

The Federal Government should devote its efforts to setting standards, reviewing the data submitted by the independent testing organization for a product to be marketed, and enforcement. It would fall upon the manufacturer to prove safety and the testing organization to document the proof.

I would like to turn now to what I think is the most essential aspect of the task force report—the environmental protection system. Without it, in my judgment, strategy means nothing.

The strategy we recommended was very simple. It was to isolate the environmental insult by degree of severity and attack it with an evolving technology.

To do this, the system is mandatory. The system was obvious once we looked at the functions being exercised by the environmental health agencies of the Department. These functions were research and development, determination of criteria and standards, enforcement, manpower development, public awareness, and intergovernmental relations.

But these functions were not integrated toward a policy of reaching quantitative goals.

We recommended a system which would first, through a research surveillance program, isolate any and all environmental insults individually or synergistically; identify their source, and their composition; and, second, measure and begin to uncover their effect on human health and welfare.

The data from this program would then pass as developed to the environmental design program, where it would be converted into a range of criteria that would incorporate concern not only for health but the socioeconomic factors as well. With this data, Government or Government authorized agencies would set a dual-level standard. The first level would be the immediate requirement based upon the minimum health needs and technology available. The second level would be the next desirable and accomplishable level.

As a result of these standards, the next program in the system, applied technology, would act to advance the state of the art so technology could provide the higher standard.

Finally, the fourth element of the system, compliance, would insure that applicable standards were being adhered to.

The two fundamental aspects of this system, which must be radically changed from present Department approaches if such a system is to work, are the Department's ability to set criteria and standards and ability to conduct an applied technology program. In fact, disregarding even this proposed system, without radical changes in the Department's ability to handle these two programs, nothing it does in environmental protection will amount to much.

Criteria cannot be developed and applied by a variety of agencies. There must be an integration of information, a central source for what I call biblical material. The criteria issued will provide a basis for setting standards and, unlike religion, if this is to work, there can be only one bible. The basic concern is for health responsibility; for criteria development should be within the Public Health Services.

But neither that agency nor any other, Federal or non-Federal, can today do the job of developing criteria, the way it need to be done. And they will not be able to do this job until it is understood what a

vast and difficult job it is. Substantially more manpower than now available in the Department, including ecologists, economists, sociologists, behavioral scientists, as well as physical scientists, engineers, and medical doctors, will be needed.

But more than manpower requirements is the need to understand that criteria cannot be static. It must be subjected to continued evaluation. There must be a constant effort to improve the validity of data upon which criteria is formulated.

The data for criteria will be developed by scientists. The public policy decisionmaker must be assured of the validity of that data.

Right now, I, as a public administrator, am not convinced that the scientist and technician can provide the answers necessary to establish criteria and standards in anything more than rudimentary form.

Let's look at ambient air quality as an example. Let's start here with me acting the role of a politician with no technical background. I would be aware of a general dissatisfaction among my constituents with the condition of the atmosphere; and so I would call for clear air.

That means something at the polls, but nothing in terms of action.

Now, let me assume the role of the appointee of the politicians, I have to turn the campaign promise into action. I am still a nontechnician, so my analysis is in terms of common language. I find out that people think they want the air clean enough so that they don't sneeze, get matter in their nose or eyes, experience eyeburn, or develop emphysema.

I turn now to the scientists and I say, "What are the things in the air which cause this discomfort?" Among the things that cause the problem, I am told, are sulfur oxides.

Now, I tell my scientist, "I want to set a standard which will eliminate eyeburn." Thus elimination of eyeburn becomes a criteria for the standard, as far as I as a public administrator, am concerned.

But, that doesn't help us in terms of control. So my next question is, when and under what conditions does sulfur oxide cause or contribute to causing eyeburn? Now the answer to this question provides us with the preliminary criteria data for setting standards. I must also have economic data. And, for the matter to be complete, examination of the question should have been done in terms of climate condition, demographic condition, and geological conditions.

When we sit down to set standards, we find that the technician has given us a range of measurable volumes of sulfur oxide which contributes to eyeburn and so we can set a standard for volumes of sulfur oxide that relates to a criteria of no eyeburn.

Mr. Chairman, that is an oversimplification of the problem, because obviously you don't have a single criterion, you don't have a single element in the earth to deal with. But I wanted to use that for practical illustration purposes.

I don't want to be on record as citing that as a unique or specific problem.

Today we will set standards essentially in an arbitrary manner as we have limited ability to develop criteria. But this is no excuse not to move ahead with standards and criteria, for we need the experience of developing criteria and standards. Nor can we wait until we have perfected our ability to act.

I would prefer to act on little knowledge and err on the side of caution in protecting human health and welfare. My plea here is not to avoid action until we have perfected our ability to develop criteria and set standards.

I would like to turn now for a moment to applied technology.

A useful applied technology program means involving industry. To a minor extent, this is being done. Much more involvement is required.

The Department of Health, Education, and Welfare should be using industry as Defense and NASA have used it. And the Congress should write a basic procurement law to cover HEW's needs to use industry.

We ought to be spending at least \$1 billion a year on contracts with industry to develop the hardware necessary to control and prevent environmental deterioration. But the Department now can't do this. It lacks from the Congress a clear indication of public policy in this area. That policy must cover patent problems. It must deal with sole-source procurement. It must deal with research competition. It must deal with marketing problems.

The Department of Health, Education, and Welfare certainly is different from Defense and NASA in that HEW is not the ultimate consumer of a mass product for environmental protection.

Nevertheless, the Department alone can provide the leadership to bring about the technological advances necessary to maintain a high-quality environment and allow for economic expansion.

But we must face the reality that it is going to cost money, for nothing is free—neither air nor water, and certainly not soil or space.

We cannot now measure the cost of using resources for waste assimilation, because we don't know the true effects; nor can we correct it properly, because we are not creating the technology. We had better do both now.

Mr. DADDARIO. Mr. Linton, you say that HEW differs from Defense and NASA and that you could not be the ultimate consumer of the mass product for environmental protection.

Isn't this one of the selling arguments that you have, that in this instance the public would be the consumer?

Mr. LINTON. That is correct.

Mr. DADDARIO. It fits within our competitive economic system.

Mr. LINTON. That is correct.

Mr. DADDARIO. The \$1 billion could generate a great deal of activity which could in the final analysis run into billions of dollars.

Mr. LINTON. Absolutely. In fact, Mr. Chairman, I feel it possible to devise the means involving Government and industry development to the point where the investment by the Government would eventually be returned by the economic activity which is created protecting the environment.

I think some direction in this effort has been made by FAA, and that is simply that where the Government provides the research funds to develop new technology, which is then disposed of on an open market, that it receives off the top the amount it put into the direct research, which could then be used in a continuing fund for advancing the state of the art and evolving new technology.

We could conceivably reach a point where it required very little additional congressional appropriations to maintain this fund and keep moving technology ahead.

Mr. DADDARIO. I think that those problems could be worked out.

You mentioned some were patent problems. It is a matter of policy how this relationship could be developed.

We are learning how to handle this better in every agency of Government. Experience, developed in these last few years, should enable us to come to a policy determination as to how this relationship is to work for the benefit of our society.

You talk about what is needed here; more manpower, unavailable in the Department, which I expect would include other agencies, and necessity for criteria.

You don't touch upon how it is structured and don't recommend how it could be better structured. Must I assume from what you have said that you are happy with the way we are handling all of our environmental problems in the Government?

Mr. LINTON. No; I don't think you would assume that.

Mr. DADDARIO. You don't touch on it.

Mr. LINTON. You mean structured in the sense of the way it is organized?

Mr. DADDARIO. Structured in the way it is organized.

Mr. LINTON. I don't touch on it, Mr. Chairman, because my own feeling about organization is that it is generally an extension of the personality of the people assigned the responsibility of running the agency. I don't think organization, per se, really makes that much difference in the effectiveness.

I would say that certainly the present structure of HEW could be improved.

When we developed the report—

Mr. DADDARIO. Before you get going any further in this—I don't know I agree with your definition of how management can be improved.

How about the relationship HEW has with Interior and other agencies which are also involved in this research? The competition does exist as to who is going to get the biggest share of the problem.

Mr. LINTON. I did touch on that, Mr. Chairman, by my comment that I felt at the moment that the responsibility, the basic, essential responsibility for the evolution of criteria, should rest with the Public Health Service. I think the health effects are the predominant concern. And as far as the relationship between the agencies—

Mr. DADDARIO. I don't mean to limit you. I was only referring to your approach to the management. I do think, as we get advice from the agencies in the environmental area, it must necessarily include not only that work which is being done in the agency you happen to be associated with at the moment, but also its relationship conversely to other agencies of Government, and the problems which exist as a result of this relationship.

Mr. LINTON. I agree with you, Mr. Chairman, and in the report we did address ourselves to this problem.

We did recognize the existence of the problem, of the competition.

I did not speak to it specifically in this statement this morning, but my feeling is that a great deal of the competition, a great deal of the difficulty in coordinating among departments, results from the lack of specific objectives and goals. And if they have a problem in HEW

you have even a greater problem in integrating the objectives of several departments in working together.

Mr. DADDARIO. I understand that, but because we have problems in this area, it doesn't mean that it has to be that way. You do have non-health-related environmental problems. Criteria has to be established about those things, and HEW, using your own yardstick here, ought to be in charge of the health area through the Public Health Service. Adjustments need to be made.

Mr. LINTON. Right.

Mr. DADDARIO. We are trying to make recommendations about it, because we recognize some of the problems are those imposed upon us as a result of congressional structure.

Mr. LINTON. Well, that is true.

Mr. DADDARIO. It is extremely complicated. We have to look at our problems here and try to work out a way to handle it so that we can prevent pressures being put on you which may result in bad management decisions.

Mr. LINTON. That is correct.

Mr. DADDARIO. We can't do it, unless we hear from you as to what the problems are. We may come to some judgments which could be improved if we could get an interpretation about the situation from those of you who work in it from day to day.

Mr. LINTON. Well, again, Mr. Chairman, I am not sure that it really is that difficult to function under the present setup.

Mr. DADDARIO. I think it is difficult to function the way we would like it to be. Obviously you are functioning, but that is not the answer.

Mr. LINTON. Let me add the caveat then: I don't think the present system really prevents substantial improvement in functioning the way we would like it to be.

I would agree that it would be a great improvement to resolve the appropriate roles among Federal agencies and to create a mechanism that allowed them to cooperate together.

I am not sure that there is that much friction or competition among them, and I am more concerned with the lack of quantitative goals at the top levels in the departments as a means of developing that cooperation. I think until, for example, the Department of Health, Education, and Welfare, does establish for itself some very specific measurable goals on a time basis, it is extremely difficult for it to relate to HUD and Interior's and Agriculture's interests.

I think the problem is an awful lot of generalities that are used as goals, and that these leave openings for a great deal of interpretations by separate agencies that then have to be resolved.

Mr. DADDARIO. Well, we could chase that one around for a long while.

What you have said has been helpful in that regard.

The goals of your report—materials, trace metals, chemical controls, et cetera.

Can you discuss how such a concept would be implemented?

Mr. LINTON. It assumes first of all that the Congress passes legislation which authorizes this, and it then would become necessary for the manufacturers who are now marketing, or using materials, trace metals, and chemicals, falling under this definition, to provide to the

Department necessary data to establish their levels of safety and recommend the kinds of decisions that need to be made, for the Department to develop the criteria and establish standards to apply to items.

As I said in my statement, if it is to be achieved, if this kind of a goal is to be achieved, it seems almost mandatory that there have to exist in one fashion or another something which we did not at the time of writing this report really conceive, and that is a mechanism for testing, for evaluating the data, the development of data.

I spoke of the independent nonprofit testing agencies that would have to exist. I don't know if that is the only answer or the best answer to it. But the smaller, medium-size companies who do market or use these type of things, find themselves in extremely difficult situations if they had to conduct the testing themselves. I don't think it is possible to create within the Department an agency, with the manpower, and with the capability to do the entire job. I don't think we have the resources to devote to that.

But this is essentially the concept of how that would be implemented.

Mr. DADDARIO. Would some kind of an approval, in testing the mechanism, be made?

Mr. LINTON. Right.

Mr. DADDARIO. You don't think the product liability laws as they presently exist assure the quality of protection that you are interested in?

Mr. LINTON. No, sir. Our judgment was that more serious than at present, would be the developments of the future, and that if the changes that have occurred in the last 25 years in the sophistication of our products and our processes, are a test the sophistication will be even greater in the years ahead. And that a safety mechanism is required to, as best as possible, protect human health and welfare. It was certainly not believed, and I don't believe, you are going to guarantee that under no circumstances will there be any products or materials or trace metals produced and marketed which may not cause a problem. I don't think human beings are capable of solving and protecting themselves in an absolute fashion against anything. This was not designed as some people have suggested subsequently that this was an absolutely safety measure. It is designed as a fire department, as the best means of protection, but with clear understanding it is not going to guarantee safety.

Mr. DADDARIO. Last year, Mr. Linton, Chairman Harris raised the point that I think leads into your hopes and ambitions for goal 3, on garbage and solid waste disposal. He wanted to make it clear that the purpose of the program was not to subsidize the solid waste disposal. He said that the Federal Government is not going to assume the responsibility and the obligation for disposal of garbage and all solid waste, and so forth. He wanted to make sure the purpose was to do some research in the area and that was all.

When you talk of grant and aid programs for solid waste disposals at the local level, aren't you in fact moving in the direction of subsidizing such disposal contrary to Mr. Harris' limitation?

Mr. LINTON. Yes, sir; we did. We did move in the opposite direction. The judgment of the task force was that the experience in the water

pollution field, of providing grants for sewage treatment plants, was an appropriate direction for the Government to move in. Assisting the local governments in handling the increasing problem of disposal of solid waste in the same manner is valid.

Without questioning the validity of Senator Harris' position, but merely expressing myself in the terms of the task force's feeling, the judgment was that the city governments, county governments, and regional agencies, were not able at this time to carry the full burden of the financing of governmental installations to dispose of solid waste. This is true whether by incinerator or landfill, or whatever technique is developed, this wasn't designed just simply for creation of incinerators. Our view was that it was appropriate to do this in solid waste, as it was to do it with sewage treatment plants.

Mr. DADDARIO. I raised that only because in the formation of the legislation, Senator Harris, who had a great deal to do with it, raised these points, and because of the direction you are moving in. I think it ought to be thought about seriously.

Mr. LINTON. In 1965, the solid waste disposal act was recommended to the Congress by the administration. At that time I was chief clerk and staff director of the Committee on Public Works of the Senate. We revised that legislation to include a grant-in-aid construction program for incinerators. It was taken out after the Department convinced the chairman of the subcommittee handling the bill that they needed to spend several years in research before investing substantial amounts of moneys in incinerators that would become outdated.

I think it has become apparent now in the Department that by the time they reach the point of developing their research, the facilities that would have been built in these few years would have outlived their economic usefulness anyway. The result now is that we have neither. And I think that we are much better off spending some money over the next few years building incinerators where they are really needed, and then replacing them in 25 or 30 years, than we are waiting until we have produced the technology that eliminates the needs of these incinerators, or provides for improved incinerators.

I think there is too much of a tendency to wait until we have perfect answers before we act. With the result, we go for an extended period of time with less than what we could do at the moment.

Mr. DADDARIO. I think that is, of course, a tendency.

Mr. LINTON. We don't do it, Mr. Chairman, in the Defense Department. There we go right ahead, under the euphanism of national security, and we spend millions and millions and millions of dollars on equipment and material which within a few years is outdated or discovered to be of no value.

Mr. DADDARIO. Precisely for that reason you can't use the Defense Department as an analogy, because you don't have that room to move around in. Therefore, you have to do it in a different way.

Mr. LINTON. We don't because we apparently, as human beings in the United States, just don't place protection of our own health and welfare at the same level as the protection of our national security.

Chairman MILLER. Is that the responsibility of Congress or should the medical and the biological professions, through the medium of education, tell him about that?

Mr. LINTON. Absolutely, Mr. Miller.

Chairman MILLER. I think this is a part of the problem.

Mr. DADDARIO. Because I raised the question of solid waste disposal does not mean, we ought not to be giving help. This is of interest to many communities who have very limited funds with which to work.

Mr. LINTON. Right.

Mr. DADDARIO. Yet I do think we have to recognize that we ought to be moving ahead in certain areas, incinerators could very well be one of them. We ought to be careful that we do not move ahead in certain areas where we are not able to accomplish much and where great expenses can fall on us, just because those areas happen to be extremely popular. Somewhere along the line a whole series of judgments are needed. None of them, even the incinerator area, can be made so that we should go ahead in every case. There may be places where we should be helpful and other places where we ought not to be.

Mr. LINTON. I agree with that. That is a part of the thing that complicates the problem, you can't find a universal solution.

Mr. DADDARIO. Well, Mr. Linton—Mr. Chairman, do you have any further questions?

Chairman MILLER. No, I want to congratulate Mr. Linton on his statement. I find myself in full agreement with a great deal of it.

Mr. LINTON. Thank you, Mr. Miller.

Mr. DADDARIO. We are pleased, of course, Mr. Linton, to have you here, and with the help you have given. We were anxious to hear from you.

We will, I hope, be able to take advantage of you as well as the other witnesses, by contacting you and filling out your testimony so that we can make the record as intensive as possible.

Mr. LINTON. Mr. Chairman, I feel an obligation to do that, since I have learned so much over the last several years from what you have done with the committee, that I am only happy to see if I can give some of it back in terms of some new ideas. Please feel free to call on me.

Mr. DADDARIO. It is a mutual enterprise. Thank you.

Mr. LINTON. Thank you very much.

Mr. DADDARIO. We appreciate having you here.

We have Dr. Gershinowitz with us this morning, and I know we are running a little bit late, but we would like to hear him if possible. We would appreciate it if you could come forward and see how much of your testimony, Dr. Gershinowitz, we can get out of the way.

I regret doing it this way, but we have had some scheduling problems.

Dr. GERSHINOWITZ. I am quite happy to have this opportunity to at least start on this presentation, Mr. Chairman.

(The biography of Dr. Gershinowitz is as follows:)

DR. HAROLD GERSHINOWITZ

Harold Gershinowitz, chemist, was born in Brooklyn, New York, August 31, 1910. He holds the B.S. from City College of New York (1931), the A.M. (1932), and the Ph. D. (1934) from Harvard. He is a fellow of the American Association for the Advancement of Science, and a member of The American Chemical Society, the New York Academy of Sciences, Phi Beta Kappa, and Sigma Xi. From 1953 to 1962 he was President of Shell Development Company. He then was elected a Member of the Board of Directors, Chairman of the Research Council and Research Coordinator for the Royal Dutch Shell Group of Com-

panies. Dr. Gershinowitz retired in 1966. He is now Chairman of the Environmental Studies Board of the National Academy of Sciences and the National Academy of Engineering, consultant to the Organization for Economic Cooperation and Development (Paris), and affiliate in the Faculty of the Rockefeller University.

STATEMENT OF DR. HAROLD GERSHINOWITZ, CHAIRMAN, ENVIRONMENTAL STUDIES BOARD, NATIONAL ACADEMY OF SCIENCES, NATIONAL ACADEMY OF ENGINEERING

Dr. GERSHINOWITZ. My name is Harold Gershinowitz and I am Chairman of the Environmental Studies Board of the National Academy of Sciences and the National Academy of Engineering.

I am particularly pleased to have this opportunity to present to you this report on the activities of the Environmental Studies Board.

The existence of the Board itself is, in a very large measure, due to the desire of the two Academies to provide a scientific-engineering resource for the Federal Government, and that desire was very much stimulated by the interests of your subcommittee in the problems of the environment, particularly as exemplified in the hearings which you held in 1966. We were very honored, Mr. Chairman, when you attended our initial meeting on the 27th of January of last year.

Mr. DADDARIO. I was honored to be asked, Dr. Gershinowitz.

Dr. GERSHINOWITZ. After rereading the initial draft of this report, which I am making to you, I felt a bit apologetic about the emphasis which I had placed on matters of organization, but after hearing the tenor of discussion this morning perhaps it is what you are interested in hearing.

I do give a substantial amount of detailed information about the origin of the Environmental Studies Board, the responsibilities assigned to it, and the organization through which it operates. Most of this is included, because the way in which the Board has found it desirable to operate is indicative of the character of the problems with which it is faced.

The first thing that one can say about any one problem of the environment is that it cannot be considered in isolation. Air pollution cannot be considered without also examining fuel resources, solid waste disposal cannot be discussed without reference to potential air and water pollution. Both in science and governmental organizations knowledge and responsibilities are divided in ways which make difficult comprehensive examination of either causes or remedies. Much previous work, both in the realms of technology and of policymaking, has been done without adequately taking into account side effects and interrelationships.

The Environmental Studies Board with its broad charter has considered it essential to take these interrelationships into account. Much of what may seem to be a preoccupation with organization which has taken up much of our time for the first 6 months of our existence has been due to the need to provide mechanisms which would make it possible to include interactions. This need is clearly reflected in the opinions and suggestions currently being reviewed by the Environmental Studies Board, and which constitute the major part of this statement.

The responsibilities and composition of the Environmental Studies Board were described in the announcement made on March 3, 1967, by Dr. Frederick Seitz, President of the National Academy of Sciences, and Dr. Eric Walker, President of the National Academy of Engineering. A copy of this announcement is attached as exhibit A. One of the original members of the Board, Dr. John Perkins, resigned in June 1967, when he left the University of Delaware to become president of Dun & Bradstreet, Inc., and Dr. Harvey Perloff, economist on the staff of Resources for the Future, Inc., was appointed to take his place. Subsequently, two additional appointments to the Board have been made. Dr. Hendrik W. Bode, professor of systems engineering at Harvard University and formerly vice president of the Bell Laboratories, and Dr. G. Evelyn Hutchinson, professor of zoology at Yale University.

At its first meeting the Board discussed its responsibilities and functions. I quote from the minutes of that meeting:

It was generally agreed that the Board may:

- a. Serve as a focal center of the NRC activities underway or potentially so, in the broad field of environmental problems.
- b. Serve as a source of recommendations for additional work to be done either by the two Academies or by a branch of the Government.
- c. Serve as a central source to serve the legislative and executive branches of Government which may come to the NAS-NAE to find out what might be done to help solve problems, or how to work cooperatively with agencies.
- d. Provide a means of contact between local agencies and centralized centers of scientific activities, such as the Academies.
- e. Serve as an "impedance-matching device" in the sense of promoting understanding and cooperation among the scientists, engineers, lawyers, statesmen and the man-on-the-street concerned with the complex problems of man's environment. By way of this Board the language from one group to another might well be translated, and it was agreed that this is one of the most important things the Board can do.

You can see, Mr. Chairman, we are taking seriously the charge that you have put to the scientific community in your previous statements and reports, and we do think that it is our responsibility to include not only the physical and biological sciences, but also the social sciences and economics, and all the political implications of the problems of the environment.

It was agreed that the Board would work through the divisions of the National Research Council to the maximum extent. The Board, of course, has the authority to establish committees and panels as required to carry out its responsibilities. The Board felt it should call on the services of behavioral scientists, political scientists, economists, and ecologists as well as physical scientists and engineers.

The consensus of the Board was to limit its considerations to problems arising from the physical interactions of the individual with his environment. It was agreed that the Board would look not only at possible short term solutions but would also concern itself with possibilities which go beyond the technical/legal solutions now possible.

We also decided that although our charter covered the whole range of environmental problems, those concerning pollution were the most most pressing and that we should devote our initial attention to them. It seemed to us that one of the urgent needs was to provide a mechanism whereby current engineering knowledge could be made available to

the Congress and the executive branch. One of the reasons for the establishment of the National Academy of Engineering was to provide such assistance to the Federal Government in the same way as scientific knowledge had been made available through the National Academy of Sciences. The following excerpts from a letter from me to the other members of the Board describes the principles and procedures which we have adopted.

At our last meeting we discussed at some length the matter of subcommittees which might cover the wide range of problems which are encountered in dealing with pollution and its interrelationships with natural resources. We approved in principle the proposal of the ad hoc committee of the NAE that a committee be set up to deal with the USPHS Office of Solid Wastes and to continue the discussion of possible projects to investigate. The Board also agreed that similar committees should be set up to deal with air pollution and water pollution. This would have the advantage of permitting concentrated attention to be given to existing or anticipated problems in a manner which is organizationally compatible with the existing division of responsibility among the agencies of the Executive Branch (and to some extent within the Congress as well).

In our discussions we have continually emphasized the interdisciplinary character of the problems of environmental pollution, not only among the physical and biological sciences but the social sciences as well. At the same time I think that we must recognize that there are many immediate and urgent instances in which sound quantitative engineering thinking should be made available to the Government as soon as possible.

It seems to me that we are now faced with a kind of planning and organizational problem that is very similar to those encountered in industry. The Government is already committed to a program of regulation and enforcement which is underway. As a basis for this program it must make use of the best data available, and where not enough data are available it must make provisions for the securing of essential data as soon as possible. In a manufacturing industry this would correspond to the final stages of design and construction of a new plant. Although it may be found that some research is necessary, there is such a commitment of resources and such a time schedule that whatever research may be essential must be done on a crash basis. Even though it may be known or felt that additional research would result in an improved process, it is recognized that it would be economically unsound to delay the progress of the work while waiting for the ultimate. Substantial changes must await the construction of a second plant.

This is the kind of work best done by engineers. I think that it is important that the engineering point of view be the dominant one. I think, however, that the very specific nature of the present crisis should be emphasized and that the proposed ad hoc committees be clearly instructed to confine their attention to the immediate short-range problems, with the understanding, of course, that they still have a responsibility for recognizing and defining problems which will need more extensive study.

It is essential to differentiate and separate the responsibilities for immediate technological assistance and long-range planning. Thus

while it is important that the two Academies set up an appropriate relationship with those executive and legislative agencies whose immediate responsibility is to propose, enact, and enforce regulations concerning the protection of the environment and of natural resources, it is likewise essential that other bodies be set up or designated with the responsibility for studying the longer range aspects of the subjects involved.

Mr. DADDARIO. Do you have anything in mind in regard to these committees with long-range objectives which you speak of?

Dr. GERSHINOWITZ. Yes, I will describe this in a moment.

We have agreed that the most effective way of interacting with what may be called the operating agencies and legislative committees is to parallel their organization. Specifically, since the field of pollution is conventionally divided into air, water, and solid wastes, the proposals that have already been made that the NAS-NAE set up ad hoc committees with these areas of responsibility is the proper one. Nevertheless, it is clear that these committees will have so much to do to interact with and satisfy the demands of the governmental agencies with whom they will deal, that they will have little opportunity to look at the problems in broad perspective and in relationship to each other.

I do think that there exists within the actual and potential structures of the two Academies, and within their relationship with the National Research Council, not only adequate but unusual opportunities for achieving the kind of interaction between applied research and its utilization that is essential for the optimum application to our national problems of the resources of our national community of scientists and engineers. I do not wish to belabor the analogies with industry, but I believe that it is true that only in a few larger research-minded companies and in our more successful mission-oriented national laboratories that basic research, applied research and engineering application have been able to work in such a manner that the efforts of each both benefit from and reinforce the others. The responsibility that has been assigned to us involves the first major interaction and cooperative effort of the NAS and the NAE. If we can develop a satisfactory method of operation and cooperation we will have achieved something which in the long run may be even more important than our specific task.

As I said earlier, the charter of the ad hoc committees should limit them to the known and the immediately attainable. The three chairmen, presumably all engineers, would become members, ex officio, of a committee, whose other members, also ex officio, would be the chairmen of the other committees which are involved in the problems related to the environment.

That is the mechanism for the long-range study. Mr. Chairman.

This committee would report to us, the ESB, and through us to the loci of planning in the Executive Branch and the Congress. It would be the responsibility of this committee of chairmen to propose and recommend the longer range and interdisciplinary activities, the need for which arises from the projects underway.

I also have remarks later on as to what might be desirable in the interdisciplinary activities.

It would still be the responsibility of our Board to recognize and define and promote the studies in and interaction of physical and

social sciences with each other and with the hard realities of politics and public opinions and pressures. Contacts with the Government relating to such longer range and complex problems would be made through our Board.

That, essentially, is a statement of the procedures we have chosen to operate under, Mr. Chairman, in this type of committee structure we have set up. I would now propose to discuss a few specific examples of what is happening in that realm.

As soon as one becomes involved in any one of the specific problems of the pollution of the environment it becomes apparent that no one problem can be treated in isolation. Methods for waste disposal, whether they are concerned with gases, liquids or solids, interact with each other; incineration of solids can cause contamination of the air, sanitary fills can cause contamination of water supplies, substitutes for incineration, such as maceration, can increase the load on water purification systems. Nevertheless, the technologies for the handling of gases, of liquids and of solids are fairly distinct from each other and furthermore, the delegations of authority and responsibility to the various Federal agencies divide this responsibility along the three lines of air, water and solid waste (with, unfortunately, some overlapping).

In spite of our consciousness of the interrelated aspects of these problems we thought it essential to provide engineering in these conventionally separated compartments in order to facilitate communication with those responsible for each of these areas.

We have, accordingly, set up four ad hoc, engineering oriented, committees to deal with air, water, solid wastes and noise. The membership of each of these committees is given in exhibit B.

(The documents, exhibits A and B referred to, are as follows:)

EXHIBIT A

NATIONAL ACADEMY OF SCIENCES—NATIONAL ACADEMY OF ENGINEERING

WASHINGTON.—Citing the rapidly increasing national concern about the quality of the environment, Dr. Frederick Seitz, President of the National Academy of Sciences, and Dr. Eric Walker, President of the National Academy of Engineering, announced today the establishment of an Environmental Studies Board to coordinate all activities of the two organizations in this area, to work directly with the legislative and executive branches of the Government in attacking related problems, and to initiate broad new studies when necessary.

A major purpose of the Board is to provide a national focus for broad interdisciplinary efforts toward reducing or controlling pollution and other environmental problems.

Dr. Harold Gershinowitz, former Research Coordinator and Chairman of the Research Council of Royal Dutch/Shell, and former President of the Shell Development Company (retired), is the chairman. Dr. Gershinowitz received his B.S. degree from the City College of New York, his A.M. and Ph.D. degrees in chemistry from Harvard University, and did postdoctoral research at Princeton, Columbia, and Harvard Universities. He has been active in academic affairs, serving as chairman of the Council of the Harvard Graduate Society for Advanced Study and Research and a member of the visiting committees to the Department of Chemistry and the Division of Engineering and Applied Physics at Harvard, and to Departments of Geology and Chemical Engineering at Massachusetts Institute of Technology.

Two major considerations prompted the decision of the Academies to establish the Environmental Studies Board:

Recent reports on pollution abatement have emphasized the interdisciplinary nature of environmental problems and recommended that coordinating bodies be set up. The establishment of such a board within the Academy structure was

specifically recommended in a 1965 report of a panel of the President's Science Advisory Committee, *Restoring the Quality of Our Environment*, prepared under the chairmanship of Dr. John W. Tukey. It was one of several measures suggested to provide for early identification of pollution problems and to avoid gaps and imbalances in their study.

Five of the eight Divisions of the National Research Council—an operating agency of the two Academies—are currently studying problems directly concerned with pollution of the environment. Among the activities are studies of the potential effects of pesticide residues, food chemicals, hazardous materials, sonic boom, medicated feeds, and the work of committees on water, atmospheric sciences, geography, food protection, and toxicology. Many other problems under study also relate to the environment, and it seems more than probable that the Academies will be asked to take on additional work in view of the mounting concern being expressed by Federal, state, and local governments and the public at large.

The Environmental Studies Board has been given authority by the Councils of the two Academies to review ideas, requests, proposals, and programs directed to them concerning pollution and other stresses on the environment. In addition to coordinating National Research Council activities currently underway on environmental problems, the Board will also recommend additional work to be done by either the two Academies or by an appropriate branch of the Government.

A major responsibility of the Board will be to promote understanding and cooperation among scientists, engineers, political leaders, and the general public concerning the complex problems of man's environment.

Members in addition to Dr. Gershinowitz are Dr. Wallace L. Chadwick, Vice President (retired), Southern California Edison Company; Dr. Frederic A. L. Holloway, President, Esso Research and Engineering Company; Professor Robert Morison, Director of the Division of Biological Sciences, Cornell University; Dr. John Perkins, President of the University of Delaware; Professor Roger Revelle, Director of the Harvard Center for Population Studies; and Dr. Chauncey Starr, Dean of the College of Engineering, University of California at Los Angeles.

EXHIBIT B

NATIONAL ACADEMY OF SCIENCES—NATIONAL ACADEMY OF ENGINEERING

ENVIRONMENTAL STUDIES BOARD

MEMBERSHIP—NAE-NRC COMMITTEES ON WATER QUALITY MANAGEMENT, SOLID WASTES MANAGEMENT, AIR POLLUTION, AND NOISE

NAE-NRC Committee on Water Quality Management

Chairman: Dr. Edward J. Cleary, Executive Director and Chief Engineer, Ohio River Valley, Water Sanitation Commission, 414 Walnut Street, Room 302, Cincinnati, Ohio 45202

Mr. J. Floyd Byrd, Engineering Division, Proctor and Gamble Company, M. A. & R. Building, Cincinnati, Ohio 45217

Mr. James B. Coulter, Assistant Commissioner, Environmental Health Services, State Department of Health, 301 West Preston Street, Baltimore, Maryland 21201

Dr. Gordon M. Fair, Professor of Sanitary Engineering, Emeritus, 224 Pierce Hall, Harvard University, Cambridge, Massachusetts 02138

Dr. Mark D. Hollis, Chief Engineer, Pan American Sanitary Bureau, Regional Office of WHO, 525 23rd Street, NW., Washington, D.C. 20037

NAE-NRC Committee on Solid Wastes Management

Chairman: Dr. Donald N. Frey, Vice President, Product Development, The Ford Motor Company, Dearborn, Michigan

Mr. Frank R. Bowerman, Program Manager, Von Karman Center, Aerojet-General Corporation, 1100 West Hollyvale Street, Azusa, California

Mr. David J. Damiano, Acting Director, Solid Wastes Program, City Hall, Philadelphia, Pennsylvania

Dr. S. A. Hart, Associate Professor, Department of Agricultural Engineering, University of California, Davis, California

Professor Percy H. McGauhey, Director of Sanitary Engineering Research Laboratory, University of California (Berkeley), Richmond, California

NAE-NRC Committee on Air Pollution

Chairman: Professor Thomas K. Sherwood, Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139
 Professor Merrell R. Fenske, Head, Department of Chemical Engineering, The Pennsylvania State University, 133 Chemical Engineering Building, University Park, Pennsylvania 16802

Dr. Robert L. Hershey, Member, Board of Directors, E. I. du Pont de Nemours Company, Dupont Building, Room 2088, Wilmington, Delaware 19898
 (Other members to be appointed.)

NAE-NRC Committee on Noise

Chairman: Mr. Laymon N. Miller, Bolt, Beranek and Newman, Inc., 50 Moulton Street, Cambridge, Massachusetts 02138
 (Members to be appointed.)

Each of these committees is now engaged in discussions with the appropriate agencies of the executive branch concerning actual or proposed contracts for advice and services; for example, HEW, AEC, the Appalachian Regional Commission.

It is the continuing responsibility of the ESB, however, to make sure that these committees interact with each other and do not make recommendations incompatible with each other.

One of the recommendations of the PSAC report, the Tukey report, "Restoring the Quality of Our Environment," was the following:

We recommend that the following steps be taken to provide for early identification of broad problems involving pollution and to avoid gaps and imbalances in their study: (a) The Federal Council for Science and Technology should establish a Committee on Pollution Problems, composed of its own members. (b) The National Academy of Sciences—National Research Council should be asked to establish an Environmental Pollution Board, to be supported by government grant. (c) This NAS-NRC Board should meet jointly with the FCST Committee at least once a year to discuss newly recognized broad problems and current changes in the apparent importance of those previously recognized. (d) This Board and Committee should cooperate, through working-level mechanisms such as joint panels, to identify the most pressing broad problems, and the general character of new knowledge or techniques needed to study or ameliorate them.

The Environmental Studies Board was established in part as a response to this recommendation, although our basic support is derived at present from the academies themselves rather than the Federal Government, as recommended in the Tukey report. The parallel committee of the Federal Council for Science and Technology, the Committee on Environmental Quality, was established in the spring of 1967. A joint meeting of the ESB and the CEQ was held on October 19, 1967, and arrangements were made for continuing close contact and cooperation of the two groups.

Dr. King, the chairman of the Committee on Environmental Equality attends many of our meetings, and Mr. Reed, the executive secretary of the ESB attends many of the meetings of the CEQ.

With the accomplishment of two of its first projects, the coordination and reorganization of the activities of the NAS-NAE-NRC and the establishing of mechanisms and channels for both policy and working level contacts with governmental agencies, the ESB and its committees have begun to concentrate on their major responsibility, a response to the challenge so clearly stated in the report of your subcommittee of October 21, 1966:

The scientific and engineering community should respond to the challenge of the pollution problem as a major opportunity to serve a public need. Work in

this field should be recognized as interesting, rewarding, and important. Proposals for organization, funding, and schedules which will assure the participation of excellent technical personnel in adequate numbers should be the joint responsibility of Government and private sector research and development leaders.

Accordingly, another aspect of our activity concerns our responsibility for getting the scientific and engineering communities involved in the problems of the environment. There is no lack of interest, rather the questions asked are how rather than why should we help. Each of the divisions of the National Research Council has had representatives attend one or more of our meetings and we have discussed with them the precise nature of some of the scientific problems which need solutions. We are working closely with the American Chemical Society, the American Institute of Chemical Engineers, and other professional organizations, to make sure that the effort is coordinated rather than fragmented. The interest of scientists and engineers is so great that small groups have sprung up in many places and in many disciplines each trying to make some contribution. You need have no fears about the concern of the scientific and engineering community nor their willingness to help. The problem at the moment is to break the major unsolved questions into manageable problems and to concentrate the effort on them.

I have already stated that the individual problems of the contamination of the environment are inextricably intertwined with each other insofar as the technical solution to one considered in isolation almost always complicates the solution to another. But there is complexity of other kinds as well.

Contamination of the environment cannot be adequately examined without taking into consideration the questions of availability and conservation of natural resources. Standards of purity of effluents cannot be set without taking into account the ultimate use or disposition of the effluent. The complexity of the relationships between the health of individuals and their environment is such that it is improbable that we will soon have incontrovertible evidence permitting one to set absolute limits of tolerance for contaminants. In such circumstances it is tempting to try to play safe, to set limits very low. In all of our human activities we take risks. We put up buildings and live in areas subject to violent earthquakes or hurricanes. We do most of our long distance travel by air. We do much of our shorter distance travel by automobiles. The problems of environmental pollution must be looked at in the same way, by balancing risk against convenience, against cost, against feasibility. Our solutions should represent an overall balancing of these and other factors such as recreational use of land and waters.

The charter of the ESB is a broad one and we have interpreted it broadly. We have recognized that the solutions to environmental problems involve not only the physical and biological sciences but also questions of law, of political science, of economics, of sociology, of psychology. There can be alternatives, for example, between institutional changes and technological solutions, for example, between a multistate-multimunicipality water basin authority which might provide a few centralized treatment plants and the treatment of all effluents individually at their sources. The feasibility of an institutional structure can thus determine the direction in which technological progress should be sought.

In a similar manner, it is obvious that the questions of standards and criteria will involve choices between alternative uses for land and for water. As in the case of institutions, the kind of technology required and certainly the cost of the technology will depend on the degree to which contaminants or refuse must be suppressed, which in turn depends on the end uses of the body of land or water used for disposal. One needs to know what are the real desires of the people, how much they are willing to pay for the satisfaction of these desires, both in money and in the sacrifice of other things such as convenience or accessibility.

The Division of Behavioral Sciences of the NRC is working with us on the examination of such questions. Such questions as how does the individual perceive the environment. What does he consider tolerable, desirable or undesirable? We have asked each of the engineering committees to compile a list of nontechnological factors which inhibit the application of known or existing technology.

So far we have a reply only from our Committee on Water Quality management, the other committees are preparing their replies. But the reply of this Committee on Water Quality is so informative and instructive that I think it is worthwhile quoting those parts which refer to institutions and legal procedures:

It is neither prudent nor practical to continue to rely primarily on the promulgation of prohibitions governing discharges at individual waste sources for mitigating pollutional effects. This traditional approach is hardly suited for the exacting task of managing water quality. Management of quality invites consideration of a variety of technological alternatives (such as mechanical aeration of streams, low flow augmentation and programmed discharge of effluents) which alone or in combination offer promise of maintaining desired quality conditions at lowest social cost.

Although this concept has been gaining recognition, its application is handicapped because the functioning of state and federal agencies is geared primarily for the exercise of regulatory activities. In brief, the need exists for revamped institutions that are empowered to plan, design, finance, build and operate facilities within a systems-context for the management of water quality.

Opportunities for the creation of such institutions may be visualized within the framework of interstate compacts, conservancy districts, or special authorities. Some innovations are being developed, as exemplified by the Delaware River Basin Commission and proposed Susquehanna federal-state compacts; the recent creation of the State Pure Waters Authority in New York; the proposed Maryland Waste Acceptance Service Authority; and expansion of the rôle of the Miami Conservancy District in Ohio.

The Water Quality Management Committee would also point to the desirability of an inquiry looking toward improvement of judicial practices. They do list a number of specific recommendations that perhaps should be looked at by lawyers, but I think since they really need legal attention, I would rather not cite them at this moment.

In addition, the subcommittee would invite discussion of the merits or limitations involved in the establishment of quasi-judicial boards or commissions for the adjudication of pollution control cases.

I have outlined for you the scope of our responsibilities, the nature of the mechanisms by which we hope to fulfill these responsibilities and some of our more general views of the ways in which solutions to the problems of the environment should be sought. I should now like to describe for you some of the difficulties we have encountered in dealing with specific proposals for additional research and development. I shall cite two specific examples.

The first is concerned with the evaluation of the effects on human health and well-being of the contaminants of the environment. Both industry and government are actively engaged in such studies, but we think that both would benefit from an independent evaluation. We have formulated a proposal for such a study, which would involve both long-range effects of small amounts of contaminants and the effects of high concentrations for short periods. We will need financial support from both government and industry for this study.

We would then propose to use these data in combination with engineering and economic data to put forth clearly the feasibility and cost of achieving various levels of contaminant reduction. This would then provide a rational basis for setting allowable or desirable levels of contamination on a risk-cost-benefit basis.

Our ad hoc engineering committees are already engaged in the collection of the available factual data which are essential to these studies.

We look upon the combination of the medical and engineering-economic aspects of the problem as essential to the optimum solutions. We think that joint industry-government financial support of this work would emphasize and insure the impartial character of the review. We have already received an assurance of support for part of the work from the Automobile Manufacturers Association, and are approaching other industries for support as well, but we find difficulty in identifying the appropriate agency of the Federal Government which should be interested in supporting this work. The wide scope of the study transcends the interests of the Public Health Service. The inclusion of water as well as air brings in a multiplicity of Federal agencies with separate responsibilities for separate parts of the problem. There is no overall coordinating or integrating body to examine the kinds of policy questions which inevitably arise when one considers the problem of pollution as a whole.

The second case which we have had a similar problem in is in attempting to discuss a project concerning the evaluation of energy resources not only in terms of their availability and nominal cost but with respect to their potential contribution to environmental pollution. Again, there is no body or agency within the Government that has that broad scope of interest or responsibility.

Mr. DADDARIO. You don't believe your relationship with the Federal Council on Science and Technology allows you to look at it in this way?

Dr. GERSHINOWITZ. It allows us to look at the technological interactions of programs. It does not allow us to look at policymaking problems or problems in which one has to make choices, or choose alternatives in deciding criteria.

Mr. DADDARIO. You see this as sort of a vacuum which needs to be covered?

Dr. GERSHINOWITZ. We do, and I conclude my paper by reading that statement.

It is the consensus of the ESB and its committees that one of the most urgent and critical problems in environmental pollution is that of definition of standards and criteria. These standards and criteria should be developed from economic and technological bases as well as public health considerations. Because of the potentially controversial

nature of such criteria they should be developed with cooperation and participation of industry, government, and nongovernmental institutions representing the public interest. The factual data on which the standards and criteria should be fixed should be developed by an institution or agency which does not have a responsibility for policy-making or enforcement of a particular aspect of the pollution-resources question. An agency that has served a similar function is the Bureau of Standards of the Department of Commerce. If a nongovernmental institution is considered preferable the NAS-NAE-NRC could be the medium for establishing such an institution.

I can conclude this part of my comments with the general observation that from the viewpoint of a board charged with surveillance of the whole field of the interactions of man and his environment, the problems involved seem of such complexity and involve interactions of so many diverse agencies of Federal, State, and municipal governments that serious consideration should be given to the establishment of a single coordinating, policymaking body within the structure of the executive branch of the Federal Government.

Mr. DADDARIO. Dr. Gershinowitz, your paper and your presentation have been excellent and will be extremely helpful to us. I thank you for your presentation.

You touched on municipalities and their part in this. How do you see the relationship between Federal and local governments?

Dr. GERSHINOWITZ. Well, Mr Chairman, in what I have said up to now I have been acting essentially as a spokesman for the Environmental Studies Board and its committees. My opinions about the inter-relationship with Federal and local governments, however, are based on my personal experience and what I say now is that.

I will preface it with the remark that although my biographical statement shows that I was born in New York and am now a resident of that city, actually the major part of my adult life has been spent elsewhere. For 11 years I was a resident of Texas, and during that time gained an understanding of and sympathy with the principle of States rights. For nearly 30 years I was employed by a large, complex corporation, and my career was divided between central offices and outlying divisions. From these two backgrounds I developed a bias in favor of decentralization in delegation of certain kinds of responsibilities.

I think that one should make a distinction between the setting of criteria and standards and the specifications and mechanisms whereby these criteria should be met.

In a great many ways the problems faced by one community or one State are different from those of another; whereas, the determination of standards and criteria can best be done by the Federal Government, the determination of how to achieve these standards is usually best done at a local level. Local authorities can be remarkably ingenious in the disposition of the resources available to them. In addition, the feeling of creative participation stimulates and encourages the adoption of new methods.

The Federal Government has a very important role, however, in providing means of acquainting others with the possibilities of and techniques for using new technology in a way analogous to that which farm agents, land grant colleges, and State agricultural stations make such data available to the farmers. That is, there is a substantial role

for the Federal Government in doing research and development, exploring new technologies, building demonstration plants, instructing municipalities and States in the use of these plants. But in my opinion the decision of which of the technologies to use should be left to the local authorities.

Mr. DADDARIO. As progress is made in this field, do you feel we must be careful not to disturb this relationship?

Dr. GERSHINOWITZ. I would think so. I think that the progress of technology shows particularly improvements of technology come from local applications of what has been developed elsewhere, and that a continuing improvement in efficiency changes in design, modifications in the way of operation will come from the independent utilization of technology by the sources that have to make use of it.

Chairman MILLER. Mr. Chairman.

Mr. DADDARIO. Mr. Miller.

Chairman MILLER. I am interested in your reaction, Doctor, to this because I agree we have been through an exercise where some of the other things were explained by very competent people.

I wonder if the artificial geographic lines in which we bound our States are the things which should limit this or should they be more like the environment of a watershed that may cover two or three States. Texas is a big State. Something could take place in the panhandle—well, I will illustrate it better by saying when Dallas and Fort Worth were fighting over the building of an airport, what it was going to be called, I asked a man from Beaumont, "Now you Texans have to make a decision. You have to line up with Dallas or Fort Worth. On which side are you?"

He said, "Those people are so far north where we come from we call them damned Yankees."

California is a big State. What might be good for San Diego might not be very good for some other portion of the State.

On the other hand, Rhode Island and Massachusetts, and Mr. Daddario's Connecticut are relatively close.

Can we lay down any fixed rule in this field saying we are going to let the States do part of it and let somebody else do the other part? We are falling into a trap when we do that.

Dr. GERSHINOWITZ. I hope I am not falling into a trap, Mr. Miller. I believe that the term I probably should have used was not simply "States," but "local regional authorities" that are concerned with the aspects of the problem. Certainly river basins and air sheds and all things of that sort have to be included.

Chairman MILLER. I concluded that is what you really meant.

Dr. GERSHINOWITZ. That is what I meant; yes, sir.

Chairman MILLER. Rather than saying the artificial lines should be followed.

Dr. GERSHINOWITZ. Yes.

Chairman MILLER. It doesn't necessarily follow those are true.

Mr. DADDARIO. I find myself intrigued by the organizational setup you suggested in working our way through this morass of problems. In fact you tie all the various pollution problems together, emphasizing, and reemphasizing for us that these cannot be separated one from the other.

And yet, I wonder about the time involved in the formation of these, and the chairman of these committees working together seeing there is no problem of antagonism.

The government is being charged already with certain responsibilities of establishing the air quality standards. How do we prevent the situation from becoming catastrophic while we are establishing this very nice organizational structure?

Dr. GERSHINOWITZ. Well, I would be the last to deny that an organizational structure can be inhibiting rather than assisting in progress. However, I think in this particular case the assignment of responsibility for short-range solutions to these engineering committees, combined with the simultaneous assigning of some responsibility to each of the chairman for making sure that he is looking over the shoulder of the others around, is already some assurance that rash things would not be done but also that more important things will be done quickly without waiting for a complex interaction of committees. I think the mere realization that there is such a structure, that there are channels available to these specialized specific committees, to obtain the kind of advice and information that interacts with them, is enough in itself to take care of the lack of interaction. It provides for immediate support, immediate application of knowledge. At the same time it provides for fairly immediate application of knowledge from interacting disciplines.

I don't think it is necessary, as I conceive it, for each of these committees to delay any recommendation until everyone else has had a chance to look at it. I think that is not the way they are intended to work. It is just as long as they are conscious they have that broader responsibility, they will almost automatically start to incorporate that way of thinking into their recommendations.

Chairman MILLER. Doctor, have you ever taken a look at the National Council on Marine Resources and Engineering Development, or the work that is being done in the Space Council? I, as a member of the Merchant Marine and Fisheries Committee, 8 or 9 years ago was made the first Chairman of the Committee on Oceanography after the Academy of Science rendered its report.

There had never been a complete study of this kind within Government. The first thing we found was that oceanography was centered primarily in seven agencies of Government. Although there had been an interagency committee, it was on the third or fourth echelon and everyone would have to go home or work their way up to the Secretary and on down. Nothing was done, so much so that there was no one place in Government you could go and find out what was being done in this field. There was duplication.

Well, one of the first things we did was to set up the calibration center. We tried it by law and it got bogged down but fortunately, a very fine Under Secretary of the Navy succeeded in getting an authorization through under the general powers of the President.

We found that there was no standard for instrumentation in the field of oceanography, even in the private sector. Woods Hole wanted to do something; they wanted to do something else at La Joya, Tex. Many were getting into this field because of exploration. So we established the calibration center so that we could standardize.

Now we have an agency headed by the Vice President and staffed by a competent man who can direct its activities.

If it wasn't for the National Space Council, because space program was scattered in numerous agencies; I don't think our space program would be where it is.

Now, do you think that if we had some sort of environmental agency comparable to this council that we could make more progress than we could in trying to reorganize the Government? Because every chairman feels this is giving up of authority, when you know it might be good to do so. You don't like to establish a precedent.

Have you looked at this or has the Academy of Engineering looked at it?

Dr. GERSHINOWITZ. Yes, Mr. Miller, I think those are very important and valuable precedents and examples we can use in dealing with the environments.

Chairman MILLER. I think this can be a new form that we can take to get solutions for some of these distinct problems. I am inclined to think sometimes local government can handle them. I live in the San Francisco Bay area that is governed by one of the first very successful air pollution boards. Mr. Linsky is responsible for it. I had the privilege of going over to the University of West Virginia at his invitation the other day. In our own city, Alameda, we disposed of the waste by dumping it into the bay or burned it down at the bay. They used to do this at Berkeley.

The board put a stop to burning, even the burning on these dumps. This just raised the dickens. The city fathers said, "We have about 5 more years. What are we going to do when that is gone?" They are still worried.

Then they brought in a counterproposal. The mayor said, "What are you doing? You are stopping burning; this smoke isn't going to hurt you, but the rats will." I tell you the housewives and people concerned with burning were ready to turn turtle when they pictured rats running all over the place. We controlled the rats, and the burning. I don't know what we are going to do with it. There is not much more of the bay we can fill in. I realize the importance of this.

I wonder, in view of some of these things that have taken place, if you can depend too much upon local authorities. Left to local authorities, the instance I cited in my own hometown, we would still be filling and burning. But they consented to an environment group coming into the bay area that could override them. Thank goodness we are not burning anything.

Dr. GERSHINOWITZ. I said, Mr. Miller, that the responsibility for criteria and standards are definitely those of the Federal Government, rather than local authorities.

Chairman MILLER. I don't know, it might be Federal, but I do think you have to have some sort of a regional part.

Dr. GERSHINOWITZ. Regional, certainly.

Chairman MILLER. I could cite cases where one small political subdivision blocked stream control; it would have been much more economical on a watershed basis. You get into these little jealousies.

Mr. DADDARIO. I don't see any particular conflict, Dr. Gershinowitz, with what you said and what the chairman is talking about. I quite

agree with him that unless it is done in the right way it will stifle progress. You would take advantage of various alternatives to accomplish what ought to be accomplished, and if it was spelled out in the right way, public opinion would demand it be done.

Dr. GERSHINOWITZ. Yes; exactly.

Mr. DADDARIO. Did I hear you say that we ought to take this matter of establishing criteria and put it into the National Bureau of Standards.

Dr. GERSHINOWITZ. No. I said—I better read what I said just to make it sure. I would like to read, or requote my statement, which involves the National Bureau of Standards.

The factual data on which the standards and criteria should be fixed should be developed by an institution or agency which does not have a responsibility for policymaking or enforcement of a particular aspect of the pollution-resources question. An agency that has served a similar function is the Bureau of Standards.

Chairman MILLER. We will buy that.

Mr. DADDARIO. You are not saying the Bureau of Standards. What you are doing is offering an opportunity for a solution by having one central agency which could, in fact, establish these standards.

Dr. GERSHINOWITZ. Yes.

Mr. DADDARIO. Dr. Gershinowitz, we have reached the time when we have to bring this meeting to a close.

I appreciate your testimony and the work which you have done in the National Academy of Engineering. You have been a great help to this committee.

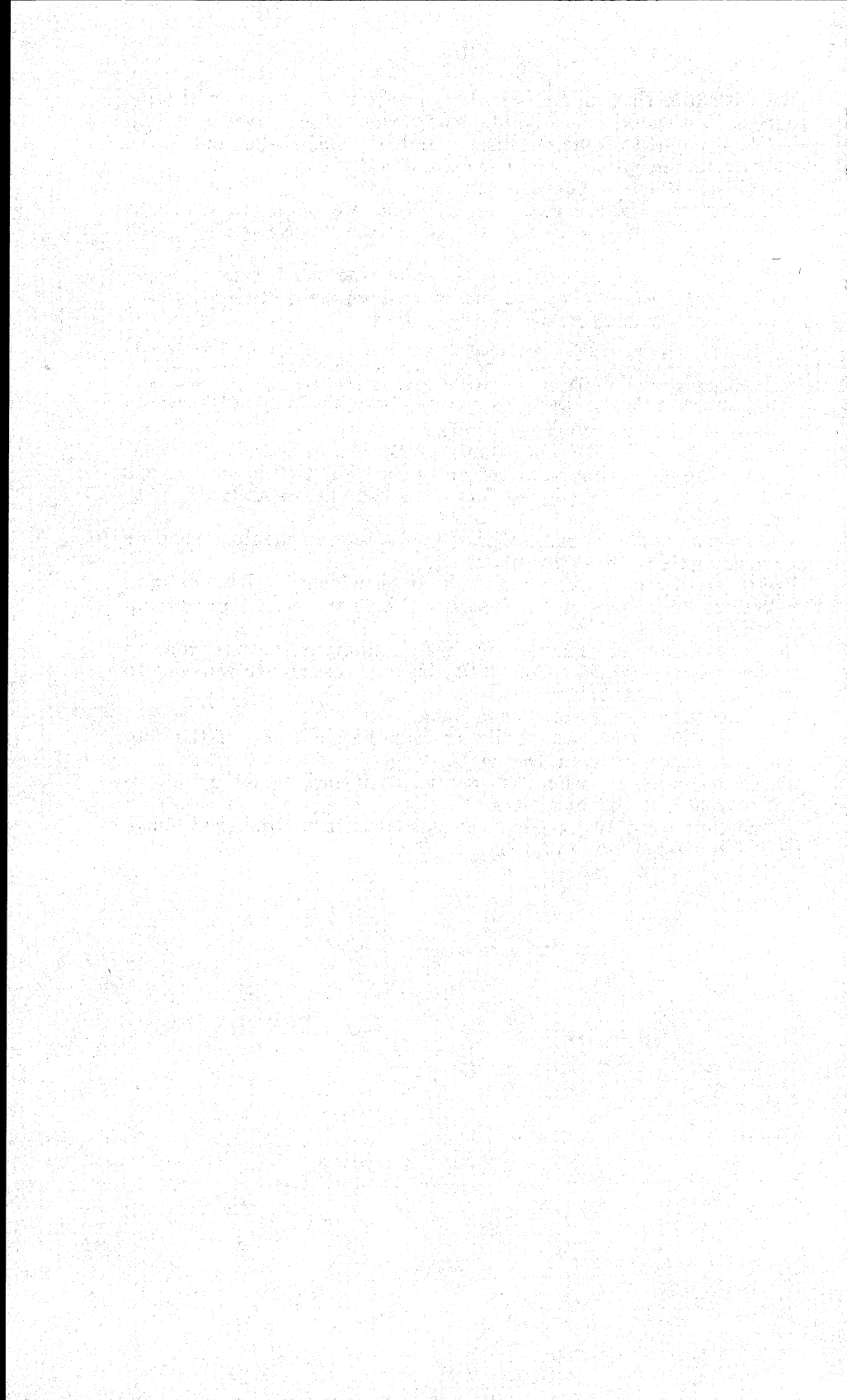
Dr. GERSHINOWITZ. Thank you, Mr. Daddario. I assure you we consider it not only our responsibility but our pleasure to continue to work with you and your committee.

Mr. DADDARIO. Thank you ever so much.

Chairman MILLER. I would like to join the chairman of the subcommittee in that comment, Doctor.

Mr. DADDARIO. This committee will adjourn until tomorrow morning at 10 o'clock at this same place.

(Whereupon, at 12:45 p.m., the subcommittee adjourned until 10 a.m., Thursday, March 14, 1968.)



ENVIRONMENTAL QUALITY

THURSDAY, MARCH 14, 1968

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND ASTRONAUTICS,
SUBCOMMITTEE ON SCIENCE, RESEARCH, AND DEVELOPMENT,
Washington, D.C.

The subcommittee met, pursuant to adjournment, at 10:08 a.m., in room 2325, Rayburn House Office Building, the Honorable Emilio Q. Daddario (chairman of the subcommittee) presiding.

Mr. DADDARIO. This meeting will come to order.

Our first witnesses today are colleagues who have introduced bills concerning a Council on Environmental Quality and a Council of Ecological Advisers.

These concepts are very interesting to me, and I am pleased to see the thoughtful work which has gone into their preparation.

I would point out the train of thought which is contained in these recommendations coincides somewhat with suggestion of a technology assessment board as indicated in H.R. 6698.

We have had considerable discussion of all kinds here of a super-agency management coordination function, and I frankly have not reached any firm conclusions as to the exact form of structure which would best meet the problem. Therefore, I am pleased to have the opportunity to hear from my colleagues who have given a great deal of time and attention to this.

Congressman John D. Dingell, of Michigan, has been an ardent champion of the environment for many years. The viewpoints which he has brought to conservation policy have been enlightening and persuasive. Therefore, it is no surprise to me to see his great interest in this particular field.

Congressman Dingell is also an old friend who has appeared before this committee before. We have always found his testimony to be of great interest and of great help to us in our deliberations.

Mr. Dingell, we will be very happy to hear from you at this moment and recognize that you are in a rush to go off somewhere else.

(The text of H.R. 7796, introduced by Mr. Dingell, and H.R. 13211, introduced by Mr. Tunney, follows. H.R. 14605, introduced by Mr. Matsunaga, and H.R. 14627, introduced by Mr. Corman, are identical to H.R. 13211.)

[H.R. 7796, 90th Cong., first sess.]

A BILL To establish a Council on Environmental Quality, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Environmental Quality Act of 1967".

SEC. 2. The Congress, recognizing the profound impact of man's activity on the interrelations of all components of the natural environment, both living and nonliving, and the critical importance of restoring and maintaining environmental quality to the overall welfare and development of man, declares that it is the continuing policy of the Federal Government, in cooperation with State and local governments, urban and rural planners, industry, labor, agriculture, science, and conservation organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.

SEC. 3. The President shall transmit to the Congress annually beginning June 30, 1968, an Environmental Quality Report (hereinafter referred to as the "report") which shall set forth (1) the status and condition of the major natural, man-made, or altered environmental classes of the Nation, including, but not limited to, the air, the aquatic, including marine, estuarine, and fresh water, and the terrestrial environment, including, but not limited to, the forest, dryland, wetland, range, urban, suburban, and rural environment; and (2) current and foreseeable trends in management and utilization of such environments and the effects of those trends on the social, economic, and other requirements of the Nation.

SEC. 4. (a) There is created in the Executive Office of the President a Council on Environmental Quality (hereafter referred to as the "Council"). The Council shall be composed of three members who shall be appointed by the President, by and with the advice and consent of the Senate, each of whom shall be a person who, as a result of his training, experience, and attainments, is exceptionally qualified to analyze and interpret environmental information of all kinds, to appraise programs and activities of the Government in the light of the policy set forth in section 2 of this Act, and to formulate and recommend national policy to promote the improvement of our environmental quality.

(b) The Council may employ such officers and employees as may be necessary to carry out its functions under this Act. In addition, the Council may employ and fix the compensation of such experts and consultants as may be necessary for the carrying out of its functions under this Act, in accordance with section 3109 of title 5, United States Code (but without regard to the last sentence thereof).

(c) It shall be the duty and function of the Council—

(1) to assist and advise the President in the preparation of the Environmental Quality Report;

(2) to gather timely and authoritative information concerning the conditions and trends in environmental qualities both current and prospective, to analyze and interpret such information for the purpose of determining whether such conditions and trends are interfering, or are likely to interfere, with the achievement of the policy set forth in section 2 of this Act, and to compile and submit to the President studies relating to such conditions and trends;

(3) to appraise the various programs and activities of the Federal Government in the light of the policy set forth in section 2 of this Act for the purpose of determining the extent to which such programs and activities are contributing to the achievement of such policy, and to make recommendations to the President with respect thereto;

(4) to develop and recommend to the President national policies to foster and promote the improvement of environmental quality to meet social, economic, and other requirements of the Nation; and

(5) to make and furnish such studies, reports thereon, and recommendations with respect to matters of policy and legislation as the President may request.

(d) The Council shall make an annual report to the President in May each year.

(e) In exercising its powers, functions, and duties under this Act—

(1) the Council shall consult with such representatives of science, industry, agriculture, labor, conservation, organizations, State and local governments, and other groups, as it deems advisable;

(2) the Council shall, to the fullest extent possible, utilize the services, facilities, and information (including statistical information) of public and private agencies and organizations, and individuals, in order that duplication of effort and expense may be avoided.

[H.R. 13211, 90th Cong., first sess.]

A BILL To create in the Executive Office of the President a Council of Ecological Advisers

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Ecological Advisers Act of 1967".

SEC. 2. (a) There is created in the Executive Office of the President a Council of Ecological Advisers (hereafter in this Act referred to as the "Council"). The Council shall be composed of nine members who shall be appointed by the President, by and with the advice and consent of the Senate, and shall include representatives of science, industry, and major areas of ecological and environmental concern. The President shall designate one of the members of the Council as chairman and one as vice chairman, who shall act as chairman in the absence of the chairman.

(b) The Council shall study the national environment and the national ecology, including the atmospheric, aquatic, and terrestrial environment, relating each area of study to the health, social, and economic needs of the United States. The Council shall—

(1) report regularly to the President on the state and condition of our national environment, and report yearly on its activities;

(2) advise and assist the President on the formulation of national policy to protect, preserve, and improve our national environment;

(3) seek long-range solutions to environmental and ecological problems created by both man and nature;

(4) gather information concerning the conditions of the environment, drawing as much as possible on existing sources, and make such information available to all organizations and individuals, both public and private;

(5) coordinate research between and among public and private agencies, organizations, and individuals for the purpose of promoting advances in research and eliminating, to the extent desirable, duplication of efforts; and

(6) promote cooperation between public and private agencies, organizations, and individuals at all levels of government in the area of ecological and environmental protection, preservation, improvement, control, and research.

(c) The Council shall give priority to the following areas: air pollution, water pollution, solid wastes, atmospheric radiation, and environmental noise (especially problems associated with sonic booms). One year from the date of the enactment of this Act, the Council shall, with respect to the areas of priority, submit to the President—

(1) an appraisal of all policies and programs effected wholly or partially by Federal funds;

(2) recommendations for continued Federal support to existing policies and programs; and

(3) proposals for any new policies or programs deemed necessary by the Council for the promotion of the health, social, and economic needs of the United States as such needs relate to ecological and environmental conditions.

SEC. 3. (a) (1) Each member of the Council except the Chairman appointed from private life is entitled to \$100 per diem when engaged in the actual performance of the duties of the Council, including travel time.

(2) Members of the Council who are officers or employees of the United States are not entitled to additional pay for their service as members of the Council.

(b) Each member of the Council may be allowed travel expenses, including a per diem allowance, in accordance with section 5703(b) of title 5, United States Code, when engaged in the performance of services for the Council.

(c) Section 5313 of title 5 of the United States Code is amended by adding at the end thereof the following new paragraph:

"(20) Chairman, Council of Ecological Advisers."

(d) The Council shall appoint, without regard to the provisions of title 5, United States Code, governing appointments in the competitive service, such personnel as it deems advisable, and prescribe their basic pay without regard to the provisions of chapter 51 and subchapter III of chapter 53 of such title, relating to classification and General Schedule pay rates, at rates not in excess of the maximum rate of the General Schedule in section 5332 of such title.

(e) The Council may procure the temporary or intermittent services of experts or consultants or an organization thereof, including stenographic reporting services, in accordance with section 3109 of title 5, United States Code, but without regard to the last sentence thereof.

**STATEMENT OF HON. JOHN D. DINGELL, MEMBER OF CONGRESS
FROM MICHIGAN**

Mr. DINGELL. Mr. Chairman, I want to express my particular appreciation to you for the privilege of being before this committee. I also wish to express to you my sincere thanks for the privilege of working with you on legislation in the area of preservation of our environment.

I wish to express apologies to the committee, in that I am forced by circumstances, including the fact that several Members of Congress are waiting for me elsewhere, to perhaps abbreviate somewhat my testimony before this distinguished body this morning.

I would like to commend the committee. My valued friend, the distinguished and able chairman, the gentleman from Connecticut, for his interest in this. This is, I think, something that is very much in the frontiers of the law and the wise use of natural resources.

It is something where a man has, as of this time, not really placed his foot down for the first time.

I think that the wisdom of the Chair and the members of the committee in inquiring into this problem, of the wise use of environment, is something for which Americans in many generations to come will have cause to be deeply grateful and express a very real and lasting gratitude to the Chair and to the members of the committee.

For the record, Mr. Chairman, my name is John D. Dingell. I am a Member of Congress from the 16th Congressional District. If I may, Mr. Chairman, I would like to simply insert my statement in the record, perhaps summarizing very briefly.

Mr. DADDARIO. You may proceed in that way, Mr. Dingell. We will put in the record your full statement.

Mr. DINGELL. I have submitted to the committee, Mr. Chairman, a statement and a very brief analysis of H.R. 7796, of which I am the author.

For a number of years, Mr. Chairman, I have been much concerned about the problems of our environment, what mankind is doing to it.

It is my experience that man little knows the effects of what he is doing, where he does he oftentimes disregards those effects which almost invariably are destructive and with great frequency, in fact almost complete regularity, highly destructive—either for mankind or his future interests in this earth and on this world of ours.

It is my experience, Mr. Chairman, that we have found no way of putting together a real understanding of what we are doing, and we have no agency that is chargeable solely with responsibility for continuing scrutiny of what we are doing.

We lack knowledge; we lack organization; we lack the ability to establish a lasting policy and to appropriately evaluate the effects of what we do. There is very little that man does with his enormous technological capability that does not have a tremendous impact upon the environment, much of which is either unforeseen or unforeseeable under the present state of affairs. It is fair also to say, Mr. Chairman, that the handling of environmental problems is totally disorganized within the government. For years I was chairman of the Subcommittee on Oceanography, and it was our subcommittee's purpose to

try and bring some order out of the oceanographic endeavors of this country. It was my experience during this time that first of all, the establishment of an institution in the form of a department within the Federal Government was not a resolution to the problem. That it would simply set up additional competition and additional duplication. It would not arrive at any organization in that area. It would not enable the bringing of more real order out of the rather chaotic circumstances that happen to exist in the field of oceanography. I believe the same general principles apply to the matter before this committee, and would urge that the device that was finally utilized by the Congress after a number of drafts be utilized here. I urge an organism which would generally be responsible for the handling of ecological or environmental problems in a wise and orderly fashion by coordinating departmental efforts.

It was my experience that the establishment of a new department would accomplish very little except to multiply the competitions that happen to exist.

I believe a worthwhile and meaningful device exists for the establishment of order out of the rather chaotic use of our environment that happens to exist today.

Perhaps the best model for this is the Council of Economic Advisers who have for years engaged in trying to establish some order out of the rather chaotic and laissez faire economic system that this country had had for many years. The remarkable success of that agency is pretty well known by all persons, whether they be conservatives or liberals in the field of economics.

And the success of this country in establishing a remarkable pattern of growth and an extraordinary pattern of economic stability is in large part traceable to the Council of Economic Advisers established under the Full Employment Act of 1946.

It is my belief, Mr. Chairman, that if something similar were done, using this as a model in the field of environmental use, we might well look forward to something similar happening in the field of environmental sciences.

I have had a number of contacts and a great deal of correspondence with the ecologists and others in this area and they have uniformly and warmly endorsed and accepted the idea that something of this sort should be done.

I could not offer you any assurances over the short haul that great things could be accomplished, but I believe that the experiences that we have had with similar problems, referring now again to the Council of Economic Advisers, and of course to the efforts that we have finally successfully achieved to order our environmental research in the field of oceanography, that I can offer you rather firm expectation that over the long period the knowledge that is necessary for man to live in harmony with his environment and to understand the changes he is making, how these changes may be modified and controlled, so that he may look forward to long term availability of resources, will flow from the establishment of a council on environmental quality, or perhaps council of ecological advisers, as it has been called. This idea goes back to some discussions I had with the task force established

by Secretary Gardner, when they appeared in the city of Detroit about 3 years ago. At that time I pointed out the chaos that exists. Favorable recommendations in this direction did flow from the Secretary's task force.

This is the history, Mr. Chairman, of the matter. I would suggest to the Chair that since this is essentially an embryonic concept, and since there is a great deal that we do not know, we should utilize to the fullest degree possible the principle of allowing this agency the maximum of freedom that we can afford it. In its early days we should afford it perhaps only the most limited kind of staff that is necessary to carry out its responsibilities.

The Council of Economic Advisers exists with a very limited staff, and does provide great work. I believe starting slow and small in this way would provide the basis for whatever growth is necessary in future times as the knowledge becomes more comprehensive and as the organism has gained experience and ability, and has begun to establish a meaningful program for establishing the order that is necessary in our use of the environment.

With those remarks, Mr. Chairman, I wish again to commend you, and members of the committee, for your scrutiny into this very important matter. It is my hope that something of this kind will come about at an early time because we are frankly playing Russian roulette with our future, and with our environment. There is strong reason to think unless something very drastic is done in this country the pollution of our air, soil, atmosphere, waters, may conceivably mark the beginning of the extinction of mankind.

Certainly, the possibilities of change in the oxygen balance in the air, the exhaustion of the oxygen supply, change in the nitrogen balance, exceeding the capacity of photosynthesis to replace oxygen in the air, or perhaps the excessive pollution of the oceans, may now be taking place, may be marking at this time, without our knowledge, the beginning of the extinction of mankind.

I think the only way we can ever really come to an orderly understanding of these matters so that we can head them off calmly in time that future generations won't blame us for our stewardship of our resources is to establish a device of the kind I have indicated, a council of environmental quality or ecologist advisers.

Mr. DADDARIO. The gentleman from Michigan is to be complimented for the advice he has given us this morning, and the strong feeling not only about his own bills but the whole matter of the environment.

I would like to ask him just one question if he has the time.

Mr. DINGELL. Certainly.

Mr. DADDARIO. You have referred to the Council of Economic Advisers as a model of the structure which you contemplate in the legislation you are proposing.

I wonder how you correlate this with the Federal Council for Science and Technology and its Committee on Environmental Quality, under the control of Dr. Hornig, which provides within the executive branch some structure within which environmental activities would be controlled and could be developed, including as I understand it, a recommendation that an annual report be made.

Mr. DINGELL. I must confess to you, Mr. Chairman, I am a little troubled about exactly where the organism is placed or what it be called.

My experience with the Office of the Science Advisers to the President has been that almost without exception that the individual who holds that office and the staff with whom he works are outstanding men. They are, however, it is my feeling, rather timorous in that they lack both the strong concern over these problems, manifested in public statements, that would necessarily flow from an organism like the council of ecological advisers or council on environmental quality.

It is my feeling that they also lack sufficient dignity in the scheme of things to really have the kind of impact that is necessary in the light of the magnitude of the problem as we know it exists. Now we don't know exactly what the problem is and we don't know exactly what the effects of the abuse of our environment are. But we know they can be disastrous, and we have enough evidence to indicate that the time of disaster may be nearer at hand than most realize. I happen to think that the institution you mentioned is not going to be sufficient under the long-term needs of the country.

I have the feeling that the only way we can get sufficient attention focused on environmental problems is to set up as H.R. 7796 would, and other bills would, independent organisms within Government, not directly under the thumb of the President. And I think the Science Adviser has the defect he is too much under the President's thumb. The agency to which I refer must be made up of men who are renowned in prestige in their fields, made up of men of ability, experience, high attainments, exceptionally qualified as the bill would provide—to carry forward their responsibilities is the way to handle this. It must be independent to be effective.

I think the Science Adviser is a fine step, and I think an office under him is certainly a step forward, but I think it lacks the prestige, I think it lacks the ability, I think it lacks the dignity, I think it lacks the prestige that is necessary to make the kind of progress that is going to have to be made in just the new few years to preserve mankind in this country and on this earth. With the technological demands we are making on our resources, the waste problems that we have, and the other problems like pesticides which are very, very troublesome in the long pull we must have the effectiveness which comes of independence.

Mr. DADDARIO. John, thank you ever so much.

Mr. DINGELL. I again wish to commend you. I am delighted to see that somebody with authority to do something within this body, and with the committee responsibility appropriate for the consideration of legislation is working on this problem. I do hope, Mr. Chairman, in early time some kind of legislation—I don't advocate it necessarily be mine or any other Member's, but just some kind of legislation comes forth from this committee because I think this is one of the major problems this country is going to face in the years to come. I am grateful to see you are doing it.

Mr. DADDARIO. Thank you.

Mr. DINGELL. Thank you, Mr. Chairman.

(The prepared statement of Hon. John D. Dingell is as follows:)

PREPARED STATEMENT OF HON. JOHN D. DINGELL, MEMBER OF
CONGRESS FROM MICHIGAN

Mr. Chairman and Members of the Subcommittee, for the record, my name is John D. Dingell; I am a Member of Congress from the Sixteenth District of Michigan. I wish to thank the Chair and Subcommittee for giving me this opportunity to testify in behalf of my bill, H.R. 7796.

Mr. Chairman, mankind is playing an extremely dangerous game with his environment. Unless we change our ways, mankind faces the very real possibility of extinction from misuse of environment.

For centuries, man has exploited and freely used the resources provided by his natural environment, unhampered by restrictions, secure in his belief that nature's bounty would last forever, heedless of any consequences in his headlong rush toward greater power and prosperity.

For the last two hundred years, Western man's attitude toward his environment has been characterized by an emphasis on economic motives. The industrial revolution which has provided us with the gift of technology also inaugurated specialization and division of labor as prerequisites for production for profit. Technology could be used profitably if production were specialized; indeed, the profit margin often depended on the technological capability of an enterprise. In turn, this idea produced improved technology with even greater capabilities. Our Nation's wealth was founded on technological progress spurred on by the profit motive.

However, this single-minded attention to production for profit resulted in severe social problems. Dislocation of the labor force, a highly mobile society, rapidly changing manpower needs, were some of them. More importantly, specialized production technology took no heed of the wastes created by it. A producer, intent on manufacturing a better mousetrap did not, in those days, need to concern himself with the pollutants and wastes his plant dumped indiscriminately into the air, the water, the surrounding countryside. This was someone else's problem. He did not need to concern himself with the noise his factory made, or the clogged roads caused by his delivery trucks. A coal mine operator did not worry about the scarred landscape left after a mine was abandoned, the severe erosion caused by rain water coursing down hills stripped of vegetation so access roads and auxiliary service plants for a mine could be installed and the mine operated at its full technological capability.

It is the force of these now accumulated changes, of unrestricted and uncoordinated manipulation and neglect inherited from past generations which is haunting us today. Not too long ago, Admiral Hyman Rickover stated:

"In the brief span of time—a century or so—that we have had a science-based wasted irreplaceable fuels and minerals and perpetrated incalculable and technology, what use have we made of it? We have multiplied inordinately, irreversible ecological damage. On the strength of our knowledge of nature, we have set ourselves above nature. We presume to change the natural environment for all the living creatures on this earth."

It is simple enough to detect the deterioration in our present natural environment. Air and water pollution, rising mountains of solid wastes being disposed of by antiquated methods, roads and highways choked by rapidly increasing numbers of automobiles, decayed neighborhoods, rising decibels of noise, disappearing open spaces, all represent a backdrop for American life in the second half of the 20th century. John Kenneth Galbraith provided us with a thumbnail sketch of this situation in his "Affluent Society":

"The family which takes its mauve and cerise, air-conditioned, power-steered, and power-braked automobile out for a tour passes through cities that are badly paved, made hideous by litter, blighted buildings, billboards, and posts for wires that should long since have been put underground * * * they picnic on exquisitely packaged foods from a portable icebox by a polluted stream and go on to spend the night at a park which is a menace to the public health and morals. Just before dozing off on an air mattress, beneath a nylon tent, amid the stench of decaying refuse, they may reflect vaguely on the curious unevenness of their blessings. Is this, indeed, the American genius?"

Our natural environment must maintain a constant, delicate balance. If any of its components are jarred by a pollutant, by the overenthusiastic use of a pesticide, by overcrowding, the dire effects will be many and varied on the whole environment. Our knowledge of the nature and extent of some of these effects is inadequate. We have been warned by scientists, citizens' organizations, public

officials and government agencies of the dangers and consequences of such upsetting agents as air pollution, water pollution, excessive noise, urban blight, the population explosion. We do react to crises in our environment but we anticipate and avoid them only occasionally and haphazardly. Public awareness and interest in a problem is allowed to lag as soon as its critical stage has passed. We have not yet learned that we must consider the natural environment as a whole and assess its quality continuously if we really wish to make strides in improving and preserving it. In his recent message to the Congress on conservation, President Johnson said:

"Technology is not something which happens once and then stands still. It grows and develops at an electric pace. And our efforts to keep it in harmony with human values must be intensified and accelerated. Indeed, technology itself is the tool with which these new environmental problems can be conquered."

There have been many thoughtful proposals made on how to deal with the problem of our rapidly deteriorating environment. They have come from the scientific community, from government agencies, from private groups reflecting the varied concerns of their members. There have been suggestions ranging from the establishment of select Congressional subcommittees to the use of nongovernmental "environmental think tanks" or "resources intelligence agencies" to avoid any bias.

H.R. 7796, which I introduced on March 23, 1967, expresses my conviction that we need the vigorous involvement in this problem on the part of the Executive Office of the President of the United States. The underwriting of a national strategy for overall, long-term environmental management would guarantee continued public interest and willingness for long term planning. I propose that the President begin to submit to the Congress an annual report of the status of our natural resources coupled with an assessment of the current and anticipated trends of their utilization and the effects of such utilization on public health and welfare.

Such an assessment would make it possible for us to eliminate potential abuses at the source rather than having to undertake the costly and time consuming effort to control and abate an environmental insult after it has occurred. To issue a meaningful and accurate report, a great deal of information and knowledge must be gathered, beginning with an understanding of fundamental environmental and ecological factors which must be controlled in order to achieve and maintain a desirable and attainable environmental quality. We must develop a systematic approach toward maintaining a healthy and livable environment as a whole and abandon the idea of focusing our efforts on specific, isolated forms of environmental contamination.

To aid the President in accomplishing this task, I propose to create in the Executive Office of the President a Council on Environmental Quality composed of three members who, as a result of their education and training coupled with experience and personal accomplishments, would be exceptionally qualified to analyze and interpret environmental information, and assess remedial programs and activities in terms of immediate and long-range planning goals.

The Council would thus be the focal point for all new and authoritative data concerning the status and trends in environmental quality. It would interpret these data, analyze their usefulness and importance, and inform the President of their impact on the national ecology as a whole. Based on its findings, the Council would then make appropriate recommendations for Federal action designed to foster and improve environmental quality "to meet social, economic, and other requirements of the Nation."

I agree with those who maintain that Federal action alone is inadequate. I firmly believe that coordination and close contact must be maintained at all times with State and local agencies, industry, urban planners, agriculture, conservation groups, and the scientific community. I therefore recommend that the Council consult regularly with all these groups and make the fullest use of their services, facilities and information of all kinds. We need sustained, wholehearted public support for a program of this magnitude, and there is no better way of than to enlist the help and active understanding of every qualified individual.

There may not always be agreement on a good policy to follow. But there would at least be a consensus of what is bad in our environment. This, too, would give us a basis on which to select an effective remedial program.

Numerous agencies and departments are now engaged in extensive research, surveys, data collection and evaluations of ecological phenomena and the results of man-made manipulations of his natural environment. However, the Council would provide a top level, independent body, unencumbered by the demands and

politics of operating programs and individual interests, free to draw independent conclusion and to formulate a broad policy which would be of nationwide benefit.

I am pleased that this Subcommittee is continuing its inquiry into the status and condition of our natural environment. My bill, a brief analysis of which is submitted for the record, was referred by the Committee on Interior and Insular Affairs to the Committee on Science and Astronautics on April 17, 1967. It is my sincere hope that it will be acted on favorably by the Committee.

We know that man, as the dominant species, is the focal point of his environment. Man has created the environmental problems which confront him today; he must now move swiftly to remedy them in order that the environment may continue to meet his needs rather than destroy him. We can no longer subordinate environment to our technology; rather, technology must become a servant to our natural environment, shaped and adapted to the conditions we want to live in. Enactment of H.R. 7796, the proposed Environmental Quality Act, can effectively aid us in a nationwide effort to consider the consequences of our actions and take a rational approach toward improving and maintaining the chosen quality of our environment.

Mr. DADDARIO. Our next witness is the Congressman from Hawaii, Mr. Spark M. Matsunaga, who has introduced a bill, H.R. 14605.

We are pleased, Mr. Matsunaga, to have you here this morning. We are anxious to listen to your advice and recognizing that you have a statement, you can proceed in any way you like.

STATEMENT OF HON. SPARK M. MATSUNAGA, MEMBER OF CONGRESS FROM HAWAII

Mr. MATSUNAGA. Thank you, Mr. Chairman and members of the subcommittee.

Since the statement is very short, Mr. Chairman, I will read it for the purpose of conserving time.

Mr. Chairman and members of the subcommittee, I thank you for this opportunity of appearing before you and expressing my views with respect to H.R. 14605, a bill to create in the Executive Offices of the President a Council of Ecological Advisers.

This is an identical bill introduced by my colleague from California, Mr. Tunney.

The distinguished Secretary of the Interior, Mr. Stewart L. Udall, a former Congressman from Arizona, has summed up our traditional attitudes toward our environment in these words:

We have accepted noise, foul air, (and) dirty rivers as inevitable consequences of industrialization . . . But now we are changing our basic assumptions. We have been a filthy generation. What will become of our grandchildren if we don't change our approach?

Secretary Udall's concern is shared by men of science who have voiced their opinions with increasing frequency in recent months. There is a sense of urgency in the scientific world that meaningful studies ought to be undertaken—and soon—in the field of ecology, the branch of science which deals with the relationship of living organisms to their environment, including man and his surroundings.

An understanding of the need that H.R. 14605 and similar bills would fulfill may be gained by a closer look at the study of ecology itself and what it involves. The basic unit in ecological studies is the ecosystem, which is the total complex of plants, animals, terrain, climate, etc. For example, a forest area may be studied as an ecosystem. Such a study would include the interrelationships between the trees, the smaller plants and animals living in the forest, and nonliving factors such as climate and soil conditions.

In a broader view, nations, continents, or even the entire planet, may be considered to be a large and complex ecosystem in which man and his activities play an important role. On a planetary scale, there are a number of disturbing theories concerning the effects of man's activities on the ecology of the earth. For example, there are theories that large-scale emission of carbon dioxide is warming the climate, or, conversely, that the emission of exhaust gases from jet airplanes into the upper atmosphere is cooling the climate. It has even been suggested that various human activities, notably the poisoning of marine plant life by water pollution, may result in the depletion of the world's oxygen supply. None of these theories has been proven to be either true or false, but the mere fact that these possibilities exist serves to underline our ignorance in the field of ecology and our need for more knowledge and more study in this relatively neglected science.

It is to the well-earned credit of the Congress of the United States that legislation has recently been enacted and other legislation is presently under consideration to halt or curb the ever growing contamination of our air, water and soil. In the consideration of such legislative measures, however, I am sure that members of Congress, with possibly a few exceptions, would be the first to admit their lack of scientific knowledge and background to delve into these environmental problems in depth and to determine the nature and effect of the interrelationships which the science of ecology encompasses.

For the reasons I have stated, and in order to provide a continuing link with the future, the establishment of a Council of Ecological Advisers is a necessary complement of the legislative effort to improve man's status in relation to his total environment. Under the terms of H.R. 14605 and similar bills, the Council of Ecological Advisers would study the national environment and ecology, giving advice and assistance to the President on the formulation of national policy to protect, preserve, and improve our national environment. The Council would conduct an appraisal of the various Federal programs dealing with the environment and would direct the coordination of these programs. First priority will be given to five key problem areas: air pollution, water pollution, solid wastes, atmospheric radiation, and environmental noise (especially sonic boom problems). However, the Council would not be limited to these areas and would be expected to study other ecological problems as they arise.

The Council would be made up of nine members, to be appointed by the President with the advice and consent of the Senate, and would include representatives of science, industry, and major areas of ecological and environmental concern.

Mr. Chairman and members of the subcommittee, I urge your favorable consideration of H.R. 14605.

Thank you very much.

In closing, Mr. Chairman, I, too, wish to join my colleagues who preceded me in congratulating the chairman for bringing this matter to an early hearing.

Mr. DADDARIO. Mr. Matsunaga, you make before this committee a very persuasive argument for the need to do something in this area. I am particularly pleased by the kind of approach you have taken and the language which you have used in your remarks, because it shows

an increasing development in the Congress of an awareness and an ability to handle this kind of a problem.

I think as we in the subcommittee see it and others see this, too, there is developing within the community generally a confidence in our ability to handle matters of this problem.

We had some ecologists in here the other day headed by Dr. Lammont Cole, from Cornell University. He touched on this subject and many others. He was quite confident about the programs in being and those proposed.

These, as we examined them, were programs which depend a great deal on the international biological program. The international biological program on the other hand depends on the support we are going to be able to give it in the Congress. If, in fact, this is not funded, these programs, upon which they are so much dependent, will not be brought about. A great deal we do not know will then not be learned so that we can legislate with knowledge on the subject.

This committee will be making some recommendations about the international biological program. I do think it is going to be important for all of us to see that this gets support, because unless it does we will not have developed the knowledge necessary, not only in this country, but in this whole hemisphere.

I bring this up because I do think that our concern will show itself unless we do have a successful international biological program from the standpoint of U. S. involvement."

Mr. MATSUNAGA. I appreciate the chairman's mentioning of the international biological project because it is my information that a study is expected to be made of Hawaii and the waters surrounding Hawaii—a study which is primarily based upon the fact that Hawaii is an isolated community, thousands of miles away from the mainland of the United States, as well as from the Asian mainland. It is hoped that the study will be made soon enough, before industrialization will catch up so much in Hawaii that it will have ruined the basic ingredients of the study before the study is made.

I join with the chairman in the hope that the international biological project will be given full support by all countries involved.

Mr. DADDARIO. How does the Committee on Environmental Quality fit into the scheme of things? This is the same question I asked Congressman Dingell.

Mr. MATSUNAGA. The Committee on Environmental Quality no doubt serves a very laudable purpose within its own sphere of work. However, I see the proposed Council as a preemptive coordinating body. As was expressed by Mr. Dingell, the Council would provide the impact necessary to emphasize the urgency of the problems which now face us. I think this can come about only by the establishment of an independent agency, such as that suggested by the bills now before the committee.

Mr. DADDARIO. Are there any questions?

Mr. LUKENS. No questions.

Mr. DADDARIO. Thank you ever so much.

Mr. MATSUNAGA. Thank you very much.

Mr. DADDARIO. Our next witness is the Congressman from California, Mr. John V. Tunney.

John, we welcome you here. As the chairman of the subcommittee, I have a particular fondness for the gentleman from California, because his early and formative years, which we believe have added to his capabilities and strength, took place in Connecticut.

We look to him as the supporting Congressman from Clearfield County which he knows so well, and which knows him so well. I have found over the course of time that we in Connecticut, as well as the people in California, have every reason to be proud of the gentleman.

I am especially pleased he has taken such great interest, as Mr. Dingell and Mr. Matsunaga have, in the problems of our environment. It shows a growing tendency on the part of the Congress to be concerned not only with the impact of pollution on our environment, but with an overall problem. We cannot separate water, soil, and air pollution, one from the other as we have.

Mr. Tunney, in his statement and in his private conversations with me, has been particularly concerned about the way these things are managed—how do we, in fact, put together the structure of these things and apply our best talents and resources to come to a solution about these problems before they become disastrous.

Mr. Tunney, we are happy to have you here and happy to hear you.

**STATEMENT OF HON. JOHN V. TUNNEY, MEMBER OF CONGRESS
FROM CALIFORNIA**

Mr. TUNNEY. Thank you, Mr. Chairman. I can't tell you what a great pleasure it is for me to appear before your committee because perhaps more than any other man in Government you have shown leadership that I think is going to be needed to bring about a resolution of our environmental problems, and the one sad note that I have about my residence in Connecticut is that I didn't come from a district where I could have voted for you because you were in Congress while I was still in Connecticut, and unfortunately I came from a different county. But I want you to know that the nutmeg as a part of my early life certainly has helped me take care of the citrus farmers out in California. You are very gracious to allow me to make a few remarks today about H.R. 13211, my bill to create a Council of Ecological Advisers.

I would like to say that my statement is rather long, and if it could be made a part of the record I would like to just make a few excerpted remarks from my statement.

Mr. DADDARIO. Without objection it will be entered into the record.

Mr. TUNNEY. I feel perhaps Congressman Dingell also should be mentioned as a great leader in this effort. His bill which was introduced before mine certainly is the pilot light which inspired me and my bill is but a refinement, in my opinion, of his legislation, and he certainly is to be complimented for his imagination and initiative in this area.

I feel that whether we have a council of environmental advisers or a council with ecological advisers makes no difference, but what we

do need is a council at the Presidential level coordinating all the programs that the Federal Government has to handle the pollution of our environment.

I feel that a council of ecological advisers would be helpful in establishing in the Office of the Presidency, a basic policy objective. It would have the advantage of being able to take an overview of all the environmental problems, whether it is radiation, air pollution, water pollution, it makes no difference. Essentially, ecology is the relationship of life to the environment around life, and our major concern of course is man, and man's relationship to his environment.

But equally important is the relationship of plant life to the environment, because we all need food, and animal life to the environment, whether they are animals that we eat, or whether they are animals in the forest that are a part of our heritage.

And so I think that we have to understand the interrelationship between life and environment and environment and life.

I think this is not being done at the present time by any governmental agency. I don't feel that we have an appreciation of the interaction of all kinds of pollution, one to the other, and to all kinds of life.

I would also like to say that it seems to me that it necessarily follows in Government that when you recognize that there is a problem, for instance, say, with water pollution, that many different departments become involved in trying to rectify the situation.

We have for instance the Department of the Interior, which has an obvious interest in trying to abate water pollution, but we also know that the Department of Commerce has an interest, because industry needs water, and it needs good quality water, and so they have an interest.

The Department of Health, Education, and Welfare has an interest. If water is polluted it is obviously going to affect the health of human beings.

And so you have a division of responsibility, and sometimes you have a duplication, and sometimes the departments are working at cross purposes one with the other. So it is for this reason that I feel it is essential that we have a council, or another body, whatever you would like to call it, which is capable of coordinating, giving a sense of direction, and advising the President as to how there can be a synthesis of the programs that we now have in the Federal Government.

I might say that I sent a copy of the legislation that I introduced to a number of leaders in environmental and ecological problems throughout the country, and I would like to include for the file their responses to me if you feel that that would be appropriate. And then I would like to excerpt from the letters a few comments which I think would be of particular interest to this committee.

(The letters referred to are shown in app. C, p. 557.)

Mr. TUNNEY. Dr. Frederick Sargent, chairman of the Committee on Human Ecology of the Ecological Society of America, wrote that the members of that committee, and I quote:

* * * decided that the "Ecological Advisers Act of 1967" was sufficiently important to demand a supporting statement from the Committee as a whole.

Hughes Aircraft Co.:

I have read with interest and approval the print of H.R. 13211 which you provided, and your speech of 27 September 1967, which introduced the measure to the Congress. I endorse the principal thrust of your proposal and will be interested to observe its progress.

W. H. Pickering, director of the Jet Propulsion Laboratory:

The matter of environmental control with which you have concerned yourself in H.R. 13211 is unquestionably one of vital and immediate concern.

The letter continues for four pages and I strongly urge each member to read it.

Athelstan Spilhaus, president of the Franklin Institute:

I was greatly cheered by the imaginative and comprehensive approach of H.R. 13211, the "Ecological Advisers Act of 1967."

He then spells out in some detail his ideas for solutions to the problems.

Prof. Norton Nelson, chairman of the New York University Medical Center, Institute of Environmental Medicine:

Your proposed Council of Ecological Advisers goes directly to this point; the need is real and urgent.

Dr. James H. Steiner, medical director of Eastman Kodak Co.:

Although it has been my privilege to give testimony on a number of occasions on proposed legislation, I cannot remember a single instance when, even though I favored the proposed bill, I did not have at least minor modifications to suggest. Consequently it is a real pleasure to tell you that I am enthusiastic about H.R. 13211, and would strongly urge its enactment, as one of the most important and constructive actions which the Congress and the President can take.

The managing director of the National Tuberculosis Association:

It seems to us that the time is ripe for the type of National Council of Advisers your bill proposes.

Roy E. Peterson, Litton Systems, Inc.:

I am in complete agreement with this proposed legislation since I firmly believe that a comprehensive ecological approach, one stressing cost/benefit as well as cost/effectiveness represents the only intelligent response to our total problem.

There are many other letters, Mr. Chairman, which I could read, but which I know the committee doesn't have time for me to read, that I would like to introduce into the file, because I think that they are pertinent.

It seems that there is almost unanimous support from people who do have a concern about this problem, that something should be done and should be done now.

We just can't afford to wait until our environment becomes so polluted that it changes the basic ecology of the world, of our planet, and, therefore, I am particularly pleased that you are holding these hearings, that you have such a tremendous interest in the problem, and are really popularizing this concept for the Nation.

Mr. DADDARIO. The service you have rendered, Mr. Tunney, not only in your statement but the indication of support by the letters that you have given us is important because it shows the dialog developing of an important kind. People are becoming interested.

Congressman Dingell, Matsunaga, and others in Congress are developing a relationship which is extremely important.

Dr. Sargent who wrote one of the letters to you was a witness that appeared before us.

An example of the way in which this activity is growing is the University of Wisconsin branch at Green Bay, where a center of ecology is in fact being put together.

During the course of our discussion, one of the witnesses said that he did not know of any place where this was being done. Dr. Sargent was able to show that there was one place at Green Bay, and then it came out the University of New York, at Albany, has another center being created, and which will be inaugurated in ceremonies beginning this coming Sunday.

I can recall a year or two ago when we were dealing with the subject we put out a statement which in the first line contained the word "ecology." One of the reporters who had been covering the hearings thought ecology was such a little known word that we ought to define it so that people would understand it.

In the time since we find that this is no longer a criticism. People, in fact, are beginning to associate the word with the problem, and I think this is a sign of progress.

We will certainly take into consideration what you have said, and as indicated earlier by informal remarks to me, the concern you have about managing these programs.

One of the underlying purposes for these hearings is that we can take a look at the agencies of government involved in this program and can see how they have carried out recommendations made by the Sargent committee, the Spilhaus committee, and others that have been involved, and the recommendations that this committee published as a result of our hearings on the environment a year or so ago.

We are not only looking at this in depth through these hearings, but we are having staff work done on it, and we have outside consulting advice of a highly skilled nature which will be able to give us a hand in the report, recommendations, and conclusions we reach as a result of these hearings.

So, we all, I think, are emphasizing the various aspects of this problem which need to be looked at seriously. I compliment Mr. Matsunaga, and I compliment you and Mr. Dingell and Mr. Corman, who also has submitted a statement for the record.

I am pleased to note congressional support, and pleased to have an opportunity to have heard from you.

Mr. TUNNEY. Mr. Chairman, thank you very much. Just one last point that I would like to make, and that is I think that it is very important that any council that be established include laymen, citizens, nongovernmental employees. I think that we ought to have social scientists; we ought to have city planners; we ought to have city administrators, because let's face it, anything that man does in the way of building up industry, or building up a transportation system, or whatever it is, it is going to pollute the environment to some extent. And this is a question of a trade off of values. We know that when we put chemical sprays on crops that to a sense we are going to pollute the water systems in the nearby areas. But on the other hand this is a trade off. We feel to eliminate the pests is more important for food than the minor damage that may be created by some water pollution.

So I think that we have to have citizens outside of government helping to make these value judgments of what the trade off should be, and that is why I think that we need to have a council at the Presidential level that does have these private citizens involved in making the determinations as to what the trade offs are and should be in the future.

Mr. DADDARIO. Thank you, Mr. Tunney.

(The prepared statement of Mr. John V. Tunney is as follows:)

PREPARED STATEMENT OF HON. JOHN V. TUNNEY, MEMBER OF
CONGRESS FROM CALIFORNIA

America has been blessed with abundant resources. Together all of our resources comprise the basis of the environment of the wealthiest nation on earth. Until this century, our Nation was primarily occupied with the development of most of those resources—with the mining and processing of mineral deposits, the planting and harvesting of the land, the cutting and milling of timber, the transport and industrial uses of water, and the mining, drilling, processing, and combustion of fossil fuels. In the early part of the 20th century, conservation of some of the overexploited resources of our country became a national interest. The Government began to take steps against the misuse of our most precious national wealth, next to our people, the natural resources of America. Characteristically, conservation was first concerned with the most obvious blemishes resulting from earlier misuse—denuded timberland, eroded farmland, very inefficient and wasteful mining and processing operations, and eventually polluted and poisoned waterways.

In the past two decades the concern over the resources of our environment has grown immensely. Not only are we concerned with the impact and effect of that use and misuse of our resources, we are now concerned with the impact and effect of that use and misuse throughout our environment. Man and nature have altered our environment; and, in doing so, have altered the ecology of our Nation—the interrelationship, interaction of all parts of our environment. We are no longer concerned just with the misuse of mineral deposits and its impact on the land; we are also concerned with the poisoned waters resulting from poor mine drainage. We are no longer concerned just with the agricultural problems which result from the misuse that created the great midwestern Dust Bowl, we are also concerned with the effects of the dust in the atmosphere and the air breathed by millions of people in those agricultural States. We are no longer concerned just with the inefficiency and waste of poor smelting and metal processing; we are concerned with the impact of poisonous air emissions on the lungs and lives of millions of urban and rural dwellers.

We have not yet dealt with these problems effectively. We have not even considered all of the problems besetting our environment and their effect on our ecology. We have a tendency to deal with problems in a piecemeal manner. We do not anticipate a problem in a so-called preventative fashion. Rather, we let problems reach a point where we must try to cope with them in order to keep them from getting even more out of hand. This certainly has been the case in the area of environmental quality control.

The Congress, State and local governments, and industries have only recently begun to show their concern and awareness of the problems of air and water pollution in the face of the ever-increasing outcry of public dissatisfaction. We have, however, continued to act in our manner of responding to problems once they have become large enough to attract national attention. We have been caught ill prepared to deal with these problems, and the indecisiveness of our legislation is indicative of our lack of foresight. While we are presently looking at the two giants in the area of environmental quality control, air and water pollution, we are not viewing them in a sophisticated enough manner, nor are we paying enough attention to their impact on each other and on the entire environment. We are not giving enough consideration to other problems which will increase with our national growth if they continue to go on unchecked.

We have a need to look after the entire environment and the ecology of that environment. We must know the relationship of air to water pollution, and of each to solid waste matter, and of all to each other. We must understand the effects of radiation on all forms of pollution, the effects of pollution on the weather,

the relationship of topography to pollution, and the beneficial combinations of urban planning to topography and the relationship of that combination to pollution abatement. We must understand the impact of environmental change on human beings, and how the changes in the quality of the atmosphere and the appearance of the environment affect man both physiologically and psychologically.

We have a need to understand our physical surroundings and the ecology of that environment better, so that we may direct our efforts at beneficially altering our environment, and so that we may be able to foresee future problems that could be averted at an early stage. We must have an overview of our surroundings so that we can understand our strengths, weaknesses, and needs, and act accordingly.

At present we are dealing with many of the problems of our environment in many areas of the Government. I do not question that each of these areas has a special and particular interest in its area of authority. The Public Health Service, in the Department of Health, Education, and Welfare, certainly has appropriate interest in air pollution. For air pollution has direct effects on our health. However, the Department of Transportation also has an interest in air pollution as it relates to automobiles and their ability to create air pollution, and as it relates to decreased atmospheric visibility which affects air transportation. Commerce has obvious interests when one of the great sources of air pollution is industry; and Agriculture is keenly interested in the impact of polluted air on crops and vegetation. I do not deny that each of these departments has a specialized and necessary interest in air pollution.

The Department of the Interior has an important concern with water pollution, for it has jurisdiction over the billions of gallons of water which come from areas of Interior's jurisdiction. The Department of Housing and Urban Development also has an intense interest in water use, for it must concern itself with the water needs, and water and sewage systems of the great cities. Agricultural use of high quality water is a need that speaks for itself. Industrial use of water again involves commerce, and there are obvious health needs in water purification systems. Again, I maintain that these areas all have individual legitimate and necessary authority in these realms.

The Atomic Energy Commission has obvious authority in the area of radioactive materials. The Department of Health, Education, and Welfare has interests in the health aspects of these potentially harmful materials. The Department of Defense has needs for nuclear fuels, and every Department involved with water which is interested in desalinization as a source of additional fresh water has considered atomic facilities for such processes. These interests each have certain special concerns, and I feel that they are rightfully exercising authority in their own particular areas.

I could go on and on, but certainly it is not necessary. There is nothing wrong with his departmental specialization in related fields; it is advantageous for the Government to look at problems from a variety of specialized points of view. There are, however, some major needs which are not being met.

First and foremost is the need to view the entire environment and its total ecological interaction. It is essential to relate all of these areas of interest to each other. The environment is certainly composed of many more elements than have been mentioned here. And the ecology of the environment—the interaction of all of those elements—is something that I could not entirely explain here for we do not yet entirely understand it. That is my point. The understanding of our ecology is essential if we hope to successfully deal with the many problems of our environment. The understanding of our ecology is essential if we hope to create programs that will alleviate our environmental problems. Both now and in the future. The understanding of our ecology is essential if we are to make the various individual programs in our government relate effectively to one another, and to advance our activities in the realm of improving the entire environment. And effective overall view of the environment and its ecology will enable us to evaluate the effectiveness of our present efforts throughout the Government.

It is for this reason that I introduced the Ecological Advisers Act of 1967. This bill proposes the creation of a Council of Ecological Advisers in the Executive Office of the President.

The purposes of this Council are manifold. Primarily this branch of the Executive Office is to provide an overview of the problems of the ecology of the national environment, and to recommend and develop ideas and concepts for the

implementation of programs designed to improve, protect, reclaim, restore, and conserve the various aspects of our environment. The Council is to establish devices for reviewing the effectiveness of, and the need for programs throughout the Federal Government, or sponsored or supported by the Federal Government, in related areas of environmental or ecological quality.

The most important of the Council's tasks will be the relating of the various areas of environmental interest to each other, and the development of creative concepts and plans for the continual improvement of the ecological and environmental conditions of the Nation.

The Council is also to direct the coordination of the efforts throughout the Government by its appraisal of programs. Through its staff and research facilities, it is to streamline and coordinate the research activities of the various areas of Federal interest and involvement in ecological questions. The Council will also advise the President on the allocation of funds for the various Federal areas involved with environmental questions.

The overview of the Council will be directed at the entire ecology of the environment—from the point of view of man and his needs. Ecology itself is not a concept which directs itself toward the effect of the interaction of the elements of the environment on one individual organism or element. However, in the case of the Council, we are interested in the environment and its ecology as it relates to man. The Council should not occupy itself with the narrow definition of each constituent element of the environment, but rather with the overall interaction of the constituent elements as they relate to man through their interaction with each other and with man. The Council must take a larger and not a smaller view of the picture of the environment. It must take a creative and comprehensive look at the ecology of our environment, concerning itself not only with the physical implications of the environment, but with the psychological and sociological implications of the conditions and interactions of the ecology of the environment on man. This will certainly include both the man-made as well as the natural elements of the environment.

The need for such a Council is clear. I have been in contact with representatives from industry, Federal departments, the Executive Offices, and scientific specialists, and they all express the idea that, in one form or another, some type of overseeing body is necessary to deal with the ever-increasing and continually proliferating questions and areas of authority concerned with our environment. They all affirm that an ecological view is necessary. There is a need to develop a long-range view of the problem, and corresponding long-range plans. There is a need to see that those areas of the Government dealing with various environmental problems are able to bring all resources to bear on those problems, are using all of the material available to the Federal Government, are not duplicating other efforts and programs, and are far reaching and creative in their efforts—with an understanding of the relationship of their projects and work to other related undertakings, other places in the public and private realms.

It is only fair to ask questions concerning the placement of such a council at the level of the Executive Office of the President. Once the need for such a body was determined, careful consideration was given for the placement of such an overseeing policy body. During the course of deliberations, the places considered for such a governmental function varied from the new Cabinet-level department to an Assistant Secretary of Health, Education, and Welfare.

It has become increasingly clear that a body created to deal with the entire environmental ecology must be in a commanding place in the Government if it is to be in any position to get an effective overview of national efforts and is to be a far-reaching policy determiner. If it is to be such an overseeing body, it cannot be placed in the structure of any one department involved in any one area of ecological or environmental quality control. It could never oversee or direct the efforts of activities in other departments equal in stature to the department in which it was a subdivision. Therefore, creating an assistant secretary, or some such similar position in an existing agency would essentially be impractical and make such a body or position impotent.

On the other hand, there is no desire to create a "super department"—a department to collect all of the various environmental quality research and control functions rooted throughout the various agencies and departments. As stated earlier, there are certain specific areas which are best kept where they now are, and such a massive reorganization would only postpone further the needed advances in this field.

The logical place for this Council, therefore, is at the level of the executive. There, as a result of its position and its composition, and through its contact with the President, it is in a position to direct and enhance the activities in the Federal interests in environmental quality control, and to exercise independent and creative judgment in a previously much neglected field.

The power of this Council is derived from a number of areas. First and foremost is the position of the Council in the Executive Office of the President. The ecological advisers should be the executive equivalent of the Council of Economic Advisers, and through their function of reporting directly to the Executive on a regular and frequent basis, and recommending policy, programs, and allocations, the advisers maintain a prominent and powerful position in the Government.

The composition of the body also lends itself to authority both within and outside of the federal structure. The prestige value of a membership composed of experts and outstanding figures from a number of areas of private service should enable the Council to wield a great deal of influence in areas of environmental concern. The arrangement within the Council which enables the advisers to serve on the council without leaving their important positions in public and private life, enables, each individual member of the Council to maintain and enhance his own individual position of status in his area of specialty and influence.

The composition of the Council should be designed to include representatives of science, industry, and areas that are major concerns of environmental quality. The advisers themselves should be individuals who are capable of taking an effective overview of the situation, and not become involved with the particulars of the various programs which come under the purview of the authority of the Council.

For this reason I feel that the larger part of the Council membership be composed of social scientists, social and community planners, and public administrators. The great volume of the needed scientific expertise should come from the staff of the Council which will serve on a full-time basis. As previously mentioned, the Council members will retain their positions in public or private organizations in order to maintain positions of authority, and to help the member to maintain his specialized expertise and thus contribute more to the Council.

There is one additional underlying question which must be answered. This question deals with the concept of creating a new structure within the Government each time a problem is newly recognized, or appears to have grown or be growing. Should we create some new part of the bureaucracy every time we discover or redefine a problem? Of course we should not in every case or even in most cases. For we surely have the facilities within our gigantic federal structure to handle most problems. This question can honestly be asked of any new proposal, and it certainly must be asked of a proposal of such far-reaching proportions.

In the case of this plan I have introduced, I believe wholeheartedly that the need for its creation is clear. Our environment is our most immediate need. It affects us every minute of every day, and the ecology of that environment can alter our lives. This is not a simple problem, and therefore cannot be met by a simple solution. This is a problem that has roots throughout our country, and is dealt with in almost every area of the Federal Government. It is an area which includes environmental elements which must be actively related to each other if any valuable headway is to be made in the field of environmental quality control.

The possibilities of such a plan are very encouraging. The purview of the Council will deal not only with the interrelationship of the elements of the environment, but with the effects of those interrelationships on man himself. Only a Council in such a commanding position could be capable of collecting related information, coordinating efforts and projects, streamlining Federal activities in this rapidly growing field of interest, and developing the long-range and creative plans involving all areas of the Government which are necessarily involved in this realm.

Only a council such as the one proposed could have the latitude to develop such new concepts as the psychological implications of life in an urban area in terms of total ecology, and only such a council could be in a position to promote now unknown projects and concepts which are certain to develop in areas of urban and rural social ecology, and total concepts of waste disposal and related pollution abatement projects.

The need for such action is obvious. The environmental problems of this country are increasing daily and we must stop dealing with them only as they appear as blemishes on the national countenance. We must be far-reaching in our own efforts to establish a body with needed authority to view an immense problem from a comprehensive position and to develop effective solutions to complex and important problems.

(Prepared statement by Hon. James C. Corman is as follows:)

PREPARED STATEMENT OF HON. JAMES C. CORMAN, MEMBER OF
CONGRESS FROM CALIFORNIA

Mr. Chairman, I thank you for the opportunity to testify in support of H.R. 14627, a bill I introduced January 16 of this year, to create in the Executive Office of the President a Council of Ecological Advisers.

The dictionary defines ecology as "the branch of biology that deals with the relations between living organisms and their environment; in sociology, the relationship between the distribution of human groups with reference to material resources and the consequent social and cultural patterns."

While our Nation has been blessed with an abundance of natural resources, our population has grown immensely and our environment has changed drastically. The responsibility to plan for these changes lies with all levels of government. And, we in the Congress must concern ourselves with the use and misuse of our resources as our population continues to grow and our environment continues to change.

We are now facing the problems created by air and water pollution, but we responded only after tremendous public outcries. And even here, our response has not been sufficient to permit real progress in the very near future, partly because we do not know enough about the ecology of our environment.

We must anticipate the problems that our changing environment will create so that these problems do not become insurmountable. Our knowledge in this area is scant. We must learn more if we are to provide a livable environment for ourselves and those who come after us.

My bill will take us in this direction.

Very briefly, it would create a Council of Ecological Advisers to the President. It would conduct studies of natural environmental systems; it would advise and assist the President on the formulation of national policy to protect, preserve and improve our national environment; it would seek long-range solutions to the problems created by man and nature; it would make such information available to all public and private organizations and individuals; it would coordinate research and promote cooperation among all agencies, organizations and individuals in the area of environmental study; it would give priority to the very important areas of air pollution, water pollution, solid wastes, atmospheric radiation and environmental noise.

The rapid rate of increase in population and the pressures on our natural resources and on our environment make the need for increased ecological research urgent. My bill will take the first step to meet this need.

Thank you.

Mr. DADDARIO. Our next witness is Dr. Richard Morse, who was the Chairman of the Panel of the Electric Automobile for the Department of Commerce, which recently published its report "The Automobile and the Air Pollution, a Program for Progress."

Dr. Morse, we are happy to have you here this morning and are anxious to hear from you.

(Dr. Morse's biography follows:)

DR. RICHARD S. MORSE

Born: August 19, 1911, Abington, Massachusetts.

Degrees:

S.B., M.I.T., 1933; Tech. Hoch, Munich, 1933-34.

D. Eng., Brooklyn Polytechnic Institute (honorary), 1959.

D. Sc., Clark University (honorary), 1960.

Field: Technical Management, Research and Development.

PROFESSIONAL EXPERIENCE

1934-35: DIC Staff, M.I.T.

1935-40: Scientific Staff, Eastman Kodak Company.

1940-59:

President, National Research Corporation.

President, Vacuum Metals Corporation.

Director, Escambia Chemical Corp., Columbia-National Corp., New Enterprises, Inc., Leybold Hochvacuum G.M.B.H.

Chairman, Army Scientific Advisory Board.

Member, Defense Science Board.

1959-61:

Director of Research and Assistant Secretary of the Army (R&D).

Distinguished Civilian Service Medal.

1962-:

Senior Lecturer, Sloan School of Management, M.I.T.

Technical Advisory Board, U.S. Department of Commerce.

1965-:

U.S. Department of Commerce Study Panel on Innovation and Invention.

Chairman, U.S. Department of Commerce Panel on Automotive Vehicle Pollution.

Trustee: Midwest Research Institute; Research Analysis Corporation; Marine Biological Laboratory.

Chairman, New England Council Committee on Science and Technology.

Director: Dresser Industries, Inc.; Japan Fund, Inc.; Air General, Inc.;

New England Council; Research Analysis Corporation.

Member, Advisory Board, Air Force Systems Command.

Home: 330 Beacon Street, Boston, Massachusetts, 02116.

Member, American Chemical Society, St. Joseph Botolph Club, Algonquin Club, Quisset Yacht Club.

STATEMENT OF DR. RICHARD S. MORSE (MEMBER ON THE PANEL OF THE ELECTRIC AUTOMOBILE), THE DEPARTMENT OF COMMERCE

Dr. MORSE. Nice to see you, sir.

I don't have any prepared statement as I believe was agreed before my coming down. I do have a draft of a talk I gave recently in Detroit to the Society of Automotive Engineers which summarizes some of my thinking with respect to certain aspects of the auto pollution problem.

If you would like to have that in the record, I would be glad to send you a copy of it.

Mr. DADDARIO. We would be pleased to have it.

Dr. MORSE. This touches on some of the subjects some of the previous Congressmen mentioned this morning. I am impressed with the sound thinking they have given to this subject. In view of the kind remarks you have made to the other Members of Congress this morning, Mr. Daddario, I would be remiss if I didn't say that my scientific friends look to you as the guiding light in this area here in Washington. I have always found it a great pleasure to talk with you because you understand and are concerned with the technical aspects of our complex national problems.

Mr. DADDARIO. You are very kind. I am not used to such kindness before noontime.

Dr. MORSE. I am not entirely sure what you would like me to say, but perhaps I might briefly refer to the genesis of this report dealing with the auto industry air pollution problem.

Mr. DADDARIO. I think it would be extremely helpful. This is one of the areas not only of great importance, but one which naturally attracts the thinking of the public. An explanation of it could be extremely helpful to us, Dr. Morse.

Dr. MORSE. In late 1967, the Technical Advisory Board of the Department of Commerce, of which I have been a member since its formation, addressed itself to the question as to whether it would be appropriate for such a body to look at the auto industry air pollution problem. It is fair to say that the stimulation for this action probably came from Senators Muskie and Magnuson who, as you know, have had great concern for our pollution problems and have done a very fine job.

Subsequent to this meeting of T.A.B., the Secretary of Commerce established a Panel of some 16 members and asked me to serve as chairman. Simultaneously with the establishment of this ad hoc study panel by the Department of Commerce, other departments within the executive branch, and Federal agencies, indicated their desire to become associated with the study. This included HEW, Department of the Interior, Department of Defense, Housing, and Urban Development, the Atomic Energy Commission, Post Office, Federal Power Commission, and the Department of Transportation. Each of these organizations supplied a certain amount of money for expenses and staff assistance. People on my committee served without pay.

I would like for a moment to talk about the panel because we have had some talks today about the possibility of establishing a Council of Ecological Advisers. I am personally allergic to committees as I'm sure we all are, unless they are effective and can implement their findings.

This particular panel was an interesting one and followed the pattern of a previous panel of the Department of Commerce—the so-called Sharpie Panel, dealing with innovation and invention.

Within the panel itself we had members drawn from a variety of segments of society with diverse technical, scientific, and industrial backgrounds. We had people from industry, universities, and government.

I think it was important that we had the same approach as the Sharpie Panel, where we had lawyers and scientists, engineers, inventors, business people. It is only by establishing study groups with this kind of a composition that you can get objectivity.

A panel of our type may create some heated dissension, but in the process of the deliberation, it also gets education. In both of these study groups the panel members learned as they went along with their evaluation process. Furthermore, this study dealing with the automobile pollution had representation from more than one department in the executive branch. I think this is also important in attacking a problem, which as mentioned by some of the earlier witnesses, does transcend the responsibility of any one department.

Otherwise, I think we might have turned in a written report—a Commerce report—and then HEW might well say, "That's fine, but let's now set up a committee to look at the report of the committee." Action would be delayed and the usual interdepartmental conflicts would be magnified.

With representation from all of the responsible agencies, some with divergent views and interests, and staff from these agencies working with all of us in concert, I think that we came up with a report which perhaps has a better prospect for implementation than might otherwise have been the case. Some recent actions of HEW suggest that this is true as a matter of fact.

This also meant that we could get on with the job fairly fast. We had a very hard working group.

Almost immediately after the panel's creation, I was successful in getting some 40 additional people to serve on subpanels with specific expertise in required areas of competence. We then broke the job down into components, and set up subpanels, dealing with such topics as the total U.S. energy sources; the requirements of the country for the next 50 or 100 years or more; turbines, steam engines, fuel cells, batteries; air pollution, current gasoline engine, etc. We had medical people specifically acquainted with atmospheric problems and the health aspects of pollution. These subpanels, then, looked in depth technically in their area of competence, and then the panel as a whole tried in its best judgment to evaluate the data developed. In the evaluation process we just didn't have medical or business people, scientists, or physicists or chemists, but a composite group of broad experience in science, industry, and government.

We may have come up with somewhat tougher recommendations, perhaps, with respect to our recommended action, if we had reflected the majority view regarding recommendations. By arriving at a report in which all of the members concurred, call it consensus or what you will, I think perhaps we did a better job and are now in a better position to recommend action than might otherwise have been the case.

I was impressed with Mr. Tunney's last statement about management. All through our studies that was one of the things with which we were greatly concerned. Technical problems are relatively simple. If you get competent people to sit down and analyze, let's say, a zinc air battery, or a sodium sulfur battery, against some fuel cell, or steam engine, you can develop factual data that can be interpreted with a high degree of certainty. You don't argue about these technical problems.

When one examines the question of how to run an organization, or how the Government should get on with the job, there are differences of opinion and shades of view. Judgment and experience becomes important.

This question of management is terribly important in industry and Government, particularly in our changing technological society. From a broader viewpoint this country has a very difficult task right now in many areas and particularly in the allocation of our scientific and engineering resources as a whole, if we are to solve many national problems. There are only so many people. It is all very well to talk about let's set up another department; let's have another Council. Councils and committees are composed of people; there aren't many available people that know this game—let's say of ecology, for example.

Mr. DADDARIO. Isn't it precisely because there are so few people with competence in this area that the management situation becomes more important?

Dr. MORSE. I agree. You have to use them more effectively; certainly.

I find on the outside in setting up a committee when you start looking who is on the committee you pull out the same names in the file down there the last 10 years. These people are all busy—the good ones. I think we have to address ourselves more effectively to management problems, and as you and I have discussed before, I am particularly concerned about a better use of our scientific and engineering resources in areas such as this as to the problems in the air and on the earth's surface.

One of the other items which we reviewed was the lack of innovation and perhaps lack of underevaluating of the innovation process within the auto industry.

I must say also that the more we studied the automobile industry problem, the more we realized that the industry also had problems which perhaps the Government people didn't appropriately appreciate. The time factor of getting into mass production, questions of antitrust, and the economic problems, for example.

On the other hand, innovative ideas have not come forth from Detroit at a startling rate. We recognized this and said so.

I think we should realize that the California smog from a scientific point of view, was at least understood, in the very early 1950's; that is a long time ago. It is also fair to say that without the relatively prompt action on the part of the State of California, we wouldn't have the air pollution situation even under control as much as we do today with respect to standards for automobiles.

The Federal Government has been considerably behind California. On the other hand, we must again recognize a very difficult problem, presented to us by many people: Why should somebody in let's say northeast Maine, pay something more for an automobile because California people need to have an antismog device? This is a practical problem evolving production costs, the use of cars in interstate travel and so forth. You can't have three or four different production lines in Detroit.

We were faced with many of these kinds of decisions during our deliberations, and in many cases we just had to make a judgment. I think by having a committee with a high level of competence, and more particularly with diverse backgrounds of experience, our judgments had some merit.

Again, on the technical side, the question, when you came to discuss the organization was: What should you do about a standard, let's say, for a product that you really didn't have good health data on? It was then a matter of judgment and it was tough.

In general our subpanel technical reports suggested more rigorous positions, but when the panel as a whole looked at the subpanel recommendations, we tried to develop a broader viewpoint.

Mr. DADDARIO. What does your experience lead you to tell us about health? What do or don't we know about it? What judgment should we come to? How do we reconcile these problems as we deal with

this in the future? Should we not be looking way down the road so that we can learn more about the health problems?

Dr. MORSE. We started out with our first recommendation to the effect that "the national goal for air quality should be the achievement of an atmosphere with no significant detectable adverse effects from air pollution on health, welfare, and quality of life."

We thought it was important to set this goal for America because it can be achieved.

We had a number of people, both witnesses and one or two people, as a matter of fact on our committee, who felt that we should place a dollar sign upon the quality of air. I don't happen to subscribe to that although we must be practical. The statement "no significant detectable adverse effects was set as a goal. Obviously, if you have a goal you are going to do your best to get there. If you have technical problems, or economic problems, or funding problems, you obviously aren't going to get there.

It seemed to us that somebody ought to make that statement. We have enough science and technology in this country if we can marshal our resources to achieve such a goal. Time is running out and we should have started long ago.

You won't do it in every part of the country. You won't do it in the Lincoln Tunnel or obviously a few other places for some time to come. You probably won't do it in Los Angeles, Boston, or New York for awhile.

We have some 80 million vehicles in this country, and we are generating let's say some 10 million new autos a year, and taking 2 or 3 million off the road. With this massive flywheel underway, no matter what you do today, to new cars there isn't much effect, because of our backlog and number of vehicles. The same large national problems apply to the numbers of plastic bottles we are throwing all over our beaches which are going to be there for years to come because they do not rust and decay. The noise problem of our industrial life is also getting out of hand. You have to move in earlier on these things or you will never really make an impact on the solution to the problem because of its massive size and increasing importance. Our European cities and Tokyo are now finding it too bad they didn't start earlier in their war against pollution. Their rate of increase of vehicles is substantially greater than in the United States; they already have their vehicles in production, without controls and did not benefit from our mistakes.

We found a dearth of quantitative data in the health area. As you know, when you get in the medical field, it is a little difficult to get people to be precise. But we certainly had an abundance of information—not by specific pollutant in many cases—but good data to show that in areas of urban living, health of our people does deteriorate. This is not as simple a problem as the cigarette-cancer matter. You have different pollutants in the air, different meteorological conditions. The general case is pretty well supported to show that pollution is bad for you. There is no question about that. But we can't say x number of people died from nitric oxide, or x number of people died from carbon monoxide; we don't have reliable information in that specific sense.

Mr. DADDARIO. How difficult is the problem that faces us? Do you find it to be an unmanageable one? Should we be developing the ways and means through which this information can in fact be obtained so that we can establish the criteria with greater confidence?

Dr. MORSE. Well, with respect to your first question, Mr. Daddario, I think we can get the data. We have not organized research and collection programs appropriately to get the information.

Mr. DADDARIO. Do you think we should?

Dr. MORSE. Yes; I think we should. Furthermore, I think we must continue our research with respect to health effects on a long term basis. We also need better economic data and information regarding the impact of pollution on agriculture, materials, and resources in general.

Mr. DADDARIO. What would be your judgment, taking into consideration the experience you have, as to how dangerous the situation is? What might we find out as a result of the statistics which we would gather through such a procedure?

Dr. MORSE. You are talking about impact on health?

Mr. DADDARIO. Health-wise.

Dr. MORSE. I don't think I would want to guess on that one and my committee had varying views. We had many medical people talk to us. We had, for example, curves showing the correlation between deaths against the smog content in Los Angeles in old-age people's homes, but this problem is a difficult one. Somebody might say, "They are going to die anyway," as they were 70, 80, or 90 years old, so this doesn't mean anything. This attitude doesn't impress me as a responsible view to an obvious adverse effect of pollution.

Mr. DADDARIO. I hope not.

Dr. MORSE. No, but I can tell you the kinds of things we were concerned with.

Mr. DADDARIO. Sure.

Dr. MORSE. I don't think I could possibly guess the deaths or decrease in life expectancy resulting from pollution, I wouldn't know how to express it quantitatively. Air pollution does impair this country's quality of life and definitely impairs health.

Mr. DADDARIO. We find ourselves facing this dilemma: On the one hand, many people say to us, "This is just a harum-scarum situation, and it is really not so bad and therefore we ought not to be spending as much money as we are."

Dr. MORSE. Well, we are not spending much money.

Mr. DADDARIO. And others who say, "It is so bad that we ought to be doing much more." We could by just guessing, do the wrong thing altogether. The automobile exhaust situation which you mentioned is a device added to the cost of the automobile which each year comes up to some \$500 million. Many people feel this is an absolute necessity. Others have tried to convince us that it is not.

If you take this problem and spread it out into many other areas such as the bottle and its disposal problem you have a tab of hundreds of millions. In the sewage area, we are talking about estimates of \$100 to \$150 billion. When you ask people, "Why do we need to do it?" nobody can really prove that separation of storm and sanitary sewers is going to answer the problem, and make everything sweet and pure again.

Unless we do have base line criteria, the expenditure of public funds then becomes a real problem. We do look, Dr. Morse, toward you and others who have had to thread your way through this morass and develop through experience, judgment capabilities of what we ought

to do. I agree with you wholeheartedly it is better to come to a judgment and do something sooner, rather than later, and take perhaps the chance we spend a little more money than perhaps we ought to.

Dr. MORSE. I think you will save money in many cases by making earlier decisions. I think we would have saved money if we had adopted more stringent standards earlier in the auto case. I am almost sure you will have saved the country money. Now we can't go back to fix used cars, to put in the test facilities, and inspection facilities needed for such an exercise.

Mr. DADDARIO. You were somewhat critical in your earlier remarks that Detroit was not reacting as quickly as you would like.

Dr. MORSE. I think historically that was true. As far as the study activities with which I have been associated, we have had good cooperation in Detroit, from the industry executives at the top, and from the laboratory people. We talked to them in the early course of our study suggesting that they should get together with the oil people in cooperative research. I'm glad to say they are now doing this. We now have a number of auto-oil industry compacts, which never existed before.

However, in 1952 we knew the nature of the chemical smog reaction in California. It is only within relatively recent years we have really done anything about this problem.

That is the thing that concerns me. There wasn't any considered technical management appraisal of the problem within the States, within the industry or within the Federal Government at an early enough time period. There is no new technology or new science required to make a substantial reduction in automotive exhaust systems. Essentially nothing has been put on a car the last 3 years that couldn't have been put on 10 years ago. That is what I am addressing my statement to. It is also my guess that the really innovative ideas in this general area very well came from outside the auto industry.

Mr. DADDARIO. I think that is extremely important.

Dr. MORSE. The mechanism is lacking.

Mr. DADDARIO. How do we take advantage of this and keep developing these capabilities and keep getting more and more people involved?

Dr. MORSE. Are you speaking of the Federal Government, particularly.

Mr. DADDARIO. Mechanisms within the country including the Federal Government and bringing in outside people. I would expect when you brought your people together you had many of them working as a labor of love, really.

Dr. MORSE. Right.

Mr. DADDARIO. So you are able to get people to do these things, providing you can show leadership and can give them an opportunity to participate?

Dr. MORSE. Many of these problems should be attacked at the State or local level. With few exceptions this is very difficult, because within our States we don't have the technical, scientific, or management competence, or even a willingness to communicate with outside experts on this subject. I think this is a real serious national problem.

At the Federal level there is no difficulty in getting people who are both concerned and willing to work on important problems.

The real question in my mind comes down to the delegation of authority and responsibility to implement actions at the Federal level in cooperation with the States.

Now the President has, as you know, stated, and written, that the Secretary of Health, Education, and Welfare has primary responsibility in such areas as air pollution.

Our committee, and I'm trying to speak both as a former panel chairman and as an individual, felt that within HEW the responsibility for air pollution should be raised to a higher level than it was and is at the present time.

There is a great hue and cry about automobile safety; and yet, in actual fact, I think the air pollution problem is a far more complex, difficult, and important problem perhaps than safety. Complex in the sense that you are affecting the oil industry, supplies, tires, and it is a difficult situation. You are going to deal with the States' monitoring and inspecting, and because of the excitement about safety, this was raised to a very high level, and then perhaps very appropriately so, but the responsibility in the pollution area in HEW is still not perhaps at a level where it has appropriate visibility, nor does the group have authority and responsibility to perhaps do it as rapidly as they might. It is a great improvement over the past.

Mr. DADDARIO. Great improvement at the State and local level?

Dr. MORSE. No, within HEW.

Mr. DADDARIO. Within HEW?

We went into this State and local problem a little bit during the course of these hearings.

Congressman Oren Harris was particularly concerned about the Federal Government getting involved in the area of local responsibility in solid waste and garbage disposal. As we talked about that the Government witnesses felt that we were able to put together the technical advice which a State-local government had to have in order to improve its situation and give them alternatives. The judgment ought to be left to them so that they could in the final analysis make the economic determination. The problem does appear to be that in many places there is a technical and mechanical inability to do that.

Do you see this as being a problem that cannot be overcome? Do you see the Federal Government necessarily having to do all of this?

Dr. MORSE. Well, in general, I would like, from a management point of view, to see more national programs and their management and implementation, decentralized. You can't do everything in the Office of the President as we all know.

In the case of things such as national air quality, or the collection of environmental health data, among cross sections of the population, by age group, and occupation, it seems to me that this probably is going to have to be implemented and managed by the Federal Government, hopefully on a well-organized, long-term-program basis.

I am concerned, however, that such work for example, should be performed as a long-term managed program. I think historically we had a tendency to undertake disorganized small research projects in the form of grants as NIH does basic research, National long-term research and development efforts require a good program and a good manager with authority and responsibility. This is true in this area

of research, whether it be performed in a university, industry, or government.

It isn't practical to have industry run it. You have industry participation, obviously. The Federal Government should organize and fund our efforts in this area of health effects from air pollution, because the problem is national and international in scope. We are talking long-term health trends, and the program requires careful planning and implementation.

Mr. DADDARIO. Getting back to the management situation in government, your panel had representatives of the various agencies. What inhibiting factors did you see which prevented these agencies from working together in a better manner?

Dr. MORSE. During the course of our panel activities—this went on for about a year—we did not really encounter any serious problems between individuals. If you have good people, it doesn't matter where they come from. In Washington one always has conflict between agencies because of their desire to get programs and funds. It has always been the competition for funds and program responsibility that create interdepartmental problems and conflicts. We had no difficulty in arriving at essentially the same conclusions on almost every topic to which we addressed ourselves.

I think it is quite clear that HEW has the responsibility for getting medical data, or other air pollution information, in order to develop criteria for air quality. They clearly have the responsibility to establish both such criteria and standards.

If suppose you talk about the urban problem, either in terms of intercity or intracity transportation, from the point of view of pollution then interagency conflicts are presented.

Who has responsibility for developing new nonpolluting transportation systems, or engines, that is, HUD, Department of Transportation, HEW, or Interior? In this area we need a clear delegation of authority and responsibility. If you start talking about burning low sulfur content oil, you might have an interdepartmental problem. Interior is interested in oil resources; the Atomic Energy Commission has an interest in promoting nuclear power. There is perhaps need for improved coordination between HUD and Transportation and HEW. I think it is in the nonhealth areas where perhaps we have our major potential coordinating and conflict problems in Government.

It has been my experience in Washington that if you have rank and money, and are not running for office, you can get a lot accomplished if you want to. In this business you cannot please everybody and get anything done.

Mr. DADDARIO. We have looked into the necessity of the health-related and nonhealth-related problems being properly coordinated. I agree with you this is a problem. We have to pay some attention to the management situation because it does seem to me that it is in everybody's interest to use their resources in the best possible way.

You might talk about the question of lead in gasoline. This is part 1 of the report you referred to.

Dr. MORSE. Yes.

Mr. DADDARIO. On page 4 you have a recommendation regarding lead, and on page 24, you say:

These uncertainties, with their corresponding health and economic impacts, dictate immediate action if the risks are to be reduced. As a minimum, steps should be taken to assure that current atmospheric lead levels are not exceeded.

How did you determine what lead levels we ought to have? Not having the health situation nailed down and considering the economic impact, how do you make a determination as to what ought to be done?

Dr. MORSE. Let me tell how we approached that problem.

We had a subpanel concerned with the environment under Professor Eliassen, who is professor of environmental engineering at Stanford. He has been in the general field of environment for his entire professional life. He had associated with him a number of medical people, technical people and management people. They held meetings with people from the Rockefeller Institute, Harvard School of Public Health, the State of California, New York City Department of Air Pollution Control, etc.

It was the recommendation of that subpanel that the potential risks associated with lead in the atmosphere were potentially high, on the basis of a number of considerations. As I mentioned previously, we had this question of the backlog of 60 million autos and 80 million vehicles. You can't do much about that; they are here. You can't change the engine; it is impractical.

Therefore, in view of the potential risk, the continuing increase in autos, and the increasing amount of lead, as the larger sizes and numbers of engines are built, they felt we should begin to reduce the total lead content in the atmosphere. These experts recommended a 10 percent per year lead reduction and this was submitted to the main panel as a whole. After great deliberation we felt on the basis of a judgment factor that it would be inappropriate to take such action. Bear in mind the decision was in the absence of specific quantitative information that people are dying because of lead. There is no data to substantiate this viewpoint. The risks of increasing lead content in the air may be very high and other reasons dictate a serious consideration of its reduction.

Members of the subpanel on air pollution included Professor Eliassen of Stanford University as chairman; John R. Goldsmith, chief, environmental hazards evaluation unit, California State Department of Public Health; Eric P. Grant, executive officer, Los Angeles Motor Vehicle Pollution Control Board, Calif.; Austin N. Neller, Commissioner of the New York City Department of Air Pollution Control, N.Y.; Alan G. Loofbourrow, vice president-quality and reliability, Chrysler Corp.; Robert W. Schiessler, vice president-research, Mobil Research and Development Corp.; James L. Whittenberger, of Harvard School of Public Health; Arthur C. Stern, of the Department of Health, Education and Welfare.

In addition this group talked to a number of other technical people and medical people in the field and had the benefit of our other panel experts who were concerned with a reduction in lead for other non-health reasons.

After a lengthy deliberation on this lead subject by our panel as a whole—and it was the main panel which of course prepared the recommendations, we felt that we needed more information in the health field. Because of the recommendation of the subpanel from a

health point of view, because of a small amount of information that lead may affect weather, and possible future needs for catalytic devices to produce lower auto emissions, we decided that the risk of a further increase in atmospheric lead content was too high to be tolerated at this time. But our technical experts are of the unanimous opinion there is no catalytic device which will operate on a muffler as to today, which will operate in the presence of lead.

Again, trying to anticipate technology ahead, because of the massive current number of autos, we ought to do something, not wait until the problem becomes insoluble. Because of all of these reasons, we felt that HEW should obtain better quantitative data on the health aspects of lead, and we should in fact stop increasing the lead in the air now. That is a matter of judgment. You can say we ought to cut it 20 percent or we ought to forget it, but with all these factors involved it was the considered judgment of our people, that we just could not take the risk of increasing lead every year. Ten years from now we would be at another hearing, we would look back, and say, "Gosh, I wish we had done it then."

Mr. DADDARIO. How are you affected by people who have come to their judgment on these things as a result of their participation in the situation as in Los Angeles?

As we look at these things, Dr. Goldsmith is on your panel, he is also on the panel in California. The language in both instances, seemed to be almost the same. The reference to the need in California, and the standards you have set there, are understandable. What kind of judgment goes into determining how you apply this to the whole country? And should it in fact be applied to the whole country?

Dr. MORSE. You are still discussing lead?

Mr. DADDARIO. Yes.

Dr. MORSE. I want to make it clear our deliberation with respect to lead paid little attention to the California problem. Atmospheric pollution in California is quite different from New York. The smog problem is not aggravated by lead. There is no established association between lead and smog. So that really was not a consideration. The question of lead, from a health point of view, comes up in those instances where you have let's say garage mechanics working near an auto, you have policemen associated in heavy traffic conditions, not California.

One of the major automobile manufacturers, for technical reasons, not health reasons, was very interested in making a substantial reduction in the tetraethyl lead content of gasoline. They felt this eased their problem of designing an engine and control devices to meet the characteristics which they can anticipate in the future. This was a technical economic consideration, not a health consideration.

Another automotive executive didn't agree with this viewpoint. That is where the deliberation and judgment factor of our panel came in. We had a very strong recommendation from one of the major auto people that they would like to see lead reduced substantially, and in addition the octane rating of gasoline reduced, and the compression ratio. If you in fact reduce the octane rating of gasoline and the compression ratio of our engine, then it may not cost more money to use nonleaded gasoline.

These are the kind of arguments we had for many weeks. And after filtering out all this information we didn't think we ought to say, "Stop putting tetraethyl lead in gasoline." We should at least take a good look at the problem now and we ought to stop increasing the current potentially high level of lead in the air.

Mr. DADDARIO. The reason I asked you about this is that people are disturbed. It seems that Los Angeles is the base of the criteria on which you make these judgments.

For example, on page 8, of part II. On the right-hand half of the page, the first paragraph goes into that, substantiating what you have said that there is not sufficient medical evidence, which qualifies your statement, that there is no medical evidence, or not sufficient. Then you say:

Accordingly—

In the last sentence—

in certain metropolitan areas such as Los Angeles County, the present levels of atmospheric lead are considered to present a public health hazard and it would be a prudent public health policy to prevent further elevation of atmospheric lead levels in such areas as well as to take reasonable steps to reduce them.

The judgment here appears to be based on there being some medical testimony.

Dr. MORSE. Oh, yes.

Mr. DADDARIO. Since Los Angeles has this problem, others ought to be careful of not creating the same problem. This is the reason I ask the question. I think in a sense you clarified it.

Dr. MORSE. I just want to make it clear that the smog problem in Los Angeles is not the air pollution problem in other areas. It is a unique kind of problem because of geography, and the atmosphere, and lead does not contribute to that. We didn't come to our conclusion regarding lead because of Los Angeles, but after all the evidence from a number of aspects on a national basis.

Mr. DADDARIO. How did you work out the problem when the idea came that you ought to reduce this 10 percent per year, as you said it would have disruptive effects? What were the economic considerations which fit into that? How did they lead to other judgments, if they did?

Dr. MORSE. Well, we tried to strike a balance between practical recommendations, and one which would just be totally unacceptable economically, particularly in areas where there wasn't quantitative data that showed a health problem. I don't know how you would place a value in dollars upon, to my mind at least, the untenable situation of even living in Los Angeles. How do you evaluate the fact when you get up in the morning you can't see very well? I don't know how to put a dollar sign on that one.

The impact of pollution on the quality of life is difficult to consider in the usual cost effectiveness way. Fortunately the American Petroleum Institute had just made a very competent report, with respect to the capital investment and increased operating costs associated with producing nonleaded gasoline.

We looked at that. We had close collaboration with all the automobile manufacturers, and we weighed their judgment as to whether they really wanted to run engines at current high compression ratios

in the future. Nonleaded gas can, and is being sold in this country now but it is expensive to convert to nonleaded gas if high octane rating gas is also required.

Our discussions involved judgment based on careful technical health and economic data.

Mr. DADDARIO. I understand that.

Dr. MORSE. I think you have done remarkably well, considering the economic and technical factors involved to have made any headway at all because these economic judgments can be prevailing ones. The discussion seems to get us constantly back to the point that we need to have better medical knowledge.

At that stage of the game the economic judgments would be that much easier.

Dr. MORSE. The auto pollution problem isn't the cancer-cigarette problem. I don't care whether you smoke cigarettes or not; that is your problem. I don't particularly care if my own car has harmful emissions, but I am interested in the cars that others drive, if I'm driving through a polluted environment. There is, therefore, no incentive for the individual to worry about his own auto as an emitter.

We also recognized that there has been no economic incentive for any one of the automobile manufacturers to make a low-polluting auto. I think we have to appreciate that. They are in business to make money. They should be. This is our free enterprise system. It is a highly competitive business. Neither Ford, Chrysler, nor General Motors, or American Motors can add \$50 to their costs just because they want to be good citizens—because they are competing right across the line, car for car.

I'm glad to say that during our deliberations I talked to many automobile executives and had many constructive discussions. They all said, "we accept the role of the Federal Government to set reasonable standards. This is the only way the problem is going to get solved."

I was surprised to hear that, and I was delighted. All they wanted was to have realistic standards that didn't completely disrupt their production line, and they wanted these applied nationally. They also wanted to be sure that such standards applied to them and all their competitors. They would fight out their problems technically and engineeringwise, do the job, and still make a profit.

The establishment of standards and their effective date of enforcement presents many problems. We tried to spend a great deal of time in trying to establish the exact technical status of all pollution control devices and then effectiveness and future prospects. I hope that we clarified that situation so that HEW can set realistic standards which will be acceptable and which will work at the earliest possible time.

I would like also to point out that pollution does not only effect health. We should also recognize the impact on agriculture, particularly in California, and areas near high densities of autos.

Frankly, I don't know the economic impact of air pollution on agriculture and more quantitative data is needed. This seems to be a serious matter and must be given serious consideration.

Mr. DADDARIO. There is no question that there is an agricultural problem.

Dr. MORSE. There is no question.

Mr. DADDARIO. Connecticut, for example, tobacco.

Dr. MORSE. And fruits and vegetables in California and Florida.

Mr. DADDARIO. We have gone to tremendous studies of the need to develop new strains of tobacco to overcome this particular problem. You go to the experimental station in New Haven, you can see the pock marks that come up in your tobacco leaf because of polluted air.

Dr. MORSE. This is why I would like to be more responsive when we say we need more quantitative data. Recommendation No. 1 of our report sounds perhaps a bit bland but as a nation we should recognize the great advantage of really having a kind of life that is pleasant and not put a dollar sign on clean air. In every airport we now have a haze, a brown smoke in some cases. Is that good? A whole generation of Americans now have never seen the clear clean air that is now only available in relatively remote nonurban areas of the United States.

Mr. DADDARIO. Everything you said, of course, Dr. Morse proves out that you are not in the camp of those that believe we ought to develop a tolerance for this. The fact we develop new and additional strains of tobacco all the time to meet this is not the answer to it.

I am particularly impressed with the way in which you have come to some judgments in a very difficult area. It does give us, you know, dealing in the environmental area here today, some opportunity to look into how you have assessed this situation. The Congress is concerned at the moment about being able to develop for itself a technology assessment capability, because the legislative process begins to involve more and more scientific-technical problems. You have looked ahead with very little really to go on and I think this has been an extremely commendable fact. I raised some questions, and will have other questions to raise as to how these problems can be better approached in the future.

I'm particularly pleased that you have come to give us a hand here again. We have strayed away a bit from some of the things that we wanted to talk to you about, but this morning has been very helpful.

Any questions?

Mr. FELTON. No.

Mr. DADDARIO. Thank you, Dr. Morse.

This committee will adjourn subject to the call of the Chair.

(Whereupon, the hearing was ended at 11:50 a.m.)

2. The second section focuses on the role of internal controls in preventing fraud and mismanagement. It outlines various measures that can be taken to strengthen these controls, such as separating duties, conducting regular audits, and establishing clear policies and procedures. The document stresses that a strong internal control system is crucial for the long-term success and sustainability of any organization.

3. The third part of the document addresses the importance of communication and collaboration within an organization. It highlights that effective communication is key to ensuring that all team members are aligned with the organization's goals and objectives. The text encourages the use of open communication channels and regular meetings to foster a collaborative work environment.

4. The fourth section discusses the need for continuous improvement and innovation. It notes that organizations must stay current with the latest trends and technologies to remain competitive in the market. The document suggests that regular training and development programs, as well as a culture of innovation, are essential for achieving this goal.

5. The final part of the document provides a summary of the key points discussed and offers some concluding thoughts. It reiterates the importance of the topics covered and encourages readers to take action to implement the suggested practices in their own organizations.

APPENDIX A

Staff Meetings on Environmental Quality

THURSDAY, FEBRUARY 15, 1968

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND ASTRONAUTICS,
SUBCOMMITTEE ON SCIENCE, RESEARCH, AND DEVELOPMENT,
Washington, D.C.

Mr. Joseph M. Felton, counsel, and Mr. Richard A. Carpenter, Legislative Reference Service, Library of Congress, met with Dr. John Middleton, Director, National Center for Air Pollution Control, and other officials of the Department of Health, Education, and Welfare, in room 2062, South Building, HEW, at 2:20 p.m. Accompanying Dr. Middleton were Mr. S. Smith Griswold, Special Assistant to the Director, NCAPC; Dr. Emanuel Landau, statistical adviser, Office of the Associate Director for Criteria and Standards Development; Mr. Thomas F. Williams, Chief, Office of Legislative and Public Affairs; Mr. Irwin Auerbach, Chief, Legislative Section, Office of Legislative and Public Affairs; and Dr. Bernard Steigerwald, Chief, Office of Program Planning and Evaluation.

Mr. FELTON. First of all, I would like to thank you for meeting with us this afternoon. As you know, Mr. Daddario indicated at the hearing that the subcommittee would send written questions to you. Subsequently, he decided it might expedite matters if we sit down across the table and discuss these things back and forth.

You have a copy of the general questions we propose to cover, so I do not think we should have any problems.

The question I want to start with has to do with the definition of who we are talking about when we use the word "persons" in the act.

Can you give us some idea of what you have in mind or what you consider to be "persons"? Is it someone who is sick, healthy, old, young, or is there some norm to which you direct these criteria?

Dr. MIDDLETON. Your question, then, is, what air quality criteria are, or, in other words, what they mean. The answer is that air quality criteria are an expression of available scientific knowledge of the relationship between various concentrations of pollutants in the air and their adverse effects on man, animals, vegetation, materials, and so on. Criteria are descriptive. That is, they describe the effects that can be expected to occur whenever and wherever the ambient air level of a specific pollutant or combination of pollutants reaches or exceeds a specific figure for a specific time period. Insofar as human health is concerned, air quality criteria reflect knowledge derived from epi-

demiological, statistical, and clinical studies of illness and death in the general population as well as among special groups in the population.

Mr. FELTON. Let me frame the question in another way. I assume, for example, that we would not abate traffic going to New York because one person may get sick. Would these standards protect the sickest?

Dr. MIDDLETON. That is a different question. Air quality standards are not the same thing as air quality criteria. Air quality criteria describe the air quality that must be achieved to prevent the occurrence of various adverse effects on health and welfare. Air quality standards prescribe the air quality that a State or community has decided it will actually try to achieve and maintain. This decision must, of course, be influenced by knowledge of the adverse effects of air pollution, as presented in air quality criteria, but it will also be influenced by economic, technical, legal, and other factors. So it is in setting standards that a State or a community decides the extent to which it will actually try to protect people, the extent to which it will actually try to prevent soiling and damaging of buildings and materials, the extent to which it will actually try to prevent injury to vegetation, and so on.

Mr. WILLIAMS. Under the Air Quality Act of 1967, Mr. Felton, we are charged with developing and publishing air quality criteria; in addition, we will develop and publish data on air pollution control techniques. Then it will be up to State governments to set air quality standards and develop plans for implementation of the standards. It is at this stage that States will, first, be prescribing the air quality they will actually try to achieve and maintain in air quality control regions we designate, and second, prescribing schedules for accomplishing this. Since the Air Quality Act requires State standards to be consistent with the air quality criteria we publish, this will mean that their standards must be at least good enough to protect people's health. Economic and technical factors must be and will be taken into consideration primarily in the formulation of plans for implementation of the standards.

Dr. MIDDLETON. I think it would be well to refer to the introduction to the sulfur oxides criteria, published by the Department in March 1967. I will read it slowly.

The criteria presented here then are not exact expressions of cause and effect that have been replicated from laboratory to laboratory. Instead the criteria are useful statements of the effects of the sulfur oxides in the atmosphere derived from a careful evaluation of what has so far been reported.

As more studies of these effects expand our knowledge the criteria will be modified accordingly.

The use of these criteria by State and local governments may vary with individual judgment and with local circumstances. In the Federal Clean Air Act the American people have expressed through their representatives a strong desire for clean air. Guidelines for the choice of criteria are that the quality of the air be good enough that—

Now there are seven points—

1. The health of even sensitive or susceptible segments of the population would not be adversely affected.
2. Concentration of pollutants would not cause annoyance such as the sensation of unpleasant tastes or odors.
3. Damage to animals, ornamental plants, forests and agricultural crops would not occur.

4. Disability would not be significantly reduced.
5. Metals would not be corroded and other materials would not be damaged.
6. Fabrics would not be soiled, deteriorated or their colors affected. And
7. National scenery would not be obscured.

I think here, then, you see that these are the kinds of things that we need to be concerned with, and that the criteria are the expression of the pollutant dosage that affects these particular items that we have enumerated. As Mr. Williams has said, it will be up to States to decide the extent to which they will try to prevent these things from occurring.

Mr. FELTON. Where did these seven points come from? Were they in the committee report? In other words, how did you understand this to be your mission?

Dr. MIDDLETON. This document is a document issued by the Department of Health, Education, and Welfare. It has a foreword on the part of the Secretary. It has a preface from which I read.

Mr. FELTON. No; I mean within the general guidelines of the act—

Dr. MIDDLETON. This is in response to the requirement prior to the Air Quality Act of 1967, that the Department published criteria on.

Mr. FELTON. I am not questioning that. I am just asking, where did the seven points come from? Were they mentioned by the committee in its report or by the chairman during the floor debate?

Dr. MIDDLETON. The seven were exercises of prudent judgment by our organization.

Mr. FELTON. I see.

I assume the criteria that affects No. 1 will be different—or I might put it another way. The concentration, if you will, as it affects No. 1 will be different as it affects No. 7?

Dr. MIDDLETON. I am saying the criteria for the sulfur oxides show the gamut of effects from one through seven. In other words, you may have very different pollutant concentrations with varying periods of times of exposure causing a variety of effects depending, among other factors, upon the nature of the receptor.

Mr. FELTON. Then it would be up to the States to determine standards, and if they felt free to exclude one of your seven, I would assume this would be permissible.

Dr. MIDDLETON. Yes; up to a point. If a State depended rather heavily upon its recreational values as a part of its real economic-social structure, it might wish to adopt standards that would preserve natural beauty. This is a State election, or local option, so to speak.

It is incumbent upon us to state what the dosages are that affect those things. The least a State or community can do is be responsible for the health of its people. It may wish also to be responsible for the health of things, protection of things. These are options that can be worked at different levels.

Mr. FELTON. I had not planned to go into it now, and perhaps it might be better that it be done later, but section 108(k) authorizes you to seek an injunction. I assume you would not seek an injunction for all seven of those reasons?

Dr. MIDDLETON. No. Because persons are not property. Therefore, the criteria that deal with persons, the dosages that affect people may

be different, but not necessarily, than the dosages that would affect fabrics or trees or other things.

Mr. FELTON. So you would exercise section 108(k), then, only in relation to No. 1 or No. 2?

Dr. MIDDLETON. Health of people.

Mr. FELTON. Including sick people?

Dr. MIDDLETON. Health of all the people, including sick people. Let us not forget that we are talking about large numbers of people. By its very nature, air pollution seldom, if ever, affects only a few people at a time. In an area of polluted air, everyone is affected, to one degree or another. Most of the effects are neither seen nor immediately felt, but they are nonetheless real. It may take 20 years, or even more, for emphysema to develop, even among people who live where the air is heavily polluted. This is a real threat to the health of tens of millions of urban dwellers. Furthermore, the numbers of people who already have respiratory disease and who are particularly vulnerable to air pollution are by no means small. I believe Dr. Landau has some figures on this.

Dr. LANDAU. Based on data from National Health Survey for the period July 1966 through June 1967, the number of people in the United States with bronchitis, without mention of emphysema, was 3,980,000; emphysema, without mention of bronchitis, 726,000; bronchitis and emphysema, 197,000.

The same National Health Survey estimates that there are 5,380,000 people in the United States who have asthma. This would make more than 10 million people who have respiratory ailments which studies have demonstrated are associated with air pollution.

Mr. AUERBACH. May I suggest that we go through that list of questions that you presented in the order we have them. We can come back to any which you want to clarify.

Mr. CARPENTER. As a preamble to that let me read a couple of paragraphs from the transcript of January 18, which Mr. Daddario called to my attention as exemplifying his concern. He was talking to Dr. Blomquist.

What do you see that we used to do in order to be able to come to such a clear understanding about this or to a much clearer one than presently exists so we can eliminate this confusion and have a level of confidence about the criteria established by which people can then move ahead and get support and be willing to act under emergencies as they arise?

Then, on a following page, Mr. Daddario states:

Wouldn't it have a great deal of effect on what we are willing to pay if we could know that it does have an ill effect at a quicker level than we expect or if we can understand that it does not? If it does in fact aggravate those who already have some kind of an illness, we would then approach it in a different way altogether.

So, if you want to read the questions, then, and your replies, that might carry us on.

Mr. AUERBACH. OK. Do you want me to read them? I guess we had better do that.

The first question:

A variety of data suggests that air pollution is not getting worse from year to year in major cities. These facts indicate that the hazard lies in the air pollution episode when weather conditions magnify normal pollution loads to the atmosphere.

Are present efforts to eliminate episodes showing any promise? Is episode elimination a possible alternative to year round improvements in air quality? Does the hazard in episodes make short term average concentrations more meaningful to standards setting than yearly averages?

Dr. MIDDLETON. You see there are several questions involved.

I guess the first would be, is air pollution getting worse? The answer to this would be that the air pollution problem is really spreading out and thus affecting increasing numbers of people for longer time periods. As the size of the urban areas increase, and as industry builds new facilities in the outlying areas—in other words, with the spreading out of metropolitan areas, the attendant transportation, traffic patterns reach the suburbs so people can work in all these areas—the size of the area affected increases, and in this way the magnitude of the air pollution problem increases.

This is to say that the more people are affected—and moreover they are not affected solely while they are in downtown areas, but also while they are now in residential sections. So the air pollution blanket is spreading out.

As to your question about short-term versus long-term averages, you really need both measurement systems. You need them for different reasons. The long-term averages, which relate to pollution dosage, reflect the chronic exposure to routine levels of pollution.

And the short-term averages show the extent and the frequency of relatively high levels that will affect persons already ill, including not just those with emphysema but also, as Dr. Landau mentioned, the asthmatic patient and others.

Mr. CARPENTER. Would you expect that a locality in setting standards, ambient air standards which would then lead to emission source restrictions, would use both a long- and a short-term criterion?

Dr. MIDDLETON. Well—

Mr. CARPENTER. And are these such that they would lead to roughly the same emission-source restrictions?

Dr. MIDDLETON. Let's be sure we understand that there is a very intimate relationship of short-term exposure to the long-term exposure. They are mathematically related. The average on an annual basis is an integration of all the peaks of the short-term exposures.

So, I would suggest that you can't really separate them, except on the basis of specific effects you may look to.

Would a locality or a State elect to have short-term or long-term numbers as standards? I would think that they may wish to have, for very practical reasons, a standard of ambient air quality that is on a 24-hour basis. Simply for regulatory purposes one needs to know day to day what is happening. This number, I would suggest, would be something that wouldn't be violated more than a certain percent of the time.

I think the same agency would see the wisdom in having a longer term average so they could have their sights fixed on what achievements are being made or what changes are taking place. So also they would have a basis then to see whether they should be concerned about the chronic effects as well.

Mr. CARPENTER. Now in terms of prospective environmental epidemiological research, would your emphasis on the short-term standard allow the researcher to perform experiments and confirm the chosen

short-term standard which was adapted from criteria, whereas if we relied only on, say, annual exposures the experimental approach would be so long that we might not be able to do it?

Dr. MIDDLETON. That is why I prefaced my remarks by the mathematical association of short term with long. And whereas the relationship varies somewhat from area to area, one has to use ambient air quality data itself.

Mr. CARPENTER. Yes.

Dr. MIDDLETON. This would allow the research worker to project in his experimentation those figures or those numbers that may meet what his particular research needs were.

Mr. CARPENTER. Well, would you say that it would be worth while before the next step was taken, that is the translation of ambient air standards to emission-source restrictions and perhaps substantial changes in industrial or municipal or personal practices, to conduct confirming experiments at the very point on the concentration-time chart that you chose as your standard, to go in with animals or with human volunteers and to confirm that this was a threshold of response?

Dr. MIDDLETON. This confirmation, whether it is laboratory or field, is not so much the question since the documents that relate to criteria contain both.

I think maybe what you are referring to is the fact that in making a diffusion model to relate pollution emissions to the ambient air quality standard, by their geographic location, knowing something about the tonnage being put out, the meteorology of the area, one then can predict what the ground-level concentrations would be from a particular source for a particular period of time, and the air pollution control agency may wish to validate whether in fact this occurs.

That is a different kind of validation, and I would see this would have some merit in getting at emission standards to be determined by local governments, but I don't see the need to validate the earlier question you are talking about.

Mr. CARPENTER. You would say that retrospective data taken into consideration in publishing the criteria would be adequate, would contain this confirming evidence at the point, at the chosen standard point?

For example, in a concentration-time plot, if you decided on a dose which in fact might not have corresponded actually in time and concentration to some retrospective research on an historical episode or on animal work, your interpolation here would be adequate and you would not perform confirming experiment at that dose?

Dr. MIDDLETON. I am really not talking about the confirmation. We are talking about the fact that the several categories of events that take place, that are health effects, are fairly well described as to whether they are chronic or acute, and that we already know something about the dosage, in other words, the time concentration. And regardless of where those will be located you can expect those effects to take place.

So if you are talking about validation and trying to get an integration of chronic and acute—

Mr. CARPENTER. No, I am not, really. I was just simply talking about where, if you wanted 24-hour standards and, in making up your

criteria you had not been able to find any data on a precise 24-hour exposure, or repeated exposures of 24 hours, would you then think that it would be possible and practical to go in and check at 24 hours?

Dr. MIDDLETON. I think what you are asking is a question that we normally take care of in our research needs prior to publishing the criteria, namely, we find out whether these things in fact take place.

Isn't this a part of our—

Dr. LANDAU. Yes.

I think what you may have reference to is the kind of thing planned in London, where, having adopted certain control measures, you now go ahead and measure morbidity in London, illness in London, and see whether or not the control measures have actually had an effect.

Certainly in the United States we would plan an ongoing program to assess the control activity. If the measures we are using are reasonable, there should be some reduction in the morbidity and mortality from these diseases after appropriate control measures have been taken.

Mr. CARPENTER. Well, to be specific if you choose, as New York has done, I believe, 0.1 parts per million sulfur oxide, 24-hour period not to be exceeded 1 percent of the time, would you think it practical and worth while to conduct experiments at precisely that concentration for that period of time to confirm that this was a threshold point of dose response in a properly selected sample of the population?

Dr. MIDDLETON. Your question really is validation of a theoretical assumption?

Mr. CARPENTER. Yes.

Mr. WILLIAMS. Which is not theoretical.

Mr. CARPENTER. Empirical.

Dr. MIDDLETON. OK, empirical.

We are at the point, whether we want to validate that or other things, we are at the point of using mathematical modeling of sulfur oxide emissions from tall stacks to see whether the meteorology, the formulas that have been produced for prediction, are in fact true, and the fact that we do this for some physical measurement is no different than being equally willing to do this for some biological reason.

Mr. AUERBACH. I think what we are basically talking about here is how criteria are set.

The Congress has directed us to develop and publish criteria based on whatever valid scientific evidence exists. We look at that scientific evidence, every bit of it, eliminating what seems to be invalid or inapplicable, and develop criteria based on what the data show about the relationship between levels of pollution, both short term and long term, and the effects that they produce on health, property, plants, and so on; so that the criteria are based on the best available evidence at the time that those criteria are published.

At the same time, we continue our own research, and we continue supporting research by other groups, and when and if that research shows that the criteria we have published should be revised in any way, they can be revised. It may, of course, confirm the criteria down to the last decimal place.

Mr. CARPENTER. But you wouldn't want this revision to occur after some economic or industrial change had been made if you could have

run simple tests within a reasonable amount of time to confirm those points before the changes were made?

Mr. WILLIAMS. There are no such simple tests.

Mr. AUERBACH. That is the whole point.

Mr. CARPENTER. That is what I was asking, whether you considered it practical.

Mr. WILLIAMS. No.

Mr. AUERBACH. No quick and easy ways. It is not likely that research will suddenly produce a whole new set of figures forcing you to change your judgments.

Dr. STEIGERWALD. Also, I don't think there is any point to verify. We are saying that control to achieve that standard will preclude episodes and will preclude chronic effects because of day-to-day exposure. We are only talking about what happens on 3 days a year, 1 percent of the time.

That control, because of the strong relationship between the average pollution for the year and the peak day of the year, the peak hour of the year, and this 1 percentile point—there is a strong relationship.

We have been looking at this for 10 years, in 10 or 12 cities. We are saying that control to that point will preclude the episode effect and will preclude the chronic effect; so, there really is no point to verify. You can't expose animals to that level of pollution 3 days a year and then not expose them to anything else, because that is not the way people are exposed.

Mr. CARPENTER. Let me pursue this once more, because if this point which a municipality would choose from the criteria which you published had a confidence limit on it, as to whether it was one-tenth plus or minus 0.05, that as I understand it might make a substantial difference to the power industry, a difference which all of us would want to know about and to be able to consider.

So perhaps I could ask this question. When a criteria for 24 hours is suggested by your publication, what are the confidence limits likely to be for the guidance of local government?

Dr. MIDDLETON. The confidence that would be involved here is not just a statistical one but the fact that we have exhaustively looked at all the information available. I think you are making a premise that the document might be a flimsy one in the first place. I want to disabuse you of the idea right now. This is a very considerable effort, involving exhaustive study and analysis of the scientific data that are available.

And when we recommend a set of numbers being related for a particular chemical or criterion, dose response, what we say is not going to be said lightly or capriciously. It is going to be based on useful data. If we don't have the useful data, we will see that we get what we think is required.

And when you keep reiterating the need to validate, I read this as meaning that because scientific knowledge is never known at one moment, that we may make some premature decisions. They are premature only in respect to the future, the speculative future. We have to deal with the pollution as it is now.

So if you want to have fiducial limits set for a particular number, this is statistically possible. It is mathematically predictable.

I think when we published our sulfur oxide criteria—and we gave annual averages and we also gave them daily and hourly, and we also gave the range of variability, which is standard treatment.

Mr. CARPENTER. And your criteria would also contain a cost factor and a technological feasibility factor?

Dr. MIDDLETON. Not the criteria, themselves, but under the 1967 amendments to the Clean Air Act, criteria for a pollutant will be accompanied by data on the control techniques available to abate sources of that particular pollutant, together with data on the cost of that abatement.

Mr. CARPENTER. And you are saying that the difference between one-tenth part per million sulfur oxides and two-tenths percent should not be a contested point, even though that might relate to substantial differences in the cost of achievement?

Dr. MIDDLETON. I am saying if there is clear-cut evidence that a tenth protects the people and two-tenths doesn't, there isn't any contest.

Mr. CARPENTER. And you are able to make that clear-cut distinction before you publish the criteria?

Dr. MIDDLETON. If we are not able to make that, we certainly would have expressed it in some range system so that there would be a clear understanding on the part of the reader of the document about the validity of the number.

Mr. GRISWOLD. I heard this number, John described, explained to the Federal Power Commission, under cross-examination by attorneys of the oil and coal industry, and the gas industry, and the one-tenth of 1 percent which you are talking about is the lowest number at which you can find health impairment. It couldn't find it below that because research tools are not sufficiently sensitive.

When you are getting to one-tenth of a part of pollutant at a million parts of air, you are getting down into fine numbers and fine instrumentation. They just hadn't been able to discover any health impairment under that number, at lower levels, but this did not insure that there wasn't health impairment under that level. They couldn't say that, either, under cross-examination.

Mr. CARPENTER. But, of course, they have been saying that at 0.015 on an annual average the same judgment held.

Mr. GRISWOLD. Yes.

Mr. CARPENTER. So they have measured the much more delicate tenth—

Mr. GRISWOLD. Over a longer period of time.

Mr. CARPENTER. Over a longer period of time.

Mr. GRISWOLD. Yes.

Mr. FELTON. Continue.

Mr. CARPENTER. Irv, why don't you go on with the next question?

Mr. AUERBACH. All right. [Reading]:

A common statement is that air pollution is getting worse. Does this mean that there is more contamination in the air over a specific area in a city? or that more areas in more cities are reaching a polluted level? Is there a saturation tendency corresponding to geographical density of industry, buildings and automobiles? For example, can automobile pollution get any worse in the central city?

I think we partly answered that already.

Mr. CARPENTER. I think you have adequately answered unless you have something you want to add.

Mr. GRISWOLD. I would like to expand a little on that, John. This question is asked of witnesses at committees of Congress and Senator Muskie asked it on one occasion.

Now, there is a tendency for air monitoring stations in given regional areas within a metropolitan area to peak out at certain levels under average conditions. And as Dr. Middleton says, the outlying areas tend to build up, but on the short-term basis where the potential for episodes occur you have to take meteorology very much into consideration.

Now, when I say meteorology, I could say a lot of things, but just to put it in context, the air over a large city might be like the Mississippi River down on the delta area. There are stagnant areas where the air doesn't move. There are other parts of the area where the air moves very quickly and rapidly, up to 7 miles an hour, where in the stagnant areas it is just circling around. It isn't being evacuated.

Now, when you have an expanded area with high levels of pollution over it, where the air condition or meteorology tends to maintain stagnant periods in certain areas, the concentrations build higher and higher in those areas.

Follow me?

Mr. CARPENTER. Yes.

Mr. GRISWOLD. In other words, a control officer with the responsibility for 16½ million people isn't worrying about averages, he isn't worrying about a 24-hour peak; he is worried about 14 consecutive days where these stagnant areas build up.

These are the situations under which you have your so-called episodes. And these are what you consider in developing a control program, to see that this doesn't happen, because God help you if this happens and you don't have a pretty good explanation for why you let it happen.

Mr. CARPENTER. If you have any more on episodes, we might take that at this time.

Mr. AUERBACH. I think we would like to get an answer in the record on it. That is, is episode elimination a possible alternative to year-round improvements in air quality?

Mr. CARPENTER. Right.

Dr. MIDDLETON. The answer is very simply, "No." I think it is based again on our earlier discussion that you have different effects at these high episodes as contrasted to lower level, long periods of time.

Episodes are to be avoided for the reasons that Mr. Griswold just spoke to you about. But to try and control air pollution simply on an episode basis is not good sense, it is not proper, it is an improper attitude for the Government to assume, it doesn't discharge the Federal responsibility for the protection of the health of people.

Mr. FELTON. Is there any normal period that an episode will last in different regions of the country?

Dr. MIDDLETON. Yes. In Los Angeles there are periods, Mr. Felton, when it is normal for inversions to last for—

Mr. GRISWOLD. Fourteen days.

Dr. MIDDLETON. Don't you have 253 days a year in Los Angeles when you can expect inversion of 1 to 2 days regularly?

Mr. GRISWOLD. That is right. However, for the most part, and here is another common fallacy, anyone that thinks that concentrations of air pollution of any contaminant being uniform over a whole city is just as wrong as he can be. With 15 air monitoring stations over Los Angeles, over a period of 14 years, with 82 meteorological stations, with wind direction and velocity, we could plot wind trajectories in a manner where you could to some degree, not always but some degree, predict exactly when a high level of pollution—if it hit downtown Los Angeles at 10:30 in the morning, it would hit Pasadena at 1:30, it would hit Azusa out in the Pomona Valley at 3:30. While the previous concentrations were falling. This stuff goes in clouds, and follows trajectories and those people that are exposed to these areas, plus the stagnant areas—there are four big stagnant areas over the Los Angeles basin where you do have buildups.

But here again you get into a philosophy of control. In air monitoring, for instance, do you monitor the atmosphere, place your monitoring stations in those areas where you have a normal air condition, what might be considered a norm for the area, in order to determine the effective dose of a control program over a period of time, because control programs take periods of time to implement, or do you establish the air monitoring program to protect the public?

Now, if you want to do it to protect the public, you can put an air monitoring station downwind from a powerplant and you can have that thing going off at scale regularity, you see. I mean talking about what you are talking about, and if you were living downwind, in a prevailing wind direction from a powerplant, and understanding this, you wouldn't want any part of it.

But this one-tenth of a part per million—you talk about the difference between one-tenth and .15, for instance. Why I mean that doesn't mean a thing.

Mr. CARPENTER. Is that what you would recommend, that you would put your monitoring station downwind?

Mr. GRISWOLD. You monitor for two reasons: One, you monitor to protect the public, and the second thing is you monitor to find out what is the general situation on a given contaminant, in order to develop an orderly and phased plan to get the whole thing for the entire area down within a tolerable situation.

Mr. FELTON. Dr. Middleton, in your testimony, I think you made the statement that the Los Angeles plan was most effective as it applied to industries as opposed to, say, automobile traffic. I think you also said that in major cities automobiles caused 75 percent of the pollution.

Now, what does the State do in a situation like this?

Dr. MIDDLETON. You recognize that the reason that Los Angeles, as an example, has effective control for industries is that industries are a source of pollution that they have the authority to control. It is not that they wish to ignore the motor vehicle. It is the fact that the State in that instance, California, has the control of the motor vehicle.

I think that is the case today across the Nation. The Federal Government has assumed the authority and responsibility for motor vehicle pollution control. The moving source of pollution is to be controlled primarily by emission standards which are invoked across the country.

Now, in those situations, and they are not all on the west coast, they are anywhere across the country, in which the control of the motor

vehicle is inadequate to cope with the air pollution buildup, to which the motor vehicle is a significant contributor, we are expecting any organization that comes to us for control program grants to have a plan of action which will deal not only with the industrial source but a plan to take care of mobile sources in an emergency situation.

Mr. FELTON. What percentage of your effort are you putting into, say, title II of the bill relating to automobiles as opposed to title I?

Dr. MIDDLETON. I can supply you some budget figures if you like.

Mr. FELTON. Offhand, do you know what the ratio is?

Dr. MIDDLETON. The effort on stationary sources versus that on motor vehicles?

Mr. FELTON. Yes.

Mr. WILLIAMS. I don't think we break it out that way.

Dr. MIDDLETON. Ordinarily, we do not. But if the \$64 million appropriated for fiscal 1968 for all our activities—including research, enforcement, training, criteria development, and so on—were to be allocated either to motor vehicles or stationary sources, the total for motor vehicles would be approximately \$20 million. This is a rough estimate, of course.

Mr. CARPENTER. I would like to ask concerning your statement that episode avoidance is not a suitable alternative—if studies have been made on the relative cost of a national program that would eliminate episodes and the short-term effects as opposed to a national program that would eliminate the long-term effects, conceding that both effects are damaging to health and that they are different?

Mr. WILLIAMS. We said, I think, that elimination of episodes is a practical impossibility—impossible as a practical alternative to controlling sources of pollution on a year-round basis. There is no way known to control air pollution in anticipation of episodes.

The data on meteorology, the pipeline we have to God's intent, is not good enough nor going to be good enough for us to ever control air pollution as we see it on that basis.

Dr. LANDAU. I think there may be some confusion with regard to what we are talking about in terms of episodes. If by episodes we clearly mean those unusual situations, such as the Thanksgiving Day episode in New York City, this is one thing. But if you are thinking about pollutant levels which affect asthmatics, for example, these are not the kind of things that take place only during episodes. These are the kinds of effects that take place whenever you get even a fairly moderate increase in the pollutant level.

It doesn't require an episode to cause asthmatic effects, and we are certain it doesn't require episodes to cause effects on bronchitics and persons suffering from emphysema.

What we ordinarily refer to as episodes are real disasters, in which you have excess mortality, usually accompanied by excess morbidity. That is, you have an excess number of persons going to clinics, and so on.

In talking about episodes, you are talking about very high levels as opposed to the fact that during the course of a year you have low values and somewhat elevated levels, but certainly for most areas nothing close to what we call an air pollution episode disaster. You have to have unusual meteorologic conditions to hit this kind of air pollution disaster.

Mr. WILLIAMS. It has been suggested many times that we deal with the problem of air pollution mainly by relying on emergency plans which could be put into action whenever a buildup of pollution might occur. Such plans would include, for example, switching from high-sulfur to low-sulfur fuels. This approach was suggested most recently by the American Petroleum Institute, which hired an engineering firm to make a study of its feasibility. The firm's report, issued in May 1967, concluded that the plan would be impractical, principally because of the difficulty of making accurate forecasts of pollution buildups and of administering a system which would require action by hundreds, and, in large cities, thousands, of private facilities on relatively short notice. Furthermore, such a system, even if it would work, would not be a substitute for full-time control of air pollution. This kind of system might, in theory, take care of the worst possible situations, but it would do nothing about the greater threat to human health associated with daily exposure to so-called ordinary levels of pollution in urban communities. An emergency plan is a necessary adjunct to an effective program for achieving and maintaining acceptable air quality in a community, but it clearly is not and cannot be used as a substitute for such a program.

Mr. AUERBACH. Your next question [reading] :

How do you reconcile the difference in physiological response among members of an urban population? Is the air quality which would not affect even the sick or allergic or weakened person a practical goal? Are there alternatives for this portion of the population?

I think this has already been answered, in part.

Dr. MIDDLETON. I will give you the answers I put down here.

Is the air quality which would not affect even the sick or allergic or weakened person a practical goal? Yes. It is quite practical to establish goals to take care of these people.

Mr. FELTON. May I interject?

Practical, yes, from a scientific standpoint. I keep having problems, though, with this abatement business, where you go before a court and they have to consider technological and economic considerations. It is going to have to be a very wise court that makes this final judgment. So I do think the "Yes" has to be modified to some degree to take care of the practicalities of implementation.

Dr. MIDDLETON. I don't think we have to modify whether it is a practical goal at all, Mr. Felton. I disagree with you, however I understand your question.

If you are talking about implementation of the goal into a set of local actions where economic and technical feasibility and so forth are involved, that's the area where you need to find out what it is going to cost and whether society is willing to support it. It is a different situation.

Let's be sure we get goals separated from criteria from standards. When you asked the question, "Is it a practical goal?" unequivocally the answer is yes, it is a practical goal. Whether you can attain that by an action program, and have standards and an implementation plan, and is that practical, I have to say I don't know. This has to be evaluated by all the factors involved.

Mr. FELTON. OK.

Mr. CARPENTER. That is a very good answer.

Mr. GRISWOLD. Since Mr. Felton mentioned the abatement actions and I have been deeply involved in all of them because the staff assigned to me has developed the information on them and I am presiding officer at the conferences, I would say there hasn't been a conference yet held where the economics, economic studies, and the testimony didn't show that the cost of pollution was far greater than the cost of control, and this is in the magnitude of 10 times. And this did not even include any health benefits.

All this did was include material benefits, like dry cleaning costs, household costs, and this type of thing. And some of these studies weren't made by anyone that might be considered prejudicial, such as we were. This latest study was made by Ernst & Ernst, a firm entirely apart and under contract to us to bring the facts out.

Here again in the Washington, D.C. study—

Mr. FELTON. Would you supply some of this material for the record?

Mr. CARPENTER. I might say they supplied Michelson & Tourin's Washington, D.C. study, which I consider to have a number of internal inconsistencies.

Mr. GRISWOLD. Well, it depends. That was the first study that they made, and I would say in viewing that one and one they did for us in New York, where they considered both sulfur oxides and particulate control, that data, in conjunction with other economic studies we made based on studies of two cities in the Ohio River Valley, where there are identical ethnic backgrounds, identical market, identical everything except the degree of pollution in the area, where it came out I think to \$245 per family of four; excessive cost, in the polluted city more than the other city, as against the cost of control which ran to a bare fraction of that.

Dr. MIDDLETON. If we could revert, Mr. Felton, to the other parts of the same question: Are there alternatives for this portion of the population? We don't have any practical alternatives at this time. We just don't know what to do. But we have a limited number of studies that bear on this issue.

Mr. CARPENTER. Such as the provision of hospitalization or the alerting of bronchitics?

Dr. MIDDLETON. Yes. And can you protect the hospital space that you are going to send them to is a very important part of this. What do you do?

Dr. LANDAU. This protection you are talking about relates only to an emergency situation. But we have to be concerned with the population during this exposure for 20 years or 30 years before people develop either bronchitis or emphysema. So we are very much concerned about the long-term chronic effects, not only about protecting the population during acute episodes—during acute disaster periods.

Dr. MIDDLETON. This is the value of the program, you can see, in having the preventive aspects. We are attempting to avoid having episodes. We are attempting to avoid having more emphysema patients. We are attempting to prevent these things from happening. So if we work at the episode level to just chop off the peaks we still have basically this chronic threat to the population.

You need to get the regular, routine levels of air pollution down so we begin to have relief, so we have fewer of this elite population, if

you wish to separate them at this point, to contend with in an episode situation.

Another part of the program that we unfortunately don't understand at the moment is what are the differences in pollution levels indoors and outdoors. What is the difference in this room compared to outside on the street?

We just have not had time, money, or facilities to answer this, and it is part of the question of how well can you protect people indoors. We are very poorly prepared to cope with that question. We could just enunciate that we don't have any practical way of doing it.

Mr. AUERBACH. The next question, which I think we fairly well covered [reading]:

Please discuss the meaning to practical administration of the law of such statements as "air quality that will not harm or offend man, animals, or plants" and "the health of even sensitive or susceptible segments of the population would not be adversely affected."

I believe those statements come from the air quality criteria document. Dr. Middleton has already commented on the meaning of those.

The next question [reading]:

Odors are considered air pollutants but raise a great problem of value judgment. As Senator Randolph has said, some people are willing to put up with the odor of limburger cheese. Are there instruments which will evaluate odors (not merely detect chemical compounds)? Or odors evaluated by panels of persons? Are criteria for odors contemplated under the Air Quality Act?

The next question also talks about measuring odors.

Mr. FELTON. First of all, are you in the odor business?

Dr. MIDDLETON. Yes. We are getting rid of them.

Mr. WILLIAMS. Everybody doesn't believe it, but—— [Laughter.]

Dr. MIDDLETON. Yes; we consider odors to be air pollutants, not only because they are a nuisance, but also because they have other adverse effects.

We recognize odor as being a serious problem in some places and a nuisance, of course, in many places. There are some cases in which odors are serious enough to be a well-documented health hazard.

We have conducted consultations, a conference, and also recently had a hearing, have we not, Mr. Griswold, on an odor problem in the State of Delaware?

But to the point can we measure odors easily, available instruments to measure odor objectively are very crude. We rely on panels of people. We rely on multiple-choice, three-point validation system.

We are in the process, through several contracts, of establishing the selection of panels and how to use them. These things, I think, emphasize that we do not now have instrumentation to sense odor and make a quantitative evaluation of it.

We do have the capability in a limited way to identify chemical compounds and quantify them. We are now in the process of trying to identify what the chemical compounds are that are specifically associated with an odor factor. So this is the state of our knowledge in this particular field.

Mr. FELTON. In other words, would you say that the common law of nuisance could not take care of the odor problem?

Mr. WILLIAMS. It hasn't.

Dr. MIDDLETON [pointing to Mr. Griswold]. I was thinking of your experience in Los Angeles.

Mr. FELTON. How is your approach going to be different?

Mr. GRISWOLD. If you apply for an injunction under a common law procedure you have a very difficult time in abating it, you see. However, if you have stringent rules in regard to odor where it is adequately described and they are to become law and then are enforced with adequate evidence, you can get through the court.

But in the cases Dr. Middleton is talking about, in two cases I recall on odors—one was the rendering plant at Selbyville, which gave out a strong pungent to a nauseous odor, the medical practitioners in the town testified to the fact that this type of odor was a health impairment because of nausea or vomiting that took place under certain occasions or continued loss of sleep and this type of nervous strain was very difficult for respiratory cardiac patients.

In another one, and this was a little amusing, of a Ticonderoga papermill, New York, affecting Shoreham, Vt., across the lake from Ticonderoga; the odors of these mills, according to businessmen, and particularly to motel and hotel operators, seriously impaired their business, because even honeymooners that stayed there and checked in early in the evening left at 12 or 1 o'clock because they couldn't stand the odor.

Mr. CARPENTER. What was the disposition of that case?

Mr. GRISWOLD. It was to require the International Paper Co. to put on control equipment that would materially reduce or eliminate the odor to a point where it would not occasion a problem in Shoreham, Vt.

Mr. CARPENTER. And that was successfully accomplished?

Mr. GRISWOLD. That has been accomplished, except right now Vermont is complaining again and it is possibly because the mill is running at peak capacity and is overloaded, and they are contemplating building another mill there three times as large.

Dr. MIDDLETON. Mr. Felton asked: "Is the present law system adequate, and how would we approach it differently?"

I think from our comments you may have sensed how we would do it differently, in that we would attempt not to rely on just a public reaction, an adverse public reaction to some smell, an odor, but rather be able to identify this chemically so some law could specifically regard the regulation of that compound, so we wouldn't have to rely on nuisance law, with all its vagueness.

We would say hopefully in our publication of criteria on odors we could identify the odor constituents that are obnoxious and give the measurement techniques for sensing them, and then, by establishing the threshold of sensory perception, establish levels that would be acceptable or not.

Mr. CARPENTER. Would you infer that you would eventually publish a criteria for cadavering, for instance?

Dr. MIDDLETON. I would have to say I don't know what you mean by this. How to dispose of—

Mr. GRISWOLD. Odors from rotting human—

Mr. CARPENTER. One of sulfur-containing amines from rotting meat?

Dr. MIDDLETON. Very well could.

Mr. CARPENTER. And you would get that specific?

Dr. MIDDLETON. I think until we are specific enough to identify the odor factors, we will never be able to specifically enunciate what it is to be cleaned up, except in very vague terms.

Dr. STEIGERWALD. I think hydrogen sulfide is one that we certainly could go after. The current plan is to think about going out after it as a separate pollutant, although it is one of the most common odors.

Dr. MIDDLETON. Methyl mercaptan is another one.

Mr. FELTON. Would you say it is a little lower on your priority list, though, than some of the other items in general?

Dr. MIDDLETON. Odor criteria?

Mr. FELTON. Yes.

Dr. MIDDLETON. Yes. I think we indicated our primary emphasis is on criteria for particulates as a class, to be followed almost simultaneously by republication of criteria for sulfur oxides, and from there we would expect to go into carbon monoxide, and then we will give consideration to the others we have mentioned—hydrocarbons, oxides of nitrogen, and oxidants.

Mr. CARPENTER. Can you be more specific at this time on your timetable for those first three?

Dr. MIDDLETON. I plan to have the criteria for particulates and sulfur oxides completed this fiscal year. And I plan to have several air quality control regions designated so that full implementation of the Clean Air Act will begin.

Mr. CARPENTER. Right.

Dr. MIDDLETON. Is that timetable to the point?

Mr. CARPENTER. Yes, sir.

Mr. AUERBACH. The next question:

A Bishop, Md., plant is under HEW orders to end unpleasant odors. The company says it will challenge the constitutionality of the Air Quality Act if the Secretary of HEW seeks a court injunction to enforce the order. On what grounds would the company base its case? What is the HEW legal opinion? Do you know of any other resistant court suits concerning the Clear Air Act as amended?

Dr. MIDDLETON. I can read a statement regarding the Bishop Processing Co.'s challenge. [Reading:]

Presently there is no pending litigation involving the Clean Air Act. In a suit entitled "*Bishop Processing Co. v. Gardner*," the company asked the Federal district court to review its claim, made at the public hearing that the statute was unconstitutional. The Government's motion to dismiss that suit was granted on the grounds that the suit was premature, without mention of the constitutional issue. At this time, any discussion of grounds on which the Bishop Processing Co. may rely in attacking the constitutionality of the Clean Air Act would be speculative and of course, inappropriate. It is the view of this Department that the statute's constitutionality will be upheld.

Mr. FELTON. Do you know of any State cases involving this same general area?

Dr. MIDDLETON. Mr. Griswold, will you reply to that question?

Mr. GRISWOLD. The only one was Western Oil & Gas Association, which, in Los Angeles, questioned the constitutionality of rules and regulations limiting the sulfur content of fuel oils burned in various powerplants and other in industry, there. And the net result of that is that they lost all the way up to the State Supreme Court, and then they finally withdrew from that.

Mr. FELTON. Did it have the same factors—

Mr. GRISWOLD. Constitutionality.

Mr. FELTON. Yes, but did the regulation have the same factors such as considering the technical feasibility of it and its economic impact?

Mr. GRISWOLD. Yes.

Mr. CARPENTER. Was it due process?

Mr. GRISWOLD. Well, it was unreasonableness and stuff like this, which requires the burning of oil or of fuels not to exceed one-half of 1 percent sulfur, which practically legislated natural gas, up until this Indonesian oil came in, under the new oil import.

Mr. CARPENTER. Proceed.

Mr. AUERBACH. All right.

The next question, or the next series of questions concerns carbon monoxide: First, what is the evidence that carbon monoxide levels are increasing in the Times Square area?

Dr. MIDDLETON. I don't think we have that specific information, do we?

Mr. AUERBACH. We have not ourselves been conducting measurements in the Times Square area.

Mr. CARPENTER. We will put in the record this quote from Science Magazine, which is the reason for that particular question.

Mr. AUERBACH. Yes, there is a quote.

(The quote referred to follows:)

Lethal Air Pollution: Warnings of an impending crisis because of carbon monoxide levels in New York City have been issued by two pollution experts. On 26 October New York City's Air Pollution Commissioner, Austin N. Heller, stated that growing carbon monoxide levels may force the banning of cars and trucks during certain hours in some areas of Manhattan such as Times Square. Myron Tribus, the dean of Dartmouth's School of Engineering, recently issued a stronger warning: "We're on our way to a public catastrophe * * *. Carbon monoxide levels in New York City are approaching the lethal level."

Mr. CARPENTER. Yes, but please go on to the remaining questions then, whatever you have prepared.

Mr. AUERBACH. All right. [Reading:]

Without published criteria on carbon monoxide, how can "lethal levels" be judged?

Mr. CARPENTER. May I interject here a reference to this table, table 4 in the Department of Commerce report, the "Automobile and Air Pollution," part 2, page 16, which was also submitted, I believe, in a similar form to Senator Muskie, last year, which indicates that in New York, Chicago, and Cincinnati, where measurements have been made in 2 consecutive years, the values for 1967 are less than those for 1966 in a majority of instances.

I am unable to comment on the statistical significance of these, but they do suggest questions that we are asking about saturation with respect to automobile density, the problems raised by this article quoted from Science Magazine, and the concept that in California and now in the Nation we are establishing emission-source restrictions without the benefit of published Federal criteria.

You provided as an answer to Mr. Daddario's final question a résumé of the California situation which indicates that their standards are 30 parts per million for the level mid-8-hour period, called serious

8-hour exposure, and 120 parts per million for 1 hour exposure, and I would appreciate your contrasting these figures with the industrial hygiene standards of 100 parts per million—

Dr. LANDAU. No, they are now 50, aren't they?

Mr. CARPENTER. The latest information I have is contained in "Industrial Hygiene and Toxicology," volume 2, 1962.

Dr. LANDAU. I think the tentative threshold limit value is now 50 parts per million, but we can check that.

Mr. CARPENTER. Yes, if you would.

And in this table, in this particular volume, the indication is that a concentration inhaled for 1 hour without appreciable effect is 400 to 500 parts per million.

Dr. LANDAU. Yes. On this 50 parts per million, we can read from the testimony that was submitted to the Muskie hearing. It says:

Fifty parts per million is now recommended as the upper limit of safety for health in industrial workers exposed for an 8-hour period.

So that 100 parts per million has now been reduced to 50 parts per million.

Mr. CARPENTER. Whereas, these measurements taken in traffic rarely exceed that, although of course, they do in some cases. But the general question is the—what should be the layman's reaction to this emission-source restriction at this point before criteria have been published?

Dr. MIDDLETON. First of all, let me say that the carbon monoxide levels in the Los Angeles area, for example, are going up about 5 percent per year, which is just about the increase in motor vehicle population.

Mr. CARPENTER. Excuse me. Would that be at, say, 6th and Spring?

Mr. GRISWOLD. It is the downtown area.

Mr. CARPENTER. But it would not be at any one point?

Dr. MIDDLETON. Concentration downtown would go up some, but the total tons of carbon monoxide in the whole area is increased because the total motor vehicle population is increasing.

Mr. CARPENTER. Well, excuse me again, but if I could call attention to figure 12, on page 21, of this document, which is a moving 12-month average, could you comment on that chart, the dotted line being carbon monoxide, indicating a decrease in the last year?

Dr. STEIGERWALD. If you are looking at, say, average monthly temperature variations from year to year or average rainfall or average wind speed, these have great variations.

Mr. CARPENTER. And there are cycles longer than a year.

Dr. STEIGERWALD. Yes. There is no possible way to take a 2- or 3- or even a 4-year period. And if you ignore meteorology and depend only upon concentration, you cannot draw any conclusion.

Dr. MIDDLETON. May I also point out in reference to figure 12, that the period 1961 was lower than 1960.

It is difficult to read on the graph—it would appear to be a significant drop, but since it is an annual drop I think it emphasizes what Dr. Steigerwald has just said.

Mr. CARPENTER. They are moving 12-month averages.

There are points on that curve for each month, but they have shifted the 12-month average, you see, in plotting it.

I assume that you are inferring that all of this variation is due to meteorology and that there is a long-term increase in the local concentration of carbon monoxide?

Dr. MIDDLETON. That's correct.

Mr. CARPENTER. And you have—

Dr. MIDDLETON. You perhaps have a better expression of the meteorological effect in figure 12 on nitrogen oxides, in the fact that you see shifts in its sources. Now let's be certain we also understand that changes in levels, even though they are moving averages, are often due to the change in location of the monitoring station, so that when one looks at the data one must not make the immediate assumption that the change is real in the sense of the ambient air level concentration in the region.

Dr. STEIGERWALD. The other point is that carbon monoxide, coming from the automobile almost exclusively and coming at high concentrations at the exhaust pipe, with a great decrease in concentration as you move away, is very sensitive to many things. And if in 1965 they happened to open a new freeway that took a good share of the traffic off the street in front of that sampling station, you would see drastic differences.

Mr. CARPENTER. Yes.

Dr. STEIGERWALD. At that one sampling spot.

Mr. CARPENTER. My question then would be: Does the national center have data that rigorously affirm that local concentrations of carbon monoxide are, in fact, increasing, and that there is not a saturation of automobiles per city block, and so on, which prevents any increase?

Do you have such data and could you guide us to it?

Dr. LANDAU. If you are thinking in terms of a specific street, it is very likely that there are certain streets that can take no more traffic. On the other hand, if you think in terms of the background levels of carbon monoxide, this means that people who live adjacent or fairly close to the freeways will be subjected to values which will be lower than those on the freeways. But they also will be getting background values from the areas right around the congested streets.

So the background levels are tending to build up even though the levels of carbon monoxide directly adjacent to the freeways just can't increase any more because you have a very restricted area, unless you have a highly unusual meteorological condition.

So, it is true, I suspect, that given areas can't handle any more cars and that the level of carbon monoxide really has kind of a ceiling, unless you have an unusual meteorologic condition. But the background values can increase.

Mr. FELTON. This is the same as the comments regarding the suburban level?

Dr. LANDAU. That's right. It is going from the city and spreads out. So you have much more of an equalization, I would say. So the higher values tend to spread out even though there may not be any real increase in the carbon monoxide in a given block just off the freeway.

Dr. STEIGERWALD. We now have done this in a random model, and have underway more sophisticated models that try to take meteorology and figures of traffic density in each square mile of the city in attempts to relate these two into ground-level concentrations at different points

in that city, say in the year 1985, as an attempt to look ahead at how bad will carbon monoxide be at ground level in that city, grid by grid, square mile by square mile, 15 years from now. This is being used in an attempt to compute back to what sort of standards do we need now at the tailpipe, to say, preclude hazardous situations 15 years from now.

Dr. LANDAU. I think what we are saying is that, taking the population as a whole, there is a greater residential exposure as you have more cars, so that the population not only directly adjacent to the freeway but a little farther away and farther and farther away from the freeway is being exposed to increasingly elevated levels of carbon monoxide as the numbers of cars and car usage increase within the city.

Mr. CARPENTER. Increasingly elevated, but far lower than these values reported in the National In-Car Test?

Dr. LANDAU. Yes. I think these background values—the residential exposure would have to be lower than these in-car values pretty much by definition. I would like to quote a statement from the Swedish Medical Air Quality Guides, which may have some relevance. It says:

It is to be expected that persons especially sensitive to anoxia, those suffering from diseases of the heart and lungs, for example, are also sensitive to exposure to low concentrations of carbon monoxide.

Then it says:

With respect to the effect mechanism of carbon monoxide, it may be questioned whether any threshold value exists for persons sensitive to anoxia. In any case, no investigations have been carried out which show where such a threshold level is to be set.

I think what we are saying, then, is that we cannot accept an industrial standard for the general population. Further, we are not certain, as the Swedish experience indicates, we are not certain as to what is the proper level for persons who have deficiencies, certain kinds of deficiency in the terms of the oxygen-carrying capacities of the blood, to be able to make a judgment as to what threshold level is at which these people will be affected.

Certainly there is every indication that this level will have to be substantially lower than the accepted industrial levels and certainly, probably very definitely, lower than the levels that would be found in cars.

Mr. AUERBACH. Dick, do you have further questions on carbon monoxide?

Mr. CARPENTER. Yes, I do, and they are related not to carbon monoxide per se but to the question which Mr. Daddario asked. Dr. Middleton answered to the effect that the rapid promulgation of exhaust emission restrictions was not going on in the dark, that you were following the lead of California, which had, in fact, followed this same sequential process of criteria to standards to emission controls.

My question is related to that answer, in which I have been unable to ascertain as yet how California did arrive at the progressive reduction of carbon monoxide to these 30 and 120 parts per million standards.

Dr. MIDDLETON. Let me just generally say that the emission standards for motor vehicles in California were reached based on the belief that air quality in the early 1940's was satisfactory. And projections then

were made from later motor vehicle levels, this was in 1959, I believe. I will ask Mr. Griswold to give you more details since he was involved in this.

Based on the population at that later time and the existing levels of carbon monoxide, projections then were made back to the period when carbon monoxide was believed not to be a factor, nor eye irritation to be a factor.

Mr. CARPENTER. What was the factor in carbon monoxide effect? This is what I haven't been able to ascertain.

Dr. MIDDLETON. You mean the adverse effect?

Mr. CARPENTER. They have no adverse effect.

Dr. MIDDLETON. Well, adverse, in this sense, as damage to plants and destruction of property or impairment of visibility.

Mr. CARPENTER. Carbon monoxide does damage plants?

Dr. MIDDLETON. No, it doesn't damage plants. I am saying the word "adverse"—

Mr. CARPENTER. So it is not applicable to carbon monoxide?

Dr. MIDDLETON. It was believed not applicable to carbon monoxide, because it had no physiological function at that level. We are mixed up now in using California's terms of three categories as contrasted to one criteria.

Mr. CARPENTER. Their footnote, which I would assume is essentially their criterion here, says:

Given certain assumptions concerning ventilatory rates, acute sickness might result from a carbon monoxide level of 240 parts per million for 1 hour in sensitive groups because of inactivation of 10 percent of the body's hemoglobin. In any event, it is clear that when a population exposure limit has been set for carbon monoxide, because of exposures from other sources, community pollution standards should be based on some fraction of this limit.

So I assume they took this 240 acute response in sensitive groups, divided it by two for their 1 hour exposure, and by eight for their 8-hour exposure, to get this fraction of safety?

Dr. MIDDLETON. I would have to do an awful lot of recalling to get the old numbers back.

Mr. GRISWOLD. You recall, John, when we were all discussing the criteria out there, and also the motor vehicle standards? There were two major theories involved: One was the rollback theory, the one Dr. Middleton mentioned, to an air quality existent prior to popular reaction in the early 1940's. So a calculation was made based on 1956 or 1957 vehicles of how much carbon monoxide was being put out by those vehicles registered and operating in 1940.

Mr. CARPENTER. Just as a tonnage.

Mr. GRISWOLD. On a total tonnage basis. Then the degree of control required by California in its original motor vehicle emission standards for carbon monoxide was related to that percentage of control that would result in the estimated number of motor vehicles registered in 1970, not putting out any greater tonnage of carbon monoxide than those that were registered in the early 1940's.

That was true on hydrocarbons, too. However, in the meantime, the State Department of Health was developing these standards and, realistically it seemed that in the calculations which resulted in the standards which you have just read—they fitted in beautifully with the 1940 rollback system.

Remember, these were some of the first standards that were developed. It was recognized that not all of the knowledge was in, but their basic philosophy in the developing standards was to get a consensus of what the standards should be based on medical knowledge extant, to amend them as new knowledge became available, and also to pinpoint that or those areas where there hadn't been enough research done.

Mr. CARPENTER. And the Federal Government then has followed the California emission restrictions without particular regard to whether the rollback theory, or a stringent health criterion was the source of those standards?

Dr. MIDDLETON. This is what is being refined now for the purpose of producing the criteria that will be published in the next fiscal year.

Mr. CARPENTER. For hydrocarbons and for carbon monoxide?

Dr. MIDDLETON. Carbon monoxide will come sooner.

We have learned enough about what carbon monoxide does to people to be much more concerned with the health effect than just the rollback. We understand that the smoker is much more prone to the adverse health effects of carbon monoxide because he has already laden himself with carbon monoxide. So the smoking population is a more vulnerable population.

We also have learned more not only about the carboxyhemoglobins, but also about motor effects.

Perhaps, Dr. Landau could elaborate just a bit on this.

Dr. LANDAU. There is increasing evidence now becoming available about the effects of relatively low levels of carbon monoxide. They have an effect on psychomotor performance. They have an effect on people's ability to discriminate time and visual stimuli effectively.

These are things which are very important from the standpoint of driver efficiency. That is, if carbon monoxide at the levels which people are being exposed to in cars is that level which in our laboratory experience indicates that people do have deficiencies in judgment, that they do make mistakes in judgment much more often, that they have much more difficulty in reaction times, in terms of what we call intelligence perception—this, then, clearly is of significance to us.

Mr. CARPENTER. Would you infer from that, that cigarette smoking should be considered in issuing drivers' licenses?

Dr. LANDAU. Realistically, I don't see how you can. I think in principle that probably would be a good point.

(A short recess was taken.)

Mr. FELTON. Dick, there are still a lot of questions here. Take the ones that you really want.

Dr. LANDAU. We will have to get you some data on New York City's measurements of carbon monoxide particularly during the 1966 Thanksgiving Day episode, when the levels were relatively high.

(The data referred to follows:)

At the Central Laboratory Station, located on East 121 Street in Manhattan, hourly carbon monoxide values on November 24, 1966, were as much as $7\frac{1}{2}$ times the hourly average value for corresponding time periods during the rest of the month.

Mr. CARPENTER. Let's get to this one, then—I will have just two more.

In real life, pollutants occur together rather than singly and effects are changed due to weather, smoking, infectious agents, et cetera. What is the likely magnitude of error in cost-benefit judgments for standard selection when criteria are established only for each pollutant alone? Does the large number of possible combinations rule out criteria establishment for complex atmospheres?

Dr. MIDDLETON. That is fairly easy to answer. It is easy to answer in the sense that you are probably less likely to make errors for single pollutants based on the fact that they are acting in concert, since synergistic or enhancement effects are likely to mean that the numbers should be smaller than the criteria will be for the single pollutants.

Let me illustrate the case—

Mr. FELTON. In which way?

Dr. MIDDLETON. In the way that an ozone level that causes damage to tobacco is a very different number and much smaller when sulfur dioxide is also present. Five times less ozone is required to produce the same effect, and sulfur oxide in neither instance causes any effect.

Mr. FELTON. So that, if you issued criteria for ozone alone you might, in fact, err?

Dr. MIDDLETON. We might not be protecting the public as well as we should.

Mr. WILLIAMS. Yes.

Mr. CARPENTER. Then how do you propose to deal with these possible synergistic effects?

Dr. MIDDLETON. By trying to get the knowledge that shows what is happening in synergistic systems. Until we know something about the synergistic effects, we are obliged to use the best scientific knowledge that is available for the individual pollutants.

Mr. CARPENTER. Do you put a safety factor in?

Dr. MIDDLETON. No; our criteria are statements of fact. Let's make that clear: Criteria are expressions of effects that occur for a given dose.

Mr. CARPENTER. Would you recommend that a State using your criteria to set standards use a safety factor because of a lack of knowledge of synergism?

Dr. MIDDLETON. That certainly ought to be considered whenever standards are set. If an adverse health effect, to give you an example, is caused by a tenth of a part per million of something—that is the minimum threshold effect—and half that, 0.05 parts per million of the same pollutant causes agricultural damage of economic concern—

Mr. CARPENTER. You choose that.

Dr. MIDDLETON (continuing). Then you choose that to assure that at least you are not going to hurt people and you may even get the support of farmers in cleaning up the air to help their own economic interests.

These are the kind of things that have to be done at the local level.

Mr. CARPENTER. Now the other question I had—

Dr. MIDDLETON. Excuse me a minute. I want to ask if Dr. Landau can give us an example of synergistic action that affects people?

Dr. LANDAU. The most common one is the combination of particulate matter and sulfur oxides.

The Russians have taken this into account. They have standards for individual pollutants, 96 of those currently, but they also have

standards for combinations, including combinations where there are synergistic or interacting effects.

Each of those is reduced in some proportion so you get something less than the standard for the individual pollutants you started out with. So this problem is not unique, you see, to American experience.

Mr. CARPENTER. Then, the answer to my question is that the large number of possible combinations does rule out criteria establishment for complex atmospheres?

Mr. WILLIAMS. No.

Mr. AUERBACH. Are you talking about a single criterion for air pollution?

Mr. CARPENTER. Or for two. For sulfur oxide and particulates, to be specific.

Would you contemplate issuing a criteria for those two in combination?

Dr. MIDDLETON. I guess I am having difficulty understanding what the real point of the question is.

It would have to be a third-party system. Where you had particulates and sulfur oxide interacting and certain concentrations having effect, you would have a variable number, depending upon relative proportions.

Mr. CARPENTER. It would be like this oxidant chart on page 8 of the Commerce publication.

Dr. MIDDLETON. Well, if we knew that the enhancement or synergistic effect took place in a physical-chemical way as this, it could be predicted. We don't know that now. The size of the particles is very important, but we are uncertain whether the nature of the particle is important. Present indications are that maybe the nature of the surface of the particle is less important than its size. We simply don't have enough information at this time to put together this kind of a synergistic criteria system.

Mr. CARPENTER. OK. That answers my question. The last one, and one I am particularly interested in:

Are our planned efforts and expenditures in air pollution control being subjected anywhere in government to a comparison with other alternatives to increase the general health of the public?

Dr. MIDDLETON. The Congress has clearly established the fact that it is concerned about air pollution and it has set some goals. The new amendments to the Clean Air Act, for example, call for some specific missions to be performed.

The fact that we have appropriations and funds seems to me to have uniquely and explicitly described the extent to which we do need to expand at least this effort to cope directly with the air pollution problem.

As to trade-offs, you will recognize that we have a specific request in the Clean Air Act that addresses itself to the cost of air pollution, in the order of cost-effectiveness studies and the like.

And, we have a number of contracts that are beginning to be set in motion that relate to this question.

So I answer you in the sense that we have a mandate to clean up the air with a law that says how we would like it done, and we are pursuing that, and the larger nature of the question you described is a matter of departmental concern here.

The Department is pursuing it in its adjunct activities as a separate operation. But the cost-effectiveness system that you speak of—we have already begun some work with the Council of Economic Advisers, and I am sure we will have more.

Dr. STEIGERWALD. We are actively trying to find the cheapest way to solve the air pollution problem. We are doing a number of cost-effectiveness studies of alternative control schemes, and so on.

The bigger question of how do you relate money spent for air pollution or for noise control or for crime in the streets is not our mandate.

Mr. WILLIAMS. I would say that that answer to that question is provided largely by the Congress of the United States, which decides which bills it will pass and which it won't, and what kind of appropriations it will allow. In addition, you have, of course, the Bureau of the Budget, the Office of Science and Technology, and the Council of Economic Advisers in the executive branch trying to make these decisions.

Ultimately, I think the public is making these decisions. The public, I think, has evidently convinced virtually all Congressmen in both Houses that it would like to see a lowering of air pollution, and so we are given this job to do.

Mr. FELTON. Gentlemen, we thank you. I think this meeting has been very helpful.

(Whereupon, at 4:20 p.m., the committee was adjourned, subject to call of the Chair.)

Staff Meetings on Environmental Quality

FRIDAY, FEBRUARY 23, 1968

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND ASTRONAUTICS,
SUBCOMMITTEE ON SCIENCE, RESEARCH, AND DEVELOPMENT,
Washington, D.C.

Mr. Joseph M. Felton, counsel for the committee, and Mr. Richard Carpenter, Legislative Reference Service, Library of Congress, met with Mr. Joe G. Moore, Jr., Commissioner, Federal Water Pollution Control Administration, and other officials of the Department of the Interior, in room 4421, Main Interior Building, Washington, D.C., at 1 p.m. Accompanying Mr. Moore were Mr. John T. Barnhill, Deputy Commissioner, Dr. Leon W. Weinberger, Assistant Commissioner, Research and Development, and Dr. Allan Hirsch, Assistant Commissioner, Program Plans and Development.

Mr. FELTON. Gentlemen, we do thank you for meeting with us. As we mentioned earlier, Mr. Daddario suggested that it might expedite matters if we meet informally and discussed these questions rather than submit formal questions for the record.

Dick, would you like to start right in with the questions?

Mr. CARPENTER. Yes. As you recall, Mr. Ryan was very interested in the problem on the Hudson River and the approval of the percentage of treatment as contrasted with some statements which had been made on the normal degree of treatment which the FWPCA would expect.

Question No. 1 suggests that the New York City sewage treatment plant is reported to remove 70 percent of the organic waste. How is this figure justified? What is the relationship to the quality of the Hudson River water? What difference in water quality would have resulted from 90 percent removal? Or 60 percent?

A similar situation has been reported to us in the Raritan Bay, where they have a 70-percent treatment, and if they could extend their outfall further in the estuary, further out, they have calculated that this would be equivalent to 90-percent treatment as far as their receiving water is concerned.

There was some question as to whether they should raise this issue of the alternative of increasing their treatment or moving the outfall because it might mean that Federal funds would be withheld unless they went to the higher treatment.

So my question concerns the way in which you make these judgments of the percent removal as how they are related to the actual use of the receiving waters.

Mr. MOORE. Yes. Let me make a general comment. Others here may want to speak to it. But let me make a general comment about the one on the Hudson River. I am not acquainted with the Raritan River case. But in the case of the design of this Hudson River plant,

the plant is designed as I recall to meet its maximum capacity in the year 2010. As a matter of fact, if you design one to meet an increasing capacity, then initially it will achieve a higher percentage removal at less capacity than that for which it is designed, then it ultimately will remove at the capacity for which it is designed.

In the case of the Hudson River plant, also, the city of New York has acquired some 22 acres upon which to construct that particular plant. And it has plans to acquire additional land to expand this facility. So that you have both a combination of a plant that is designed to take a large capacity than that which it will initially take, which means you get a higher percentage removal to begin with than ultimately, and also during the course of the increase of the inflow to the plant, normal increase for which it is designed, there will also be additional time to acquire more land.

As I recall, there are some 4 acres or in that range that they propose to acquire in addition to the 22 acres they already have.

Now what you are faced with is the question of whether or not you let them proceed with a plant designed for a capacity to be reached in 2010 and achieve some removal—I think John can give you the percentages of BOD at this point in time or whether you wait until you get the entire situation in hand so you can move to get a higher degree of removal. In other words, you are faced with the question of staging of construction in order to get some improvement now.

Mr. CARPENTER. Were available funds a part of this staging?

Mr. MOORE. Funds could be considered a part of the staging, but it is a question of getting some construction underway now, on land that is available for a plant that was designed 3 years ago, as opposed to the alternative, for example, perhaps, of waiting until they acquire enough land which could take some years or one other alternative that has been internally discussed is the location of the plant somewhere else in which case you would have to start over with land acquisition for a new site. As I understand it, it has taken them some 20 years to acquire the 22 acres they do have upon which to construct this plant.

Mr. CARPENTER. And at the present time raw sewage is going into the river?

Mr. MOORE. Is going into the Hudson River. It is a difficult decision, you see, whether you move to make some immediate improvement in the quality of the discharge or whether you wait until every possible ideal situation has been developed, and then you move at that point in time. There is nothing inconsistent in terms of the objective of water quality in the Hudson River—there is nothing inconsistent with beginning now for the construction of the facilities that will achieve the degree of removal that is contemplated in the design of this particular plant.

Mr. CARPENTER. Which would be 70 percent.

Mr. MOORE. Mr. John Barnhill can give you, I think, those percentages.

Mr. BARNHILL. Well, the present plant is designed at capacity.

Mr. MOORE. In 2010.

Mr. BARNHILL. To remove 53 percent of the BOD, but as Mr. Moore said in the first few years of its operation it will remove about 70 percent of the BOD.

Mr. CARPENTER. This is due to the holding time, the capacity to hold the sewage to allow the biological process?

Mr. BARNHILL. Essentially that is correct, but it goes back to this problem of available space at the present time. The 22 acres is only large enough at this time for them to be able to construct what we call a full primary treatment facility.

Mr. CARPENTER. That removes the floating, suspended, and settleable material?

Mr. BARNHILL. That is correct. And a modified activated sludge process, as a secondary treatment.

Mr. CARPENTER. What will be the initial percent removal, then?

Mr. BARNHILL. Seventy percent.

Now the city, since this plant was designed, has acquired an additional 2.8 acres of land on which they propose to extend the secondary treatment facilities. When this work is completed at design capacity, it will remove 70 percent of the BOD. Again in the initial years of the expanded facility it will go higher than that.

Mr. CARPENTER. Tell me what percent of the BOD of the raw sewage is removed by the primary treatment alone?

Mr. BARNHILL. Normally that will run, depending on the individual sewage, 40 to 60 percent removal BOD.

Mr. CARPENTER. And the secondary treatment then adds another 10 percent, with the capacity which they will have?

Mr. BARNHILL. Well, it adds another 10 to 30 percent, depending on what you achieve in the primary treatment.

Mr. FELTON. When will the secondary treatment be completed?

Mr. BARNHILL. You mean the extended treatment works?

Mr. FELTON. Yes.

Mr. BARNHILL. I don't know.

This, of course, has to deal with what they have to clear off, the 2.8 acres they have acquired and so forth.

Mr. FELTON. Is it just a question of building it? In other words, do they plan to start in 1975, or is it just a question of how soon they can build it?

Mr. BARNHILL. Well, I think it is a question of how soon they proceed to build it. I don't believe they have designed the additions to the secondary treatment facilities yet. It is my understanding they have only recently acquired this 2.8 acres.

Now the city has also initiated administrative procedures to acquire another 4.9 acres on which they propose to further extend the secondary treatment facilities. This will provide them with enough facilities to remove 90 percent of the BOD at design capacity. This will meet the water quality standards requirements and enforcement conference recommendations that the Secretary made.

Mr. MOORE. I think—if I may interrupt at this point—that this is important, that this is a staged construction process. It would be staged in any event. That is, the normal procedure to construct first a primary plant, and then a secondary plant—then the secondary plant extension, so to speak. It is also important, I think, to understand the significance of this land acquisition question. With 22 acres available now and then 2.8 that has been acquired since this plant was designed, and then the process for acquiring another 4.9 acres, you would then have a plant that would remove 90 percent of the BOD.

Mr. CARPENTER. So there is nothing inconsistent in your approval and release of Federal funds at this point in time because you expect to continue to insist on this eventual 90-percent figure?

Mr. MOORE. Yes.

Mr. FELTON. You don't have a date on that yet, do you?

Mr. BARNHILL. Well, let me say this—

Mr. MOORE. Tell them how long it would take to construct a plant on the 22 acres; in other words, give them some idea of what the construction schedule would likely be for a plant of this size.

Mr. BARNHILL. Well for a plant of this size, and it is being designed for 300 million gallons per day capacity, it would normally take 2 years to build a plant of this size. So it should be in operation sometime in 1970.

Mr. FELTON. How long would it normally take to build the first addition to the secondary treatment?

Mr. BARNHILL. Well, I would say the design and construction of the extended secondary facilities would again perhaps take 2 years, for design and construction both.

Mr. MOORE. Actually the design of it could continue while the—

Mr. BARNHILL. Yes; the design could be going on while this initial plant is being constructed.

Mr. FELTON. Right. Now that would raise the 70 up to how much?

Mr. BARNHILL. Well, I could only make a guess, but I would say it could probably—in the initial years of operation it would approach 80 percent.

Mr. FELTON. And then the second stage of the additional facilities for secondary treatment—this has to go through the condemnation process and all.

Mr. BARNHILL. Clearing the site.

Mr. FELTON. Which I would think could probably be completed in 5 years, I am talking about in 1972. So again it would be about 1975—or would something like this normally take longer?

Mr. BARNHILL. I think that depends on a lot of things. You can get tied up pretty badly in condemnation proceedings.

Mr. MOORE. But it would also depend—in some cases you can have condemnation proceedings underway and you can actually go ahead and use the land for a public purpose while the litigation is being concluded. I don't know whether this is true in New York or not. But that might not necessarily be a long-term delay. It would just depend on the individual circumstances.

Mr. FELTON. In other words, something like 1975 would be a ballpark figure?

Mr. BARNHILL. I would hope so.

Mr. MOORE. If everything clicked.

Mr. BARNHILL. Now I think it is important to recognize that this present plant, the one that will produce 70 percent BOD removal, was designed prior to the requirement of our quality standards and prior to the Secretary's recommendations as a result of the enforcement conference up there.

Mr. CARPENTER. Which were 90 percent.

Mr. BARNHILL. Which were 80 percent at all times, or such other degree of treatment as the State of New York required to meet water quality standards, approved by the Secretary.

Now the enforcement recommendations and the water quality standards both give the city of New York until 1972 to comply both with the standards requirements and enforcement recommendations. You see, this is the reason why we feel that this kind of phased construction is quite adequate for our purposes. I think it would be quite unfair to the city of New York for the Federal Government to say, "We will not make a Federal construction grant at this time because you have not designed a plant that will remove 90 percent BOD in accordance with the water quality standards."

Mr. FELTON. I don't understand. You are requiring 90 percent by 1972?

Mr. BARNHILL. Well, we are requiring 80 percent at all times, which means the plant would have to be designed at 90-percent efficiency in order to guarantee.

Mr. FELTON. I thought you just said that you didn't expect this second additional facility to be completed until about 1975.

Mr. BARNHILL. I didn't say that. That was our guess, and I said I would hope so. I said I would hope so.

Mr. FELTON. You would hope actually by 1972 to meet the requirements?

Mr. BARNHILL. Well, as far as we are concerned, the time requirements on the water quality standards and the enforcement recommendations still hold. They are still going to try to get the city of New York to meet this commitment by 1972. They have not been relieved of this responsibility. And it has been agreed that the city, the State, and the Federal Water Pollution Control Administration will meet at 6-month intervals to discuss what progress has been made.

Mr. MOORE. Let me say almost any alternative you can mention would certainly almost have to extend the time beyond 1972.

Mr. BARNHILL. Yes. And there would be, I believe, a tremendous increase in cost for any new site and new construction. It has been reported that construction rates in that part of the country are going up an average of 8 percent. I think that might be a little high. But even if it is only 6 percent, 6 percent per year for a \$190 million project represents an awful lot of Federal, State, and local funds. So if this project were put off for 5 or 6 or 7 years, which could certainly happen, the cost increase would be very substantial. To relocate it, of course, would mean construction of substantially more intercepting sewer to convey the waste to the new site—I don't know where the relocation site would be. And in this project, just to give you an example, the existing interceptor sewer construction is costing roughly \$90 million.

Mr. CARPENTER. Is there any storm sewage going through this new plant?

Mr. BARNHILL. Well, I would assume there is.

Mr. CARPENTER. There is some combined storm and sanitary sewer?

Mr. BARNHILL. I really don't know, but I would have to guess, New York City being as old as it is and being Manhattan Island, that it is practically all combined sewers.

Mr. CARPENTER. And that might be the time when your 90 percent would degrade to 80, when you were bypassing—or are you referring to the 80 just meaning a portion of the time when you had to shut down a certain tank or for repairs? What is the relationship, again, of

your 90-percent design to assure 80-percent overall treatment? Does it have to do with storms?

Mr. BARNHILL. Well, it might have to do with storms, but it might have to do with emergencies in the plant.

Mr. CARPENTER. Yes.

Mr. BARNHILL. There are times when the character of the sewage changes and so forth.

Mr. CARPENTER. Now, I would like to use this example of your administrative action to help illustrate the sequence of selecting water quality standards and associated abatement technology that one would install.

As we heard from Dr. Weinberger in the hearings, the first consideration would have been the use of the Lower Hudson River, not only the present use but what you might anticipate as future desirable uses, from which you would have examined the criteria corresponding to those uses, these criteria including the residual BOD, perhaps nutrients and so on.

But could you tell us the sequence that you follow to arrive at this 90-percent treatment and how you would—I believe you mentioned that this plant would be 53 percent, at its 2010 capacity—

Mr. MOORE. On the 22 acres.

Mr. BARNHILL. The present.

Mr. CARPENTER. So unless more land is acquired as we go along, this percent removal will degrade to 53 percent?

Mr. BARNHILL. Yes.

Mr. CARPENTER. Just due to the volume which has to be passed through a limited plant site?

Mr. MOORE. Yes, sir; that is correct.

Mr. CARPENTER. Well, could you—

Dr. WEINBERGER. Could I add something to that? I think that one must recognize also that in the intervening period there is very little question but what we are going to be able to perhaps modify the existing treatment at existing sites and obtain increased treatment.

Mr. MOORE. By modify, you mean improve?

Dr. WEINBERGER. Improve, yes. So we can operate these plants so we do remove more of the impurities. So I think during this period that the plant is coming up to design capacity—and you do have to seek alternate solutions, one of which is perhaps going to be treating the wastes elsewhere. We should not write off the idea that at a particular site, with changing economics, we can perhaps put in a more expensive type of treatment. Some of these are not available now, but we are talking of 40 years in the future.

Mr. CARPENTER. Right. This would suggest that there would be ample opportunity through research, development, if you will, to come up with improved treatment within the constraints of a particular site.

Now what will the citizens of New York get for their money in installing this plant?

Mr. MOORE. Higher quality of water in the Hudson River.

Mr. CARPENTER. With respect to what uses?

Mr. FELTON. To put it another way: You can't swim in it even though it may not be polluted, you still couldn't swim in that type of situation?

Mr. MOORE. I think the point that needs to be made is—and I personally feel rather strongly on this point—the ultimate has to be complete treatment. There is no alternative to this. But the point I think that is important is that you don't get from raw sewage to full secondary treatment just by constructing the facility. It is extremely important that the facilities be properly operated. This is like driving an automobile. Most of us drive one that is probably not operating at its optimum efficiency. If you were to take it into a crew of racing experts, they would probably do all kinds of things to it to make it operate at its optimum efficiency. And one of the things that has to be done in the course of time is to assure that the plants are operated at their designed capacity, if you want to think of it that way. But what they get is merely a third-hand car working up to one that will operate at optimum efficiency when the time comes. But you have to begin with the primary treatment process, where you don't have it. You have to go on to the secondary process of treatment beyond the primary treatment before you achieve what it is that you are after.

Mr. FELTON. But is this raw sewage the primary cause of pollution in the Hudson River?

Mr. MOORE. Dr. Hirsch will have to answer that. I don't know the primary cause.

Dr. HIRSCH. I am afraid I would have to say that I don't know the primary cause either, but I think of the population you are talking about it would be a major cause. Do you know what the other sources are there, Jack?

Mr. FELTON. If we assumed that this plant was in full operation in 1972, which I hope, how many more years before the Hudson would then be fit for recreational type enjoyment?

Mr. CARPENTER. Or any use that it is not now usable for.

In other words, I gather from your statement that you felt that the lower Hudson should not receive any sewage that had not had full secondary treatment.

Mr. MOORE. I will extend that and say it is my opinion that none of the waters of the country, as a general proposition, should receive any municipal sewage that has not received secondary treatment. I feel that secondary treatment is one of the things which is technologically possible and, therefore, it is one of the things that ought to be achieved. Now you can get into some isolated cases that pose a hard question, and I have had them posed to me just in the time I have been here: Should a city with a population of 500 on the Mississippi River go to secondary treatment in terms of the volume of water that exists in the receiving stream? And there I will admit you get to a hard question. But as a general proposition, it seems to me that secondary treatment has to be recognized at this point in time as an absolute must, regardless of where the discharge is made.

Now with regard to the Hudson, your answer dodged what must be part of the problem, and that is this question in any receiving water. There are bound to be upstream discharges and probably industrial in the Hudson. There is an industrial stretch above the city of Manhattan.

Dr. HIRSCH. I am sure in the Hudson you also have heavy discharges from commercial shipping and so on. But there is another problem

that we are attempting to get on top of, and which we are not on top of it today. And it is a part of our overall recognition of the factors that we have to come to grips with if we are going to clean up the Hudson or any other river.

Mr. FELTON. So you are saying, then, that this plant alone will not improve the Hudson.

Mr. MOORE. It will not alone improve the Hudson River where the Hudson River will be available for all uses. But simultaneously with this approach on municipal sewage you must also be approaching all other discharges, plus the related problems of a harbor operation, refinery storage which I know exist on the New York side, all of the related problems that go with it having to be simultaneously attached in the same sense that you are moving on the municipal discharges.

Mr. BARNHILL. You want to recognize that in a metropolitan area like New York where they have as much industry as they do, the water using and liquid waste-producing industry has to discharge its waste somewhere. In New York City's system a very large amount of industrial wastes are discharged and we call it municipal sewage, but you mustn't think it is all sanitary sewage. It is a combination of both. So the lower Hudson of course is subject to industrial pollution, either directly or through municipal sewage, sanitary wastes, vessel pollution, oil wastes, and so on.

Now let's take a look now at what we are trying to achieve there in the lower Hudson. As a result of public hearings and our enforcement conference, it has been determined that the best use of the Hudson, the lower Hudson, is for recreation, for fishing—I am talking about sports fishing—for boating, and other semidirect contact sports, and for esthetic enjoyment there is a big park along there that I think you fellows are aware of.

One of the things the city of New York is doing in relation to this plant is to extend that park right down alongside the waste treatment works. This is one of the requirements as I understand it of the metropolitan planning agency up there. This is going to be a pretty good thing, because it is going to be an elevated park. There is an expressway that runs along that site, and this park is going to have to be built up over the expressway. As far as I know, the city of New York has agreed to do this.

Mr. MOORE. This has had an impact by the way on the design of this particular waste treatment facility. They have had to build into the design of this facility the landscaping requirements that would make it compatible with the existence of a park in the area.

Mr. BARNHILL. And even beyond that, this plant is quite unusual, particularly for its size, because all of the tanks, sedimentation basins, aeration tanks and so forth, are all covered. Normally these are open. But here to make every effort to make the plant not only attractive in design but to control any nuisance from odors and so forth, these tanks are all covered. And it is designed in a very attractive way. I wish I had the artist's conception of that plant here, but it is quite attractive.

Mr. CARPENTER. So you are then saying that for this investment in sewage treatment combined with all of the other improvements along the Hudson, the benefit will be new uses that can't now be contemplated at all?

Mr. BARNHILL. That is correct. They will be able to have their Hudson River Park. As you may know legislation has already been enacted. We now have the Hudson River Basin Compact Act. They are striving to beautify that area of the Hudson physically, on both sides of the river, and to achieve these kinds of high uses—recreation, fishing, and so forth.

Mr. CARPENTER. There is no sports fishing now in that area?

Mr. BARNHILL. Oh, I am assuming there is some.

Mr. MOORE. I have seen it. I would say there probably isn't any substantial degree of sports fishing, not in the sense in which you normally think of sports fishing. There may be some people putting lines in the water, but not sports fishing in the usual sense.

Mr. CARPENTER. And there is—

Mr. FELTON. You can do that on the Potomac.

Mr. MOORE. Yes, sir.

Mr. CARPENTER. There is no water skiing or pleasure boating.

Mr. MOORE. No.

Mr. BARNHILL. Well, there probably is some, but you see there is not as much as there would be if they are able to complete their objective of making this a beautiful, highly desirable place for people to come and enjoy the water and the parks and so forth.

Mr. CARPENTER. Certainly the esthetic enjoyment must be at a minimum now.

Mr. BARNHILL. I would guess that it certainly is.

Mr. MOORE. This will be one of the first objectives you would reach. The primary treatment at least could provide, or certainly it would be one of the first steps in the direction of making it more esthetically attractive. You have seen water that was not esthetically oppressive, but you wouldn't get out on it for pleasure purposes.

Mr. CARPENTER. Yes.

Mr. BARNHILL. In the metropolitan area of New York, I think it is very easy to recognize that the part of the Hudson that runs through the metropolitan area there—the land along the sides and the water itself have got to be invaluable. I don't think you could put a dollar figure on what it is worth to the people in that area, if they can go down there and water ski and swim and fish and do all the things.

Mr. CARPENTER. Do you think they would ever be able to swim?

Mr. BARNHILL. Well, I will go along with Dr. Weinberger. I have a great deal of confidence in research, and I think that before 2010 it will be entirely possible to swim in the Hudson River.

Mr. MOORE. Let me turn the answer around.

I think it would be unfortunate if we were at this time to preclude the possibility that you might be able to swim. It may take substantially more than we have done already to decide that you can't swim, and I would rather the decision not be made that you can't on the basis of the information we now have.

Mr. CARPENTER. On that subject, Dr. Weinberger, the Potomac has been mentioned for some years as a possible swimming beach. But other comments have been made that the storm runoff would keep the coliform content so high that a Public Health officer might hesitate in allowing people to swim there.

Do you have any more recent studies or experiences that you could relate to us on that?

Dr. WEINBERGER. I would say that the same type of answer that Mr. Moore just gave applies. I think it would be a completely defeatist attitude to suggest that we couldn't have swimming in the Potomac River. From a technological point of view, there is no reason why we can't control the pollution sources, including the matter of the bacterial quality of the storm and combined sewer runoff.

Right now it is a matter of cost. I think it is a decision that the public must make as to the value which they will put to any particular use.

I personally think that the Potomac should be used for all purposes that the public wants including a swimming place for them. We can develop or we do have the technology to control pollution.

Mr. CARPENTER. Will your program result in the placing of a cost figure on these various uses, and if so when could we expect such cost benefit figures to be available for major rivers and estuaries?

Dr. WEINBERGER. You want to comment on that, Al?

Dr. HIRSCH. Well, I think we can expect the cost figures to be available much sooner than realistic benefit figures in many respects, and that is because so many of the benefits are intangible or nonmonetary in nature. We can put certain assumed values of a man-day of recreation for a person in New York City to enjoy the Hudson River. I personally think those are at least semiarbitrary when you are making comparisons of this sort.

Mr. CARPENTER. Could you tell us, for instance, how much it would cost to say treat, that is to collect and treat the runoff, storm runoff in the Rock Creek watershed?

Dr. HIRSCH. Oh, I think we could make estimates of that sort.

In fact, I think some estimates of a very preliminary nature of that sort were made in connection with some of the Potomac planning that has already been done. The trouble with these estimates is that they don't look at the full range of improved technology, the combinations of things that could be done. They just take the standard costs of separating combined storms. I don't think that is the total answer.

(The information requested is as follows:)

The complete separation of combined sewers in the Rock Creek Basin, has been roughly estimated at a cost of \$105 million. However, this does not include provision for the effective collection and treatment of urban storm runoff, once it has been separated from sanitary sewage.

The solution to the storm water and combined sewer overflow problem at the present time appears to be collection, treatment, and chlorination of these flows before discharge. Treatment should probably include some form of coagulation and settling in a detention basin if a satisfactory quality is to be achieved. Such impoundment and treatment would also reduce the heavy loads of sediment, trash, and turbidity carried into the river by storm water, but disposal of the accumulated materials would present a problem of considerable magnitude.

The volumes of storm water which must be dealt with in a metropolitan area such as Washington at times of heavy rainfall, are very large. For intense storms, total volumes on the order of 6 billion gallons are involved. The collection, impoundment, and ultimate treatment and chlorination of such volumes presents substantial construction and operating problems. The "Final Report of the Interdepartmental Task Force on Project Potomac, Sub-Task Force on Water Quality" (February 1967) gives a very rough estimate based on extremely sketchy information and computations which indicates a total cost for the necessary works on the order of \$2 billion for the entire metropolitan area. That illustrates the importance of seeking cheaper and more effective solutions.

Mr. CARPENTER. But even separating combined sewers would not mean that you could swim, as I had gotten the picture, because of the amount of organic matter that would just be picked off of streets and lawns.

Dr. HIRSCH. Well, I would say two things about that. One is that when you say even separating, separation may not be, or would not be I am quite sure the full answer.

Mr. CARPENTER. Yes.

Dr. HIRSCH. We may not want to go to separation in all cases. We may hold the first flush of storm water and pump it back in and so on.

Mr. CARPENTER. Yes.

Dr. HIRSCH. Also the frequency of storms. If you can provide bathing nine-tenths of the time during the summer months, you are still far ahead.

Dr. WEINBERGER. May I interject a point here about this storm and combined sewage? I think there is perhaps a certain amount of misunderstanding concerning our ability to handle in an effective manner storm and combined sewer overflows. One of the ways of getting at this problem is separation of your combined sewers. When the presentation was developed it was a preliminary figure, and it was apparent that we were talking in terms of tens of billions of dollars. The strategy at that time was that it was worthwhile investing in R. & D. to come up with more economical solutions.

This does not mean that we have no way of handling the problem. And we have in the last 2 years supported a number of projects which led to the treatment of or otherwise reducing the pollutional effects of storm and combined sewer discharges.

This gets back to the point that these solutions cost money. I think we have to recognize that we will not have any zero cost solutions. I think this is where some of the confusion comes up. Because from an engineering point of view, we can do almost anything, and to suggest that we can't, I think, is just a horrible condemnation on American engineering or scientific capability.

These are communities who have in the past handled their storm and combined sewer problems, some in an effective manner. Some new ideas have been developed in the last couple of years and these are being supported as a part of our research and development grant program.

We do have projects to treat the wastes and come up with a quality that would not result in a deterioration of your receiving water.

Mr. BARNHILL. Another consideration that we made in recommending that we not go full scale ahead on separation was not only the costs that Dr. Weinberger referred to but the fact that this would be quite a time-consuming thing in the city of Washington, for example, over a substantial period of time.

Mr. CARPENTER. Yes.

Mr. BARNHILL. The streets in the city of Washington would be torn up for weeks on end. This is an inconvenience that probably no mayor can suffer through. It would in effect be changing the law to say—well, Mayor Washington is not elected, but they would be one-term mayors, believe me.

Mr. MOORE. Well, there is something else important here I think, and this is an overall philosophical viewpoint. The mere fact that it

does not appear feasible at this point in time to physically separate storm and sanitary sewers doesn't mean that you should just wash your hands of the question.

Mr. BARNHILL. Yes.

Mr. MOORE. Let me just raise a question that has occurred to me from time to time.

Why can't you treat storm and sanitary sewage while it is in movement in the sewer itself, before it is discharged into the receiving water?

Dr. WEINBERGER. We have a number of projects right now that are exploring technology, and here again it is important to realize that many of the problems we are talking about today in the pollution field did not have the degree of recognition and the degree of priority that they have today. Therefore, there weren't people working on these problems. So really we are in the beginning of exploring some of these techniques. We do have proposals involving physical methods for treatment in sewers, chemical methods for treatment in sewers, in-sewer storage and a whole host of possible solutions which will be more economical than some of the alternates.

Mr. MOORE. I think we need to get back to the question he asked awhile ago, which as I recall was, How do you get from the uses to the standards? This is the question that I think Dr. Hirsch ought to tackle.

Dr. HIRSCH. I am sure you recognize already that the setting of standards initiates with the States and they go through the procedure and submit them in here. Philosophically or theoretically the way you get to the standards is composed of three things. The first would be a designation of what you want to use the water for.

Second, you would say to yourself what quality of water do you need to support that particular usage, and those would be the criteria, the numerical or descriptive values.

Third, you would say to yourself, now what do you have to do in the way of remedial measures to achieve that water quality.

Mr. CARPENTER. Let's go back to your first statement.

How is the choice of use made without some knowledge of the cost effectiveness data?

Dr. HIRSCH. Well, I think it is made on a kind, in most cases kind, of a commonsense appraisal of what the cost effectiveness is. And I guess this relates to Dr. Weinberger's comments, too.

The Chicago ship canal, for example: I am sure technology would be available to make that a recreational area and a fishery area and so on. But rule of thumb would tell us that that would be so tremendous in scale that it just isn't deemed feasible.

The general approach in this regard has been to look at what normally available, conventional waste treatment methods would achieve in the body of water. On the general assumption that secondary treatment, for example, for municipal wastes is available, that it ought to be used widely, it is used widely, and the same for comparable measures in industry, and then to take a look at that and if that yields a quality of water which will support certain kinds of uses, that is a kind of a commonsense—

Mr. CARPENTER. So you use a circular process?

Dr. HIRSCH. Yes.

Mr. CARPENTER. Of reasoning, checking against the available facts?
Dr. HIRSCH. Right.

And the other thing I think we have to realize is that the standards that are being set are part of a trend here, in continuum, to try to reverse the downgrading of these uses and the downgrading of these values that have occurred, and they will be revised.

So what we have to do is we put in this conventional treatment that is available everywhere and then if we don't know, if we are uncertain as to its effects, we measure after it has been built, after it is in operation, and we see whether or not we have met our goals and expectations fully. If we haven't at that time maybe some of the newer methods will be available.

If they are not, in some cases we may have to say, well, for the moment we have done all we can in this area. It is so densely populated, so industrialized, that we have managed to prevent nuisance, but we are not going to be able to provide fishing in here as yet. I underline that as yet.

Mr. MOORE. One of the inputs into the determination of uses, though, inevitably is historical uses.

Dr. HIRSCH. The tendency is to want to either maintain the uses that are there at the moment or the ones you remember. I sat through 30 of these hearings and heard people say "I can remember when" and what they want to do is go back to where they can remember. So there is a certain amount of this, in other words, a restoration of a preexisting level of quality being the objective. So that went into the determination of what the uses would be.

Mr. CARPENTER. Now, in this same line of questioning, the recent judgment by the Secretary that no degradation would be allowed, carries with it what some critics have termed a loophole in these words:

Unless and until it has been affirmatively demonstrated to the State Water Pollution Control Agency and the Department of Interior that such change is justifiable as a result of necessary economic and social development and will not interfere with or become injurious to assigned uses made of or presently possible in such waters.

Could you discuss this and perhaps defend against this loophole charge?

Mr. MOORE. Well, let me address myself to that question. And I think you need to appreciate I am a relative newcomer to the question.

What is involved here is first of all what does the addition of a new discharge do to an existing water quality.

Now first of all you could have a situation in which the new discharge, because of its composition, would not have any effect on the quality of the receiving water.

In other words, it may be a municipal discharge for which the highest treatment is to be provided or it may be an industrial discharge for which the technology is available to maintain the quality of water that exists in the receiving stream.

So that you could have where there is a consideration as to permitting a new discharge, a situation which the new discharge would have in the sense of the uses of the water no effect. Well, that would be the easy case.

Now it seems to me that inevitably you come to the situation where the existence of the high-quality water may also coincide with other

circumstances that are socially or economically desirable. For example, a high-quality water in an undeveloped area or a high-quality water in an area that is economically depressed—and there are some of these in the Nation.

Well, here it seems that you would weigh the degree of degradation that might occur from this waste. You understand I said might, because you always have a technology involved. You weigh the amount of degradation that might occur in terms of the social or economic benefit that would accrue from allowing this discharge.

Mr. CARPENTER. So this is no more of an extension of your common-sense approach to the establishment of present standards?

Mr. MOORE. That is what I would regard it. You can I think see the potential, however, for some rather strong positions or disagreements as to whether it will or will not meet the conditions that are outlined in the Secretary's statement.

Mr. CARPENTER. These are choices ultimately that would have to be made by society?

Mr. MOORE. Yes.

Mr. CARPENTER. Weighing the facts that you can provide for them?

Mr. MOORE. And in this instance ultimately it would have to be weighed by the States and the Department of the Interior in terms of the quality of water.

There undoubtedly will be those cases in which there may be a serious question about whether you should permit any discharge at all. I think we would have to admit the existence of some areas in the country in which it may be desirable to have no discharges. However, there are areas in which there are high-quality waters that are subject to economic and social development that can't otherwise occur, and it seems to me in these instances is where you will be faced, the States and the Department of the Interior will be faced with making a decision.

Mr. CARPENTER. I would like next to discuss eutrophication. The information which you have given us on eutrophication answers a number of these questions. We will consider putting that in the record.

One question remains. From the standpoint of making realistic forecasts of the future status of lakes and estuaries which now contain a substantial nutrient content, could you tell us what happens in a closed body of water or an estuary with little change in water if new additions of nutrients are slowed or halted but the present nutrient content is not removed by any actual treatment of the lake itself? What can we expect in terms of improvement of that water through natural processes and what time would be required before that water would show any improvement if indeed it ever will?

Dr. WEINBERGER. The current approach to the control of the undesirable effects of accelerated eutrophication, normally considered to be excessive algae growths or algae blooms, is to reduce the nutrient levels in the body of water. And what is necessary using this method, is to reduce any one of the elements below a concentration which is needed for the life of those organisms.

Therefore, in order to stop the bloom or the algae growth, we have to reduce the concentration of a nutrient.

We must keep out or reduce the amount of nutrients going into the lake. There is a very simple material balance. If it comes into the lake,

it either stays there or it goes out. If more is going out than is coming in, then eventually the lake will clear itself up. This may take a very long time in the case of lakes.

As an example of this, it was suggested that the detention time or the holdup time in portions of Lake Michigan, the southern portion of Lake Michigan, is actually measured in terms of decades or possibly centuries, where in small lakes the amount of time necessary to in effect replace the lake may be in terms of years.

To reduce nutrient levels you must have more nutrients coming out than going in.

Now one of the reasons why this is such a difficult problem is that the nutrients recycle—let me deal with one of the elements, and that is phosphorus. The organisms take the phosphorus out of the water and use the phosphorus to make living material. When the organisms die and decay, they then release the nutrients. The phosphorus is then available for the following year.

So in direct answer to your question, if you reduce the amount of nutrients going into a very low level such that the amount coming out is far greater, you can then begin cleaning the lake.

In the absence of that favorable situation, then in addition to controlling the nutrients going in you have to have some way of accelerating the removal of the nutrients that are there.

Now there are a number of ways of doing this that have been proposed, ranging from such things as trying to harvest the algae and remove them physically from the lake and taking with them the nutrients. It has been suggested that we might try and effect the entire biological system and perhaps have fish consume algae and then harvest the fish. The suggestion has been made that in some cases we may want to remove some of the deposited material.

Mr. CARPENTER. From the bottom?

Dr. WEINBERGER. From the bottom to take out some of the nutrients.

Mr. MOORE. Any one of which on any sizable body of water is a difficult process.

Mr. CARPENTER. Right.

Dr. WEINBERGER. And expensive.

Mr. CARPENTER. I think the important thing, though, here is that the mere stopping or retarding of the nutrients into the body of water will not necessarily cause the body of water to clean itself up. If the cycle has been established within the body of the water so that it is self-contained, then you do not change that cycle by reducing or eliminating the nutrients flowing into the body of water.

Dr. WEINBERGER. Yes. And I would say here that this ties in with some of your previous comments.

Mr. CARPENTER. Yes.

Dr. WEINBERGER. And that is the concept that when you put in a water pollution control project you necessarily get immediate results. In other words, what you are doing is contributing to the solution.

Mr. CARPENTER. Yes.

Dr. WEINBERGER. In this case one of the first things that we must do is stop nutrients from going in. This is a step in the right direction. The next step will be to accelerate the removal of the nutrients that are there.

Mr. CARPENTER. That takes care of that question as far as I was concerned.

Dr. WEINBERGER. Dick, may I comment for your record on this phosphate problem?

Mr. CARPENTER. Please do.

Dr. WEINBERGER. The question is frequently asked is eutrophication caused primarily by phosphates. Eutrophication means enrichment and enrichment in the biological sense means the providing of food materials. One of the foods or nutrients that organisms require at the algae level is phosphates, but they also require a whole host of other elements including the same elements which we would need in our nutrition. They would be such things as carbon, nitrogen, sulphur, potassium, and so forth.

If one wants to go to starving of the organisms—and this is what we mean by nutrient control—and again the implication here is the same thing in dealing with human nutrition—we need control but one element. In other words, any one of the elements is essential to life and if we can control any one of these we should be able to, and we can, control the growth of these organisms.

Now in taking a look at the elements which might be controlled, we first take a look at the macro, that is the larger scale, requirements. One of the macro nutrients would be phosphorous. Of all of the nutrients, it seems that phosphorous is the one most likely to be controlled. And this is the reason for the emphasis on phosphorous control in most bodies of water.

There are some situations where there is sufficient phosphorous in natural waters so that this is apparently not the controlling element and in those cases one might control the process by reducing nitrogen.

From a long point of view there have been many suggestions made, all of which have scientific validity, and that is, if one could find a micro nutrient, such as cobalt, and if we could reduce its concentration below the critical level, we would likewise stop the growth of these organisms.

This is the reason why you find in the literature suggestions that we might try to control a vitamin. And again relating back to human nutrition you can actually starve a person by them not having a particular vitamin, even though their caloric intake is quite adequate.

Mr. CARPENTER. Is there any possibility of a specific herbicide as an approach to algae control?

Dr. WEINBERGER. This is always a possibility, of trying to find a very specific chemical control. This must be approached with a good deal of caution, because this is very seldom that specific. There have been chemicals added.

Mr. CARPENTER. Copper sulphate?

Dr. WEINBERGER. Copper sulphate to control algae and in limited cases it can be effective. I would say its most effective application is in terms of a swimming pool, but in terms of any continual application we would much prefer to not resort to chemicals which now add another impurity into the environment.

Mr. CARPENTER. One question remained from the prior hearing and that is that I have noticed the Department's releases, when the State standards are approved, do not give the numerical standards, that is the temperature rise or the salinity and so on.

Now are these matters of public record, and could we have a table by States and by contaminant or property of the water to show what those numerical values are?

Dr. HIRSCH. Well, the standards are public documents, and the way we have dealt with the issue to date is to have an available supply of these for public inspection. Reading copies of the standards are available in our Washington, D.C. headquarters and in the regional offices.

Now, some of these documents, as you may know, are literally about that thick (indicating). Others are a small booklet.

We do have underway, although I am not quite sure when it will be completed, the compilation of summary reports which will serve the purpose that you described, namely, taking this vast conglomeration of material and putting it down in simple form. We don't have those available today.

Mr. CARPENTER. Maybe I am asking for something that is impossible, but can you imagine a three-dimensional matrix, one dimension being States, the second dimension being use, and the third dimension being criteria. For example, salinity standards for industrial water use by States?

Dr. HIRSCH. I think you are asking for something that would take perhaps four dimensions here, and the reason for that is that a State might have a range of rivers for which salinity was classified to support industrial water use. Some States do have statewide criteria for a given usage, like fisheries. They would say any stream in the State designated for fisheries should meet the following numerical limits.

Other States, on the other hand, have tailored individual waters with some relationship to the existing quality and so on. So that there would not be one statewide, what have you, criterion.

I do think that we will somewhere along the line categorize the criteria that have been adopted for industry by parameters. I might say that the report of the National Technical Advisory Committee does this in a recommendatory sort of way generally.

Mr. CARPENTER. Yes.

Dr. HIRSCH. But then what the States submit and what the Secretary approves is perhaps more germane to what you are looking for here.

Mr. CARPENTER. I had made a study of that interim report and it seemed to me that there were certain uses which encompassed almost all of the properties, for instance, aquatic life. If a stream is chosen to support aquatic life, then it is useful for almost every other purpose—

Dr. HIRSCH. Well—

Mr. CARPENTER. With the exception of drinking water.

Dr. HIRSCH. That is not necessarily true, because, let's take salinity, which is a major problem in some of the Western States. Many of those streams support aquatic life and support recreational usage at levels of salinity which do substantial damage to industrial water supply or municipal water supply or agricultural use.

Mr. CARPENTER. I see.

Dr. HIRSCH. The general rule of thumb is, sure, if it supports fish, it is great for all uses, but in a more specific and scientific sense that is not necessarily true.

Dr. WEINBERGER. Dick, we have tried to do this, and I think you are getting from Alan the same one you got from me.

Dr. HIRSCH. I hope so anyway.

Dr. WEINBERGER. In terms of trying to come up with this simple matrix, it gets extremely complicated. I worked on this one weekend trying to see if you couldn't boil it down. What happens, for example—take one that you are very much interested in—temperature.

Mr. CARPENTER. Yes.

Dr. WEINBERGER. The temperature criteria for fish. What you quickly find out is that this varies from State to State because you have different species of fish.

Mr. BARNHILL. And stream to stream.

Dr. WEINBERGER. Stream to stream. And you have different latitude. But more than that, in other words, for this, then you run into the fact that it isn't only a specific temperature that one is talking about. You are talking about temperature during particular times of the year.

Dr. HIRSCH. Any combination with other conditions.

Dr. WEINBERGER. And you are talking about rates of temperature rise. So you find that to pick out a number, you know, just some number, which you can apply uniformly across the United States, and from State to State, is going to be lacking. But this does not mean that they are not consistent. When I looked at some of the standards as to which could be uniform, it really relates much more to the amenities. In other words, you can say that you don't want to have any floating matter.

Which are signs of fecal pollution. This is a uniform standard across the country. Or you want to have something which is substantially free of oil. But when you get into any of the uses like fishing or for human health, for swimming, you begin getting into some very vast differences. To present the data in a table you have to simplify it so that it loses any meaning.

Mr. CARPENTER. Well, I realize that difficulty, and I was just hoping that ultimately your program could do that and then add a fifth dimension, which would be the cost of achieving this, which would have to take into account the present status of the water.

Dr. HIRSCH. Of course the cost report that you see before you is a first effort which has to be updated annually to do just that, to estimate the costs.

Mr. CARPENTER. Yes.

Dr. HIRSCH. Of meeting water quality standards.

Now it was done on a State basis, on a regional basis and so on, and we will refinance it from year to year. So hopefully, you would be able to pick up that report and say that in the next 5 years it is going to cost so many dollars to meet the water quality standards which have been established by the State of Indiana or Michigan or Ohio.

I don't think this first year's report quite gets us to that point, but I think we will be at that point by next year. So that at least answers the cost half of the question that you have asked.

Mr. CARPENTER. Right.

Dr. HIRSCH. As to the other question, I think it is more a matter of summarizing the standards submitted by any State so that anyone

can pick up in a very brief document and understand basically what they mean.

Mr. CARPENTER. I wanted to ask this other question, then.

Mr. FELTON. Go ahead.

Mr. CARPENTER. Do you know of any case when enforcement of water quality standards has caused a business operation to relocate, go out of business, or shut down a specific operation? In such cases, has there been a court challenge?

Dr. HIRSCH. I don't personally know specifically of such cases. I know that is a widespread concern.

Mr. CARPENTER. Which is why I asked the question, in hopes of laying it to rest.

Dr. HIRSCH. I think it really might have only relevance to some marginal industries in some cases, you know a claim that an industry is shutting down because a certain requirement has been imposed upon it sometimes means the industry was going to close down anyway and they were looking for a way to do it.

Mr. CARPENTER. An obsolete papermill?

Dr. HIRSCH. That is right, a corporation that has one marginal and six more viable plants. It doesn't want to shut down, so it cites tax increase or something else as the causative factor.

There may be cases and there may have been court challenges. I don't personally know of those. I think it does resolve meeting water quality standards in an economic sense. If there are difficulties from an economic standpoint, I think our studies indicate that they would be in a case of the rare exception—the marginal firm that is just barely making it, and so on.

Mr. CARPENTER. Has any case ever reached a court?

Dr. WEINBERGER. John?

Mr. BARNHILL. Well, I don't know of any. This question has been around. I have been in business 32 years and it was here when I started, and I guess it will be with us for some time, although you don't hear near as much of it as you used to.

I don't personally know of any business that was forced to close its doors because of its pollution control requirements. I agree with Dr. Hirsch, that it might have been the deciding factor. They couldn't make up their minds, but this did it.

There have been some instances where an industry said it did close its doors because of pollution control requirements, but when the States looked into it they found out it was some other factor, such as a threatened strike for increased wages or some such thing as that.

I don't know of any and as I said, since the question has been around a long time, we have all spoken frequently to the States about it, and they have never once given us an example of where industry shut down because of pollution control.

Now we haven't tried to enforce any of the new standards.

Mr. CARPENTER. Yes.

Mr. BARNHILL. But I think we can get at it a little different way. We have had 42, I believe it is, enforcement conferences——

Dr. HIRSCH. Forty-four.

Mr. BARNHILL. Forty-three—that is right, 44, and in effect the recommendations that the Secretary makes as a result of these enforcement conferences is a standard-setting exercise.

Mr. CARPENTER. Right.

Mr. BARNHILL. It is agreed on the degrees of treatment, the desired water uses they are trying to reach, and so forth. So it is somewhat the same thing. In these 44 cases, I know of no instance where an industry has gone out of business.

Mr. CARPENTER. Have any of those reached court?

Mr. BARNHILL. No. Now we took one city to court.

Mr. CARPENTER. St. Joseph?

Mr. BARNHILL. Right. But this was in the opposite direction from what you are inquiring about.

Mr. CARPENTER. Did they get an injunction against the city?

Mr. BARNHILL. No, no. After we referred it to the district court, the city held another bond election and this time with the case in the court, the people voted the bond issue and the project proceeded. The case is still in the court, and it will stay there until they have completed their requirements.

Now since the standards have been in the process of promulgation, negotiation, and adoption, there is only one instance that has come to my attention of where an industry said that the standard was going to put them out of business, and this is a little gold mine up in South Dakota, at Lead, S. Dak.

Mr. CARPENTER. Is it a cyanide problem?

Mr. BARNHILL. It is partly cyanide. I think they consider that their major problem, but there are some problems of sediment attached to it, too. But the State says the company can afford to do it. It has been an issue up in South Dakota apparently for several years. It has tried to get the company to comply and have worked with the company in a couple of nearby communities on a joint project, but the industry apparently isn't buying any approach. This is an informal appeal to the Secretary only. No threat to go to the courts or anything like that.

Mr. FELTON. Let me ask one question on the Federal departments reporting the pollution which they are causing. I understand this is in some type of report form which is about to be released, is that correct?

Dr. HIRSCH. I am sorry, I don't—

Mr. FELTON. This is Executive Order 11288.

Dr. HIRSCH. Oh, the extent of Federal activities in various parts of the country which are polluting?

Mr. FELTON. Yes. Is this information available to the public?

Dr. HIRSCH. We are working on reports on that. I don't know what the status is.

Mr. BARNHILL. Well, the information we have is certainly open to the public, and what we have is a national inventory of waste discharges from Federal installations. Was it 1962 when it was completed?

Dr. HIRSCH. That is the major one, nationwide.

Mr. BARNHILL. Yes. We have picked up data in the meantime and have been able to improve this inventory a little bit. But I think what you are talking about is recently we have had a flurry of requests from various Senators and Congressman to give them a list, or an inventory, if you please, of the Federal installations in their States or their districts. We have tried to respond, but within our resources this is quite difficult.

Mr. FELTON. Well, if a private individual or a corporation wanted this type of information, what would they do?

Mr. BARNHILL. Well, they could write to us and if we had the information we would certainly supply it.

Dr. WEINBERGER. John, could we go back?

There was a report, that was a congressional document——

Mr. BARNHILL. That was based on our inventory.

Dr. WEINBERGER. Yes.

Mr. BARNHILL. You are talking about the Jones committee report.

Dr. WEINBERGER. The Jones committee report, which listed the sources of waste from Federal installations, is available. I think John says it is about 5 years old.

Mr. BARNHILL. The committee report is about 5 years old. Our inventory is about 6 years old.

Mr. FELTON. Is this being updated at all?

Mr. BARNHILL. Well, not on a national scale. We would like to update it.

Mr. CARPENTER. It was the air pollution that Middleton mentioned as being a new report. And they told me that that would not be made public until the President's message on environment.

Do you have a similar submission?

Dr. HIRSCH. Not as an inventory of Federal activities.

I might say I wouldn't think that you would want to get the impression that we are still relying however on data which was gathered in 1962.

The regional offices and our people, from the standpoint of working files, of course, have much more up-to-date information on many specific cases, specific river basins, and things of that sort. But if you are talking about a compiled source where you have the report there, to give it out, the inventory is the last major compiled source of this sort. But, for example, on the Potomac River Basin or something anywhere else, in terms of working files or memorandums or other documents and working with the agencies, this is——

Mr. BARNHILL. This is the result of the Executive order. Of course we have set up a working program in each one of our regions.

Mr. FELTON. Going back to your statement that there were no enforcement cases, section 10 is the enforcement section of your law. Could you give us for the record a rundown of what States have submitted plans and which ones have been adopted? And in the case of any State which has not submitted a plan, whether or not you have prepared water quality standards for that area? This type of background information will be helpful so we see where the whole thing stands.

Mr. BARNHILL. You mean a status report on water quality standards setting?

Mr. FELTON. Yes.

Dr. WEINBERGER. I think this is one of the questions I am also responding to, but one of the problems is it changes every day and as the Secretary approves more standards——

Mr. FELTON. All you have to say is "as of."

Dr. WEINBERGER. I know, but they ask this question.

Mr. FELTON. Yes.

(The information requested is as follows:)

All States and Territories submitted water quality criteria and implementation plans under the Act. The following States criteria and plans have been approved as Federal standards as of April 18, 1968.

WATER QUALITY STANDARDS APPROVED UNDER THE FEDERAL WATER POLLUTION CONTROL ACT, AS AMENDED

Georgia	* † Rhode Island
† Oregon	* † Missouri
New York	* † Louisiana
† North Dakota	* † Alabama
South Dakota	* † Connecticut
Arkansas	* † Alaska
* Idaho	* Virgin Islands
Massachusetts	* † Tennessee
Maryland	* † Oklahoma
Indiana	* Montana
** Washington	* † Ohio
** Wisconsin	* Hawaii
* Texas	** † New Jersey
** † Michigan	* † Delaware
** † Illinois—Chicago River and Calumet River Systems; Illinois River and Lower Section of Des Plaines River; Rock River, Fox River, Des Plaines River, Kankakee River and certain named tributaries; and Lake Michigan, Little Calumet River, Grand Calumet River and Wolf Lake	* † District of Columbia

Total: 28 States; 1 Territory; District of Columbia.

AREAS RESERVED FROM APPROVAL

Oregon—Klamath River and Goose Lake Drainage Basins.

North Dakota—Red River of the North Basin.

Michigan—Temperature criteria for protection of fish, wildlife and other aquatic life.

Illinois—Dissolved oxygen and temperature criteria for protection of fish and aquatic life for the Chicago River and Calumet River Systems (SWB 15); Illinois River and Lower Section of Des Plaines River (SWB 8); Rock River, Fox River, Des Plaines River, Kankakee River and certain named tributaries (SWB 11).

Rhode Island—Interstate waters covered by the Federal Enforcement Conference on the Blackstone and Ten Mile Rivers; dissolved oxygen criteria for Class C and Class SC waters.

Missouri—Dissolved oxygen criteria for the Missouri River and that portion of the Mississippi River below Alton Lock Dam.

Louisiana—Interstate waters classified for propagation of aquatic life where the minimum dissolved oxygen is set at 50% saturation.

Alabama—Temperature and dissolved oxygen criteria for shellfish harvesting and fish and wildlife.

Connecticut—Dissolved oxygen criteria for protection of fish, shellfish and wildlife in waters classified as C, Cc, SC and SCc.

Alaska—Items 8 and 9 on "Sediment" and "Toxic or other Deleterious Substances, Pesticides and Related Organic and Inorganic Materials."

Tennessee—Temperature criteria for protection of fish and aquatic life.

Oklahoma—Dissolved oxygen criteria for protection of fish and wildlife propagation, including smallmouth bass fisheries.

Ohio—Mahoning River; odor criterion for Little Beaver, Yankee, and Pymatuning Creeks; temperature and dissolved oxygen criteria for "Aquatic Life A."

†Partial approval.

**States with acceptable "degradation" language.

*States which have already been asked to adopt a "degradation" statement.

New Jersey—Dissolved oxygen criteria for FW-2, FW-3, TW-1, CW-1 and CW-2; temperature criteria for all coastal and tidal waters except Delaware Bay and Estuary and temperature change limits for FW-2 and FW-3 trout waters.

Delaware—Treatment requirements for Delaware City and Milton; dissolved oxygen value of 50% saturation where applied to fresh waters.

District of Columbia—Dissolved oxygen and temperature criteria.

Mr. CARPENTER. I would—recognizing the difficulty which we just heard about, could we take a half dozen properties—say dissolved oxygen, rise in temperature, salinity, residual BOD, and maybe one or two others, and get a table of the actual numerical standards that you approved, by State?

Dr. WEINBERGER. When you put it that way—

Mr. BARNHILL. Can I—I don't want to seem to be uncooperative, or unresponsive or anything, but this could only come from our water quality standards staff, who are—

Mr. CARPENTER. Busy?

Mr. BARNHILL. Well, it has the highest priority in the Department, not only in FWPCA, but in the Department. The Secretary, of course, is anxious to get on and to get these approved and these people are really up to their ears.

Now I will be happy to ask the director of the staff over there if he thinks he can possibly do this for you. If he can, if I can, we will be happy to do it.

Mr. CARPENTER. If he could do it for one use, say sport fishing—again, what I want it for is not idle curiosity, but I would like to see both the actual levels that you have approved with respect to this interim report of the technical advisory committee and also I would like to see what variation there would be between States.

Mr. BARNHILL. Well, I will see—

Dr. WEINBERGER. Dick, let me come in.

One of the things behind all this, John, is apparently a certain amount of confusion as to the amount of scientific data available in terms of setting of standards. Now you remember I referred to you the report that Jack McKee prepared.

Mr. CARPENTER. Yes; California—

Dr. WEINBERGER. With support from our agency.

Now, if we take any one of these—and here is one of the things you were asking about. Here, for example, is dissolved oxygen.

Mr. CARPENTER. Yes.

Dr. WEINBERGER. These would have to be updated, but you see just in the case of dissolved oxygen, here is a general statement, and then this is related to domestic water supplies, fish and other aquatic life, and you see it starts—

It starts running here. Now here is shellfish culture. Now here is dissolved solids. You see, there is a general statement. Then it relates to effects upon beneficial use, which you are talking about. Now here is domestic water supply—I am trying to read upside down. Here is for industrial waters. Here is for irrigation water.

Mr. CARPENTER. Let's go back to this dissolved oxygen now. In summary he says:

On the basis of available information described above, it is not feasible to attempt to suggest an optimum dissolved oxygen content of water to domestic, industrial, stock and wildlife or recreational uses, or fish and other aquatic life. The recommendations of the Aquatic Life Advisory Committee of Orsanco, as quoted above, appear to be logical.

So may I assume that you would approve no State standard for dissolved oxygen for fish and other aquatic life which would be lower than 5 milligrams per liter during at least 16 hours of any 24-hour period?

Dr. WEINBERGER. Well, they have these figures. Now again, these are not our criteria. All I am indicating—you see this is about 4 or 5 years old.

We set up some technical advisory committees. We have asked them to go back and take a look at all of the information that has been developed, and on the basis of that to bring our current knowledge up to date.

Now, it is on the basis of this available knowledge that you are able to say that, now if you are going to protect a stream for trout, then this should be dissolved oxygen that you are going to maintain. They would not—John, correct me if I am wrong. We would not deviate from that if the uses for trout—we are talking about the same trout. Then this would be the criteria that would be established for DO and these would be the levels.

Mr. CARPENTER. Could we have that a month from now?

Mr. BARNHILL. Well, how would it be—let's have DO because that is one that is somewhat in controversy. I will have them provide you with the State and then a statement on the dissolved oxygen criteria that have been approved by the Secretary. There have been 16 State plans approved so far.

You are going to find in some of these instances they were approved without approving the DO criteria for certain streams. So whether we can eventually resolve this with the States or whether the Federal Government states the DO standard we don't know yet, but I will give you a status report on DO, on the 16 States that have been approved so far. And you will find variations in them. It is not really cut and dried. We have pushed the States as far as we could in getting them to upgrade their DO criteria. In some instances you will find that the Secretary appears to have approved the standard that is not as high as it should be, but this is an instance of the State cooperating with us and trying to upgrade and enhance the water that is already seriously polluted.

It is an attempt to bring it up to a good quality water. It is going to vary, because it depends on whether you are talking about a warm water fishery or a cold water fishery or whether you are talking about lake trout or stream trout, or whether you are trying to protect an anadromous fishery. So they will vary. You will see differences there.

Dr. WEINBERGER. May I suggest this, Dick, that when they come up with the thing—again, we worked on this thing. When you get the table, let us help you interpret it. Because as I say, it may not be uniform but it is consistent. I think this is the thing you want to get on the record, to show—I didn't mean to overwhelm you when I gave you this. The question raised, you know, well is there any scientific base. Well, here is a report which has 3,800 references. As a matter of fact, there was an addendum to this. Now these are all representing scientific investigations and studies.

Mr. BARNHILL. And difference of opinion.

(The information requested is as follows:)

DISSOLVED OXYGEN CRITERIA (MINIMUM)

State	Cold water fishery	Warm water fishery	Miscellaneous (highest use in stream)
Oregon.....	75-percent saturation at seasonal low or 5 to 7 mg./l. by stream; 95 percent saturation in spawning areas during spawning, hatching and fry development.	-----	Marine—not less than saturation. Estuarine—6 mg./l.
Idaho.....	75 percent saturation at seasonal low; 100 percent in spawning areas during spawning, hatching and fry development.	-----	
Indiana.....	6 mg./l daily average 4 mg./l anytime.	5 mg./l—16 hours per day.... 3 mg./l—anytime.....	
Georgia.....	5 mg./l.....	4 mg./l.....	Industrial and navigation— 2.5 mg./l.
Massachusetts.....	5 mg./l.....	5 mg./l—16 hours per day.... 3 mg./l—anytime.....	Coastal—not less than 6.5 mg./l. Industrial—2 mg./l.
Maryland.....	5 mg./l minimum..... 6 mg./l monthly average.....	4 mg./l minimum..... 5 mg./l monthly average.....	Industrial—4 mg./l.
North Dakota.....	-----	5 mg./l, or 5 mg./l—16 hours per day and 3 mg./l anytime, by stream.	
South Dakota.....	6 mg./l or 5 mg./l, by stream.	4 mg./l.....	
Arkansas.....	5 mg./l.....	4 mg./l or 50-percent saturation.	
New York.....	5 mg./l.....	4 mg./l.....	Agricultural—3 mg./l. New York Harbor—2.5 mg./l.
Washington.....	5 mg./l, 6.5 mg./l, 8 mg./l or 9.5 mg./l, by stream.	-----	Marine and estuarine-waters—4 mg./l (or 50 percent-saturation), 5 mg./l (or 70 percent saturation), 6 mg./l or 7 mg./l, by water area.
Wisconsin.....	-----	5 mg./l—16 hours per day 4 mg./l anytime.	Fish life—80 percent saturation or 5 mg./l.
Texas.....	-----	5 mg./l, 4 mg./l, or 3 mg./l, by stream.	Houston Ship Channel—2 mg./l.
Michigan.....	6 mg./l.....	5 mg./l—intolerant species. 4 mg./l—tolerant species.	Navigation—3 mg./l.
Rhode Island.....	5 mg./l ¹	5 mg./l—16 hours per day ¹ 3 mg./l—anytime. ¹	Sea water—6 mg./l. Navigation—2 mg./l.
Missouri.....	-----	5 mg./l—except.....	Missouri River—4 mg./l. ¹ Mississippi River—below Alton Lick Dam—4 mg./l. ¹
Louisiana.....	-----	50-percent saturation ¹ or 60-75 saturation in some waters.	
Alaska.....	6 mg./l—salt water 7 mg./l—fresh water.	-----	Shellfish spawning—6 mg./l.
Illinois.....	(1).....	Lake Michigan not less than 80 to 90 percent saturation; other interstate waters. ¹	
Tennessee.....	6 mg./l.....	5 mg./l except in limited sections of stream receiving treated effluent—3 mg./l.	
Virgin Islands.....	-----	-----	Marine Life—5.5 mg./l. Harbors—5 mg./l.
Ohio.....	6 mg./l.....	Aquatic Life A—1..... Aquatic Life B—3 mg./l average, 2 mg./l minimum (applied only where no higher levels can be attained with treatment).	
Hawaii.....	-----	-----	Coastal waters—Class AA—6 mg./l. Class A—5 mg./l. Class B—4.5 mg./l—limited to docking areas. Fresh waters used for fish propagation 5 mg./l.

Footnote at end of table, p. 508.

DISSOLVED OXYGEN CRITERIA (MINIMUM)—Continued

State	Cold water fishery	Warm water fishery	Miscellaneous (highest use in stream)
New Jersey ¹		All ¹ except.....	FW-1, to be maintained in natural state. Delaware River: Zone 2—daily average 5 mg./l except Apr. 1 to June 15 and Sept. 16 to Dec. 31—6.5 mg./l. Zones 3, 4, and 5—daily average 3.5 mg./l except Apr. 1 to June 15 and Sept. 16 to Dec. 31. Delaware Bay—daily average of 6 mg./l. Atlantic Ocean—natural. Delaware Bay—daily average of 6 mg./l. Other coastal waters—50 percent saturation ¹ or 4 mg./l. Chesapeake and Delaware Canal—6 mg./l.
Delaware.....		50-percent saturation ¹ or 4 mg./l except Delaware River—daily average 3.5 mg./l except Apr. 1 to June 15 and Sept. 16 to Dec. 31—6.5 mg./l.	
District of Columbia.....		(9).....	

¹ Not approved by Secretary.

BACTERIOLOGICAL CRITERIA IN APPROVED STATE STANDARDS*

PUBLIC WATER SUPPLY

Standards generally reference the U.S. Public Health Service Drinking Water Standards (1962) in establishing criteria for protection of public water supplies. Raw water supplies are protected by total coliform and/or fecal coliform limits. Typical examples are given below:

Total Coliform.—Coliform bacteria content shall not exceed an average of 10,000 per 100 milliliters (ml) in any month.

Fecal Coliform.—Fecal coliform bacteria count shall not exceed an average of 2000 per 100 ml in any month.

FULL BODY CONTACT RECREATION

Typical criteria are as follows:

Total coliform.—Average concentrations of coliform bacteria shall not exceed 1000 per 100 ml, with 20 percent of samples not to exceed 2400 per 100 ml.

Fecal coliform.—Fecal coliform shall not exceed a geometric mean of 200 per 100 ml based on at least 5 samples per 30-day period, and shall not exceed 400 per 100 ml in more than 10 percent of the samples.

PARTIAL BODY CONTACT RECREATION

Typical criteria are as follows:

Total coliform.—Coliform group not to exceed 5000 per 100 ml as a monthly average value; nor exceed this number in more than 20 percent of the samples examined during any month; nor exceed 20,000 per 100 ml in more than 5 percent of such samples.

Fecal coliform.—Same as Public Water Supply.

SHELLFISH HARVESTING

Coastal States utilized the U.S. Public Health Service shellfish sanitation manual in developing criteria for protection of shell fisheries. Total coliform limits are used, as follows:

Total coliform group shall not exceed a median concentration of 70 per 100 ml.

*Criteria based on Most Probable Number or membrane filter counts in a representative number of samples.

TEMPERATURE CRITERIA IN APPROVED STATE STANDARDS

ARKANSAS

- 20° C. Maximum in trout streams.
- 30° C. Maximum in smallmouth bass streams.
- 35° C. Maximum in other streams.

The temperature of a stream as determined by natural conditions shall not be increased or decreased more than 5° F. by discharges thereto.

GEORGIA

Public Water Supply—not to exceed 93.2°F. (34.0°C.) at any time and not to be increased more than 10°F. above intake temperature. In streams designated by the State Fish & Game Commission as trout waters, there shall be no elevation or depression of natural stream temperature.

Recreation—same.

Fish, shellfish—same.

Industrial—not to exceed 93.2°F. at any time and not to be increased more than 10°F. above intake temperature.

IDAHO

No measurable temperature increase when stream temperature is 68°F. or above, or more than 2°F. increase when river temperature is 66°F. or less (except 70°F. and 68°F., respectively, in Snake River—RM 407 to 247).

INDIANA

Aquatic Life—(warmwater fisheries) temperature not to exceed 93°F. at any time during the months of April through November, and not to exceed 60°F. at any time during the months of December through March.

Trout Streams—temperature is not to exceed 65°F. (However, slightly higher temperatures may be tolerated with higher dissolved oxygen content than specified). (This criterion is in addition to the temperature criteria above.)

Drastic or sudden temperature changes are not permitted. Gradual changes in temperature may not exceed 2°F. per hour nor more than a total change in 24 hours of the maximum diurnal change or 9°F. whichever is greater.

MARYLAND

Section 7.60—Temperature standards (Temp.):

Temp. 1.—For all water use categories other than IV, there must be no temperature change that adversely affects fish, other aquatic life, or spawning success. There must be no thermal barriers to the passage of fish or other aquatic life. Maximum temperature must not exceed 100° F. beyond 50 feet from any point of discharge.

Temp. 2.—For nontidal waters.—For “trout waters,” waters so designated to the Department by the Department of Game and Inland Fish, temperature must not exceed 72° F. at any time. For the propagation of fish and other aquatic life (Water Use Category IV) in all other nontidal waters, temperature must not exceed 93° F. beyond such distance from any point of discharge as specified by the Department as necessary for the protection of the water use. In addition for all nontidal waters other than “trout waters,” maximum temperature elevation is to be limited as follows:

For natural water temperatures of 50° F., or less, the temperature elevation must not exceed 20° F. above the natural water temperature, with a maximum temperature of 60° F.

For natural water temperatures greater than 50° F., the temperature elevation must not exceed 10° F. above the natural water temperature, with a maximum temperature of 93° F.

Any deviation, other than natural, from the above requirements is to be evaluated for risk to the propagation of fish and other aquatic life by the Department of Game and Inland Fish, and will be permitted or denied by the Department of Water Resources after consultation with that agency.

For tidal waters used for the propagation of fish and other aquatic life (Water Use Category IV), temperature must not exceed 90° F. beyond such distance from any point of discharge as specified by the Department as necessary for the protection of the water use. In addition, for all tidal waters, maximum temperature elevation is to be limited as follows:

For natural water temperatures of 50° F., or less, the temperature elevation must not exceed 20° F. above the natural water temperature, with a maximum temperature of 60° F.

For natural water temperature greater than 50° F., the temperature elevation must not exceed 10° F. above the natural water temperature, with a maximum temperature of 90° F.

Any deviation, other than natural, from the above requirements is to be evaluated for risk to the propagation of fish and other aquatic life by the Department of Chesapeake Bay Affairs, and will be permitted or denied by the Department of Water Resources after consultation with that agency.

MASSACHUSETTS

Class A (excellent waters)—no increase other than of natural origin.

Class B (recreational criteria; excellent aquatic life habitat)—no increase except where temperature will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 83° F. in warm water fisheries, and 68° F. in cold water fisheries, or in any case raise the normal temperature of the receiving stream more than 4° F.

Class C (good indigenous aquatic life habitat)—same as Class B.

Class D (industrial, power, navigation)—no increase except where temperature will not exceed the recommended limits on the most sensitive receiving water use and in no case exceed 90° F.

All coastal and marine waters—no increase except where temperature will not exceed the recommended limits on the most sensitive receiving water use.

NORTH DAKOTA

Maximum, 93° F. (Red River of the North, Boise de Sioux, parts of Sheyenne and Pembina Rivers).

Limitation, 10° F. plus, on amount of temperature change in the receiving water from wastes of any single source.

Maximum, 90° F. (all other interstate waters). No limit numerically on temperature change; general narrative statement limits harmful effects of wastes.

OREGON

General statement that no measurable increase in temperature allowed when the receiving water temperature is 64° F. or above, or more than 2° F. increase when receiving water temperature is 62° F. or less. The following are exceptions to this general statement:

Multnomah Channel, main stem Willamette River, main stem Snake River: 70° F. and 68° F. respectively in statement similar to above.

Main stem Columbia River, main stem Grande Ronde River, Walla Walla River: 68° F. and 66° F. respectively in statement similar to above.

Marine waters: No significant increase above natural background temperature allowed.

SOUTH DAKOTA

Fisheries:

Cold water permanent—68° F. maximum, 4° F. change.

Warm water permanent—85° F. maximum 4° F. change.

Kar water semi-permanent—90° F. maximum, 8° F. change.

WASHINGTON

Class AA (extraordinary waters): No measurable increases in temperature permitted within the waters designated which result in water temperatures exceeding 60° F. (fresh water) or 55° F. (marine water) nor shall the cumulative total of all such increases arising from nonnatural causes be permitted in excess of $t=75/(T-22)$ (fresh water) or $t=24/(T-39)$ (marine water); for purposes hereof "t" represents the permissive increase and "T" represents the resulting water temperature.

Class A (excellent waters): same statement with the following numerical limits—65°F. and 61°F. maxima for fresh and marine waters respectively. Fresh water formula for increases— $t=90/(T-19)$; marine water formula for increases— $t=40/(T-35)$.

Class B (good waters): same statement with the following numerical limits—70°F. and 66°F. maxima for fresh and marine waters respectively. Fresh water formula for increases— $t=10/(T-15)$; marine water formula for increases— $t=52/(T-32)$.

Class C (fair waters): same statement with the following numerical limits—75°F. and 72°F. maxima for fresh and marine waters respectively. Fresh water formula for increases— $t=125/(T-12)$; marine water formula for increases— $t=64/(T-29)$.

WISCONSIN

Fish and other Aquatic Life: In waters where this use is of primary importance, the temperature shall not exceed 84°F. No change from natural unpolluted background by more than 5°F. at any time nor at a rate in excess of 2°F. per hour. Where fishing is desirable in conjunction with other uses, the temperature shall not exceed 89°F. for warm water fish. There shall be no abrupt change from background by more than 5°F. at any time. In addition, authorization must be obtained for proposed installations where the discharge of a thermal pollutant may increase the natural maximum of a stream by more than 3°F.

Streams classified by law as trout waters shall not be altered from natural background by effluents that affect the stream environment to such an extent that trout populations are adversely affected in any manner.

Industrial Water Supplies—Temperature not to exceed 89°F.

TEXAS

For all waters except the Canadian River and tidal waters—Upper limit of the representative temperature—96°F and not to exceed a 5°F rise in the representative temperature above natural conditions.

For the Canadian River Basin—upper limit of the representative temperature—93°F and not to exceed a 5°F rise in the representative temperature above natural conditions.

For Tidal Waters—Fall, winter, and spring, not to exceed a 4°F rise in the representative temperature above natural conditions. Summer—not to exceed a 1.5°F rise in the representative temperature above natural conditions.

(These criteria will apply until a study of stream uses has been made and recommendations set forth.)

MICHIGAN

Domestic Water Supply—The maximum natural water temperature shall not be increased by more than 10°F.

Industrial Water Supply—same as above.

Recreation—90°F maximum.

Irrigation and Stock Watering—not applicable.

Navigation and Power Generation—the maximum natural water temperature shall not be increased by more than 10°F.

(Aquatic Life—not approved.)

ILLINOIS

Public Water Supply—93°F. maximum.

Industrial Water Supply—not to exceed 95°F. at any time.

Recreation—no criteria.

Lake Michigan—(shore water) not more than 85°F., (open water) not more than 85°F.

(Aquatic Life other than Lake Michigan—not approved.)

RHODE ISLAND

Class A (excellent quality)—no increase other than from natural origin.

Class B* (bathing, all uses except untreated PWS)—no increase that will impair assigned uses.

*The temperature increase shall not raise the temperature of the receiving waters above 68°F. for cold water fisheries and 83°F. for warm water fisheries. In no case shall the temperature of the receiving water be raised more than 4°F.

Class C* (fish and wildlife, recreation)—same as Class B.

Class D (navigation, power, cooling water)—No increase except where the increase will not exceed the recommended limits on the most sensitive water use and in no case exceed 90° F.

Class SA (shellfishing)—no increase over the recommended limits for the most sensitive use.

Class SB (bathing, restricted shellfishing)—same.

Class SC (shellfish habitat)—same.

Class SD (navigation)—same.

MISSOURI

Effluents shall not elevate or depress the average cross-sectional temperature of the stream more than 5° F. The stream temperature shall not exceed 90° F. due to effluents.

Lakes and Reservoirs—temperature not to be increased due to cooling water discharge.

(Exceptions include: Des Moines, White, Current, and Eleven Point Rivers.)

LOUISIANA

Not to be raised more than 3° C. above normal ambient water temperature, nor to exceed a maximum of 36° C.

A few rivers—2° C. rise, 35° C. maximum.

ALABAMA

Public Water Supply—ambient temperature not to rise more than 10 percent after reasonable mixing from effluents, nor shall temperature exceed 93° F. except for 8 hours during a 24-hour period with a normal maximum of 90° F.

Total body contact—same as PWS.

Agricultural and Industrial Supply—same as PWS.

Navigation—no criteria.

VIRGIN ISLANDS

Class A (preservation of natural phenomena)—no change.

Class B (bathing, marine life propagation)—not to exceed 90° F at any time nor as a result of waste discharges to be more than 4° F above natural during fall, winter, and spring, nor 1.5° F above during summer.

Class C (harbors)—no criteria.

TENNESSEE

Domestic Water Supply—the temperature of the water shall not exceed 93° F and the maximum rate of change shall not exceed 3° F per hour. In no case shall the maximum temperature rise be more than 10° F above the stream temperature which shall be measured at an upstream control point.

Industrial Water Supply—same.

Recreation—same.

Stock Watering—no increase to impair assigned use.

Navigation—no increase to impair assigned use.

OKLAHOMA

Differential changes in temperature from other than natural sources shall be limited to a maximum of 5° F provided the maximum temperature due to man-made causes shall not exceed 70° F in trout streams, 75° F in small-mouth bass streams, or 93° F in warm water streams.

CONNECTICUT

Class A (water supply)—no increase other than from natural origin.

Class B (bathing, all uses except untreated PWS)—no increase to exceed recommended limits on most sensitive water use, and in no case to exceed 4° F over natural with a maximum of 85° F.

Class C (fish and wildlife)—same as Class B.

Class D (navigation, power, cooling water)—same as Class B.

Class SA (shellfishing)—same as Class B.

Class SB (restricted shellfishing, bathing)—same as Class B.

Class SC (shellfish habitat)—same as Class B.

Class SD (navigation)—same as Class B.

MONTANA

Public Water Supply (treated)—no increase over natural conditions; (untreated)—not applicable.

Recreation (bathing)—not applicable.

Salmonid Fish:

Increases: 32°F to 67°F—2°F maximum; above 67°F—0.5°F.

Decreases: Over 55°F—2°F max./hr.; 55°F to 32°F—2°F, provided that water temperature must be below 40°F during the winter season and above 44°F during the summer season.

Non-salmonid Fish:

Increases: 32°F to 85°F—4°F maximum; above 85°F—0.5°F maximum.

Decreases: Over 55°F—2°F max./hr.; 55°F to 32°F—2°F maximum, provided that water temperature must be below 40°F in the winter season and above 44°F in the summer season.

Agricultural Water Supply—not applicable.

Industrial Water Supply—no increase that would impair uses.

ALASKA

Public Water Supply—below 60°F; waste flows above 60°F adjusted to ambient receiving water temperature.

Recreation—numerical value is not applicable.

Fish and Wildlife Propagation—may not exceed temperature of natural conditions by more than 5% for salt water or 10% for fresh water. No change permitted for temperature over 60°F. Maximum rate of change—0.5°F.

Shellfish Propagation—less than 68°F.

Stock Watering Irrigation—between 60°F and 70°F.

Industrial Water Supply—less than 70°F.

HAWAII

Classes AA, A, B (all uses of coastal and tidal waters)—temperature of receiving waters shall not change more than 1.5°F from natural conditions.

DELAWARE

Ocean Waters—shall not exceed 5°F above normal for the area or a maximum of 75°F.

Most Rivers—shall not exceed 5°F above normal for the section. (For some rivers—a maximum of 85°F or 87°F.)

OHIO

Public Water Supply—no criteria.

Recreation—no criteria.

Industrial Water Supply—not to exceed 95° F. at any time.

Aquatic Life B (fish passage)—not to exceed 95° F. at any time.

(Aquatic Life A—not approved.)

NEW JERSEY

FW-1—preserve natural conditions.

FW-2 (public water supply)—not to exceed 5° F. increase over natural, up to 87° F. Natural stream temperature above 87° F.

FW-3 (all uses except PWS)—same as FW-2.

FW-4 (some fish life)—no criteria.

(Tidal and Coastal Waters—not approved.)

Delaware River Bay and Estuary—shall not exceed 5° F. above the average daily temperature gradient displayed during the 1961-1966 period, or a maximum of 86° F., whichever is less.

NEW YORK

To: Engineering firms practicing in New York State.

Subject: Thermal aspects of discharges on water resources (Technical Bulletin No. 36).

To protect water resources, fishlife, and stream biota from effects of transient and long-range adverse temperature changes, careful studies of stream environ-

ment should be conducted where discharges of thermal significance are contemplated.

Such studies might include, but not be limited to:

- (a) Natural background conditions of temperature, ecology, base flow, and physical and biological character of receiving waters
 - (b) Stream geology, hydrology, tides, currents, and man-made barriers
 - (c) Climate, winds, critical summer temperatures, and general meteorological conditions
 - (d) Effects upon assimilative capacity of receiving waters
 - (e) Stratification of heated liquids
 - (f) Need for full-channel or part-channel diffusion works
 - (g) Heat transfer calculations, against environmental factors determined above, to assess magnitude of expected change in receiving water quality.
- These factors should be evaluated against the following criteria:

Trout waters

No thermal discharges will be permitted to waters classified for trout, stocked with trout, or supporting a naturally occurring propagation of trout, or in upstream reaches of such waters as would cause adverse effects thereon.

Nontrout waters

1. *Mixing zone.*—The mixing zone will be separately determined for each discharge so as to minimize detrimental effects. Fish and other aquatic life shall be protected from thermal blocks by providing for a minimum fifty percent stream or estuarine cross-section and/or volumetric passageway, or establishing artificial fishways where considered necessary.

Generally, the surface water temperature shall not exceed 90° F. within the mixing zone. Consideration will be given to effects of each discharge based on hydrodynamics and other factors of receiving waters.

2. *Outside mixing zone.*—Stream temperatures in excess of 86° F. will not be permitted after mixing. Further, no permanent change in excess of 5° F. will be permitted from naturally occurring background temperatures.

In multiple discharge situations stream capacity to meet such criteria will be apportioned among the discharges.

3. *Outside mixing zone: Fresh surface water classes.*—Temperature change rate shall be limited to 2° F. per hour, not to exceed 9° F. in any 24-hour period, further limited in that for any seven day period the average change will meet the 5° F. change of background criteria stated in item 2 above.

4. *Outside mixing zone: Tidal salt water classes.*—Discharges shall not raise monthly means of maximum daily temperatures more than 4° F. from September through May, nor more than 1.5° F. during June, July, and August.

Temperature change shall not be more than 1° F. per hour, not to exceed 7° F. in any 24-hour period at maximum, except when natural phenomena cause these limits to be exceeded.

Where necessary, cooling towers or other devices must be installed to meet these stream criteria. The State Conservation Department will act as a consultant to the Health Department insofar as fish life and aquatic biota are concerned.

This Bulletin was developed to advise and provide guidance to engineering firms, industries and others of water quality objectives and requirements for thermal aspects of discharges to the surface waters of New York State.

ROBERT D. HENNIGAN,
Assistant Commissioner, Division of Pure Waters.

Mr. CARPENTER. Let's get these other questions on the record.

Have you made any attempt to transfer space or military research results to application in pollution control? What mechanisms do you have to try to use such on-the-shelf technology. What is your experience so far? What would you recommend to improve interagency technology transfer?

In other words, have you gone to NASA or the Atomic Energy Commission and talked with their technology transfer people in terms

of specific questions. Or have you asked them what they think they have that you might use?

Dr. WEINBERGER. Dick, we have had some very direct liaison with these people, and I know Mr. Daddario doesn't like the word "liaison."

We have actually carried out a project with NASA in terms of some of the work which they have developed in terms of biological treatment. It was a jointly supported project.

NASA has on our behalf made an analysis of the projects which they have supported in terms of applicable technology. Our people—and remember that our program has in-house capability as well as the extramural support—in-house staff, our research scientists, constantly are reviewing the literature, reports of NASA, DOD, and AEC.

There have been a number of innovations developed by those agencies which we have tried out in our laboratory, which is currently under consideration. Again I can give you some examples of this.

Some of the work done on identification of micro-organisms is part of the space program, where they need rapid methods for measuring pathogenic organisms. These obviously have an application to our field.

The analytical techniques that are developing, the methods which they are employing for some of the space work has a direct application. As a matter of fact, our requirements are usually considerably less stringent than the space program, because we do not have their space and weight restraints.

Mr. CARPENTER. Have you translated your requirements into the terms of the technology that might be needed, or have they come to you with possible things that they have seen? Maybe it has gone both ways.

Dr. WEINBERGER. It has gone both ways. We of course continuously indicate what our needs are. In the case of AEC, as an example, there has been continuing direct liaison between the Commission staff and ours and their laboratory staffs and ours where we specifically pinpoint some of our needs for pollution control equipment.

Mr. FELTON. Do you contract with any other Federal laboratory for the performance of work related to pollution?

Dr. WEINBERGER. Yes. A transfer of funds I think is more the term, but some of these agencies do work for us.

Mr. FELTON. Could you put in a background statement on what this involves?

Dr. WEINBERGER. It has been limited, but I will get the indication of what these have been.

I might say again in answer to the question, it worked both ways. We have done some work for other agencies in terms of pollution control, and one of the projects we had was trying to determine the quality of recycled water for a reuse system.

(The information requested is as follows:)

REIMBURSABLE WORK PERFORMANCE BY OTHER AGENCIES

	Fiscal year 1967	Fiscal year 1968 estimate	Expendi- tures as of Mar. 26, 1968	Fiscal year 1969 estimate	Purpose
U.S. Geological Survey—Acid mine drain- age (0840)	\$150,000	\$100,000	-----	\$20,000	Acid mine drainage studies.
U.S. Geological Survey—Estuarine (Corval- lis) (9841)	450	900	-----	1,000	Estuarine, flow gauge.
U.S. Geological Survey—(Newtown) (4884)	-----	19,000	-----	-----	Construct weirs.
U.S. Geological Survey—Eutrophication (Ely) (5883)	-----	10,000	\$4,000	8,000	Stream gauging.
Bureau of Mines (0840)	486,400	170,000	100,000	-----	Acid mine drainage studies.
Sports, fish and wildlife (0840)	50,000	75,000	17,700	-----	Do.
Alaskan Air Command, U.S. Air Force (9842)	-----	12,000	8,000	-----	Pilot treatment plant, co-op.
Total	686,850	386,900	129,700	29,000	

Mr. CARPENTER. The AEC reminds me of this one specific. In the large nuclear desalting plant that is now being considered, has there been a study of the effect on marine ecology of the salt and hot effluent?

Dr. WEINBERGER. John, I think you called on that one.

Mr. BARNHILL. Yes, I called Jack Hunter, Director of the Office of Saline Water, and he furnished me with this statement. You may have this.

He tells me that there have been extensive cooperative studies with the Bureau of Commercial Fisheries and the Bureau of Sport Fisheries and Wildlife in this Department on possible ecological effects of the thermal discharges from that plant. He is of the opinion that they have the problem well in hand.

Mr. CARPENTER. And that Fish and Wildlife agree with that opinion?

Dr. WEINBERGER. Yes.

(The document referred to is as follows:)

SUBJECT: DISCHARGE OF EFFLUENT FROM A LARGE NUCLEAR ELECTRIC POWER AND DESALTING PLANT

OSW has always been concerned about the possibility of degrading the marine environment through the discharge of the waste brine and cooling water from desalting plants. The Bureau of Commercial Fisheries and Fish and Wildlife Service of the Department of the Interior have been consulted within this matter and several studies have been made by the Office of Saline Water to investigate the hazard that might be presented to the marine ecology through the thermal effects, salinity concentration, and other contaminants that might be contained in the discharge. The most recent study made by the Dow Chemical Company for OSW in conjunction with the Texas A&M University was completed in September 1967. This study investigated the effects of a plant of the same size and type as the MWD plant on the marine environment utilizing the specialized talents of these two organizations and the available pertinent literature including reports by the Atomic Energy Commission, U.S. Public Health Service, California State Water Pollution Control Board, Department of the Interior, etc. Also meetings were held with cognizant Department of the Interior personnel including Commercial Fisheries and Fish and Wildlife to obtain additional information for the study, and they are in agreement with our approach and recommend bio-assay surveys during plant operation.

An important fact which should be brought out in connection with a study such as this is that the effluent from a large nuclear dual-purpose power-desalting plant comes from three sources—the concentrated brine blowdown, the cooling water from the desalting plant, and the cooling water from the power plant. In a plant the size of MWD with a concentration ratio of about 2, for every gallon of potable water produced, approximately one gallon of brine at twice

the salinity of normal sea water and at a temperature of about 12° F above ambient will be discharged. However, about 15 gallons of other sea water used for cooling the desalting plant and power plant, at the same salinity and about 12° F above ambient, will also be discharged. Combining these discharges will result in a composite effluent only slightly above the ambient salinity and about 12° F above ambient temperature. Thus, the discharge from a plant like MWD should present no more of a hazard to the ecology from a salinity and temperature standpoint than the discharge of cooling water from a large power plant due to the high dilution of the waste brine effluent from the large amount of cooling water required.

During the operation of a desalting plant small amounts of chemicals are sometimes introduced into the feed water for scale control and are contained in the discharge along with small amounts of other corrosion products picked up in the plant. The effects of these small perturbations on the effluent have been, and will continue to be, studied and monitored through bio-assays made prior to and during operation of various desalting plants. This has been done at the San Diego Test Facility. Further, by proper design and location of the effluent outfall other factors of safety can be added to negate any possible harmful effects to the ecology.

Mr. CARPENTER. The final question—

Dr. WEINBERGER. Let me just add one sentence to that. Again, even more effective communication is nonetheless warranted, and here you run into the problem of the amount of time that you do spend on liaison and coordination in getting your story across.

I would say that there is a good degree of exchange. I might say that steps are being taken in the executive branch to improve communication, with information storage and retrieval systems.

Mr. CARPENTER. This is right within one department. That is one of the reasons for our question, is whether on these complex subjects of ecological effects you had experience in your department here any conflict that required resolution. And this statement, then, in your answer, would indicate that you have had the OSW and Fish and Wildlife together, and they have agreed that the situation is—

Mr. BARNHILL. Well, we haven't done it, but they have gotten together within the department and apparently from that statement, and my conversation with Dr. Hunter—

Mr. CARPENTER. But you would cover these coastal waters?

Dr. WEINBERGER. Yes.

Mr. CARPENTER. The final question: In air pollution the law now calls for registration of fuel additives, not to show that they are safe or unsafe, but to simply alert the Surgeon General that these new chemicals might be entering the environment.

Would you advocate a similar law for effluents to surface waters, should industry or Government be responsible for forecasting or anticipating ecological effects of new effluents?

Dr. WEINBERGER. I will ask Mr. Barnhill to take a crack at that one.

Mr. BARNHILL. Well, the law does not now, at least not the Federal Water Pollution Control Act, require the registration or announcement of new chemicals or new wastes. This is obviously something that we discussed, and we were particularly concerned at the time with pesticides. And this was while we were in the Department of Health, Education, and Welfare. And we actually proposed that this needed to be done, but we ran into the difficulties that you would normally expect to, and that would be that we were encroaching on someone else's jurisdiction, and of course opposition from industry.

Mr. CARPENTER. You mean USDA?

Mr. BARNHILL. Yes, it was USDA. And of course industry would oppose, as they always have, and if I were in industry I would do the same thing. But they oppose it.

We still think it is a good idea.

Mr. FELTON. Was the section of your act which says in effect that industry does not have to divulge trade secrets or secret processes in the act from the beginning, or was this added sometime along the way?

Mr. BARNHILL. When was it added?

Mr. MOORE. Was it in the original act or has it been added since?

Mr. BARNHILL. It has been added since. I don't remember that it was in the original 1956 act at all. I think this was in the 1966 amendments.

Mr. FELTON. So this was subsequent to your push to get this type of registration?

Mr. BARNHILL. Yes.

Mr. FELTON. Which pretty well closes the door on—

Mr. BARNHILL. Well, except for one thing. First let me answer the last part of the question. We think industry should be responsible for defining the potential or actual toxic effects of any material that they supply that will find its way in the water as a pollutant. At the same time I think this infers that we would do enough work of our own to be able to monitor what industry is telling us.

Now I have forgotten what you just asked me.

Mr. FELTON. Well, this section would preclude you ever seeking registration.

Mr. BARNHILL. No; I don't think it would, because they register, they are required to register under other acts these proprietary chemicals, you see. They get a patent on them. So once they have refined and are ready to produce the material, it becomes—

Mr. FELTON. A trade secret by definition is not patented. Normally trade secrets have to do with that which is not patentable.

Mr. BARNHILL. Yes; but they don't have to tell us how they manufacture this product. They only need to tell us what this product does to the environment. You see the trade secret would be in how they produce this material.

Mr. FELTON. Or what is in it.

Mr. BARNHILL. Well, any good chemist, I think, could eventually tell you what is in any of these.

Mr. CARPENTER. Well, I am thinking of the responsibility that you might see in new refractory organic materials that are being synthesized if not produced at a high rate, thousands per year, as to the feasibility of doing ecological studies on these chemicals, but the still substantial chance that they might turn up in effluents.

Dr. WEINBERGER. If I can, again let me add onto what John Barnhill said. I would say that it is a joint government-industry responsibility to develop test procedures by which new chemicals, new products, may be evaluated for their pollution potential, and this has been a role which we have had and we have worked rather satisfactorily with industry. We worked with them in terms of coming up with a

biodegradability test. We currently are working with them trying to develop what we call an algal growth potential test. We have done quite a bit of work in terms of measuring how the acute and chronic or long-range effects on fish and aquatic life. We are getting more sophisticated in trying to develop ecological chambers, so you can measure the ecological effects.

Incidentally, we are a long way from being able to do that. I am not even suggesting that we will be able to do this in the near future, and as John points out, at the same time we have got to have the analytical capability to measure these materials.

But here again I think we have to put added responsibility on the industry, when they come up with a new product, to begin requiring them to develop analytical techniques. Incidentally, this is not too different from FDA.

We, of course, would be completely overwhelmed, and I don't think it is a proper Government role, to evaluate every new product under every possible circumstance.

Mr. MOORE. Well, it seems to me this is one of the points at which the practical considerations would have to have some weight. I see no point in requiring a series of registrations or a series of reports or a series of analyses if all you are going to do with them is file them somewhere.

It seems to me some thought would have to be given before you could commit yourself on a program of this scope.

Dr. WEINBERGER. That is right.

Mr. MOORE. I think you would have to give some consideration to what might be required of FWPCA if you were going to do something with them, before you answered the question as to whether they ought to all be just routinely filed.

Now it seems to me that the question I believe you were getting at is one that might be more pertinent, and that is there could be something in the effluent that would not necessarily be in the end product that could be more dangerous than the end product was.

Mr. CARPENTER. That is right.

Mr. MOORE. It seems to me that in any event the primary responsibility for what gets in the effluent has to lie with the industry, because this could happen if the reporting process were working.

Mr. CARPENTER. Yes. The primary responsibility would have to lie with industry, to be sure, as it proceeds, it does not come in conflict with the standards or criteria that have been established by the FWPCA.

Mr. BARNHILL. I hope Dr. Weinberger will agree with you—at least I feel we can work with industry and develop a screening test that would be short and reliable and would very quickly dispense of 95 percent of these chemicals, and then we could develop test procedures—

Mr. CARPENTER. Yes.

Mr. BARNHILL (continuing). For whatever the remaining amount would be, without too much difficulty.

Mr. FELTON. Are you doing anything along this line now?

Dr. WEINBERGER. Oh, yes.

Mr. BARNHILL. Well, yes.

Dr. WEINBERGER. Most of your test procedures for assessing the long-range effect on fish and aquatic life, these testing procedures were developed by biologists at our laboratories. Many of these toxicity tests were developed on the procedure—

Mr. FELTON. No, I mean is industry now voluntarily submitting its products to you for assessment.

Mr. BARNHILL. No.

Dr. WEINBERGER. No.

Mr. CARPENTER. That is it.

Mr. FELTON. Gentlemen, once again we thank you.

(Whereupon, at 3:35 p.m., the committee recessed, subject to call.)

APPENDIX B

Communications to the Subcommittee on Science, Research, and Development

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SMITHSONIAN INSTITUTION,
Washington, D.C., April 2, 1968.

HON. EMILIO QUINCY DADDARIO,
*Chairman, Subcommittee on Science, Research and Development,
House Committee on Science and Astronautics, House of Repre-
sentatives, Washington, D.C.*

DEAR MR. DADDARIO: I am pleased to respond to the invitation to participate in your Subcommittee's hearings on environmental quality. In an effort to provide a useful contribution, I have prepared the attached statement for inclusion in the record. The first section of the statement provides a description of the conceptual framework within which those activities of the Institution that have a direct bearing on the issues of environmental quality are evolving, together with a brief inventory of some of the relevant, ongoing programs.

The second part of the statement represents an attempt to gain a coherent overview of the numerous proposals that have emerged in response to the need for institutional mechanisms capable of developing an understanding of the interrelationships between human societies and the sustaining environment.

It is our belief that the problems which create the need for such mechanisms require no further documentation. We must now concentrate our efforts on reaching agreement concerning the most comprehensive and positive way in which to proceed. The second part of our statement is an outline of what we feel is necessary.

You are to be congratulated for your foresight in recognizing the significance of the problems that exist in the area of environmental quality. By providing a forum for an exchange of views on this topic, you are performing a most important service to the nation. I commend your efforts and look forward in assisting you in any way possible.

Sincerely yours,

S. DILLON RIPLEY,
Secretary.

STATEMENT BY S. DILLON RIPLEY, SECRETARY, SMITHSONIAN
INSTITUTION

Mr. Chairman and members of the Subcommittee, I am pleased to participate in these hearings on environmental quality.

In order to provide you with the conceptual framework within which the Smithsonian Institution is evolving its program in ecology, I would like to insert a statement that was prepared for our Board of Regents.

For the average citizen, ecology is fast becoming a household word, as increasingly it is being demonstrated to him that man is in nature and is a part of nature. No longer can he regard himself simply as a separate creation divinely appointed to manipulate nature at will. He now begins to understand that a human society with its total en-

vironment functions as an integrated whole in nature—that is, as an ecological system, or ecosystem.

He sees, moreover, that with his modern technology man is capable of massive environmental manipulations that were unimagined even a few years ago; and because he is told that such changes are usually irreversible and can adversely affect the lives of future generations as well as his own, he now senses the importance of seeking scientifically valid means of predicting the consequences of any alteration in the ecosystems of the world.

He begins to recognize, in short, that he must increase his scientific understanding of whole ecosystems, taking man as an essential component, if he is to establish a viable basis for the cultural and intellectual development of human society. Leading humanists, scientists, and Congressmen have for some time been keenly aware of this, and of the adverse ecological changes occurring throughout the world today, and they express mounting concern lest the quality of human life deteriorate to an unbearable degree through improper management of the environmental systems which sustain it.

We openly admit that unstable relationships between man and his total environment have formed and that under the twin pressures of an expanding economy and of excessive self-constricting population growth, competition for the finite resources of the earth almost inevitably results in their misuse.

Having accepted the fact that human society is an integral part of the earth's ecosystems and that the resources of its environments are limited, when then must we do? If the critical problem facing humanity today is the ecological one of harmoniously relating human societies to sensitive environments of finite scope and potential, we are forced to conclude that the growth of human society must henceforth be measured mainly in terms of quality rather than of quantity. The problem, in its most restricted form, lies within the domain of the natural sciences. Indeed, from one point of view, we can regard ecology as the most recent scientific outgrowth of natural history. But in its most general form the problem involves all the dynamics of man-in-society. Here it is that ecological principles are confronted with those of economics, political theory, law, and education—indeed, with all the institutions and organized structures of knowledge that deal significantly with the social reality. Clearly, the problem is too intricate and too important for the ecologist alone to solve.

Putting in perspective the present destructive influences of man on his environment, and ultimately on his own society, requires a new approach involving a synthesis of relevant knowledge from the humanities and behavioral sciences as well as from the natural sciences. Eminent contemporary intellectuals have already pointed out that we need a new science; ecologically oriented but not ecology in its traditional sense. The subject matter of the new science is human society and its total environment. If we think in terms of levels of biological integration—the molecular, cellular, organismal, population, community, and community-plus-environment levels, then we must regard the highest and most complex level as that dealing with the human dimension, where human society and its containing environment exist as a functioning whole in nature. We have seen that near the bottom of the spectrum, in molecular biology, spectacular advances in our understanding of the genetic code have resulted from

the integration of ideas found in chemistry, physics, mathematics, and biology. Can we expect anything less exciting and significant to grow out of our concentration upon the highest levels of organization, at the other end of the spectrum, where the penalty of ignorance may well be irreversible and devastating change?

The challenge is enormous and the difficulties immense. In view of the complexity that presents itself, even at the lower levels of biological integration, the task of building a conceptual structure that would enable us to deal effectively with the upper regions of the spectrum, and with the spectrum in its entirety, seems almost overwhelming. Some have remarked that the highest ecosystem level is not more complex than we think it is, it is more complex than we *can* think.

Yet the problem is often one of perspective; and if we are to face our work squarely, we must make every effort to rid ourselves of that form of cultural near-sightedness which obscures the total design of the canvas even while it brings the details into focus. For example, the cycling of radioactive particles or pesticides through plants and animals into man—who released these destructive contaminants in the first place—is an ecosystem phenomenon, the attributes of which involve decisions in the minds of men as well as the physical movement of these substances through the air, water, soil, and living organisms. Thus, recognizing that human values and the motivating forces of economics and politics can contribute directly to the structural and functional characteristics of ecosystems in which man is the dominant force, it is clear that one must direct thought and research toward searching out the unique and possibly controlling phenomena—in this case, man's cultural behavior—that operate at whatever level in nature is under study.

Within this broad context of the search for solutions to contemporary ecological problems relevant to or embracing modern society, the Smithsonian program in ecology is evolving. Its primary goal is to advance basic ecological theory at all levels of biological integration, but its emphasis is upon the largely unexplored higher levels—on such areas as populations and communities of animals, on vegetation as a structure or pattern of plant communities, and on communities-plus-environments as total ecosystems. It seeks particularly to study ecosystems that are least modified by man. These are natural complexes, which are self-maintaining when human interference does not intrude upon the regulatory processes enough to cause the system to deteriorate, and they can therefore provide the means to understand and measure the effects of such interference. This type of undisturbed area is becoming increasingly rare in our day, and without protection from man's activities it will soon disappear.

The Smithsonian program of ecology also, therefore, encourages and practices conservation, which has two aspects—the aesthetic and the scientific. With the aesthetic aspect all are familiar; the arguments in favor of preserving unmolsted the beauty of the land elicit something like a conditioned reflex, and we dutifully nod approval. But with the other side of the coin, the scientific values of conservation, we are much less familiar. From a scientific point of view, conservation means preserving the capacity of ecosystems to support rich and varied forms of life. This is a matter of biological necessity if we are to maintain a diversity of environments in which it is not only possibly

to live but also in which it is worth living. The natural area, so-called because the works of man are not significant elements in its composition, is an outdoor laboratory and, as such, it is the only apparatus by which we can gauge the changes that occur in the regions dominated and modified by man. These reserves are the only frame of reference we have. In them we can make observations with a minimum of disturbance, or carry out controlled and carefully recorded environmental manipulations to determine how ecosystems actually function in nature. This sort of research contributes to our ability to predict the consequences of man's alteration of his environment.

The Smithsonian Institution encourages, and aids where possible, the establishment of natural areas for research, education, and a means of communicating ecological ideas to society. The Chesapeake Bay Center for Field Biology, under the administration of the Office of Ecology, reflects this interest and activity. Such areas must be under the best protection that society can provide through its laws and institutions; and the 120 years of Smithsonian tradition in preserving objects of cultural and scientific importance provides assurance that natural areas, which might be thought of as outdoor museums, will be saved in perpetuity for science and society.

While emphasis is placed on the higher orders of biological integration and on the conservation and study of natural ecosystems, the Smithsonian ecology program also includes species-oriented ecology, and the biological problems related to urban development are not excluded. And although research is given priority, the ecology program is also deeply committed to education and to the diffusion of sound ecological information throughout society. In this sphere its efforts are directed toward constructing a conceptual framework, drawing upon the humanities, the behavioral sciences, and the natural sciences, that will enable man to deal purposively with his world on the level of human society-plus-its-total-environment. To gather these strands together, research is being linked with university education at home and abroad, and contemporary ecological thought is being transmitted through lectures, seminars, and publications.

If we accept the thesis that advancement of scientific theory about ecosystems and man's place in these systems is oriented primarily around the understanding of how they actually behave in nature, then with sufficient knowledge about how ecosystems work, we may be able to manage them in the best interests of society by manipulating the controlling (or regulatory) processes. Increasing our understanding of how an ecosystem works requires two general types of research.

One type of research is concerned with basic descriptions: (1) of the physical, chemical, and biotic components of the system; (2) of the structural and functional relationships of these components to each other and to the system as a whole; (3) of the variations of the system in time and space; and (4) of the environmental relationships of the system to other ecological systems. The total systems approach, embracing climate, soils, hydrology, vegetation, and animal life—including man—provides a foundation for studies of regulatory processes.

These basic descriptions require a solid foundation in the taxonomy of the species components; precise identification of plants, animals, and other organisms is fundamental to the advancement of ecological theory. Basic descriptions, also include preliminary interpretations.

These concern, for example, the ecological interrelationships of the component populations, the cause and effect of changes in vegetation and its associated animal life through time, or the influence of upwelling ocean currents on the productivity of marine life—and in turn they often generate ideas for further studies on the functions and processes of ecosystems.

As was pointed out earlier, ecology is sometimes said to be the scientific outgrowth of natural history. In the ecology program of the Smithsonian a strong foundation for research concerned with basic descriptions is provided by the vast collections and the enormous bank of taxonomic knowledge in its Museum of Natural History, a bank to which the Smithsonian has contributed for over 100 years through its expeditions into the "virgin" areas of the Western States, the Arctic regions, the Tropics, and elsewhere throughout the world.

The massive task of curating the collections from these expeditious leads naturally into systematic and evolutionary biology, and as a consequence, taxonomists have often become so specialized in the systematics and biogeography of their own particular group of organisms that they have had little time or inclination to explore the significance of ecological studies. Ecologists, on the other hand, have often tended to underestimate the importance of these basic descriptions and the significance of systematic biology and ecology at the species level. A related objective of the Smithsonian ecology program is, therefore, to bridge the gap that has developed between systematics and ecologists and to renew the close relationships that formerly existed between these two disciplines. Obviously, such interdisciplinary integration is essential if we are to increase our knowledge of how ecological systems work in nature.

The second type of research required to increase understanding of how ecosystems work is concerned with interpretive, ecosystem-oriented studies rather than basic descriptions. Examples of such studies would be: (1) the role of social behavior or the significance of predator-prey relationships in the numerical regulation of animal populations; (2) the principles of vegetation change; (3) the flow of energy through the system as expressed in rates and amounts of primary and secondary productivity; (4) the cycling of mineral nutrients; or (5) the consequences of man's environmental manipulations. These examples point the direction in which the new quantitative ecology is developing. These are the studies at the higher levels of biological intergation, although usually below the level of human-society-plus-environment, that excite ecologists intellectually.

To sum up: the Smithsonian program in ecological research embraces both basic descriptions and ecosystem-oriented studies. It emphasizes studies of significance to both ecological theory and to the understanding of man's place in nature. Its aim is to form a small group of scholars, each of whom will advance knowledge significantly in his own specialty—be it vegetation science, animal behavior, the dynamics of animal populations, or the energetics of ecosystems—and who will also help construct a new interdisciplinary framework that will enable us to assemble a broad spectrum of knowledge relevant to the current ecological problems of our society. By this means, it is hoped, a viable scientific basis can be established for maintaining and improving the quality of man's environment.

In this challenging new era of multiple, competing demands and shifting perspectives, the Smithsonian Institution, as a privately en-

dowed organization with strong governmental relationships, serves as an important focal point for both national and international programs in basic research and education in ecosystem-oriented ecology.

Within this context, Mr. Chairman, I should like to refer briefly to those elements within the Smithsonian Institution that have a distinct bearing on its capability to contribute to the quality control of our environment.

The Museum of Natural History is an international center for the biological specimens in the nation. The interests of the museum include all aspects of the natural sciences. Anthropology, botany, entomology, invertebrate zoology, mineral sciences, paleobiology, and vertebrate zoology are well represented. The scientific program of the museum consists of the efforts of over 100 research scientists. Although most of the research is collection-based, it also involves field observation and refined laboratory techniques. The ongoing investigations reflect a considerable diversity of interests, largely within the areas of systematic biology and biogeography. Studies of autecology and physiology are pursued primarily as pathways for determining phylogenetic relationships. The 50 million specimens provide not only a documentation of organisms in space and time but also information indispensable to the understanding of speciation and ecological relationships. Thus the Museum of Natural History provides a strong taxonomic foundation for ecosystem-oriented science.

The Information Systems Division of the Smithsonian is now in the process of computerizing the information on biological and mineral specimens. The development of computer-supported systems will enable the Smithsonian to manage better its information resources and to respond to inquiries with speed, accuracy, and completeness. It also provides increased capability for mathematical and statistical approaches to research, mathematical modeling, and the classification of plants and animals by numerical taxonomy. The Smithsonian's computer capacity is sufficient to initiate storage of ecological information pertinent to contemporary problems of environmental alterations.

The Smithsonian Tropical Research Institute (STRI) has been a component of the Smithsonian since Barro Colorado Island was transferred to the administration of the Institution in 1946. Barro Colorado provides opportunities to study tropical jungle (more precisely, lowland seasonal humid forest) with its characteristic community of animals. The Smithsonian Tropical Research Institute has also acquired a small tract of land on the mainland of the Canal Zone, in the "Navy Pipeline Reservation." It has, in addition, made arrangements to use areas in other parts of the Canal Zone, and the Republic of Colombia in the near future. These circumstances will permit scientists to study in different types of lowland forest, montane forest, alpine moor, grasslands, scrub, and marsh. It will also permit them to make experimental modifications of environments. Its status as a reserve precludes this activity on Barro Colorado. Two marine biology stations have been established in the Canal Zone, one on Naos Island on the Pacific coast and the other on Galeta Island on the Atlantic coast. The focus of marine research is primarily concerned with the evolution of isolating mechanisms in species pairs of marine shore fishes.

The objective of these studies is to determine the actual correlation between types of isolating mechanisms and factors such as morphology,

time, geographic separation, competition, and ecology. The terrestrial dimension of research activity at STRI has been primarily zoological. Emphasis has been on problems concerned with biological processes that can be studied best in the tropics, particularly the causes for high species diversity and the social behavior of certain groups of animals (notably anurans, birds, and primates) as they are related to the complexity of tropical communities.

Our Radiation Biology Laboratory conducts research on the functions of living organisms that are affected and controlled by solar radiation. The sun is the principle source of energy for life on the earth. Radiant energy from the sun is trapped by pigments and converted into potential chemical energy. The research of the RBL is directed toward understanding the cellular and subcellular mechanisms and processes by which organisms use radiant energy for their growth and development. Such studies produce information fundamental to the development of technological advances and applications, especially in food production and environmental control. The modern fields of biophysical physiology and biochemistry have a continuing requirement for a precise characterization of solar radiation in developing experiments of health-oriented importance to man. The physiological studies of the RBL provide, as in the case of the Museum of Natural History, an important foundation for ecosystem-oriented studies.

The Office of Oceanography and Limnology operates the Smithsonian Oceanographic Sorting Center which processes marine specimens from national and international expeditions for use by scientists of the world in specimen-related research. The office also facilitates the productive involvement of Smithsonian scientists in aquatic research of national and international significance, and provides outside scientists and research organizations with a focal point for their effective use of Smithsonian competence. Through its Sorting Centers in Washington, D.C., and in Tunisia (the latter principally supported by the Smithsonian Foreign Currency Program), the Office serves as a substantial producer and repository of biological and geological data for the Federal Government. These data are used in the evaluation and harvest of fisheries and mineral resources; in the resolving of naval problems of fouling, bioluminescence, and bioacoustics; and in studying the effects of pollution on the marine environment. The Office of Oceanography and Limnology is concerned with marine ecological studies as well as systematic biology, and coordinates its efforts closely with those of the Office of Ecology.

The Chesapeake Bay Center for Field Biology, which is administered by the Smithsonian Office of Ecology through a consortium arrangement with the Johns Hopkins University and the University of Maryland, provides a relatively stable baseline against which to compare other ecological systems in the rapidly changing Washington area. The Center lies about 7 miles south of Annapolis, Maryland. Its 700 acres of land include areas still in cultivation, areas abandoned from agriculture for 22 years, and areas of relatively undisturbed mature forest. Control of about 10 miles of undeveloped shoreline (the largest such expanse on the western shore of Chesapeake Bay) provides opportunities for long-term studies of salt marshes, eroding bluffs, sandy beaches, and shallow estuaries. Under Smithsonian ownership, the land and surrounding estuaries are preserved effectively

for a program of studies extending indefinitely into the future. The objectives of the Center must be viewed within the larger context of the overall program of the Smithsonian Office of Ecology, a central concern of which is to advance scientific understanding of the functional design and processes of ecosystems as a basis for predicting the ecological consequences of man's alterations of natural systems. The research objectives at the Center are: (1) to develop a baseline of knowledge about the composition and structure of terrestrial and estuarine ecosystems at Chesapeake Bay, (2) to conduct specific research relevant to the functioning of ecosystems, and (3) to conduct biosocial studies. In addition to the research objectives, the Center is concerned with the education of young scientists and technicians to meet the critical shortage of manpower required to cope with problems concerning the quality of man's environment. A third goal of the Center is to make information from scientists and other authorities available to the public, particularly on environmental conservation and on social issues as they apply to environmental quality.

A Center for the Study of Short-lived Natural Phenomena was established in response to the recognition that most scientists, including those at the Smithsonian, were missing opportunities for studying the critical early stages of important geological, biological, and meteorological events. The Center, utilizing the excellent facilities and procedures established by the Smithsonian Astrophysical Observatory for the worldwide exchange of information about astrophysical occurrences, has expanded on the SAO system to include events of interest to the other sciences. During the first 21½ months of its existence, the Center has been extremely active in mobilizing activity on such events as the Tonga Island Volcano, the Desception Island Volcano, and oil spillage from damaged tankers. It is anticipated that as soon as funding can be provided, the Center will operate on a larger scale.

The Smithsonian's interests in environmental studies are international as well as national. Representative of our international program are the following projects.

The Island of Dominica in the West Indies has been the site of a program of field studies, based on a rotation of scientists from various disciplines, since January 1964. To date at least 55 investigators, including systematic biologists and anthropologists from universities, as well as from the Smithsonian, have participated in the study. Floristic studies are being published in the *Contributions from the United States National Herbarium* and faunistic studies are being published in the *Proceedings of the United States National Museum*. It is intended that intensive ecological studies be undertaken, based on the data that have been accumulated throughout the survey.

At Belem, Brazil, the Smithsonian is engaged in a cooperative venture in studies of tropical biology at the Guama Ecological Area (APEG). The objective is to bring together in one place the special research talents of a variety of persons and institutions to the end that a comprehensive program of study will emerge, leading to a better understanding of the ecology of the Amazon rainforest and the biology of some of its more important component species. An integrated study of a specific area of equatorial rain forest has never been attempted before on the scale proposed for APEG.

In Korea, a long-range program of research has been initiated, using as an ecological baseline a study area immediately south of the Demilitarized Zone. This area has been rigidly protected over the past 15 years, and provides a key to understanding man's impact on Korean environments. Preliminary studies have led to a proposal for a Korean Center for Environmental Studies, within which an integrated program of research and education in ecosystem ecology can evolve. The design of this program is intended to incorporate into its structure provisions for the accumulation of significant data, for growth of ecological theory, for the strengthening of cooperation within the international scientific community, and for the diffusion of modern ecological thought within the Republic of Korea. The program represents an opportunity to develop some of the basic scientific information Korea requires in its efforts to become self-sufficient.

In Ceylon, under the Smithsonian Foreign Currency Program, a cluster of research projects has evolved, including studies of the behavior and ecology of elephants, studies of Ceylonese flora and vegetation, and investigations of the behavior and ecology of primates. These integrated studies will provide a foundation for conservation practices that are compatible with the development of forestry and agricultural resources. With these projects as a nucleus, the potentialities for a Ceylonese Center for Environmental Studies now exists. All of these projects are being carried out in cooperation with faculty and students at the University of Ceylon.

The concepts and activities described in the preceding paragraphs indicate the manner in which environmentally-oriented studies are being pursued at the Smithsonian Institution. I should now like to discuss those important issues before your Subcommittee that concerns the response of our society to what has been termed the ecologic crisis.

As you have frequently recognized, Mr. Chairman, one of the critical requirements of this nation is for mechanisms which will foster a more adequate understanding of the relationships between society and its total environment. In its report on Environmental Pollution, issued October 21, 1966, your Subcommittee reached several conclusions relevant to our present discussions. It is useful to quote some of these at length:

* * *

Considering the powerful forces for ecological change which are at man's disposal, admitting the impossibility of complete foreknowledge of the consequences of many activities, and granting that a highly technical, overpopulated world must continue to take risks with natural resources, an "early warning system" for unwanted consequences is extremely important. We do not have such a system at present.

* * *

Firmly established criteria and standards for environmental quality are necessary to give industry a basis for planning and action.

* * *

Federal Government scientific activities are not yet channeled to support announced goals in pollution abatement. There is no organization or coordinating group capable of systems analysis

and broad management of Federal projects. Insufficient funding has made support of research spotty and disproportionate among problem areas. Agency missions may inhibit long-term and comprehensive ecological studies. "Pollution" can cover an enormous variety of Federal agency programs ranging from water resources research to agricultural engineering. Limitations of definition will be necessary for effective program coordination.

These and other conclusions which can be reached about our capability to understand the complex interrelationships of society and the environment have generated a flurry of proposals aimed at remedying various aspects of the problem. It is my view that we must now examine all these proposals to identify those elements that are essential for a coherent and realistic national program. Our own attempt to achieve an overview has resulted in the conviction that an integrated three-part approach is necessary. It is my hope that the presentation which follows will contribute in a meaningful way and help bring the dialogue into focus.

I. NATIONAL ASSOCIATION OF REGIONAL CENTERS FOR ECOLOGICAL STUDIES

The expansion of human population and onrush of technology, two phenomena long in developing but only recently the items of widespread concern, are causing us to reassess man's role as a component in the systems of nature. Repeated testimony, before your Subcommittee and elsewhere, gives clear evidence that many of our activities are changing the environment in fundamental and profound, but often unknown ways. Unfortunately, this realization is generally produced through a painful process of hindsight, and yet the development of principles sufficient in depth and scope to predict the consequences of many decisions that face us lags well behind our growing recognition of their need. Perhaps the central challenge of our times is to provide the understanding that will enable us to establish and maintain harmonious relationships between human society and its rapidly changing environment.

In large part the failure to achieve an adequate understanding of these matters stems from man's tendency to separate, and treat as independent, various aspects of the natural system. In a most extreme pattern man considered himself apart from nature. Examples of more subtle patterns are found in the consideration of animals apart from plants, cities apart from rural areas, energy apart from pollution, and many other erroneous distinctions.

We now know, although only in the barest essentials, that all of the living and nonliving components of the natural system, including man, exist in an interrelated, web-like relationship, and that an unfavorable alteration of one strand in the web may have profound effects on the system as a whole.

Institutional mechanisms directed at achieving an understanding of the ecosystem and making it relevant to public activity are lacking in our social organization. The structural weakness of the I.B.P. is a case in point. We must tap the intellectual resources at our disposal, principally in universities and research laboratories, and develop a process which will make possible the interdisciplinary study of ecological systems. The Smithsonian Institution feels that these resources

are presently available in adequate, although minimal, strength—and that a framework must be developed within which they can function.

To create this framework we advocate the establishment of a non-mission-oriented, neutral, independent organization which, through the development of a national network of research centers would:

- (1) Develop an integrated foundation of knowledge in ecosystem science, with emphasis on society and its total environment.
- (2) Establish an ecological information storage and retrieval system.
- (3) Stimulate education and training in ecosystem science.
- (4) Perform advisory services regarding the ecological impact and consequences of proposed action programs affecting man's environment.
- (5) Disseminate ecological knowledge as a basis for the harmonious development of human society and its sustaining environment.

It is to be stressed that only with independence can the resources that exist in the universities and private sector be fully utilized and the all-important goals of synthesis and objectivity be achieved.

One working model for the creation of an organization meeting these standards has recently been proposed by the Ecological Society of America (ESA) in its testimony and submitted statement before this Subcommittee. The Smithsonian Institution agrees in principle with the concepts outlined in this presentation, but believes that the ESA proposal must be developed and expanded, particularly in terms of integration between the public and private sectors.

If a regional pattern of university-based consortia is to be successful, it will inevitably require substantial financial and technical assistance from both the federal and private sectors. It is therefore necessary that the organizational structure provide for intimate cooperation among universities, federal agencies, industry, private foundations, and other relevant organizations. Cooperation of this nature is essential for the rapid advance of ecological knowledge which must underlie the quality control of our environment.

We are convinced that the programs and resources of the Smithsonian are extremely relevant to the objectives of a national program in ecosystem ecology. Throughout its history the Smithsonian has played an important role in the genesis of many new organizations. It has served as the spawning ground and home in adolescence for many undertakings, which upon reaching sufficient maturity came to stand on their own strength; the Weather Bureau, the National Bureau of Standards and the Bureau of Commercial Fisheries are all examples. The Smithsonian has no desire to see an organization of this nature centralized and inserted as a Bureau of the Institution. However, there is merit in considering that the Smithsonian (1) serves as the initial home of such an association on a temporary basis and (2) participate as a permanent and integral component through affiliation and partnership in a "consortium" approach. Through these means the Smithsonian Institution could contribute valuable and possibly otherwise unattainable assets.

Through its unusual character as a basically private Institution with strong governmental relationships, the Smithsonian can help provide the synthesis so critical to the successful creation of a national association of regional centers. Furthermore, the Smithsonian could help provide administrative support, including legal services, which will be so vital in the early stages of the association's development.

In our view, the basic concepts of an association of regional centers for ecological studies include: (1) a cybernetic system of research, education, and communication of information to society, (2) interdisciplinary and interinstitutional integration focused on contemporary ecological problems, (3) a network of regional university-based consortia, and (4) an ecosystem approach focused on man and his total environment. We would welcome the opportunity to join with Congress, the Ecological Society, private institutions, and universities across the land in meeting the challenges which confront this enterprise.

II. MANDATE FOR MISSION-ORIENTED ECOLOGICAL RESEARCH IN THE FEDERAL AGENCIES

The quality control of our environment is largely determined by the policies and activities of the various federal agencies whose concern is the management of the nation's natural resources. It is now clear that the exercise of this responsibility requires a strengthening of authority and financial support for the conduct of ecological research as a foundation for the management of these resources. A report prepared by the National Academy of Sciences for the National Park Service is illustrative of the problems involving ecological research that exist in one natural-resource agency of the Government. It is submitted that the conclusions reached in the NAS report apply in general to the policies and programs of the Fish and Wildlife Service, the Bureau of Land Management, the Federal Water Pollution Control Administration, the Forest Service, the Soil Conservation Service, the Public Health Service, the Atomic Energy Commission, the Federal Power Commission, the Tennessee Valley Authority, and others.

It is acknowledged that there exists in statutory authorizations many directives for scientific research of various types of these agencies. Nowhere, is there a clear expression of the requirement for integration through an ecological approach in the research. These agencies should be granted explicit authority and sufficient funds to conduct ecological research and directed to coordinate existing research authorities into a mission-oriented ecological research program to provide, as applicable, the following items:

- (1) An ecological survey and inventory of the lands and resources controlled or responsible for.
- (2) An ecological analysis of problems in operational or regulatory management, administration, and planning resulting from, and contributing to, *inter alia*, program policy, visitor use, demographic, economic, social, and technological change as may relate to resource and landscape use and development.
- (3) Cooperative planning with other Federal, State, and local agencies that administer or regulate the use of natural resources.

(4) The maintenance of selected areas under agency jurisdiction for representative, baseline ecological research, and

(5) Encouragement of research within the areas of jurisdiction by universities, private research institutions, and qualified independent investigators.

Furthermore, each mission-oriented, natural-resource agency of the Federal Government should be directed to establish a coordinator, or otherwise designated office: (1) to assist in the planning and coordination of research efforts within the department or agency and (2) to act as a point of contact for department or agency coordination with a Presidential advisory group and with the national association of regional centers for ecological studies described above.

III. A PRESIDENTIAL COUNCIL OF ADVISERS ON ENVIRONMENTAL QUALITY

The Smithsonian Institution believes that there is a need for a council in the Executive Office of the President to perform certain important roles for the President and the executive branch of the Government. Foremost among its functions, this council would: (1) advise and report regularly to the President on federal programs concerned with our environmental relationships and (2) assist in the formulation of national policy to preserve, protect, and improve the environment. Secondly, this council must: (1) act as a liaison between the various federal agencies that have responsibilities over certain aspects of the environment and (2) insure that the policies and programs set by the President are accomplished in an efficient and complementary fashion. As an alternative to the *de novo* establishment of this council, it could be developed as a specific function within the President's Office of Science and Technology.

If this Nation is to produce the kind of programs that are so widely recognized as necessary, neither the scientific community nor the public at large can afford selfish competition in finding a solution to the conditions which exist. This is the underlying position of the Smithsonian Institution and we look forward to working with your Subcommittee and all other concerned individuals and groups in achieving this goal.

In an effort to be constructive toward this end, may we suggest that your Subcommittee convene a conference at a suitable location near Washington to bring together a representative cross-section of outstanding individuals concerned with ecosystem science in an effort to narrow the range of alternative programs available and reach accord on a mutually satisfactory position. This would represent politics in its most progressive form and would be enthusiastically received, not only by those who participate, but by society at large. The Smithsonian Institution would be happy to assist in the administrative preparation for such a conference and would share some of the expense. It is further suggested that the Smithsonian facilities at Belmont, Maryland (descriptive brochure enclosed) might be suitable for such a conference. We would be happy to assist in developing a list of conferees that would incorporate the cross-sectional representation we think would be necessary.

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STATEMENT OF MAURICE K. GODDARD, SECRETARY OF FORESTS AND
WATERS, COMMONWEALTH OF PENNSYLVANIA

Mr. Chairman, Members of the Subcommittee, I am Maurice K. Goddard, Secretary of the Pennsylvania Department of Forests and Waters, and I welcome the opportunity to appear before you as you review the environmental pollution situation as it exists in this country today.

The Commonwealth of Pennsylvania, gentlemen, has more than its share of environmental pollution. It is a Commonwealth where our forefathers, far-removed and not-so-far-removed, feasted on a heavy banquet of natural resources and threw the bones under the table for posterity.

We probably cannot blame these empire builders for the destruction they wrought—they were riding the wave of industrial expansion and growth, and since the Commonwealth's supplies of coal, lumber, oil, and water seemed inexhaustible, they had few, if any thoughts of conservation and orderly development.

While their activities most certainly helped to make Pennsylvania the great industrial and mineral-producing State that she is, and contributed immeasurably to our national growth and economy, the simple fact of the matter, gentlemen, is that their past gluttony and lack of foresight have placed the Commonwealth in a position today of facing the future with a marred and disfigured face and an acute case of acid indigestion.

Being a forester by profession, I could more easily describe the devastation and destruction of Pennsylvania's forest areas by the lumber barons of the last century, and the long and painful period of recovery which is just now bringing our forests back into production. I am, however, going to limit my remarks to Pennsylvania's present mine drainage and mined land reclamation problems.

Both are massive, both are inhibiting our economic growth, and both will continue to do so in the future unless we meet them head-on today.

Judge for yourselves, gentlemen—the past six generations of Pennsylvanians have imposed about a 2 billion dollar burden on the present generation. Of this figure, slightly less than a billion dollars is the amount estimated that present and future generations will be saddled with for operation and maintenance of the projects and facilities necessary to do the job. This is what we estimate it will cost to rid our some 3,000 miles of adversely affected streams of mine drainage pollution.

These streams receive approximately 2,750 tons of acid per day from a mine water discharge of about 964,000,000 gallons. Roughly 75% of this flow emanates from abandoned deep mines.

On the reclamation side of the ledger, it has been estimated that over 300,000 acres of land have been disturbed by coal mining operations. This includes the huge accumulations of debris from deep mining operations, as well as the surface scars of strip mining operations.

When I first came to the Department of Forests and Waters as Secretary in 1955, everybody was discussing the effects of these problems on the State's economy with apprehension and dismay. The stock opinion was that they were too massive to be solved, and hence, we might as well accept them as necessary evils which would always be with us.

It is true that, back in the WPA days, some work was done on the sealing of abandoned mines. This program met with varying degrees of success, but was not followed up. It is also true that chemical reactions causing the formation of acid were understood at an early date, and hence, certain possible methods of abating acid pollution were known. In addition, it was evident that there was no single "cure-all", and that each individual situation would probably call for a different combination of techniques and methods.

In short, the fact that there was no single or simple solutions fostered the opinion that these inherited problems were, from both the economic and technical standpoint, too insurmountable to be tackled.

Now, gentlemen, I have never believed these criers-of-doom for an instant, and quite frankly, I got awfully sick of listening to them!

When I was a boy in New England and was faced with a problem for which I could see no ready solution, my grandpappy would invariably quote two common axioms—one of these was "Can't, never tried" and the other was "Where there's a will, there's a way!"

I won't say that his advice necessarily lessened my frustration at the moment, but I have never forgotten it, and I feel that it is just as true today as it was then.

Now, I would be quite remiss if I did not point out that great progress has been made in the Commonwealth since 1945 in the control and abatement of pollution from active mining operations and in the reclamation of surface areas affected thereby. For example, of the over 300,000 acres disturbed by coal mining operations, approximately 93,000 acres have been completely reclaimed and part of the remainder has been partially reclaimed.

Progressively since that date, through the process of passing new legislation and amending old laws, our General Assembly, prompted by the very evident desire and intent of Pennsylvania's citizens that stream pollution and surface disturbances caused by mining operations be controlled and eliminated, has given us the most effective legislative tools in the country with which to do the job.

For example, the 1965 amendments to our Clean Streams Law completely removed exemptions previously granted for certain mine drainage conditions and placed all mine drainage in the same category for regulation and control as industrial wastes. No mining will be permitted if discharges from mine areas will be, or will become, injurious to the public health, animal, or aquatic life; or prevent the use of waters for domestic, industrial consumption or recreational purposes.

Under the Clean Streams Law and other pertinent mining legislation, responsibility for administration, regulation, and enforcement are shared by the Sanitary Water Board of the Department of Health and the Pennsylvania Department of Mines and Mineral Industries.

I believe that I can safely say, gentlemen, that with effective implementation and administration of these laws, the adverse conditions

stemming from active mining operations are now under control and will be eliminated. Our future generations may be assured that our mining activities of today will not compound our inherited environmental pollution problems.

As I stated earlier, however, the later are massive and must be corrected now, or Pennsylvania's economy will continue to suffer from their effect. In order to correct these conditions, we have four basic needs.

The first of these is money; the second is additional trained personnel; the third is additional research which I will qualify later; and the fourth is effective direction and coordination of effort.

Taking these needs in order the citizens of Pennsylvania recently passed a Constitutional Amendment authorizing the creation of a \$500,000,000 Land and Water Conservation and Reclamation Fund, \$200,000,000 of which is to be used by the Department of Mines and Mineral Industries to reclaim abandoned strip mine areas, eliminate abandoned deep mines as sources of acid mine drainage, and to mount an all-out attack on other problems arising from the mining of coal—subsidence, underground mine fires, as well as, the elimination of burning and non-burning culm piles.

I am happy to announce that, on January 19, 1968, Governor Shafer signed into law enabling legislation necessary to implement the Land and Water Conservation and Reclamation Fund. This action immediately released initial funds necessary to begin implementation of some of our planned projects and programs. Twenty "quick-start" projects, including 12 mine drainage treatment projects, 4 burning refuse bank projects, 3 underground mine fire projects and 1 major mine subsidence project were planned and were ready and waiting.

You will recall that I mentioned there is about a 2 billion dollar burden imposed on the present generation by the past six generations of Pennsylvanians. This figure is the estimated cost of implementing *Pennsylvania's 10-Year Mine Drainage Pollution Abatement Program for Abandoned Mines*. Obviously, the \$200,000,000 available from the Land and Water Conservation and Reclamation Fund, while it will enable us to take a sizeable bite out of the program, certainly falls far short of what is needed to complete the work. Matching Federal dollars are urgently required to extend Pennsylvania's ability to complete this program, which is divided into four phases: (1) locating sources of pollution; (2) engineering studies and plans; (3) construction, which includes the least-cost combination of following techniques, sealing deep mines, burial of acid forming refuse, backfilling, diversion of water seeping into mines, regulation of streamflows, and treatment; and (4) operation and maintenance.

Incidentally, substantial progress has already been made toward the completion of the first phase.

While we are on the subject of money, we strongly suggest that the Congress take a long, hard look at the relative size of the Federal Budget for our space effort in comparison to the amount of funds being provided for the correction of the environmental pollution problems which beset many sections of this country. We question, too, the relative size of the budget for research on various desalinization processes as compared to that for water pollution control.

While we recognize that there are beneficial spin-offs from these more glamorous programs, we respectfully submit that a better balance in Federal funding is urgently needed.

I cannot emphasize too strongly, gentlemen, that the correction of the environmental pollution problems associated with abandoned mines is not solely a Pennsylvania problem—they affect many other States. Because of the number of States affected, polluted streams are not respecters of State boundaries, and because the detrimental effects of these problems affect not only the State but also the National economy, these are National problems as well.

There are many people who will tell you that it is wrong to spend public moneys on correcting these problems—that an attempt should be made to locate the owners of the abandoned workings, or that the present coal industry should be saddled with correcting the sins of their long-gone brothers.

The simple fact of the matter is that, while we might agree that we would prefer that somebody else shoulder the burden, it is virtually impossible to trace these former owners and absolutely impossible to legally fix responsibility in those cases where the workings were abandoned prior to the passage of laws regulating mine drainage and requiring reclamation measures.

Of course, where it is possible to rectify the ills on past workings in conjunction with active mining operations, it is often possible to do so much cheaper with the cooperation of those in the private sector engaged in active mining.

I am not going to say too much about the need for additional trained personnel and technicians. This is a problem facing virtually every major program where technical skills and know-how are required, and failure to attract and utilize fresh technical blood could seriously delay our program.

Our hope is that the research programs which will be conducted by our colleges and universities will furnish additional specialists in this area. Most certainly, engineering personnel from allied fields, such as sanitary engineering, mine engineering, and hydraulic engineering, should lend their expertise to this work.

The third need—the need for research—is the one which I said I intended to qualify to some extent.

By this, I meant that our technicians in Pennsylvania are firmly convinced that many of the techniques and methods necessary to abate mine drainage and reclaim ravaged areas are already well-studied and well-understood.

Further, that research in these areas, except perhaps to find ways of reducing costs, is not urgently needed—we have adequate tools to begin and actually correct the problems now.

On the other hand, we do not deny that additional research is needed to find ways of lowering costs, to find ways of refining our cruder methods and to develop new approaches or techniques in certain areas.

I emphasize, however, that we do not need to delay our start for these.

The specialized areas where additional research is obviously needed would include: (1) research on the effects of auger-mining, (2) the study of the techniques of mining, and (3) the acid production which

might be expected to result from application of these techniques and from different seams and associated formations.

Work in some of these research areas is already progressing and descriptions may be found in *Résumés of Mine Drainage Research Programs Sponsored by the Coal Research Board of the Department of Mines and Mineral Industries*. (Available in committee files.)

Further, there is an urgent need as research continues on some of the items contained therein for demonstration projects to determine the practicality of the methods that have been developed.

Also of interest is an excellent report on the *Status of Mine Drainage Technology* by E. A. Zawadzki, as presented by James F. Boyer of the Bituminous Coal Research, Inc., Monroeville, Pennsylvania, before the U.S. Committee on Public Works, Subcommittee on Air and Water Pollution, July 13, 1967. (Available in committee files.)

The fourth need—the need for effective direction and coordination of effort—is a real knotty one.

Here, we have quite a number of suggestions, and we feel constrained to point out that the role played by the Federal Government in these areas has been inadequate, too unwieldy, too slow, and their efforts have not only been too diversified, but have duplicated those already covered by the States.

The Federal agencies which have been involved thus far have felt that they must start from the beginning and, while this is probably a good way to train personnel, the past work of the States in the same areas has largely been ignored.

An excellent example of this was a number of demonstration projects initiated by the FWPCA which were never completed.

We suggest that, if it is necessary for the Federal Government to be actively involved in the abatement of mine drainage and in the reclamation of surface-mined areas in the individual States, then one Federal agency with manpower and facilities to collect, store, catalog, map, and abate mine drainage should be established at once.

Making one agency accountable for the program will prevent duplication of work and channel efforts of various cooperating groups in the proper direction. This would certainly be more economical and effective than the present duplication of effort.

Actually, the major effort in the abatement of mine drainage and reclamation—including research and pilot projects—has, to date, been made by the individual States.

The Federal Government programs have been hampered by poor coordination and duplication, particularly in studies and in misdirected efforts.

In Pennsylvania, the State agencies and the mining industry have contributed manpower, information, and pioneered research with little help from the Federal Government. Some of the programs have in reality been funded twice by the State through Federal funds and by State funds.

In fact, it is our feeling that large Federal administrative units are not needed to carry out these programs in the individual States.

Since the expertise already exists within the States—in the State agencies, in the State Universities, and the mining industry—we feel that we are far enough ahead so that, if an influx of Federal funds is directed to the State agencies, universities, and the private industrial

research sector, these environmental pollution problems can be solved and corrected in the shortest period of time. We would hope, too, that these funds would be made available with a minimum of Federal agency restrictions and approvals with regard to the type of research to be carried out.

In your report to your parent committee, entitled *Environmental Pollution—A Challenge to Science and Technology*, 89th Congress, Second Session, Serial S, there is a statement on page 29 to which we must take strong exception. The statement that grieves us is the one that reads: "Mine drainage, whatever its effect on environmental quality, should not have funds spent on action programs until more palatable and sensible solutions can be devised."

You will recall that I indicated that our technicians in Pennsylvania are convinced that many of the techniques and methods necessary to abate drainage are already well-studied and understood, and that a combination of these techniques and methods can effectively solve the problems.

We grant that some of these techniques and methods, when applied, are quite expensive and that more research is needed to lower their costs or to develop cheaper alternative methods and techniques.

We do not, however, believe that we should delay action programs while waiting for such research to be carried out, or until "more palatable and sensible solutions" can be devised.

Even though the tools we have available at the present time may be expensive, we simply cannot afford to procrastinate any longer.

Our citizens are demanding immediate action and we are well aware of the fact that the Commonwealth's economic future is, in a large measure, dependent on completing the job as soon as possible.

As an example of exactly what I mean, let me tell you a little bit about what we are doing at our Moraine State Park in Butler County, Pennsylvania. This work is described in *Model Coal Mined Land Rehabilitation, Moraine State Park, Butler County, Pennsylvania*. (Available in committee files.)

Located in the Moraine State Park is the first strip mine reclamation project to be approved and carried out anywhere in the Appalachian Region under the Mining Area Restoration Section 205, of the Appalachian Regional Development Act of 1965, P.L. 89-16. The reclamation work at this park was approved in August of 1965 by the Appalachian Regional Commission, and actual work was begun on June 12, 1967. The entire project will cost about \$219,000 for back-filling and revegetating 177.5 acres.

This particular park, which is currently under construction, is in an area badly disturbed by mining. The total acreage of the park is 15,999 acres and we expect to make it a "showcase" and demonstration area for coal mined land rehabilitation in the Commonwealth of Pennsylvania and in the Nation.

The cooperative efforts of the Pennsylvania Department of Forests and Waters and the Department of Mines and Mineral industries are being channeled into a number of projects in the area which will eliminate and control the harmful effects of past coal mining operations. These projects will restore the aesthetic appearance of the areas within the park disturbed by mining and insure that the 3,225-acre

Lake Arthur to be created in the park will not become a "dead sea" from mine drainage pollution.

It is our hope that this park with its \$14,000,000 recreation area will become the Mecca for almost 2,000,000 visitors annually by the year 1975.

Some of the rehabilitation work is already well underway, but we have no illusions as to the magnitude of the job.

The environmental damage associated with deep and surface mining to be controlled and eliminated within the park area is: (1) acid drainage from underground and strip mines; (2) deep mine refuse piles and disfigured landscape riddled with over 100 mine openings; and (3) the stark and sterile spoil piles left in strip mined areas devoid of protective vegetation cover.

In short, gentlemen, we have in this area virtually every possible type of environmental damage.

The steps we intend to take to eliminate and control these harmful effects of past mining operations are: (1) the sealing and closure of deep mine openings to abate mine drainage; (2) the treatment of mine drainage which cannot be abated; (3) removal and burial of mine refuse piles; and (4) regarding and revegetation of strip mine spoil piles.

Also a recent *Summary and Status Report on Mine Land Rehabilitation Projects* being undertaken jointly by my own Department and the Department of Mines and Mineral Industries. (Available in committee files.)

This listing includes, in addition to another description of the work being carried out at the Moraine State Park, the status of other projects throughout the State.

You will find a short description of the Experimental Mine Drainage Treatment Plant which is being developed and which will be operated by the Pennsylvania State University for the Pennsylvania Coal Research Board of the Department of Mines and Mineral Industries at Hollywood in Clearfield County, Pennsylvania. This facility will be used to obtain urgently needed engineering and economic data and will be capable of treating between 1½ million to 1 million gallons of mine drainage per day, using the lime neutralization process. The design of the plant has already been completed and initial construction is underway. Completion of this vital effort is estimated to cost over \$1,000,000 and is dependent upon receiving matching funds from the Federal Water Pollution Control Administration. These funds have been sought since December, 1966.

I would be remiss if I did not emphasize the magnificent work already done by researchers at The Pennsylvania State University. For example, a development by the University through State sponsored research in 1965 introduced a procedure to employ coal to treat polluted water at negligible costs which is being used by industry today.

Further, a summary of the complex nature of the mine drainage pollution problem and approaches to its solution has been presented by researchers at the University and was described to the Congress in 1967 by Representative John Saylor (Pa.). Reference is made thereto: Congressional Record—House, April 20, 1967, pages H-4410-19.

Recognition of the seriousness of the mine drainage pollution problem was emphasized at the University with the establishment of a Mine Drainage Research Section in January, 1968.

Another item in your subcommittee report which bothered us was an intimation that, where technology is not clearly available, enforcement agencies should not set up standards beyond the limits of that technology.

We respectfully submit that standards, goals, and objectives should not be limited by technology, but rather should be based on the public need and welfare. Further, if they are used as goals, they serve to keep the pressure on those concerned to improve technology and come up with new and effective answers.

Now, obviously, Pennsylvania's recent statutes have put the coal industry on notice, and I will be perfectly frank in saying that they are not only fighting for survival, but that they are doing an excellent job of it by stepping up their research and improving their technology to meet their specific mine drainage problems.

I believe that you will be interested in article included in Pennsylvania's Clean Streams brochure for the summer of 1967 which describes how the coal industry is moving on the treatment of mine drainage. (Available in committee files.)

While we are on the subject of industry, we suggest that, even with the excellent job the industry is now doing, their vast technical knowledge could be even more greatly utilized to the benefit of all concerned if a method of furnishing financial incentives could be devised.

In conclusion, gentlemen, I cannot emphasize too strongly that Pennsylvania is not waiting for a cure-all for her acid indigestion, or for a new and cheaper face-lifting technique for her disfigurement. Rather, we are proceeding with the techniques and methods we have now to assure our citizens of a better tomorrow.

It is significant that, in the Pennsylvania State Supplement to the Appalachian Water Resources Plan being prepared by the U.S. Army Corps of Engineers, we have recommended as an emergency and top-priority project, 6 mine drainage pollution abatement and land reclamation projects covering either major areas of the Commonwealth or in connection with other projects which would be worthless if these problems were not solved before their construction.

What we do, and what we learn, in Pennsylvania will obviously help our sister States in solving similar problems but frankly, gentlemen, we need help, both financial and technical, from every possible source.

The Commonwealth is moving, gentlemen, and we are dropping the gauntlet to the Federal Government to match our effort without delay.

STATEMENT BY WESLEY E. GILBERTSON, DIRECTOR, BUREAU OF ENVIRONMENTAL HEALTH, PENNSYLVANIA DEPARTMENT OF HEALTH

I wish to associate myself with the very excellent statement for your Committee prepared by a fellow Pennsylvanian, Dr. Maurice K. Goddard, Secretary of the Department of Forests and Waters.

As Director of Environmental Health for the Commonwealth's Department of Health, control of environmental pollution represents a major area of responsibility for me and the Bureau staff. For the purpose of the record, I would like to emphasize the actions being taken by Pennsylvania to prevent and control water pollution due to mine drainage. During the past year, we have processed and approved several hundred mine drainage applications for permits which include provisions for treatment by the operators of mines so as to neutralize acid and remove iron from the discharges. These permits, covering installations now in active operation throughout the State, range in capacity from a few hundred gallons to hundreds of thousands of gallons per day. Thus, with respect to discharges from active mines and those being proposed, we believe that we have technologies which are economically feasible.

Discharges from abandoned mines, however, still constitute a serious economic question. In order to tackle this massive pollution problem, the Department of Health has prepared a "Ten-Year Mine Drainage Pollution Abatement Program for Abandoned Mines." This program describes in general terms the extent and character of the problem and provides preliminary estimates of cost of abatement, utilizing available technology. A copy of this report is attached.* It should be noted, however, that this report was issued on March 1, 1967. Since that time additional information has been developed which indicates that the total cost of abating pollution from abandoned mines in Pennsylvania will approximate \$1 billion. It is hoped that this information, together with that submitted by Dr. Goddard, will be useful to you in adjudging the availability of technology for pollution abatement with respect to pollutional discharges from mines.

I appeared before your Committee in the course of its previous hearings in 1966 and believe that your efforts in assessing research development and technology with respect to environmental pollution are of great benefit to the country. At the time of my previous appearance before you, I was in charge of the Department of HEW's new Solid Waste Program which had been underway only a few months before the hearings. Since that time I have become Director of Environmental Health in Pennsylvania. In my previous testimony I strongly emphasized the interrelationship between solid waste pollution problems and air and water pollution. I pointed out that satisfactory solutions to pollution control in any one phase of the environment must provide for adequate consideration for and protection of other phases of the

*The report referred to may be found in the Committee files.

environment. Our day-to-day experiences in Pennsylvania serve to strongly reinforce this conviction. Certainly there is a clear-cut need for adequate coordination and balancing of the respective functional areas and programs dealing with prevention and control of environmental pollution. Even more important may be the systematic analysis of future waste management requirements and comprehensive planning to meet over-all environmental objectives within economic feasibility. During the period ahead we will be attempting to apply this concept, not only on a statewide basis but with greater specificity in certain smaller geographical areas. Inherent in this process will be the use of improved systems analysis methodology. Much is being said about this field, but the actual application of this approach will require considerable experimentation.

As Chairman of the Committee on Environment (membership list attached) of the American Public Health Association, I wish to emphasize the views of the Committee as expressed recently on the subject of priorities for Federal Research and Development funds. Considering the substantial and growing problems in the field of environmental health and environmental pollution control, including those which are particularly serious in the more congested urban centers, the Committee feels that in the future a higher priority for Federal R & D funds should be accorded this area. The Committee is well aware of the implications of the R & D efforts relating to the space program and defense but feels that the future needs for achieving a livable environment will necessitate a larger share of available Federal R & D funds. In this connection it would be desirable to establish clear-cut sets of environmental objectives, with time tables, so that both mission-oriented and nonmission-oriented R & D projects might be assessed in terms of their contributions toward the accepted objectives.

For the information of your Committee I might comment on the extent of application of new air pollution control processes relating to sulfur which are now undergoing evaluation in Pennsylvania:

(1) A pilot plant was installed in 1967 and is now operating at Pennsylvania Electric Company's Seward Power Station to make use of the coal cleaning operation as a method for obtaining sulfur removal. The objective of this process, which appears attainable, is to remove from 60 to 70% of the total sulfur in coal during the pulverization and cleaning process and before combustion.

(2) A prototype plant began operation in August 1967 at the Portland generating station of Metropolitan Edison Company which may be characterized as a "catalytic conversion" process. This process has the objective of removing the following from the fluegas: 99.5% of particulate matter; 90% of SO_2 ; and 99.5% of sulfuric acid. The plant produces sulfuric acid as a byproduct.

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STATEMENT OF DAVID M. GATES, DIRECTOR, MISSOURI BOTANICAL
GARDEN, ST. LOUIS, MO.

Ecology is a very complex, difficult basic science. It is a holistic science that incorporates all other branches of science and for this very reason is less specific and more diverse. Ecology is the very epitome of science itself. The ecology of terrestrial natural history involves an understanding of man and of the biota and environment of the planet Earth. Ecologists have been very few in number, the science of ecology is relatively new, and basically it has only begun to flourish as a brilliant intellectual discipline. The potential for ecological thought and ideas is enormous.

The vast number of applications for ecology to the welfare of man is both a challenge and a threat. Every single activity of man perturbs an ecosystem that was different prior to the hand of man. Man exploits and uses the energy and resources of ecosystems and finally wishes desperately to understand and manage the ecosystem through rationale. Man replaces complex, stable ecosystems with monocultures which are subject to a potential instability. The demands on the ecologist for advice with respect to the management of ecosystems is enormous and yet it is the complexity of the problems which makes it so apparent that ecologists are too few with too little information and method.

Never in the history of mankind have ecologists received the support and inducement comparable with the complexity and diversity of their subject matter. Ecologists, for reasons often beyond their control, have been able to only dabble in the science of ecology. By virtue of constraints within the educational system, by traditions, and by other limitations (some fiscal), the ecologists have been unable to cope with the enormity of ecological problems. This statement can be spelled out explicitly in terms of methodology, equipment, data handling, and basic analytical technique. Ecology requires a strong theoretical structure which is built on an erudite understanding of biological systems, a deep understanding of individual organisms, a grasp of molecular and evolutionary principles, and a thorough application of mathematical techniques. Few, if any, ecologists have ever received such training. It is crystal clear that modern science is absolutely capable of producing ecologists of this calibre.

The ecologist can advise well and demonstrably concerning a wise course of action with regard to many of man's pressing environmental problems. Yet the ability of the ecologist to give the "best" advice is often limited by the complexity of the problem. Two types of individuals are desperately needed for the immediate future: the ecologist who is trained as a basic scientist with as much of the knowledge of science (physics, chemistry, mathematics, biology, and sociology) as possible, who will work on the fundamentals of ecology; and the environmental engineer who is trained as the applied scientist to direct his effort towards the management of environmental problems con-

fronted by man. This is not to say the ecologist, trained and interested in the fundamentals of the science, will not take an interest in the environmental problems of man. Indeed, he will. It does not say the environmental engineer will not learn something of the fundamentals of ecology. Indeed, he should and will. It merely emphasizes that the science of ecology and the problems of environment are so complex that it is entirely unreasonable to expect too few to do much with too little. We have run out of time and as a nation of great technology and scientific achievement we can and must correct the situation. To expect the professional ecologist to have done otherwise in the past or to expect a solution to come without a strong impetus and directive from national policy is unreasonable. The following recommendations are made as some of the possible means to correct the situation and the trends.

1. Vigorous support of basic training and of research programs in ecology. One to three ecologists per major university are far too few. Ten to twenty ecologists might be reasonable per university.

2. Emphasis on theoretical ecology as a challenging intellectual discipline which will attract theoretical physicists and chemists and applied mathematicians to the fold; but it is axiomatic that they must understand biology just as the astrophysicist is trained in physics and understands astronomy.

3. Establishment and support of ecological research centers which emphasize an understanding of specific ecosystems.

4. Training of applied ecologists to be known as environmental engineers with the same kind of relationship to ecology that engineers have to physics.

5. Recording and understanding the natural history of the planet Earth before it is too late. Complete documentation of all ecosystems must be done. This cannot wait for another generation or two or we will never know what the relatively undisturbed biota of many parts of the world were like. It is nearly too late now to understand many regions in their undisturbed state. It is also important to continue to record and understand various ecosystems throughout all stages of disturbance and change.

6. Preservation of the plants and animals of the world in the large systematics collections of the museums and herbaria. These great natural history collections contain the voucher specimens of the diverse flora and fauna of the world as evolution brought them into the twentieth century. It is primarily by use of the systematics collections that the biologist can understand the threads of evolution. Systematics collections are the bench marks of natural history and indeed the cornerstones of biology. The great systematics collections must be treated as one of our most precious commodities, yet they have been seriously abused and disregarded. They must be supported well.

7. Preservation against all encroachment of certain natural areas for future study and collecting. These areas should include representation of basic ecosystems such as rivers, lakes, ponds, forests, sand dunes, estuaries, prairies, tundras, etc. It should be self evident that we should not be the last generation to have available for study relatively undisturbed ecosystems. Future generations should have the

opportunity to learn natural history as well as to learn the lessons of history.

8. Preservation of gene pools of living plants and animals within botanical gardens and zoological parks. These gardens and parks are important repositories of living organisms, not only for the public to see and enjoy, but for students and scholars to study and to understand.

STANFORD UNIVERSITY SCHOOL OF MEDICINE,

STANFORD MEDICAL CENTER,
Palo Alto, Calif., March 4, 1968.

HON. GEORGE P. MILLER,
House of Representatives,
Washington, D.C.

DEAR MR. MILLER: H.R. 7796 by Representative John D. Dingell has come to my attention. I strongly favor any actions by the Federal Government that will contribute to a heightened level of concern and involvement on the part of this nation in addressing itself to problems associated with the impact of the population explosion and the technological revolution on the environment of the earth.

It is my personal belief that there should be a key involvement on the part of the nation's educational institutions, and that within the colleges and universities this involvement should have a strong interdisciplinary character.

I have suggested to Representative Dingell that the words "educational institutions" be inserted somewhere in lines 1 or 2, on page 2 of H.R. 7796. He has responded that it is his "intention that educational institutions play a major role * * *." He has suggested that I make my views known to you.

I retain my belief that explicit reference should be made to "educational institutions" in the bill, perhaps not only in the vicinity of line 1 or 2 on page 2, but also around line 22 on page 4. I believe, as a scientist (physicist) that the resolution of the environmental problems before us will call for a broad application of talent. Within the universities I believe that, whereas the contribution of science and engineering will be crucial, the resolution of issues relating to the quality of life must draw upon the talents of all individuals with social concern who care to become involved. The words "educational institutions" it seems to me would cover it.

With great respect for the efforts of Representative Dingell,
Sincerely,

SIDNEY LIEBES, JR.

CORNELL UNIVERSITY,
DIVISION OF BIOLOGICAL SCIENCES,
Ithaca, N.Y., April 1, 1968.

Mr. RICHARD A. CARPENTER,
Senior Specialist, Science Policy Research Division, Legislative Reference Service, Library of Congress, Washington, D.C.

DEAR MR. CARPENTER: In reply to your letter of March 20, I shall try to answer your questions.

1. I enclose a xerox copy of a question and answer giving the figure 130 curies per day. This is from the magazine "Scientist and Citizen" published by the Committee for Environmental Information, 5144 Delmar Boulevard, St. Louis, Missouri 63108. The Committee includes a number of prominent scientists and has a National Science Advisory Board of which I am proud to be a member. We try very carefully to screen out anything that might be successfully challenged, and nobody has challenged that statement.

Furthermore, calculations from independent data lead to the same figure for a boiling water reactor of that size. Also from independent sources we can estimate that the radioactivity put into the atmosphere would consist of about 20 curies of tritium with most of the remainder being ⁸⁵Krypton. I'm sure you know that, although the modern definition of a curie is 37 billion disintegrations per second, this corresponds closely to the activity of a gram of radium. In terms of biological hazard, of course, radium is the most dangerous with tritium being much more dangerous than Krypton.

I sent back the transcript of the hearing and can't recall just what was said about England discharging high-level radioactive wastes to the sea. As I recall, Chairman Miller asked if that were not the case and I replied that I had heard such a report. A cursory search of my files shows that a 1958 statement from the British Windscale reactor reports that they were releasing into the Irish Sea "several hundred millicuries of alpha-emitters a day." This is extremely vague but one can guess that it refers to ⁹⁰Strontium which is indeed a "high-level radioactive waste." Also, presumably, this antedates the accident at Windscale which released to the atmosphere large quantities of ¹³¹Iodine—perhaps the potentially most dangerous reactor accident that has occurred to date (although the accident in the Fermi reactor, 30 miles from Detroit, on October 5, 1966 is said to have released "some radioactivity" to the atmosphere—I have been unable to learn how much of what was released). I really don't know anything about England's disposal of radioactive wastes; it's difficult enough to learn anything about what's happening in this country.

2. I stated that I was not overly happy with my calculations of the oxygen balance in the atmosphere but I'll outline my procedure since you asked. If you want to pursue it further I'll be happy to send the detailed equations of the combustion formulas assumed.

(a) After months of careful study of all available data I published an estimate in *Scientific American* (April, 1958) that the net annual production of plant material for the earth amounts to 5×10^{17} kilocalories. This corresponds to the annual release of 1.43×10^{17} grams of oxygen. Since then a number of leading students of the subject have told me that they are convinced this is the correct figure, so I'm quite satisfied with this.

(b) The surface area of the earth is $510,101 \times 10^3 \text{ KM}^2$. Thus the 1.43×10^{17} grams of oxygen is produced on $5.1 \times 10^8 \text{ KM}^2$ or an average of 2.8×10^8 grams per square kilometer.

(c) The area of the 48 coterminous United States is $9,363,389 \text{ KM}^2$. This includes our deserts, cities, mountains, etc. It is more productive of plant life than many parts of the world but much less productive than tropical forests or large areas of the sea. If we assume it to be average for the world it would annually produce 2.62×10^{15} grams of oxygen.

(d) The 1966 U.S. petroleum production corrected for imports and exports amounted to 3,628,366,000 barrels of 42 gallons each. We assume a specific gravity of 0.9. This amounts to 5.19×10^{14} grams. Following a petroleum chemist, I take its average composition to correspond to the empirical formula C_7H_{12} (this assumption can be varied widely without noticeably affecting the result). I assume it to be completely oxidized to carbon dioxide and water (this is fair enough because the unburned hydrocarbons spilled and emitted to the atmosphere are eventually oxidized). This oxidation would consume 1.73×10^{15} grams of oxygen.

(e) I (arbitrarily) lump coal and peat together and find for the 1966 U.S. production, corrected for exports, 4.24×10^8 tons or 3.85×10^{14} grams. Assuming 10 percent to be non-combustible and to remain as ash, this gives 3.46×10^{14} grams oxidized annually. Let's assume its composition to be CH (again, the conclusion is insensitive to wide variations in this assumption). This would consume about 1.08×10^{15} grams of oxygen.

(f) For natural gas our 1966 production was 17,116,826 million cubic feet or 3.66×10^{14} grams. We can with negligible error take this to be entirely methane (CH_4). Its complete combustion would consume 1.46×10^{15} grams of oxygen.

(g) For the natural gas liquids our 1966 production was 19,682,722 thousand gallons or 3.66×10^{14} grams. Taking the average composition as C_4H_{10} (again insensitive to variations), its combustion would consume 1.73×10^{15} grams of oxygen.

If we add together these four figures for oxygen consumed we get 4.46×10^{15} grams per year which is 170% of the 2.62×10^{15} grams produced by photosynthesis, indicating that we are vitally dependent on oxygen brought in from outside the coterminous United States by atmospheric circulation.

You asked about the land area of the U.S. occupied by urban society. According to the 1967 H.E.W. Task Force report (A Strategy for a Liveable Environment—"the Linton report" p. 18): "Today, there are 140,000,000 people living on 35,000 square miles of land." This is just about 1% of the total area of the coterminous states including bodies of water.

The figure I presented of one million acres per year being removed from photosynthetic productivity is a commonly used figure which is undoubtedly conservative. It corresponds to a square of slightly under 40 x 40 miles. It is half the area under concrete in the National Interstate Highway System. It doubtless greatly underestimates the amount of land lost annually to dumps, parking lots, shopping plazas, and mine pits and tailings—not to mention over 1.25 million new housing units started in 1966 and the areas put out of production by pollution.

I hope this information will be of use to you.

Very sincerely yours,

LaMONT C. COLE,
Professor of Ecology.

NUCLEAR POWER: IS IT SAFE?

DEWITT, N.Y.

DEAR EDITOR: How can we be sure that the power reactor being built in our area satisfies reasonable safety requirements, (accidents, waste, etc.)? We would like (a) a general answer, for any part of the U.S., (b) specifically, for the Niagara Mohawk Power Co. of N.Y.

Mr. and Mrs. F. R. ROHRLICH.

The power reactor in question is the Nine Mile Point Nuclear Station under construction by the Niagara Mohawk Power Company on the shore of Lake Ontario, about seven miles northeast of Oswego, New York. When completed, this would be the largest nuclear reactor ever built for civilian electric power, although other still larger reactors are being planned for other sites. It will produce about 525 million watts of electrical energy; the fuel will consist of about 100 tons of uranium.

In such a reactor, small amounts of radioactivity will be released into the water of Lake Ontario, and into the air from the reactor's smokestack. Although the amounts of radioactivity are small, there remains a definite risk, for any amount of radioactivity does some damage to living things. Niagara Mohawk estimates that the maximum amount of radioactivity released from the smokestack during normal operation will be about 130 curies per day (a curie is the amount of radioactivity of one gram of radium). About one-fiftieth of a curie will be released each day to the waters of Lake Ontario. These levels are well below the standards established by the Atomic Energy Commission, but the question of their safety is actually more difficult to resolve.

In the absence of adequate information on the effects of radiation, it is difficult to set safety levels. As in the problems of fallout, there are also complicating questions created by the fact that levels of radioactivity that are low to start with may be concentrated by plants and animals, eventually appearing in human food at higher doses than would be otherwise expected. Little information on the movement of radioactive substances through the living environment has been available, and as a result, the setting of safety standards for radioactive emissions has been necessarily somewhat arbitrary.

More recently, additional information on the levels of radioactivity in areas surrounding nuclear reactors has become available, which should make possible at least the beginnings of an effort to evaluate AEC standards against the risk which is actually present. A coming issue of *Scientist and Citizen* will summarize our current knowledge in this area.

The possibility of a serious accident must also be considered. Should even a small proportion of the radioactive fuel of a reactor be released to the atmosphere, the results would be catastrophic. Such an event could occur if the rate at which fission is proceeding in the fuel elements were to increase beyond the safety level. This would result in enormous overheating of the reactor core, followed by melting or cracking of the structures which contain the uranium. A cloud of highly radioactive gases would be released which would then move with the wind, doing enormous damage until it dispersed.

The Atomic Energy Commission bears the responsibilities for seeing that both normal operating hazards and the risk of a major accident are kept to a minimum. This is done by locating reactors in relatively unpopulated areas, and by seeing that they are designed to minimize risk. The Nine Mile Point Station is

situated only seven miles from Oswego, a town of about 23,000, so that design considerations are paramount, for should any major release of radioactivity to the air occur, the city of Oswego would be seriously endangered.

Because of the time and expense involved in building a nuclear power reactor, construction is usually begun before the design of the reactor is complete. A power company which wishes to build a reactor applies to the AEC for a construction permit, submitting preliminary plans. The AEC then prepares its own analysis of the proposal, and a public hearing before a specially constituted Licensing Board is held.

In the case of Niagara Mohawk, such a hearing was scheduled for December 15, 1964. Instead, however, a private conference among the applicant, the licensing board and other interested parties was held on this date, and the public hearing was postponed until January 15. Following the hearing, the findings and conclusions of the licensing board were made public, and a construction permit was granted. The findings and conclusions of the Licensing Board were written by the applicant, Niagara Mohawk Co., and were accepted with only minor changes by the AEC.

At some future date, Niagara Mohawk will submit final design plans for the reactor, and the AEC will decide whether or not to grant an operating permit.

In the near future, S/C will publish an analysis of normal operating hazards from nuclear reactors. In our April, 1964, issue we discussed in detail the accident hazard from the then proposed Bodega (California) reactor, which has since been abandoned. We plan a more general treatment of this problem, with special attention to reactors which are projected for the near future, such as Niagara Mohawk's Nine Mile Point Station.

CONSOLIDATED EDISON CO. OF NEW YORK,
New York, N.Y., April 16, 1968.

Hon. EMILIO Q. DADDARIO,
*Chairman, Subcommittee on Science Research and Development,
House of Representatives, Rayburn House Office Building,
Washington, D.C.*

DEAR MR. DADDARIO: Your letter of March 8th asked that we provide your subcommittee with certain data relative to the economics of air pollution control. The information requested is submitted herewith in the hope that it will be useful in your studies. If you have questions or need additional data, please do not hesitate to so advise us.

Inasmuch as equipment to remove sulfur oxides from flue gas has not been sufficiently developed to permit its use on large generating units, we have been utilizing low sulfur fuels to reduce sulfur oxide emissions. During the past fuel year (April 1, 1967-March 31, 1968) we have been converting to coal and oil with a sulfur content of 1%, which compares with a permissible sulfur content of 2.2% under the New York City Air Pollution Control Code. Prior to this change, our coal cost approximated 33¢/MM Btu; it is now more than 37¢/MM Btu. Our residual oil formerly cost 33¢/MM Btu; with a 1% sulfur content, it also has now increased to more than 37¢/MM Btu. Based on estimated generation for the year 1968, these increases will add about \$15,000,000 to the electric system fuel bill and about \$2,000,000 to our central steam system fuel costs. Our electric and steam rates include an adjustment for changes in the cost of fuel whereby customers' bills reflect such modifications.

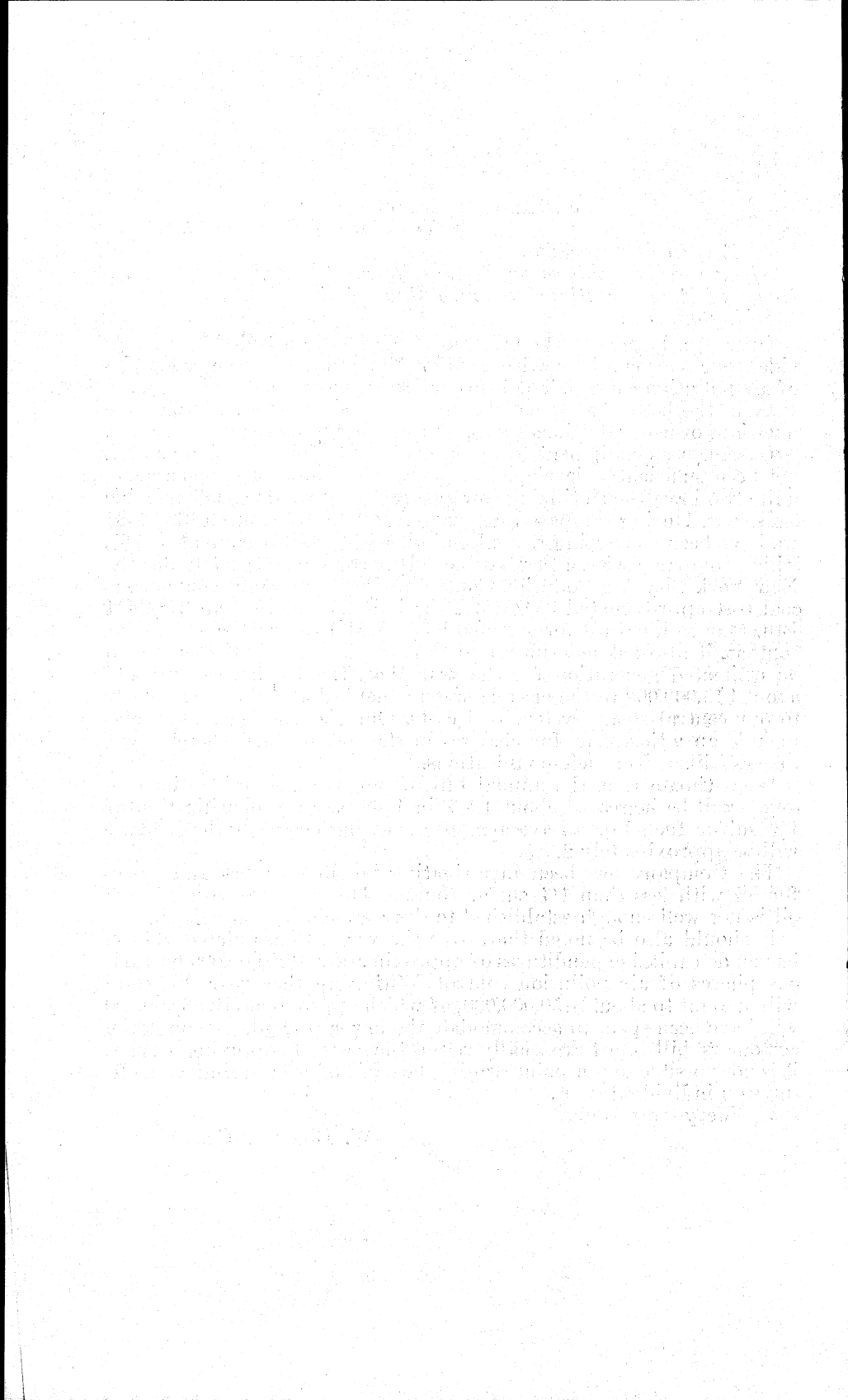
We estimate that the annual bill of our average residential customer will be increased about 1.5% in 1968 because of utilization of 1% sulfur fuel. For an average space heating customer the increase will be approximately 2.5%.

The Company has been investigating possible sources and prices for oil with less than 1% sulfur content. However, the cost of such oil is not well enough established to draw conclusions at this time.

It should also be noted that, over the years, Consolidated Edison has made capital expenditures of approximately \$126,000,000 on various phases of air pollution control. Within another year this total will amount to about \$150,000,000, of which approximately \$3,500,000 will have been spent to accommodate the low sulfur oil. Although the customers' bills must eventually reflect the costs of supplying service, it is not possible to pin-point readily the effect of such capital expenditures on individual rates.

Very truly yours,

W. DONHAM CRAWFORD.



APPENDIX C

Letters Concerning H.R. 13211

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(557)

THE ROCKEFELLER UNIVERSITY,
New York, N.Y., November 3, 1967.

HON. JOHN V. TUNNEY,
House of Representatives,
Washington, D.C.

DEAR SIR: This is to acknowledge receipt of your letter of October 25 concerning HR 13211, the "Ecological Advisors Act of 1967."

I have read the bill and the speech you made on the floor of the House on September 27, 1967. In my opinion, your statement of the problem is one of the best, if not the best, that I have ever read. I was particularly gratified to notice your concern with the fact that we deal with environmental problems in an ad hoc episodic manner, whereas it is certain that we shall not be able to solve the problems that are before us unless we take much longer range views of the ecological situation. I hope that the Council of Ecological Advisors might contribute to the formulation of an integrated approach to environmental problems.

Yours sincerely,

RENÉ DUBOS.

(558)

EASTMAN KODAK Co.,
Rochester N.Y., November 6, 1967.

HON. JOHN V. TUNNEY,
*House of Representatives,
Congress of the United States,
Washington, D.C.*

DEAR CONGRESSMAN TUNNEY: Although it has been my privilege to give testimony on a number of occasions on proposed legislation, I cannot remember a single instance when, even though I favored the proposed bill, I did not have at least minor modifications to suggest. Consequently it is a real pleasure to tell you that I am enthusiastic about H.R. 13211, and would strongly urge its enactment, as one of the most important and constructive actions which the Congress and the President can take.

The proposed action in establishing a Council of Ecological Advisers parallels the recommendation of the Linton report, "A Strategy For a Living Environment," and I believe is sufficiently urgent to move ahead of other legislation which is likely to come from that report. The placement of such a Council at the level proposed is essential to give it the importance and visibility needed for the vital job assigned to it. I served on the National Advisory Committee for Environmental Health to the Public Health Service (and am a member of its sequel, the National Advisory Council on Disease Prevention and Environmental Control) at the time responsibilities for water pollution were transferred to the Department of the Interior, and while understanding the influences involved, was dismayed at the further fragmenting of responsibilities in the attack on our total environmental health problem. Similarly, I have followed closely the "mix" with respect to ionizing radiation between the Atomic Energy Commission and the Division of Radiological Health (now the National Center for Radiological Health) in the separation of "occupational" from "public" responsibilities.

It was my privilege to serve as a member of an ad hoc Office of Science and Technology Committee to stimulate, in the 1950's, a much more realistic attack—and organization—by the Public Health Service in environmental health activities. From those meetings, the Gross Report was engendered—with such results as an escalating effort in air pollution—with a budget of four million in 1960 to sixty-four million in 1967.

That the effort should not and cannot be relegated solely to the federal government seems most important to me. In the 1950's when I was a member (and later Chairman) of the Council on Occupational Health of the American Medical Association, I repeatedly urged the Board of Trustees to mount a major activity in environmental health—and when a Council on Environmental and Public Health was established in 1963, I was asked to chair it, and have continued in that capacity. We have conducted four annual and major Congresses on Environmental Health, and plan for our Fifth Congress

next spring, a constructive and critical evaluation of the Linton Report, and an exploration as to how we can get greater and more meaningful involvement of the medical profession. Too, the Council in a joint partnership with the National Center for Air Pollution Control, has held one Conference, and will conduct another Conference on the Medical Effects of Air Pollution in Denver next July. Our first meeting, last year in Los Angeles, attracted some 500 experts from many foreign countries as well as the leaders in the United States and Canada.

There has been a most gratifying response from industry in the control of environmental health hazards, once the story was effectively presented. I serve as Chairman of the Environmental Health Advisory Committee to the Manufacturing Chemists' Association. Within that organization alone, thousands of industry people have received training, through many workshops conducted on water pollution and air pollution control and occupational health. A substantial research program has been developed, and individual industries have been stimulated to action. There's much yet to be accomplished, of course, but there is substantial acceleration.

The need for support from an enlightened and motivated citizenry in the attack on air pollution has been noted frequently. Many of the "citizen groups for clean air" in communities lacked a support base and an organized and sustained effort. I chaired a subcommittee for the National Tuberculosis Association to consider this matter, and from our recommendation has evolved the National Air Conservation Commission, with such eminent members as John Charles Daly, Barry Commoner (Director, Center for the Biology of Natural Systems, Washington University), Leslie A. Chambers (Director, Allen Hancock Foundation, University of Southern California), John Logan (President, Universal Oil Products Company), Athelston Spillhaus (President, Franklin Institute), George R. Taylor (Economist and Secretary, Staff Subcommittee on Atomic Energy and Natural Resources, American Federation of Labor-Congress of Industrial Organization), and others. The Commission is developing a program through which the 1500 affiliate Tuberculosis and Respiratory Disease organizations across the nation will serve as foci for community organization and action against air pollution. In December we are convening representatives from thirty or more of the "big city" associations to emphasize action immediately at that level. It is my privilege to serve as Chairman of the National Air Conservation Commission.

Last week I presented a proposal at the Annual Meeting of the American College of Preventive Medicine for the establishment of a National Council on Hazardous Physical and Chemical Agents. This organization, patterned after the National Council on Radiation Protection and Measurements, would serve as the scientific and professional body for developing *criteria* for agents other than ionizing radiation. The National Council on Radiation Protection and Measurements, chartered by Congress, is composed of eminent scientists and professionals, nominated only by professional and scientific organizations. Industry, government, labor, and universities are not represented as such, but the National Council on Radiation Protection and Measurements contains a well balanced composition from all those groups. When the Federal Radiation Council was established by

Presidential order, it was admonished to consult with the National Council on Radiation Protection and Measurements on scientific matters.

Such a body would establish *criteria*—with the responsibility of government to establish *standards*—accepting or rejecting the proposed criteria as a basis. We might avoid such crises as occurred recently with the Public Health Service Sulfur Dioxide Criteria. Had these criteria been developed by an eminent and independent scientific body, they would have had a much higher degree of sanction and acceptance. With such a council providing the scientific interpretation, a Council of Ecological Advisers would be helped in integrating the other factors, social, economic, political into the kinds of recommendations our society needs and must have.

I am sure that when you sent me your letter you didn't expect such a fulsome reply. This background, however, may give some added weight to my enthusiastic endorsement, and my encouragement to press forward with your proposed legislation. In fact, I feel so deeply about the urgency of these problems that I'm changing my base of action, by taking an early retirement from Kodak (next February 1) and becoming Professor and Chairman of the Department of Environmental Health in a new School of Public Health in Houston, Texas. The new school will be a part of the University of Texas system and will be located in the Medical Center in Houston.

I shall be pleased to do anything I can to advance the proposal which you have made. I'm enclosing two examples of my "missionary" efforts to create an awareness of the serious job ahead.

Sincerely,

JAMES H. STERNER, M.D.,
Medical Director.

UNIVERSITY OF SOUTHERN CALIFORNIA,
ALLAN HANCOCK FOUNDATION,
Los Angeles, Calif., November 9, 1967.

HON. JOHN V. TUNNEY,
*House of Representatives, Longworth House Office Building,
Washington, D.C.*

DEAR MR. TUNNEY: You are most correct in your assumption that concern for environmental quality has brought me into contact with several federal agencies and offices. In each there has been found sympathetic understanding of the need for a total ecological systems approach to management alternatives, but in none has there resided sufficiently comprehensive legislative authority to encompass the whole interlocking network.

In spite of this deficiency in existing governmental machinery this University, and a handful of others throughout the country, are in process of structuring interdisciplinary programs of graduate education and research designed to develop a "technology of complexity" related to the urban environment, and to produce a new breed of environmental managers. You can imagine the difficulties involved in activation of a horizontal administrative structure against the traditional vertical disciplinary grain. At USC the new program is called the Institute of Urban Ecology. It is proceeding with about 15 graduate students from a variety of professional and academic schools, under the combined and enthusiastic tutelage of a strong volunteer faculty representing systems analysis, demography, social sciences, engineering, medicine, public administration, the law, architecture, planning, the natural sciences and other areas. Progress has been slow thus far, primarily because funding must be secured in the form of multiple grants each of which must conform to the categorical mandates of the respective granting agencies. It is most difficult to sustain a central coordinating professional staff under such circumstances. However, the need for the Institute's potential products is so evident that we must find ways of accomplishing our objectives.

For this reason, among others, your bill (H.R. 13211) and your related remarks are most welcome. By some means the government must contrive analyses of ecological systems involving man, and assure a capability for generating logical sets of optimal choices available to urban managerial decision makers. The Council of Ecological Advisers you propose, if sufficiently comprehensive in breadth of competencies represented, and if constituted to avoid undue restraint by members committed to specific categorical programs, would provide the Executive and the Congress with objective recommendations which could result in effective coordination, or the creation of alternative federal mechanisms.

Senator Muskie, some months ago, sent me a copy of a bill in which he proposed that a council be set up within the Senate, comprised of

selected members from each of the relatable Senate Committees, to consider for two or three years the total environmental quality control needs and make legislative recommendations. I have no information as to the fate of his proposal; probably it has come to your attention.

The urgency of the need for ecological analysis of our urban systems seems to be recognized by almost all responsible and thoughtful people; the means of doing it in the face of a proliferation of governmental agencies fundamentally geared to cope with bits and pieces of the complex network, is certainly not obvious. Those of us seriously concerned with the problem are delighted to learn of your interest and efforts.

Perhaps it would be possible for you to visit the U.S.C. campus when you are back in California, to discuss with our very dedicated group both your proposal and our plans. In fact, we would be most pleased to have you associated with the Institute of Urban Ecology as a member of the Advisory Council. Senator George Murphy has accepted such an appointment. The Council provides one of the mechanisms through which the Institute relates directly with local, state and national governmental and legislative processes.

Thank you for acquainting me with your proposal and be assured of our support in any well considered actions related to environmental management.

Sincerely yours,

LESLIE A. CHAMBERS,
Director, Allan Hancock Foundation.

ATON FOREST ECOSYSTEM RESEARCH STATION,
Norfolk, Conn., November 11, 1967.

Hon. JOHN V. TUNNEY, M.C.
House Office Building, Washington, D.C.

DEAR MR. TUNNEY: Thank you for your letter of November 7th, with a copy of your Bill, and your statement in the Congressional Record on p. H 12604 et seq.

I whole-heartedly and unqualifiedly endorse your Proposal, and your approach as exemplified in your statement on the Floor of the House.

You will find strong support for this Council, I believe, in Dr. Dillon Ripley, Secretary of the Smithsonian Institution, and Dr. Helmut K. Buechner, Head, Office of Ecology of the Smithsonian. Several of their speeches in the last few years point out the need for a new and greatly enlarged view toward "ecology", which itself had had too many *specialist* devotees.

I shall follow the progress of your Bill with great interest.

Sincerely,

FRANK E. EGLER.

NATIONAL TUBERCULOSIS ASSOCIATION,
New York, N.Y., November 13, 1967.

HON. JOHN V. TUNNEY,
House of Representatives,
Congress of the United States,
Washington, D.C.

DEAR CONGRESSMAN TUNNEY: We appreciate your inviting our comments on your proposed bill, H.R. 13211.

I believe that any organization concerned with pollution of the environment is aware that the solution to the problem is too huge to justify continued fragmentation of efforts. It seems to us that the time is ripe for the type of national council of advisers your bill proposes.

Dr. James Sterner, Chairman of the National Air Conservation Commission which was created by our organization, has sent us a copy of his letter to you in which he personally endorses H.R. 13211. Dr. Sterner's many years of experience with scientific groups which have been working on this problem speaks for his qualifications to comment on the subject and we are glad to be able to add our approval to his.

Sincerely yours,

JAMES E. PERKINS, M.D.,
Managing Director.

(565)

UNIVERSITY OF ILLINOIS,
CENTER FOR HUMAN ECOLOGY,
Urbana, Ill., November 16, 1967.

Congressman JOHN V. TUNNEY,
Congress of the United States,
House of Representatives,
Washington, D.C.

DEAR CONGRESSMAN TUNNEY: I have your letter of November 3 in which you request that I comment on H.R. 13211. I brought your letter and its attachments to the attention of the members of the Committee on Human Ecology of the Ecological Society of America at its meeting of November 13-14.

We decided that "Ecological Advisors Act of 1967" was sufficiently important to demand a supporting statement from the Committee as a whole. We shall prepare this statement, obtain the necessary approval of the Executive Committee of the Ecological Society of America, and then transmit it to you for whatever use you may deem appropriate.

If you should also find it useful to have separate opinions from the individual members of this Committee, each has agreed to respond to a request from you. The names and addresses of these men are attached.

Yours sincerely,

FREDERICK SARGENT, II, M.D.,
Chairman, Committee on Human Ecology, ESA,
(*Director, Center for Human Ecology*).

(566)

UNIVERSITY OF CALIFORNIA,
Berkeley, Calif., November 20, 1967.

HON. JOHN V. TUNNEY,
Longworth House Office Building,
Washington, D.C.

DEAR MR. TUNNEY: I appreciate the opportunity of reading your proposed "Ecological Advisors Act" and your speech explaining the purpose of the act.

Pollution of the environment, air, land and water, is of the greatest importance. It poses a threat to the health and even the life of all living things, including man.

The threat of radioactivity is so dramatic that it is carefully monitored. The dangers from pesticides, herbicides, toxic fumes, detergents and many other products of civilization are equally great, but in contrast to radiation the effects are insidious, slow and undramatic. It is for this reason that, as you suggest, a central agency whose sole duty would be the study of pollution in general would serve a very useful purpose.

With best wishes for the success of your bill, I am

Sincerely,

JOHN H. NORTHROP.

(567)

HUGHES AIRCRAFT Co.,
Culver City, Calif., November 21, 1967.

HON. JOHN V. TUNNEY,
38th District, California,
Longworth House Office Building,
Washington, D.C.

DEAR CONGRESSMAN TUNNEY: I have read with interest and approval the print of HR 13211 which you provided, and your speech of September 27, 1967, which introduced the measure to Congress. I endorse the principal thrust of your proposal and will be interested to observe its progress.

In your letter of November 3, you request comments and reactions to the proposal. I have a few observations, as follows:

1. The wording of HR 13211 emphasizes the role of advice and counseling to the Executive Office by the Council, with no mention of the possible advocacy of legislative proposals. However, I judge it probable that legislation will eventually be required on some ecological questions where present jurisdiction, in the public interest, is either non-existent or imprecisely distributed among several executive agencies or departments. The Council should be authorized to submit to the President, for his consideration and possible forwarding to the Congress, legislative proposals upon any matter directly pertinent to the achievement and maintenance of appropriate environmental quality.

2. It is unfortunate that HR 13211 specifically identifies "sonic booms" as the only example of environmental noise. I do not regret or oppose public interest in the matter of sonic booms, but I do think it undesirable to highlight them as a particular villain. The Bill would be improved by the deletion of the parenthesis on lines 8 and 9 of page 3.

3. Finally, I would suggest to you that the performance of the Council would be enhanced if it had the participation of some of the agencies and departments whose views it must know, understand, and consider, and which the Council must hope to influence. I suggest that the Council be authorized to summon pertinent testimony, documentation, and proposals from any agency of the Federal Government directly concerned with the environment.

Sincerely yours,

ALLEN E. PUCKETT.

LITTON SYSTEMS,
Minneapolis, Minn., November 22, 1967.

HON. JOHN V. TUNNEY,
*U.S. House of Representatives,
Washington, D.C.*

DEAR SIR: The October 1967 issue of *Environmental Science and Technology* makes mention of H.R. 13211 ("The Ecological Advisors Act of 1967"), which you recently introduced in the House of Representatives.

I am in complete agreement with this proposed legislation, since I firmly believe that a comprehensive ecological approach, one stressing cost/benefit as well as cost/effectiveness, represents the only intelligent response to our total environmental problem. Furthermore, our organization has a definite interest in contributing to national programs relating to ecological monitoring, analysis, control and management.

I would appreciate receiving a copy of your bill and being placed on your mailing list for information relating to hearings held on this topic.

Very truly yours,

ROY E. PETERSON,
Manager, Advanced Systems Programs.
(569)

GENERAL ELECTRIC CO.,
Philadelphia, Pa., November 27, 1967.

HON. JOHN V. TUNNEY,
*House of Representatives,
Congress of the United States,
Washington, D.C.*

DEAR MR. TUNNEY: This relates to your invitation to comment on HR 13211, the "Ecological Advisors Act of 1967."

I believe the concept of total ecological planning is most timely. As you probably are aware, we are due for some serious re-thinking on the nature and consequences of our scientific and technical activities. This is due to an explosive increase in knowledge and capabilities to influence and change the ecology of the planet. When we can rationally think of weather modifications on a continental scale, when inter-continental aircraft speeds become of the same magnitude as the speed of the sun, when exploration of the radiation belts surrounding the earth induces permanent alteration of these belts, then, indeed, the capabilities and projections of science and technology become an appropriate concern for national policy review.

I believe that technical solutions can be found to the problems of air pollution, water pollution, solid waste, atmospheric radiation, environmental noise, etc., and I believe that a council of ecological advisors could make a major contribution in outlining the major concerns and stimulate solutions to these problems. I would think that existing bodies dealing with science and technology and their impact from a technical point of view, such as the National Academy of Sciences, the National Academy of Engineering, and the President's Scientific Advisory Committee and other similar bodies would have major contributions to make.

I, therefore, think the Bill is most appropriate at this time and I am wholehearted in favor of it.

Sincerely yours,

LEO STEG,
Manager, Space Sciences Laboratory.

(570)

STATE OF COLORADO DEPARTMENT OF PUBLIC HEALTH,
Denver, Colo., November 29, 1967.

HON. JOHN V. TUNNEY,
*Member of Congress,
Longworth House Office Building,
Washington, D.C.*

DEAR CONGRESSMAN TUNNEY: I hope you will pardon my delay in replying to your letter of October 25 relative to the "Ecological Advisors Act of 1967."

At first thought it would appear to be a mistake to add yet another echelon of federal government to the already overly complex structure; however, on further study of your proposal the creation of such an Ecological Council seems to have a great deal of merit. I think you are correct in your assumption that such a Council could eliminate much duplication in the study of environmental problems and by proper coordination expedite the solution of some of the problems affecting the environment. Hopefully some of the fragmentation of programs such as those pertaining to water pollution, radiological health and pesticide hazards could be corrected. Such a Council could study the entire environment and make recommendations to the President; the Congress; and administrative agencies on needs and activities. We feel it is important that the Council itself not become involved in administration of the actual programs but serve entirely as a study and advisory group.

If you have not done so, I wish to suggest that you send a copy of the Bill to Dr. John H. Venable, President of the Association of State and Territorial Health Officers, Georgia State Department of Health, Atlanta, Georgia, and ask for an opinion of the Executive Committee of this organization. I think you should also seek the opinion of the American Public Health Association and the American Medical Association.

I am taking the liberty of sending a copy of your letter and my reply to the Honorable John A. Love, Governor of Colorado, and to the Colorado members of the U.S. House of Representatives.

Sincerely,

ROY L. CLEERE, M.D., M.P.H.,
Director of Public Health.
(571)

UNIVERSITY OF CALIFORNIA, LOS ANGELES,
Los Angeles, Calif., November 30, 1967.

Mr. JOHN V. TUNNEY,
*Congressman, 38th District, California,
Longworth House Office Building,
Washington, D.C.*

DEAR MR. TUNNEY: I was pleased to receive your recent letter, and to learn of your proposed legislation regarding environmental quality control.

The arguments you present for creation of a Council responsible to the President are cogent and persuasive. The problems and concerns touch many agencies of the government and facets of our society.

You will find strong support for your proposal among many individuals and organizations concerned with the deterioration of our environment and its effects on health and on quality of life. A minor question concerns whether the designation as a Council of Ecological Advisors would adequately convey to the public the aims and goals of such a group. From the proposed legislation, it is clear that the interests are principally directed towards the impact of environmental deterioration on man, and one wonders if the advisors might be designated something as a council of advisors on the human environment.

Again, I would like to emphasize the need for a program such as you have mentioned and to voice appreciation for your thoughtful leadership in the area. Our society needs means of bringing problems, their possible solutions, and their long range implications clearly into focus for discussion and action. I hope you are successful in bringing your proposed legislation to fruition.

Very truly yours,

P. D. BOYER,
Director, Molecular Biology Institute.
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JET PROPULSION LABORATORY,
Pasadena, Calif., December 4, 1967.

Hon. JOHN V. TUNNEY,
House of Representatives,
Longworth House Office Building,
Washington, D.C.

DEAR CONGRESSMAN TUNNEY: The matter of environmental control with which you have concerned yourself in HR 13211 is unquestionably one of vital and immediate concern. If we and following generations are to continue to utilize the national resources for industrial, agricultural, domestic and recreational purposes, and if we are to do this in a manner which will enrich our lives as citizens, we must take the appropriate steps to prevent degradation and wasteful exploitation of our environment. There are legal and technical means today to prevent the most gross fouling and pollution of the nations resources, but there are almost no mechanisms to anticipate or control the more subtle, but equally wasteful effects from interaction within an ecosystem. Even where individuals and organizations foresee adverse consequences for their locale, they find no mechanism to deal with their problem on a regional basis—the only basis which encompasses all the detriments. Thus, there is a need to provide local authorities and advisory bodies with scientific and technical information to support their efforts in developing and maintaining a clean, healthful environment for use and enjoyment of their citizens. This legislation is the necessary first step. The problems I see are threefold: one of education, one of organization, one of authority.

Ecology, while a familiar concept to scholars, is not a household word. It correctly identifies the scientific discipline which deals with environmental problems towards which this legislation is directed, but the public is generally not aware of the strong interactions and secondary influence of the various elements that create an ecosystem.

This should not detract from the wisdom of an educated legislature examining the problems and finding solutions. I point this out to direct your attention to the need for public information in this area. Exologists, like rocket scientists prior to the passing of the Space Act that created NASA, understand their particular problems but in isolation from the public. Regrettably, the strongest motivation for public attention is a national crisis. It is fortunate, of course, that we have not yet had an environmental crisis. In fact, we may never have an environmental crisis with impact comparable to Sputnik I. It is in the nature of environmental decay that the healthy state is lost in relatively small bits and pieces until the damage comes to public attention after it outweighs our capacity for corrective action. This complicates the task of arousing the general state of public complacency before the national need is even more acute. Perhaps, then, one of the major jobs of the Committee would be to assess the methods of public education in this area.

(573)

A second concern is one of organization. The nine-man council your bill proposes should avoid the problem of communications which frequently plagues councils with too many members and results in less productivity. The only problems I see with the council are recruitment and selection, finding the proper leadership, obtaining the strong commitment of time and energy from members, and providing a strong supporting staff. We have in NASA a similar high level planning board, the Lunar and Planetary Missions Board. We were fortunate in getting some of the richest scientific talent in the country. Many of these individuals have had past association with the space programs and so identification was not a great difficulty. Locating appropriate individuals for the Council of Ecological Advisors may be more difficult since they may require an even broader scope than the space scientists. Solely to understand their duties the members will deal with environmental problems which touch upon meteorology, marine biology, biochemistry, geography, forestry, soil science, and more, for this is the fabric of which ecology is made. Furthermore, relating ecology to man's welfare involves engineering, economic, community planning, health sciences, psychology, etc. The nation has spent a great deal of time, effort, and money to train our engineers and scientists in the inter-disciplinary specialties needed for the space program. Undoubtedly there will emerge a new breed of scientist who is some hybrid between classical ecologist, practical engineer, and waste disposal administrator.

Among the duties posed for the Council of Ecological Advisors is to "seek long-range solutions to environmental and ecological problems created by both man and nature." This implies to me capabilities and resources which would not appear to be available to the Council itself. It should be within the resources of the Council to identify such problems, but the solutions, as you emphasized in your speech before the House of Representatives on 27 September 1967, rest on an understanding of the environment which we do not yet entirely possess. The necessary scientific appreciation of the full scope of environmental interaction must be gained within an institution or institutions which have laboratory research capabilities and the means to test proposed solutions to specific problems.

The last problem I see is one of authority. My concern is that the Council while having the responsibility for reporting, advising, coordinating, promoting and gathering information, will feel the need for some authority. I realize this is an executive affair and that this bill may be only a first step in the long road of legislative corrective measures to restore and preserve the national environmental resources. However, it is probably not too early to consider how a next step can be taken to provide the necessary authority.

Whatever the scope of authority, I believe the actual results of the Council will be more of prevention than correction. Once a practice has been established, it is most difficult to reverse. On the other hand, we are certainly headed for some new ecological problems that can be rectified if we can understand them and act upon this knowledge. What will be the secondary and tertiary environmental and economic results of the large-scale uses of herbicides, the changes in salinity of fresh water likes, the removal of stand of timbers, heating of stream waters? The secondary and tertiary effects alone will be significant. Lo-

cating these new relations before they become problems and suggesting solutions is likely to be the most effective activity of the Council. The emphasis must be on inter-relationship among many aspects of the environment. Only with such an emphasis will adequate knowledge and adequate planning be mustered to solve ecological problems. Without such breadth of view, new solutions may only beget new problems: a roadway to solve transportation problems can endanger irrigation water from a watershed, which in turn may alter pesticide use, which in its turn disrupts recreational use of lakes and streams, followed by loss of property values and tax loss leading perhaps to federal monies being used for relief programs, etc., in a cascade of costly pallatives when planning could have secured mutual benefit for transportation, agriculture, recreation, real estate, etc.

Clearly, we cannot continue to ignore our nation's ecological problems, when misunderstanding or lack of understanding, poor planning or lack of planning costs money and reduces the quality and potential enjoyment of life; when costs of cleanup, emergency relief, tax support of abnormally high maintenance, and loss of revenue from water use, soil depletion, and mineral wastes continue to extract an unnecessary toll.

One way that the council could bring into focus the magnitude of the problem is to assess the financial loss from environmental neglect. This could be useful to emphasize the real economic loss and to muster aid in enforcing the current laws, while equally important, providing a basis for evaluating various measures of control and prevention. Figures frequently appear on the costs to the public of air pollution and water pollution but to my knowledge there is no agency that is responsible for the official set of figures supporting the broad basis of economic loss resulting from unplanned interaction with the natural environment.

In spite of this somewhat lengthy reply, I am by no means an expert in this area. I hope, however, that the foregoing will prove to be of some small assistance to you and, in any event, I want to thank you for your interest in my opinion.

Sincerely,

W. H. PICKERING,
Director.

NEW YORK UNIVERSITY MEDICAL CENTER,
New York, N.Y., December 5, 1967.

HON. JOHN V. TUNNEY,
House of Representatives,
Washington, D.C.

MY DEAR MR. TUNNEY: I have received your letter, copy of H.R. 13211, and the speech you gave in the Congressional Record bearing on this matter.

I have, on several occasions, with the Spillhouse Committee Report, Federal Council of Technology and the Linten Committee, urged the desirability of having, at the Presidential level, an advisory council for general oversight on a national basis of Federal concerns in the area of environmental pollution.

Your proposed council of "Ecological Advisers" goes directly to this point; the need is real and urgent. We have already lost a number of battles in fighting environmental pollution and will lose still more, unless some such mechanism is devised. In my view, there are two major circumstances which make such a group imperative. Responsibility for the maintenance of environmental quality cannot be fragmented according to (1) the geography of political subdivisions, or (2) the specific responsibilities of separate Federal agencies. These problems, almost without exception, cross both political boundaries on the one hand, and departmental divisions on the other. The council should be in a position to minimize difficulties arising from these two major handicaps. In addition, as you very eloquently suggest, the council is badly needed to provide a group in which an adequately long view of national needs is maintained.

In many instances, major projects cross departmental lines involving, for example, the Departments of Health, Education and Welfare, Agriculture, Interior, Housing and Urban Development or Transportation. Such projects present many difficulties in the absence of a mechanism for developing a shared responsibility for participation and funding. This is particularly true in projects relating to the environment in which the transition from a healthy man to a healthy environment is by no means sharp but gradual with much overlapping. A group, such as you suggest, could provide a high-level body for the assuring of shared participation in such major projects.

There is one comment that I would like to make. In your talk, you say "membership should be composed of social scientists, social and community planners, and public administrators." This omits the use of scientific expertise and technical background in the fields that are vital to this council. I think this is a serious mistake. By all means, persons with such backgrounds should be drawn on, however, the council must have in its membership individuals with scientific competence in the area of concern.

I thank you for the opportunity to comment on this important bill.

I am,

Sincerely yours,

NORTON NELSON,
Professor and Chairman.

SETAUKET, N.Y., December 5, 1967.

HON. JOHN V. TUNNEY,
*Congress of the United States,
House of Representatives,
Washington, D.C.*

DEAR MR. TUNNEY: Thank you for your letter of November 2nd, in which you ask me to comment on HR 13211. This I am pleased to do, although my comments of course reflect my personal opinion and not necessarily those of either the Brookhaven National Laboratory nor the Atomic Energy Commission.

The objective of the bill is quite worthwhile, that of providing technical advice on Ecology to the President. It is of considerable importance then that the members of the council be professionally qualified to provide such competent technical advice, and certainly they should not be appointed simply on the basis that they might referee various uses of environment among competing interests. The question is large indeed, and one wonders if a part time board can do the job adequately in the face of current needs. It might be worthwhile to have a small permanent staff with perhaps one professional ecologist, a member of the board, in charge. The remainder of the board might be drawn from among professionally qualified scientists, representative of ecologists in related disciplines. The objective of the bill is commendable and timely, and I hope that a somewhat more specific version can be enacted.

Sincerely yours,

VICTOR P. BOND, M.D.,
Associate Director, Brookhaven National Laboratory.

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THE FRANKLIN INSTITUTE,
Philadelphia, Pa., December 6, 1967.

Hon. JOHN V. TUNNEY,
House of Representatives,
Washington, D.C.

DEAR CONGRESSMAN TUNNEY: Of course I have long had an interest in ecological problems because of my own work in oceanography, and these for me have been intertwined with a concern for the proper utilization of natural resources. The intimate relationship was pinpointed for me when I served on a Committee of the National Academy some years back which, at the instigation of President Kennedy, took a comprehensive look at resources. During this work I became aware of two startling things: (1) that what we call waste itself is a potential resource, and (2) that our natural environment is a God given resource which no scientist or engineer can replace or reinvent if we destroy it. It was this kind of thinking that led to the tenor of the National Academy report, which I chaired, called "Waste Management and Control." This is a preamble to the comments that follow on your Bill H.R. 13211.

I was greatly cheered by the imaginative and comprehensive approach of H.R. 13211, the "Ecological Advisers Act of 1967." and yet, although you seem to focus with precision on the many environmental problems which the Federal Government should now address in a coordinated manner, your proposed solution—in my opinion—still suffers from excessive modesty! What we need is not only a Council of Ecological Advisers: we need a "National Resource Council" with stature comparable to the present National Security Council.

The National Security Council now provides the President with a mechanism for multi-agency coordination and follow-through in matters concerning national security and international relations. But the same kind of coordination vehicle, while often needed, is not now available in matters relating to the national welfare and domestic economic and environment planning. At one time we had a National Resources Planning Board. But, created under the National Security Act of 1947, it was related to the NSC structure and designed to address chiefly national-security questions and problems such as stock-piling, commodity (export) controls, etc. The NSRB was abolished in 1953 and its national-security functions were appropriately transferred to the then newly-created ODM, and successively absorbed into OCDM (1958) and the present OEP (1961). And I do not question that these particular responsibilities should not largely continue to be discharged there.

But the National Resource Council I envisage would help the President perform his total domestic responsibilities in an effective, and newly comprehensive, manner. The Council would deal with questions concerning natural resources, production economics, and uses and applications of these national resources. The new Council could op-

erate much as the present NSC structure; now-existing bodies such as the Council of Economic Advisors could become part of the National Resource Council structure. In actual operation, economic questions, for example, could be dealt with in an NRC subcommittee with a membership representing the CEA, and the Treasury, Commerce, and Agriculture Departments and the Federal Reserve participating on an invitational basis. If environmental problems such as pollution or resource preservation demand attention, a subcommittee representing the Interior (or National-Resource), Agriculture, and Commerce Departments can be convened. And when environmental-social problems come up, say urban-population problems or solving a multifaceted transportation problem, there would be a ready-made context in which high-level task forces could readily be empanelled with the appropriate interdepartmental mix.

The proposed National Resource Council could rally State and local governments and the private sector in a most effective effort at "creative federalism." The Council would provide a more permanent, more continuously integrated, and more timely and responsive context in which to deal with critical national issues. And I do believe that *an ecological subcommittee, or advisory council or task force*, would be an essential element in the proposed NRC structure.

I hope, Sir, that you will forgive this expansive reaction to your excellent initiative. If you find the above ideas useful, either in addition to, or expansion of, your current proposal, please feel free to call on me for more detailed suggestions and support.

Sincerely yours,

ATHELSTAN SPILHAUS,
President.

NATIONAL LABORATORY ON EARLY CHILDHOOD EDUCATION,
UNIVERSITY OF ILLINOIS,
Urbana, Ill., December 10, 1968.

Hon. JOHN V. TUNNEY,
Member of Congress,
House of Representatives,
Washington, D.C.

DEAR CONGRESSMAN TUNNEY: Thank you for your letter of 3 November which, because it was addressed to me at the University of Illinois in Este Park, Colorado, traveled about a bit before it arrived. Moreover, a case of bronchitis has delayed my answer longer than I would like.

First of all, as a citizen and also as a behavioral scientist, I am delighted with the basic intent of the bill (H.R. 13211). No one could agree more with your view that our society, "Must take a creative and comprehensive look at the ecology of our environment, concerning itself not only with the physical implications of the environment, but with the psychological and social implications of the conditions and interactions of the ecology of the environment on man." The idea of establishing a "Council of Ecological Advisors in the Executive Office of the President" is, I believe, entirely sound. I agree that it is exceedingly important that the larger part of the Council membership be composed of behavioral and social scientists, social and community planners, and public administrators. I believe the Council should also include biological and medical scientists. Although these are not explicitly mentioned, I am confident that you meant them to be included, for many of the effects of such ecological conditions as "air pollution, water pollution, solid wastes, atmospheric radiation, and environmental noise" operate at least partially through physiological and bio-social mechanisms.

One problem concerns the definition of "the problems of the ecology of the natural environment." Lines 6, 7, 8 and 9 of page 3 of HR 13211 give illustrations which tend to focus entirely on the physical aspects of the environment. The population problem is another ecological condition important for our day. Moreover, the social ecology of the ghettos and of the slums of our inner cities are exceedingly important as causes of poverty and of incompetence. I am taking the liberty of enclosing a copy of one of my own papers entitled TOWARD THE PREVENTION OF INCOMPETENCE. Pages 13, 14 and 15 describe very briefly some of the social ecological conditions which foster incompetence and the poverty which follows. The pages following page 15 describe a tentative prescription which the Office of Economic Opportunity has been authorized to try out. My main point here, however, concerns simply the matter of definition. Should you not include the problem of population and the social conditions of poverty along with those of air pollution, water pollution, solid wastes, atmospheric radiation, and environmental noise, etc. if our society is to take the compre-

hensive view that you recommend in your splendid address to the House of Representatives?

Again, let me express my considered enthusiasm for the "Ecological Advisors Act of 1967." I hope your bill passes the Congress promptly.

Sincerely yours,

J. McV. HUNT.

will be of great value to the general public and to the
scientific community. The book is written in a clear and
concise manner and is easy to read. It is a valuable
reference work for anyone interested in the history of
mathematics.

on Vol. 3.

APPENDIX D

LIBRARY OF CONGRESS ADVISORY OPINION

BACKGROUND

When Dr. John T. Middleton, Director, National Center for Air Pollution Control, Department of Health, Education, and Welfare testified before the subcommittee on January 18, 1968, there was considerable discussion concerning whether the Department had the authority under the Clean Air Act to prohibit automobile traffic in a city such as New York City.

Dr. Middleton had testified that the "motor vehicle is the largest single source of pollution throughout the Nation; perhaps 75 percent". The question arose, therefore, that if motor vehicles caused 75 percent of the pollution, could the Department stop motor vehicle traffic under section 108(k) to lessen somewhat the damage caused during an episodic event such as the Thanksgiving Day inversion in New York City in 1966.

Section 108(k) of the Clean Air Act of 1967* provides:

(k) Notwithstanding any other provision of this section, the Secretary, upon receipt of evidence that a particular pollution source or combination of sources (including moving sources) is presenting an imminent and substantial endangerment to the health of persons, and finding that appropriate State or local authorities have not acted to abate such sources, may request the Attorney General to bring suit on behalf of the United States in the appropriate United States district court to immediately enjoin any contributor to the alleged pollution to stop the emission of contaminants causing such pollution or to take such other action as may be necessary.

When asked if a class action could be maintained under section 108(k), Dr. Middleton replied:

. . . I am sure you recognize this is a matter of considerable debate in the General Counsel's Office of the Department as well as in the Department of Justice. We are hopeful that the opinion will suggest we move against classes rather than individuals.

Following the hearings, the Subcommittee requested an advisory opinion from the Legislative Reference Service of the Library of Congress. Their conclusion, as indicated by the following opinion, is that a class action could not be maintained against automobile drivers, but that it could perhaps be maintained against a smaller class such as utilities or a type of industry.

*Public Law 90-148, 81 Stat. 497.

Consequently, since it would be impractical to obtain personal service of process upon every motor vehicle driver, it would appear that, based upon the opinion, the Department would not have the authority to stop motor vehicle traffic.

As these hearings went to press, the Department's opinion was not available, nor did the Department have any comment on the opinion of the Library of Congress.

(The Library's opinion follows:)

THE LIBRARY OF CONGRESS,
LEGISLATIVE REFERENCE SERVICE,
Washington, D.C., April 18, 1968.

To: House Committee on Science and Astronautics

Attention: Mr. Joseph M. Felton, Counsel.

From: American Law Division.

Subject: Competence of HEW, proceeding under § 108(k) of the Air Quality Act of 1967 (81 Stat. 485, 497) to combat air pollution in a municipality attributable to (a) automobile traffic or to (b) industrial operations by instituting a class action against (a) automobile drivers or (b) against manufacturers or utilities with a view to enjoining operation of motor vehicles or the emission of pollutants by a class of industries such as public utilities or manufacturers.

I

Class action against motorists

Inasmuch as Rule 23 of the Federal Rules of Civil Procedure (28 U.S.C. Rule 23) governing class actions was substantially modified as recently as February 28, 1966, and the revision thereof did not become operative until July 1966, the interval of time which has elapsed since the latter date has not been sufficient to permit an accumulation of recent precedents numerous enough to present an accurate assessment of the significance of the aforementioned amendments. For these reasons it is not possible to advance a definitive conclusion as to whether these modifications effect such a liberalization of Rule 23 as to eliminate what are deemed to be obstacles to the institution of a class action by HEW against motor vehicle operators.

Reasoning by analogy from factually irrelevant precedents embracing plaintiff-defendant representatives of classes such as members of labor unions, corporate stockholders or bondholders, debtors, creditors, merchants and manufacturers affiliated with a trade association, or professional men or tradesmen conspiring with manufacturers to violate the antitrust laws, and, more particularly from evaluations thereof in legal periodicals, one is persuaded to assign the following reasons in support of the contention that a class action is not maintainable against operators of motor vehicles. The latter are too disparate and unidentifiable a group to merit description as a class whose members are bound together by a substantial common interest. Unlike the groups heretofore mentioned as plaintiff-defendant representatives of a class, operators of motor cars, busses, and trucks are not affiliates of a membership association such as the A.A.A. (Automobile Association of America); nor do they share any interest in property or claims to property.

Rather they are more nearly akin to taxpayers whom the late George Wharton Pepper described as "perforce, fellow-travellers and their association is essentially a corporation; but the bond of association between them belongs in the field of political science rather than in that area of voluntary economic or social effort. They have not joined a lodge or joined the church; and, in their capacity as taxpayers, they think of themselves, not as associates, but merely as victims of a common misfortune . . . Where there is a ready-made bond of association, it is relatively easy to apply the principle of volunteer representation. Stockholders are already committed to the representative function of elected directors; it is a short step, in an emergency, to substitute a volunteer. So in the case of a membership corporation—a church, for example, or a fraternal organization . . . The 'process' that is due . . . [taxpayers] may therefore easily be thought to be a much more individual process than otherwise would suffice" (quoted by Arthur John Keefe, Stanley M. Levy, and Richard P. Donovan. *Lee Defeats Ben Hur*. 33 Corn. L. Q. 327 350 (1948)).

In accord are commentators who assert that "some type of association or interaction among members of the class before the institution of the action would prove a greater likelihood that the members consider themselves and have consented to be treated as a class than would be the case when the class arises from the acts involved in the litigation. For example, the court should be less hesitant in binding a class when it is composed of members of a union suing for back pay than when the class is composed of a number of individual shippers suing for the loss of their cargo" (*Multiparty Litigation in the Federal Courts*. 71 Harv. L. Rev. 874, 937 (1958)).

Also militating against HEW's prospects of successfully instituting its contemplated action are a number of due process issues. Included among the latter is the problem of adequate representation. "The question of adequate representation is very important in a class suit; for there . . . a judgment binds all members of the class and adequate representation is essential to due process of law . . . In an action against a defendant class the court should be particularly careful to ascertain that the defendants named by the plaintiff have the necessary interest or the inclination to make a vigorous defense of the suit" (3A *Moore's Federal Practice* (2d ed., 1967) § 23.07 at pp. 3425, 3432); *Federal Class Actions*, 46 Colum. L. Rev. 818, 828-833 (1946)). "The number of representatives and the extent of their interests, if grossly disproportionate to the number in the class, . . . should also be considered by the court in determining whether the representation is adequate. Such determinations are especially important when the class is the defendant because the representatives of the class are probably chosen by the plaintiff with a view to their weakness and lack of incentive to present an adequate defense" (*Multiparty Litigation in the Federal Courts*, op. cit., p. 938; *Peelias v. Caterpillar Tractor Co.*, 113 F. (2d) 629, 632 (1940); *Weeks v. Bareco Oil Co.*, 125 F. (2d) 84, 91-94 (1941)).

Inasmuch as the number of vehicles to be affected by litigation to suspend automotive traffic in a large metropolitan center on a given day is of staggering proportions, and in view of the absence of a common bond of affiliation among the operators of automobiles or of any agency capable of representing or speaking in their behalf, it would appear that the "representative parties" to be joined such as

"will fairly and adequately protect the interests of [the aforesaid] class" of motor vehicle operators must be substantially in excess of the number conventionally joined in class actions. Fulfillment of this requirement, however, may be self-defeating; for it conceivably might entail the joinder and service of process on so large a number of representative-defendants as to render conduct of the litigation infeasible. Also tending to contribute to a similar result is the prospect that efforts to expand the number of defendants joined for purposes of achieving more equitable representation will be negated by defaults on the part of many defendants unable or unwilling to afford the expense entailed by conscientious participation in the litigation.

Finally, inasmuch as absentee members of the class; that is, those who are not served with process and joined as party defendants to the action are intended to be bound by the decree resulting therefrom, it is important that all members of the class be identifiable for purposes of satisfying the requirements of due process. If there are absentee members who cannot be identified, manifestly the latter cannot be apprised of the pendency of the litigation and the judicial order arising therefrom; and to the extent that they remain unaware of such judicial proceedings, HEW, consistently with the requirements of due process, will be unable to subject them to contempt proceedings for disobeying the mandate of the court ordering a suspension of vehicular traffic in a metropolitan area on a given day. To the extent that their number proves not insubstantial, the unidentified operators of motor vehicles in said area accordingly cannot be dismissed as insignificant; for their existence would appear to have a bearing not only on the adequacy of representation issue heretofore considered, but also upon the efficacy of enforcement of the judicial decree enjoining vehicular movement within the municipality on a fixed date.

Any effort on the part of HEW or Government counsel acting on its behalf limited to culling from state rosters the names and addresses of licensed operators and registered owners of motor vehicles resident in the metropolitan area to be affected by the injunctive decree may be calculated to leave unidentified one or more of the following groups of licensed motor vehicle operators: (1) nonresident tourists, whether domiciled beyond the borders of said metropolitan area but within the state in which that area is located, or domiciled in another state; (2) operators, who are domiciled in the same state in which the affected municipality is situated but outside the limits of the latter, and who are authorized, either as members of the family of a registered owner, or as employees of a registered owner, or as lessees of an equipment leasing agency, all similarly domiciled, to use the vehicle throughout the state and who may be within the limits of the affected city on the day on which the injunctive decree becomes operative; and, finally, (3) out-of-state commuters operating vehicles within the affected municipality on the date fixed for cessation of automotive traffic. Perchance, operators within these enumerated categories, having been apprised by out door posters, newspaper dispatches, or by radio or television announcements of the pendency or actual issuance of the decree, may volunteer to comply therewith; but on the basis of established precedents, such casual modes of notification would appear to be inadequate for purposes of exacting obedience from such operators in a manner consistent with the requirements of due process. "Where a group names a person its representative, or an individual

vindicates a corporate right secondarily—canons of due process are not offended by holding the class to the result of the suit, either on familiar agency principles or because the possibility of being so bound is incidental to participation in corporate enterprise. But a different problem arises when absent parties are bound by judgments incurred by others *who are merely similarly situated*. At that point efficacy collides with principles of due process" (Federal Class Actions, op. cit., p. 830; emphasis supplied; *Christopher v. Brusselback*, 302 U.S. 500, 503-505 (1938)).

It is not believed that the aforementioned assessment of the measure of due process protection required to be accorded unidentified members of the class joined as defendants in litigation is in conflict with the provisions of the revised Rule 23(b)(c)(2) which stipulates that in any class action, "where the court finds that the questions of law or fact common to the members of the class predominate over any questions affecting only individual members, . . . the court shall direct to the members of the class the best practical notice under the circumstances, including individual notice to all members who can be identified through reasonable effort." In two decisions construing this new rule, federal courts, in one instance, approved notice by publication as an adequate means whereby representatives, instituting an action on behalf of several thousand taxpayers residing in a sanitary district, might notify absentees; whereas, in the second instance, also involving absent members of a class of plaintiffs, another federal court concluded the varied nature of the interests asserted on behalf of the latter required individual notice and that due process standards could not be satisfied by "free publicity" or "by paid advertisements in newspapers of national distribution" (*Eisen v. Carlisle & Jacqueline*, 41 F.R.D. 147, 151-152 (1966); *Booth v. General Dynamics Corporation*, 264 F. Supp. 465, 472 (1967)). For reasons previously assigned, members of a class, whose only common interest is deductible from the fact that they are "merely similarly situated", are believed to be entitled to a more generous measure of protection when sued as defendants than when instituting an action as plaintiffs.

II

A. Class action against manufacturers or utilities emitting pollutants

Absent any evidence that manufacturers or public utilities are bound together by common ties in the form of membership in a trade association or of corporate affiliations embracing a parent-subsidiary or holding company relationship, presumably a class action could be instituted against a group of utilities or a group of manufacturers only upon the basis that the latter were similarly situated; namely, that each group was engaging in a course of action which give rise to "questions of law or fact common to the members of the class" or group and that such "common questions of law or fact predominate over any questions affecting only individual members" (Rule 23(a)(b)(3)). For "common questions of law or fact" to predominate, the manufacturers or the utilities constituting the class sued as defendants apparently would have to be engaged in productive activities which emit like pollutants, the dispersion of which was attended by a like hazard to public health in a reasonably compact geographical area. Thus the manufacturers conceivably might be processors of chemicals or the utilities might be guilty of burning coal with a high sulphur content. As to the area in which the utilities or the manufacturers

conducted their operations, the expanse thereof might embrace a small state in its entirety, or a specific industrial area in a large state, or a metropolitan area straddling state lines such as the upper New Jersey-New York City—Long Island-lower Connecticut sector. By reason of the limitations imposed by the requirement of common questions of law or fact, a class action on a national scale could presumably not be instituted against all manufacturers or all utilities whose divergent processing activities emitted a host of different pollutants which in turn were productive of consequences which in varying degree endangered life. In short, to the extent that differences were discernible in the pollutants emitted and in the dangers to public health generated thereby, such disparities could not be depended upon to give rise to "common questions of law or fact."

B. Who would defend against such class action and how would notice be given?

Normally, in a class action against either utilities or manufacturers, the Government would select certain manufacturing or utility corporations as representative of their respective classes and would join such representatives as defendants by having process served upon them. The latter will respond by defending the action. As to other members of the same class sought to be bound by the outcome of such litigation due process requires that they be accorded notice of the pendency of the suit and of the decree rendered at the conclusion thereof. Suggestive of the manner in which notice may be accorded to absentee members of the class is the procedure observed in *United States v. American Optical Co.*, 97 F. Supp. 66 (1951). Therein, the United States joined as defendants 22 oculists out of a total of 2000 constituting members of the class sought to be enjoined for conspiring to violate the antitrust laws. The Government petitioned the District Court to permit the Antitrust Division of the Department of Justice to forward by registered mail, with return receipt requested, to the remaining 2000 oculists a copy of the order of the court, a copy of the complaint, a copy of the Government's petition to show cause, and a copy of the supporting affidavit but without the Government's exhibit.

Unlike the contemplated action against operators of motor vehicles, the public utilities or manufacturers doing business in a limited geographical area and comprising the class sought to be enjoined probably would not be an unwieldy group in terms of numbers. Moreover, each member of the class could be expected to possess resources adequate to enable it to retain counsel for purposes of actively intervening and participating in the conduct of the litigation. Unless such intervention would expand the number of defendants actively engaged in the prosecution of the class action to a point calculated to interfere with the efficient disposition of the litigation, the trial court, under Rule 24(b), in its discretion, is empowered to grant applications to intervene. As revised, Rule 23(c)(2) grants absentee members of a class a right to enter an appearance through counsel; but this privilege apparently is not to be equated with a right of active intervention. Under Rule 23(c)(2) an absentee member is also accorded the privilege, upon request, of being excluded from the class.

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