial development of environmental technology as it relates to the monitoring and protection of surface waters.

1. **Stormwater Contaminant Remediation.** Stormwater runoff represents a significant and largely uncontrolled source of contaminants to the aquatic environment. Pollutants include chemical and biological contaminants as well as floatable wastes. The nonpoint nature of storm drain systems and the relatively dilute nature of stormwater contaminants makes the use of conventional wastewater treatment methods impractical. Low-cost methods need to be developed to screen or filter at least some contaminants from stormwater before it is released from drainage systems.

2. **Water Quality Monitoring Systems**. Ocean instrument manufacturing companies typically are small entrepreneurial firms founded as spin-offs of oceanographic research centers such as the Marine Sciences Center of USB or the Ocean Science Sciences Division of Brookhaven National Laboratories. Rapid technological developments in a number of fields are providing a constant flow of opportunities for new monitoring products or for improvement in existing product lines. Great potential exists for the development of products that are more cost-effective than existing equipment. This strategy would capitalize on an existing market. Additionally, the lowering of costs and development of more "user friendly" equipment should lead to a significant expansion in market size.

Examples of potential products are:

A. Pollution Buoy: Automatic water quality monitoring station with real time or near-real-time telemetry to shore. Records data such as wind, tide, salinity, temperature, and dissolved oxygen. Such a system should be relatively low-cost (<$10-20K each), flexible, and modular for future expansion.

B. Low-Cost Current Meter: Economical (<$6K each), small device for recording time series of water speed and direction, with optional salinity and temperature recording. Should be able to interface with pollution buoy above.

C. Recording Fluorometer: A working recording fluorometer has been developed by Brookhaven National Lab and used for several years, but no commercial unit exists.

D. Organism Tracking Systems: A need exists to track and identify organisms as they move into and out of contaminated areas. Such systems have been developed to monitor salmon as they move past fish ladders, but need to be adapted to fit on smaller animals (1 pound fish versus 20 pound fish).

3. **Environmental Sensor/Equipment Manufacture.** Many manufacturers of environmental equipment tend to be small because the smaller individual end-markets (oceanographic, freshwater, air quality, aquaculture, agriculture, etc.) demand specialization that may not be applicable across the environmental spectrum. A larger market exists for manufacturers of environmental technology equipment that can be sold as OEM subsystems to a variety of the more specialized "niche market" equipment manufacturers. Some examples of potential areas for development include:

A. Telemetry Equipment:

*Cellular phone. Cellular is a cost-effective telemetry option in many urban areas. An OEM board-level cellular phone and modem combination would be usable in many applications. Problems with data glitches caused by cell-

to-cell hand-offs are not particularly important in this application because most instruments are stationary.

*Acoustic telemetry. It would be useful to transmit data from submerged equipment in areas where hardwiring is expensive or impossible because of vessel traffic or dragging operations. Even a low speed (300 or less baud rate) and short range (500-1000 meters) link would be usable.

*Satellite telemetry. The US/French ARGOS system currently provides one-way data telemetry from anywhere on earth using low-power data transmitters. Plans are underway for higher-rate and bi-directional satellite systems for a growing global network of remote environmental monitoring systems. Development of the ground-based segment of this next-generation telemetry equipment is needed.

B. Chemical Sensors: Robust sensors that can withstand deployment in the environment for periods of weeks to months are needed for a variety of chemical species. Currently, lab-based analytical techniques are the only practical method of analysis for many of these compounds. Fiber-optic technology may hold some promise for field-based analyses.

Some of the sensors of interest include:

* Dissolved oxygen sensors. There is considerable controversy at present on the long-term (weeks to months) stability of current sensor technology.
* Nutrient sensors, including nitrate, nitrite, and phosphate.

C. Low-Power Computer Products. Micropower OEM computer boards for use as controllers and data storage engines. Needed capabilities include digital and pulse I/O, analog inputs with resolution of 12 bits or greater, solid state storage from tens to hundreds of kilobytes, and semidisk or hard disk storage to tens of megabytes. Software development in high-level language should be supported. Average power consumption should be a maximum of a few hundred milliwatts for operational endurance of weeks to months on battery or solar power.

GROUNDWATER

Martin Schoonen, Facilitator,
Assistant Professor, Department of Earth and Space Sciences
University at Stony Brook

Anne Mooney, Rapporteur

Members of the working group were asked to list opportunities and/or problems relating to groundwater protection, remediation and pollution prevention which would help to promote sustainable economic development on Long Island. The group came up with a list of ideas which were then grouped into the following categories:

I. Technologies that are needed in groundwater remediation efforts;
II. Policy issues affecting local businesses;
III. Educational needs and opportunities.

I. Technologies:

The group identified several technologies that are needed to detect and monitor the movement of organic contaminants in Long Island's glacial aquifer.

- There is a need for a probe capable of measuring groundwater flow and direction which can be driven into the ground manually, and which can be used without the time and expense of drilling monitoring wells.
- There is a need for an *in situ* probe capable of identifying organic contaminants in a plume; again a device that can be used without drilling a well.

The group also identified technologies which are needed in the remediation of contaminated aquifers:

- There is a need for improved VOCs (volatile organic contaminants) removal equipment.
- There is a need for techniques to prevent the transport of VOCs to the saturated zone.
- There is a need for the development of techniques and equipment to remove non-aqueous liquid products (light residual oil products).
- There is a need for new techniques for the *in situ* remediation of soils, including bioremediation and mechanical techniques such as vapor extraction.
- There is a need for development of techniques for the removal of dense non-aqueous petroleum products (i.e. contaminants which sink below the water, down to the clay or bedrock).
- There is a need for the development of *in situ* remediation techniques for groundwater (injection techniques).

- There is a need for bioreclamation techniques that are effective on chlorinated compounds.

The group also identified several areas where the development of technologies to prevent groundwater contamination are needed.

- Development of materials for use as landfill liners which would be self-sealing and would prevent leakage from cracks.
- Development of leak detection devices for landfills.
- Companies need to focus more effort on minimizing their waste stream through technological innovation.
- Design of industrial facilities should include measures to limit the impact of accidental releases of pollutants.

II. Policies:

The group identified several policy areas where greater cooperation between regulatory agencies and businesses is needed.

- There is a need for regulatory agencies to serve in an advisory capacity, in particular, they need to provide guidelines for clean-up procedures;
- The regulatory agencies need to apply environmental regulations more consistently, several members of the group felt that rulings were not applied consistently;
- There is a need for improved collection and sharing of hydrological data between government agencies and

businesses which are involved in groundwater remediation activities;

- Sites for the disposal of household "hazardous wastes" should be more accessible to the public;
- Markets for recycled goods need to be encouraged
- Provide tax incentives to encourage the location of certain water intensive industries in areas requiring groundwater remediation. In order to make of "pump and treat" remediation efforts more feasible economically, certain water intensive industries could be encouraged to use contaminated water in their processes. Once the water had been used it would be treated before being disposed of. This proposal would only be appropriate for industries which don't require pure water in their processes and which would normally have to treat the water that they use anyway (papermills were cited as an example).
- Promote the economics of clean groundwater on Long Island. There are a number of industries that require pure water, including pharmaceuticals, biotechnology, semiconductor manufacturers, and bottled water companies. Groundwater should be protected and these industries should be encouraged to move to Long Island.

III. Education:

- There is a need for the development of educational materials to aid in teaching children at the primary, secondary and college level about groundwater processes

and problems. Computer programs or a "hands-on" model could be developed and marketed commercially.

- Information packets should be developed to educate homeowners about preventing groundwater contamination via improper disposal of household chemicals. Homeowners in special groundwater protection areas should be targeted.
- The group proposed that a Long Island Institute for Groundwater should be established to serve as a modelling center and an informational resource for industry, government agencies, universities and the public. The group noted that such an institute would not necessarily require much additional funding. For example, the Earth and Space Sciences Center at Stony Brook already has most of the resources that would be needed if the Institute were to be located there - at this point they have no hydrologists on staff.

AIR POLLUTION: EMISSION CONTROLS AND MONITORING.

Stewart Harris, Facilitator,
Dean of the College of Engineering and Applied Sciences,
University at Stony Brook

Joe Napolitano, Rapporteur

Conclusions and Recommendations

1. Newsday should be encouraged to include an air pollution report, summary and forecast, in their daily weather report. Data are available for this. This is done in some states, e.g. California, and is a factor in promoting public awareness.

2. Current major sources of air pollution problems on LI, excluding western sources, are transportation, residential space heating, and incineration.

3. The need exists for inexpensive, reliable, user-friendly monitoring instrumentation for SOx, NOx and trace metals. This is an area that LI industry (electronics) could compete in.

4. Small companies need access to technical resources that SUSB and BNL can provide. An electronic bulletin board or newsletter and regular meetings (bi-yearly) would be a valuable asset for these companies.

Discussion

We identified what seemed to be a number of outstanding opportunities; one was in the area of emissions, of monitoring all emissions, but particularly trace metals. We identified a specific technology that had been developed at

Brookhaven National Laboratory. We hope that one of the industrial people present will follow up on. We also identified control of NOx and possible actual conversion of NOx to more innocuous substances as a particularly promising area of opportunity.

Among the issues that ran through our discussions were the problems that small companies have in trying to do research and development. Of course, this is not a problem that originated in this particular context. It is something that we have seen in all the meetings that I've attended at the University which involve industry, the University and the Brookhaven National Laboratory. Information flow is a problem.

The collaboration and the effectiveness of those technology transfer processes that are in place is a problem. In other words, we know the University and Brookhaven National Laboratory are making extensive efforts in technology transfer, but these are not yet perceived as being as effective as they should be from the point of the small companies. We also talked about the access those companies have to the resources of the University and the Brookhaven National Laboratory and the possibility of some of those companies utilizing students at the University in their research projects. We pinpointed the need for a focus of responsibility for getting out this information and everybody was pretty much in agreement that we really should be holding quasi-regular meetings of this sort because one of the benefits is not so much in the specific ideas we come up with but just in the networking that takes place, and looking forward to subsequent prospects for that interaction. So I will take the responsibility of ensuring that while I am away you reconvene our group and then I will pick that up when I return.

BIOREMEDIATION OF WASTES: THE USE OF BIOTECHNOLOGY TO REMEDIATE ENVIRONMENTAL PROBLEMS

Richard K. Koehn, Facilitator,
Director of Center for Biotechnology,
University at Stony Brook

Jeanne Gulnick, Rapporteur

Bioremediation, like all aspects of the application of biological systems to problem solving, is a relatively new industry. Biotechnology is an emerging industry and bioremediation is a very tiny slice of biotechnology. The general sense is that one day bioremediation is going to explode onto the economic scene because it is concerned with new technologies relevant to fundamentally important problems of society; problems that we not only create everyday, but problems that we've been creating for hundreds of years and that need to be attended to. As a new science, or a new area of technology, a great deal of development needs to take place before it matures to the point of being a significant economic factor. Those are the areas we tried to identify -- combinations of business opportunities with science/technology.

One opportunity, but not necessarily the most important, is marine bioremediation. That is, bioremediation of marine systems. There is essentially no activity in that area. Many of the technologies that are applied to remediation of environmental pollutants in terrestrial and fresh water situations simply don't work in marine environments either for physical or

for chemical reasons. We think the Marine Sciences Research Center should take a lead in this area.

Let me turn to another area of opportunity. Much of the environmental bioremediation that is done is through the application of natural flora. That is, you go to a polluted site, dig up a sample of the natural assemblage of microorganisms, take them back to the laboratory, culture them, and then reintroduce them in to the degraded site. This strategy is contrary to the conventional concept of genetic engineering in the laboratory. In the latter, an organism is developed that is specifically adapted to attacking the specific problem. Both strategies are appropriate approaches. The former causes less concern among the public. Even if the assemblage of natural organisms isn't effective in bioremediation, nothing new has been introduced into the environment.

The point is that there is no real functional connection between what's going on in laboratories and what's needed in the field for bioremediation. It is in that middle ground where there is enormous opportunity -- where technologies need to be developed, where laboratory approaches need to be enlarged and enhanced and tested for their applicability to real field situations. There's lots we know. There's lots of money available for lab work on this sort of subject. There's very little money available for development of biotechnologies for remediation.

The third general area is one of great potential because of the common features shared between traditional medical biotechnology and bioremediation -- problems in the engineering of remediation. These

include physical problems that might be solved by the application of certain biologicals that could derive from microorganisms. For example, the products of research might be microorganisms that control the absorption and desorption of pollutants on particulate matter by altering the biological-physical interface.

A fourth area, one which we spent little time talking about, but which we think is an important area to consider is detection and environmental diagnosis. That is, using living systems for detecting levels of pollutants. I would say that this strategy has far more potential than an environmental backpack described by the next group. We think we ought to be moving away from a mentality which thinks about pollution in terms of one part per trillion of ten parts per billion or anything expressed in terms of concentrations because we don't actually understand the significance of whether these numbers represent good or bad environmental conditions. They are selected because we can measure them. We ought to be moving toward the use of biological measures -- bioindicators and biomarkers -- to assess the effects of pollution and of how effective clean-up has been.

Finally, we spent some time thinking about Long Island's specific characteristics and opportunities. We think we could take care of just about any waste and contamination problem. For example, we figured out we can take care of the garbage problem (we see that as the biggest problem). First, we bury the garbage. Then we capture the methane that is being produced by this garbage and use that to solve the energy problem. When the garbage stops producing methane, we dig it up and burn it. We take the ash and

bioremediate it to take the metals out. That reclaims the metals and now we have ash which we know we can make building blocks out of.

In summary, bioremediation and bioreclamation are extremely important. The area of research that is going on at Brookhaven National Lab has important applications to problems on Long Island.

ENVIRONMENTAL DATA/INFORMATION MANAGEMENT: CONVERSION OF MONITORING DATA INTO INFORMATIONAL PRODUCTS

J.R. Schubel, Facilitator,
Director, Marine Sciences Research Center,
University at Stony Brook

Chongle Zhang, Rapporteur

Our topic was environmental data and information. We identified several topics we are going to follow up.

First, we will convene a one-day forum this fall to explore what the environmental regulations that are now being considered by legislative and regulatory agencies might mean to small companies, and to explore what the implications might be for entrepreneurs. Among the regulations of interest are proposed changes to the Clean Air Act and to the Clean Water Act. We will invite a couple of staffers of key legislators who are drafting those bills and a couple of key agency people who would have to translate the bill into regulations. We also will invite a couple of representatives from key environmental groups, perhaps from the Environmental Defense Fund and the Natural Resources Defense Council.

The second idea we're going to follow up either with a half-day or a full-day session relates to environmental remediation, to clean-ups and environmental audits. As you know, this is a huge job. It's big business. Our

hypothesis is that if anybody develops an instrumented backpack that one can strap-on and walk around a waste site and make an environmental audit, and have those data automatically recorded, that person, or company, is going to become very wealthy. At that forum, we're going to invite some of Long Island's experts on sensors and some of Long Island's experts on computers and information systems. These are specialists who are not here today, but they exist on Long Island in companies such as Grumman, Computer Associates, Symbol Technologies and others. We'll start that session off with a presentation on what has to go into an environmental audit, on what kinds of data and information must be generated. We'll follow that up with a discussion to see what good ideas we come up with.

The third idea we're going to follow-up is Suffolk County's proposed "one-stop shopping service" to get all the permits that one would need to start a business or expand an existing one. We're going to explore the "one-stop shopping" concept which County Executive Gaffney and the Suffolk County Department of Health Services are working on which at this point is a manual operation to see if it could be computerized, and as a result, be speeded up even further. This exploration might lead to the creation of an opportunity for the equivalent of an environmental data service.

The last idea that we propose to follow-up relates to some of the new regulations on air toxics -- regulations that require monitoring of 189 toxics. We would like to get together experts on sensor technology and information processing to see if there is an opportunity for development of a portable field package which includes sensors and information technologies that

would permit surveys of individual sources of air pollution. Those are the ideas we are recommending for follow up.

BATHYMETRIC PROFILING IN THE SURF ZONE: A SEARCH FOR SAFE, ECONOMICAL, RAPID AND ACCURATE ALTERNATIVES TO PRESENT TECHNOLOGY

Henry Bokuniewicz, Facilitator
Professor, Marine Sciences Research Center

The working group attempted to integrate the best possible technology into the search for a safe, economical, rapid and accurate method to measure the shape of the coastal zone. We were not trying to solve a problem of coastal management but rather to provide a tool for monitoring beach changes. Such monitoring has been recognized as essential for good management. Four coastal states have extensive monitoring programs in place and New York is presently considering one of her own.

The basic problem is to accurately measure the beach profile from the dune to a water depth of, say, 30 feet which may be as much as a mile offshore. An accuracy of one meter horizontally and 1 cm vertically is sought. To profile through the surf zone, any system would need a response time easily less than one second. It must be portable since a monitoring program would require measurements at hundreds of stations 1000 to 3000 feet apart. It must, of course, be waterproof and preferably operable by 3 or 4 people without a boat if possible.

The traditional rod and transit provide the requisite accuracy and the problem has been one of carrying the rod into the surf zone and the "long-

shots" at the seaward end of a transect line from an observer on the beach. This has been solved in specific cases by the use of waders, divers, towed sleds or self-propelled towers but none of these methods is entirely acceptable for a monitoring program. A method requiring personnel in the water is severely limited by wave and weather conditions. Sleds and towers are slow and labor intensive. We considered the transfer of three technologies to the solution of this problem. These were:

1. Stable platform technology for aircraft has a long history. Such technology might be adapted for use on a survey boat to maintain either a stadia rod or acoustic signal vertically so that it could be continuously tracked with a laser ranging system from shore.
2. Laser communication systems have been developed for submarine communication. Such a system might be applied to do ranging between a mobile instrument package on the sea floor and portable, shore-based towers to determine the position of the instrument package by triangulation.
3. Missile guidance packages rely on inertial navigation systems. If a system of sufficient accuracy was available, it might be combined with a shore-guided autonomous ROV to record seabed elevation along a transect. This approach is particularly appealing since it could be done entirely from shore by a small crew.

The next step would be to consult with experts in each of these technologies to see if sufficient accuracy is technically feasible.

APPENDICES

APPENDIX A

PROGRAM PROSPECTUS

What: A Workshop Sponsored by the
University's Regional Development Task Force

"Turning Long Island's Sensitive Environment And Its Environmental Problems Into Opportunities For Entrepreneurs"

When: 19 June 1992
11:00 a.m. - 5:00 p.m.

Where: The Marine Sciences Research Center of the University at Stony Brook. Challenger Hall Room 165.

How: A group of creative scientists, engineers, entrepreneurs, and decision makers will meet in a workshop to search for ways to stimulate the transfer of existing technologies and the development of new technologies to address some of Long Island's most challenging environmental problems.

How Much: $15/person to cover the cost of lunch and preparation and distribution of the workshop report.

Why: One of the major factors in attracting individuals and companies to Long Island is the quality of its environment. The same environmental qualities that make Long Island an attractive place to live, often make it a difficult place to do business. The sole source aquifer, the sensitive coastal environments, the large population, the contravention of air quality standards . . . all make it necessary to have stringent environmental regulations to protect human health and the environment. These regulations often are cited as impediments to doing business on Long Island. In this workshop we will strive to turn these problems into opportunities.

Some Desired Workshop Outcomes:

1. Increased awareness by L.I.'s technology entrepreneurs of the Island's environmental problems/opportunities.

2. Identification of potential environmental applications for existing technologies.

3. Identification of opportunities for development of new technologies to address Long Island's environmental problems--problems which are not unique to Long Island, indeed problems which are widespread, but which are expressed with particular clarity and urgency on Long Island.

APPENDIX B

TURNING LONG ISLAND'S SENSITIVE ENVIRONMENT AND ITS ENVIRONMENTAL PROBLEMS INTO OPPORTUNITIES FOR ENTREPRENEURS

19 JUNE 1992
Marine Sciences Research Center
Challenger Hall Room 165

Co-sponsors
Long Island Environmental-Economic Roundtable
Long Island Research Institute
Marine Sciences Research Center
University at Stony Brook's Regional Development Task Force

AGENDA

Plenary

11:00 - 12:30 **Welcome and Introductions**
J.R. Schubel

Introductory Remarks
Provost Tilden Edelstein

N.Y.S. Senator Kenneth P. LaValle

Dr. Philip Palmedo
President and CEO, Long Island Research Institute

An Overview of Long Island's Special Environmental Qualities: Grist for the Entrepreneurs' Mill
J.R. Schubel, Co-chair,
Long Island Environmental-Economic Roundtable

Harold Berger, Co-chair,
Long Island Environmental-Economic Roundtable

Lee E. Koppelman, Executive Director,
Long Island Regional Planning Board,
Director, Center for Regional Policy Studies

12:30 - 1:00 **Lunch in Meeting Area**

Following lunch the workshop members will break up into a number of concurrent working groups, each built around a special Long Island problem/opportunity.

Working Groups

1:00 - 3:30

Municipal Solid Waste: Source Reduction, Recycling, Incineration, Composting, Secondary Materials, etc.
[Challenger Hall 165]

(R. Lawrence Swanson, Facilitator; Director, Waste Management Institute of the Marine Sciences Research Center, University at Stony Brook)

Water Quality: Protection Monitoring Restoration: Surface Waters, Groundwaters
[Surface Waters Meets in Challenger Hall 163; Groundwater meets in Endeavour Hall 158]

(Martin Schoonen, Co-facilitator; Assistant Professor, Department of Earth and Space Sciences, University at Stony Brook, and
Thomas Wilson, Co-facilitator;
Marine Sciences Research Center, University at Stony Brook)

Air Pollution: Emission controls, monitoring, etc.
[Endeavour Hall 168]

(Stewart Harris, Facilitator; Dean of the College of Engineering and Applied Sciences, University at Stony Brook)

Bioremediation of Wastes: The use of biotechnology to remediate environmental problems.
[Endeavour Hall 113]

(Richard K. Koehn, Facilitator; Director of Center for Biotechnology, University at Stony Brook)

Environmental Data/Information Management: Conversion of monitoring data into informational products tailored to the special needs of the customer.

[Endeavour Hall 139]

(J.R. Schubel, Facilitator; Director of the Marine Sciences Research Center, University at Stony Brook)

Bathymetric Profiling in the Surf Zone: A search for safe, economical, rapid and accurate alternatives to present technology.

[Challenger Hall 175]

(Henry J. Bokuniewicz, Facilitator;
Professor, Marine Sciences Research Center)

Plenary

3:30 - 5:00 Working Groups report their conclusions and recommendations to the full membership.

Prizes will be awarded in recognition of the best two projects.

APPENDIX C

ENVIRONMENTAL TECHNOLOGIES WORKSHOP
JUNE 19, 1992

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