Six Action Programs Following up on the October 19 Task Force Report

1. Controlling Pollution from Federal Sources. No progress on implementing water pollution Executive Order; draft of air pollution Order does not deal with existing installations. Recommend that BOB be required to estimate time schedule on water pollution, and to file a report on air pollution standards within six months.

2. Expanded R&D on Air and Water Pollution. Recommends systems analyses of all wastes to determine efficient combination of solids and liquids, and the interaction of a polluted environment with all forms of life. Interdisciplinary personnel and research centers are necessary: Cost, $30 million for a complete program.

3. "Clean River" Demonstration Projects. Authorizations required for relaxing limits on size of grants and for more power for River Basin Commissions. Put entire river basin on self-sustaining basis with user charges after backlog of treatment plants is removed.

4. Effluent fee legislation.

5. Solid Waste Disposal. Limited research program and demonstration of efficient facilities for $15 million. No substitute for program with impact of earlier proposal to close down all garbage heaps.

6. Junk Autos. Construction of two shredding plants, devices to flatten cars for cheap transport, melting furnaces to demonstrate junk use by foundries, metallurgical research.

Note:

These programs were not researched to substitute for recommendations in October 19 Report. Greater enforcement authority and extended Federal grants required to keep ahead of rates of increase of pollution.

THE CHAIRMAN OF THE
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON

December 13, 1965

MEMORANDUM FOR MR. JOSEPH CALIFANO

Subject: Further Report of the Task Force on Pollution Abatement

INTRODUCTION

Your memorandum of November 22 requested the Task Force on Pollution Abatement to develop specific proposals related to six specific areas. Upon receiving your memorandum, I immediately established six subcommittees of the Task Force, one for each of the six areas, requesting a report from each by December 7. Unfortunately, most of the reports were received only in the past few days, and there has been no opportunity for the Task Force as a whole to review them, or to see this memorandum.

The study of (1) Eliminating or Controlling Pollution from Federal Sources was made by James Quigley of HEW and William Ross of BOB. Possibilities of (2) Expanded Research and Development in air and water pollution were explored by OST staff under Dr. Colin MacLeod. A program of (3) "Clean River" Demonstration Projects was assigned to Mr. Quigley and Henry P. Caulfield, Jr. of Interior. The (4) Draft Legislation on Effluent Fees was written by Mr. Quigley and CEA staff, with some assistance from the staff of the Department of Justice. The program of research and demonstration on (5) Solid Waste Disposal was prepared by Mr. Quigley and Morton Schussheim of HHFA. The new (6) Junk Auto program was prepared by Mr. Caulfield and Edward Smith of Commerce.

This memorandum incorporates or summarizes each of these subcommittee reports (where it is summarized, the original report is appended). In a few cases, this memorandum goes somewhat beyond the materials submitted by the subcommittees. However, time has not permitted any substantial deviation from the content of the subcommittee reports.

Unfortunately, I cannot regard this memorandum, based on the work of the subcommittees, as adequately fulfilling your assignment. However, many of the deficiencies could be resolved by further intensive work in the relevant agencies.

(1) As the report from the first subcommittee reveals, there are as yet no detailed plans for "putting the Federal house in order." No schedule has been set by HEW and BOB for compliance with the water pollution Executive Order and there is no program of standards for air emission from existing installations in the proposed air pollution Executive Order.

(2) I have the impression that the OST report on expanded R&D (incorporated fully, since it was received only today) fails to recognize that some of the research it calls for is already underway.

(3) The memorandum on clean river demonstration projects accepts your second alternative, and thus deals "solely with organizational and Federal-State-Local relations problems."

(4) The draft legislation on effluent fees has not been put in the form of a bill.

(5) The pilot and demonstration program for solid waste disposal is entirely limited to programs now underway. No estimates of cost were provided by the subcommittee, and the very tentative estimates were made by CEA.

(6) The subcommittee report on junk autos contained some programs that I regard as having low priority (and high cost) and are omitted from this memorandum (although a description of them is attached in an appendix).

The proposals set forth below constitute a much more limited program than that included in the October 19 Report of the Task Force. Effective control of water pollution, for example, would be greatly enhanced if the proposals set forth here could be accompanied by the strengthened enforcement authority and the substantially stepped-up program of Federal grants recommended by the Task Force.

The limited solid waste demonstration program suggested below cannot have the impact of the October 19 Report proposal to close down the rubbish and garbage dumps throughout the country. The proposed new plants to shred junk autos, and the melting or metallurgical demonstration plants, would process considerably more junk autos if accompanied by the recommended State and local removal programs described in the October 19 Report.

As the October 19 Report indicated, some doubts were expressed in the Task Force about the workability of the effluent charge approach to control of water pollution. The Task Force therefore commissioned a case study of the probable effects of effluent fees on the Delaware River. That study has now been completed, and a summary of it is attached to this memorandum. It suggests that the effluent charge could achieve any given water quality standard at considerably lower total costs of treatment than conventional approaches, with a more equitable impact on pollutors (those who pollute with the greatest effect on water quality pay the most), and without regional dislocation of industry. There are administrative problems, as the summary indicates. But the findings are extremely encouraging.

1. ELIMINATING OR CONTROLLING POLLUTION FROM FEDERAL SOURCES

A program to "put the Federal house in order" has already begun with the Executive Order of November 17, 1965 calling for reduction of pollution in existing facilities "to the lowest level practicable" and in new facilities to a level in accord with rigorous pollution control standards. The next steps are to put this Order into effect, and to follow it with a similar set of directives on air pollution from Federal installations.

A. Implementing the Water Pollution Executive Order

All Federal installations are required to submit plans for curtailing the outfall of pollution by July 1, 1966. HEW personnel have already inspected most installations and have made recommendations. Further technical assistance will be provided by the staff of the Water Pollution Control Administration (HEW) in the next six months. Informational assistance is to be provided by BoB in a circular to be issued soon which specifies the information required and the criteria to govern the inclusion of installations in the planning process. But no schedule of abatement has been prepared; nor has there been an attempt to classify installations in categories of "urgency of abatement" from information in the HEW survey.

The adequacy of technical information concerning control of pollution from federally owned vessels is being assessed, including ongoing technical studies in HEW and the work of the Interdepartmental Committee on Sewage and Waste Disposal from Vessels. On the basis of the review, a program will be developed by December 31, 1965 to complete the study of Federal vessel pollution and to make recommendations for corrective or preventive action by January 1, 1967.

Plans have been made to demonstrate new equipment and techniques of waste water treatment at Federal installations. HEW is to evaluate new systems and propose to the operating agency that they be installed at various locations, presumably in constructing new facilities or renovating older installations. No estimate has been made of the extent to which this is to be done, or when the program will begin.

No plans have yet been begun for developing programs designed to reduce water pollution by recipients of Federal grants, loans, and contracts.

B. Air Pollution Executive Order

As noted in the appended HEW-BoB memorandum, initial drafts have been prepared of an order calling for control of air pollution from Federal facilities. A working draft is promised within three weeks for agency circulation and comment, and issuance of the Order is scheduled for February.

The present draft sets standards for emissions from new facilities, but postpones standards for existing facilities. The standards for new facilities are said to be as stringent as those in the water pollution Executive Order, and procedures for implementation are the same except that regular HEW review of operations is dispensed with.

Standards for existing facilities are not included at this time because stringent limits on sulfur emissions would require expensive pre-treatment or replacement of coal and residual fuel oil as energy sources. HEW and Interior are to complete a study within a year of the impact of standards on the utilization of coal and oil. This study should serve as the basis for evaluating the employment and production losses in these fuel industries, as compared to the benefits for all society from removing a major health hazard. It is strongly urged that BoB (rather than HEW and Interior) make this comparison as soon as possible after the study is completed, and report its finding as the basis for a concrete policy on existing Federal emissions.

No plans have been formulated for carrying out the proposed Executive Order on air pollution. There has as yet been no survey of emissions from Federal installations and no evaluation of the time schedule and expense of abatement. The agencies would be required under the draft Order to submit reports to BoB by January 1, 1967 on air pollution resulting from all loan, grant, and contract activities. Such reports would permit an assessment of the feasibility of requiring adherence to standards by such recipients.

2. EXPANDED RESEARCH AND DEVELOPMENT

An expanded program of Federal research and development "to explore the 'whys' of air and water pollution and the most effective and economic means of prevention or control" must:

1. Provide a basis for future actions that will lead to appropriate levels of pollution abatement and control.

Pollution is an inevitable consequence of an advanced society. We will never eliminate all pollution. But we must determine the relations between levels of pollution and consequences so that we can establish standards of environmental quality that will provide the intended balance between protection of man and his resources, and the economic burden upon those whose easiest course is to pollute.

2. Gain for us knowledge that will provide new possibilities for preventing and controlling pollution. There are many opportunities for devising new means of meeting our needs which will result in less total waste material or waste material in such a form as to have less undesirable effects upon the environment.

3. Provide knowledge that will permit us to buy the most pollution control per dollar spent in future action programs. Marked gains can almost certainly be made in dealing with the disposal of agricultural, industrial and municipal wastes and with the unavoidable remnants of pollutants which result from wear or combustion or escape from places we intend them to remain.

4. Develop a range of baseline measurements, and systems for acquiring such measurements, so that we can measure the effectiveness of the control and abatement procedures we impose in the future. In addition to continued and expanded monitoring of those portions of the environment where dangers to health, life, and amenities are judged to require particular attention, there are needs for year-by-year information on the average condition of our environment, on atmospheric changes possibly affecting climate, on baseline values for pollutants just entering a period of growth, and on natural populations in relatively unpolluted areas.

5. Lead to increasing rapidly the supply of trained men and women we will need to manage pollution.

Many different kinds of specialists are needed to conduct the research, to test and implement technological methods and facilities, and to administer programs to adequately protect the health of man, our domestic plants and animals, and our natural resources from deleterious effects of pollution. An adequate supply of properly trained manpower is our most important requirement for solving and controlling our increasing pollution problems. At the present there are barely enough specialists and experienced men and women to initiate essential new programs. Because of the rapid expansion of pollution problems and the current planning to curtail pollution, a critical manpower deficiency will develop rapidly unless actions are taken to augment the supply.

Besides the general improvement of education, especially in science and technology, specific policies and actions are needed to attract and train more people in fields related to environmental pollution.

Specific Program

1. Provide a basis for future actions that will lead to appropriate levels of pollution abatement and control.

Setting of standards requires that we take account, for each pollutant and for each place, of the effects of the pollutant, technological capabilities for its control, costs of control, and the desired uses of the resources the pollutant may affect. Standards that

require levels of pollutants below those necessary to protect the resources at stake are wasteful in two ways: first, the actions taken to reduce pollutants usually become increasingly expensive per unit of pollutant as the concentration of the pollutant decreases. Secondly, we deny ourselves the use of the capacity of the environment to dilute, degrade, or otherwise render innocuous the pollutants we must rid ourselves of. Our air, waters, and lands have an enormous capacity for self-purification; to under-utilize this capacity is economically wasteful.

Standards are now required by recent amendments to the Clean Air Act and the Water Quality Act of 1965; the regulatory responsibilities and the establishing or formal approval, of standards under these Acts are assigned to HEW. Procedures will need to be established by HEW to assure that available information is obtained from other agencies and used in the setting of standards. An apparently suitable pattern exists in the Interagency Agreement (Agriculture, HEW, Interior) on pesticide regulation.

We need answers soon on:

a. Tolerance levels for man, for domestic crops and livestock, for fish and wildlife, and for the other living organisms that man depends upon directly or indirectly so that we can decide how much of a pollutant we are willing to tolerate.

b. Transport and behavior of pollutants in the environment, so that we can tell where our control actions must be taken.

c. Instrumentation so that we can detect the presence and measure the concentration of the pollutants we are concerned with.

a. Determining tolerance levels for pollutants. Considerable research is already under way that will provide some information. Most of it is oriented toward the effects of given levels of pollutants, rather than toward determining the levels of pollutants that will have no effect or a minimum effect. Systematic review of available information (and that expected

from ongoing research) should be undertaken immediately and new research initiated to fill the gaps for the most important pollutants. Information is needed for individuals and populations, for both short term and long term exposures.

Review and research related to effects of most pollutants directly on man are the responsibility of the Department of Health, Education, and Welfare; effects on beneficial insects, crops, domestic animals and birds, and forests are the responsibility of the Department of Agriculture; and effects on non-cultivated plants and animals including fish and wildlife, directly and through their habitats, are the responsibility of the Department of the Interior. For radioactive materials, Atomic Energy Commission shares these responsibilities. Necessary backup research directed toward methods development or establishing the value of the organisms and environments affected must be included, particularly for the Atomic Energy Commission and Interior. A new program, similar to that described in S2282 should be established in Interior to carry out its responsibilities.

The job described is nearly endless, for each year new pollutants appear. Even for the most common pollutants, the time required will be long. The need is urgent and the costs quite low. An appropriate level of effort, increasing as personnel and facilities become available, might be increases of:

	First year	Second year
HEW	$1,000,000	$3,000,000
USDA	1,000,000	3,000,000
Interior	2,000,000	5,000,000

b. Transport and behavior

The flow and fate of most pollutants in our environment, and the long-term deposition of the substances are largely or totally unknown.

Specific information is needed on metabolism, flow in the environment and natural degradation, of organic pollutants, especially pesticides; on the chemical and physical nature of pollutants produced by reactions in the atmosphere; on the behavior and sources of nutrients in water (especially nitrogen and phosphorus); on the behavior of farm animal wastes in storage, in soils and in waters; on the movements of smaller bodies of air in urban areas that may carry pollutants from smoke stacks or other sources to people; and on the oceanic and biological processes by which CO_2 is removed from the atmosphere.

Movements in the atmosphere are primarily the responsibility of the Department of Commerce; in surface waters, primarily, HEW and Interior; in ground waters, primarily Interior; in soils, primarily Agriculture; and in living organisms, Agriculture and Interior.

Highest priority should be accorded the research on mesometeorology because present knowledge is less adequate and because results are needed for immediate application. No cost estimate is offered.

c. Instrumentation

A variety of instruments and devices are necessary for measuring pollution. Many "automatic" devices available today require a high degree of maintenance, and resulting high costs are responsible for inadequate coverage of many areas that need to be guarded. Responsibility for this development should be largely HEW. Development should be largely by industry, and direct costs associated with the development would be minimal. A variety of incentives,

different in different cases, may be necessary to provide necessary stimulus. Such incentives might include contracts for the development of specific hardware or systems; deliberate actions to make consumers want the product developed (such as legislation requiring the device or establishing tolerances that could be met only with the device); underwriting of demonstrations to prove the utility of the device, or waiving of the government patent rights in specific instances where vesting such rights in the government would remove the incentive to develop or market the device (as might be the case with small volume, low cost devices).

Additionally, a general index of chemical pollution of water samples would be most useful. While chemical methods are available or can be devised for most single pollutants, there is not likely to be a single chemical method sensitive to a large range of chemical pollutants. Such an index would allow us to follow many important changes in general water quality in a way similar to that in which the coliform count has enabled us to follow changes in pollution by untreated sewage. Again costs would be modest, perhaps $100,000 the first year and $500,000 the next. Assignment should be to Interior, with cooperation of HEW.

2. Gain us knowledge that will provide new possibilities for preventing and controlling pollution.

Opportunities for preventing pollution are already being exploited to a certain extent. For example, the Department of Agriculture has increased its research on improved methods of pest control during the last several years, and should continue to increase its emphasis on research aimed in this direction.

Some other opportunities have not yet been vigorously pursued. Prominant among them are:

a. Development of effective means of powering automobiles and trucks that will not produce noxious effluents. Federal pressure, such as discussion of standards for effluents that might be necessary five, ten

and twenty years in the future under various projections of auto populations, would probably serve to stimulate industrial action. HEW is the Federal agency involved.

b. Development of container materials which have adequate storage life, but which will degrade rapidly when discarded. HEW should consider how such research and development might be stimulated. No additional costs would be associated with such actions.

c. Development of new uses for farm animal wastes. Traditional use as agricultural, garden, or greenhouse fertilizer is no longer adequate because of increasing concentration in the production of animal manures. The responsibility is the Department of Agriculture's. Costs should be small enough to be absorbed by the agency.

d. Research and development that will lead to speeding the recycling of junk auto steel including means for developing more uniform scrap and for storing junk auto hulks in excess of current market demands of the iron and steel industry. Steel is a valuable mineral resource and its conservation through storage for future use is a desirable goal in addition to the more obvious goal of removing the eyesore caused by junk autos. The Department of Interior is responsible. First year costs might be $1,000,000, second year the same.

3. Provide knowledge that will permit us to buy the most pollution control per dollar spent in future action programs.

Better methods of handling, transporting and treating waste products can certainly be devised. Particular opportunities for gains exist through systems studies related to:

a. The disposal of sewage, trash and garbage including consideration of needed innovation; b. consideration of sewage treatment and water supply as a single

combined system; and c. consideration of the interaction between various disposal systems as they affect the interrelationship of solid, liquid and gaseous pollution of the environment; d. combined sewerage systems; e. better means of excluding sulfur compounds from stack effluents; f. demonstration leading to acceptance of innovations in collecting and transporting of solid wastes; and g. nutrient innovation treating sewage.

To fulfill these needs:

a. Federal support should be provided to the National Academy of Sciences and the National Academy of Engineering to jointly undertake an intensive study of the broad area of disposal of sewage, trash and garbage emphasizing both the systems approach and the types of innovation needed to give stimulus to solid waste technology. Many interesting possibilities have not yet been explored to the point where we can balance their advantages and disadvantages in dealing with these increasingly serious problems.

b. A similar study of sewage treatment and water supply as a single combined system also should be undertaken by the National Academy of Sciences and National Academy of Engineering. Water intakes for downstream cities are often largely supplied by the sewage outfalls of upstream cities, yet we have not tried to face the purification of wastes supply of water as a unified problem.

c. After completion of the preceding two studies, the same organizations should jointly undertake an intensive study of the interaction between various disposal systems as they affect the interrelationships of solid, liquid and gaseous pollution of our environment. One of the most prominent results of any study of pollution as a whole is the extent of which we must and do choose between polluting the air or the water or the land. An initial study of the combined system would contribute much to our guidance.

The costs of the three studies proposed would be minimal, probably not in excess of $200,000. HEW should provide the funds.

d. Sewers carrying both storm runoff water and sanitary wastes pose many problems. Before the very expensive programs of sewer separation that have been proposed are implemented, an appropriate ad hoc group of Federal, state and local officials should be convened to determine how best to attack the problems caused by the out-moded combined sewerage systems in the great cities of the United States. This group should give particular attention to research, development and demonstrations needed to reduce combined sewer problems. They should also consider cost sharing arrangements for different projects and mechanisms for coordination and review. Cost for convening such a group would be small and should be met by HEW.

e. Oxides of sulfur constitute a major source of air pollution in this country because large quantities of sulfur containing coal and oil are used for fuel. Removal is becoming a matter of increasing importance. Less costly means of removal will contribute to a lessening pollution. Development of more economic processes for exclusion of sulfur compounds from stack effluents is an urgent necessity. Stimulation of industry by increasingly rigid regulation will go far. The Federal government also should contribute through research programs in the Department of Interior aimed at both reduction of sulfur in fuels through removal or selective mining of fuels and on methods of removing sulfur compounds from the effluent stream following the combustion process. First year increased costs are estimated at $1,000,000 and second year costs perhaps at $2,000,000.

f. Development and demonstration projects for new and improved systems of collecting and transporting solid wastes to show what can be done to approach the problem from other than traditional methods should be undertaken. The use of Federal installations should be considered for demonstration sites. Authority carried in the recent Solid Waste Title of recent amendments to the Clean Air Act should be fully utilized. No additional funds are necessary at this time.

g. Development and demonstration of new and improved methods of treating solid and liquid wastes including methods of nutrient removal from sewage should be vigorously pursued. In addition to work by the Department of HEW, the resources of the Office of Saline Water in Interior should be utilized especially as related to removal of nutrient materials. First year costs could be included in the existing HEW budget. Second year costs could be more reasonably estimated later.

4. Develop a range of baseline measurements and systems for acquiring such measurements so that we can measure the effectiveness of the control and abatement procedures we impose in the future.

Today no agency or program is concerned with the average condition of our environment, yet we have recognized pollution as a national problem and its abatement and control as national goals. If we are to recognize how fast we are gaining or losing in this struggle we need measurement of both where we stand and where we once stood.

a. Immediate steps should be taken to plan and institute a National Environmental Quality Survey, which would provide benchmark data on the average condition of the environment of the people of the United States as a whole.

An agency should be set up to carry out planning, including sample design, and analysis of the National Environmental Quality Survey. This agency should be isolated from all enforcement or action programs and should make the greatest possible use, through transfer of funds, of expertness in carrying out measurements of environmental quality already developed in Federal, state and local governments.

Because of clear separation from enforcement and action, and because of long experience with sampling design and analysis, particular consideration should be given to setting up this agency in the Department of Commerce.

Estimated costs are $500,000 planning money for the first year with the second year cost to be determined as a result of the planning.

b. We need also to systematically evaluate the status of contamination of our soils. The Department of Agriculture should establish an appropriate unit to assess the pollution status of the nation's soils, to correlate all research, control, abatement, and monitoring concerned with soil pollution, to make suggestions as to new or additional courses of action, and to report their findings annually to the congress. Estimated first year costs are $100,000, second year costs might be $1,000,000.

c. We need also to intensify surveillance of lead and to initiate a survey of nickel. Both of these materials are gasoline additives, are not destroyed in the combustion process, and are thus widely distributed to our environment. Studies on lead have continued at varying intensities intermittently since the 1920's. They are still inadequate. Nickel is a recent addition; and before large amounts have been used, baseline data on environmental concentrations should be provided. Such studies might cost $1,500,000 the first year, somewhat less the second. The responsibilities would rest with HEW, USDA, and Interior.

d. We need to continue measuring carbon dioxide and to monitor stratospheric temperatures that will reflect changes in carbon dioxide. These programs are already underway in the Department of Commerce and no additional costs are anticipated.

e. Lastly, we need to establish quantitative base-line population densities by systematic sampling of certain natural populations of plants and animals in diverse relatively unpolluted habitats to establish a basis for comparison with populations under pollution stress. Today it is difficult to recognize that a natural population is under severe stress unless the stress is so severe as to bring it close to regional extinction. Interior should be responsible for this program. Estimated first year costs are $200,000 largely for planning, second year costs can be estimated as a result of the planning.

Manpower Recommendations

Men and women of widely differing abilities, education and interests are needed to solve the problems of pollution and to protect our human environment.

In the long run, improving both numbers and quality of highly trained manpower engaged in key actions, from research to enforcement, will do the most for us, and merits the highest priority. Existing support programs have failed to provide the numbers and quality of men and women needed.

The time-tested programs of direct support through fellowships, traineeships, institutional training grants and the indirect support through research assistantships financed under research grants and contracts should be continued and enlarged. However, existing support programs are either aimed at general support of science (NSF) or engineering (NASA) or concentrate on a particular field such as the PHS program for biomedical sciences in which human health is the central concern. If we are to stimulate education in other fields of particular need in solving environmental pollution problems, new programs will be needed. These programs should be authorized for both Agriculture and Interior, where a mission orientation is more likely to provide the needed results than a program such as that of NSF which is directed

toward the underlying basic sciences and is not targeted on the specific needs of agencies in carrying out their assigned missions.

To avoid problems of overlap and duplication with existing research training programs, new programs could be established for a fixed length of time, say 5 years, then reviewed. Quality could be assured by requiring the same review procedures as are used by the agencies with existing programs. Specifically:

a. The Departments of Agriculture and the Interior should be authorized to award, on a competitive basis, extramural contracts and grants to universities and other qualified institutions for research and research training in scientific and engineering fields supporting their missions. These contracts and grants should be used at least in part to support the education and training of graduate students in fields concerned with environmental pollution in which there are critical shortages of professional manpower. Disciplines which contribute to our knowledge of biological control of pests and of interspecies relationships should be given high priority.

First year costs are estimated at $6 million, second year costs $12 million.

b. The Departments of Health, Education, and Welfare, of Agriculture, and of the Interior should be authorized to provide grants covering up to 100% of costs to universities, or other non-profit institutions for the construction, remodeling and equipping of facilities needed for projects, institutes, or centers to be devoted to research and research training in environmental health, environmental science and environmental engineering. Present patterns of Federal support of universities are for the most part confined to research and training, on the assumption that adequate facilities are already available at universities. Where facilities are not available, the university is expected to provide them as its share of the endeavor. However, the universities are now confronted with educational responsibilities which greatly overtax their capacity to support them by conventional means. Few universities are in a position to contribute significantly to the large and complex efforts needed in the environmental pollution field, without an exceptional degree of support from the Federal Government.

First year costs are estimated at $10 million, second year at $18 million.

c. The Department of Health, Education, and Welfare and the National Science Foundation should increase their support for traineeships and fellowships for graduate students in the pure and applied environmental science, and in those areas of behavior sciences and engineering relevant to pollution problems. As soon as Agriculture and Interior have legislative authority for such support, they should establish similar programs. Modest support is already available in some of these areas. Broader support is necessary to bring in promising students from a wider variety of fields and to give them the depth of training needed for research and teaching in the environmental science related to pollution.

First year costs are estimated at $1 million, second year at $3 million.

d. The Department of Health, Education, and Welfare should provide long-term support to between five and ten universities to establish interdepartmental research centers for environmental studies, which would devote the greater part of their effort to research directly or ultimately related to pollution problems. In the support of these centers, funds should be made available for research by graduate students, post-doctoral research workers and faculty members as well as for equipment, facilities, technicians, and administrative services. To allow adequate planning and recruiting, grants to a single center should overlap, lasting as long as seven years. The centers should be encouraged to conduct faculty and graduate seminars and to recruit visiting investigators. They should be sufficiently large to contain a critical mass of scientists and engineers, able to form and reform cooperative teams to attack problems of their choice. The scope of these centers should be broader than that of the environmental health science institutes now planned or funded by the Public Health Service. This kind of effort is needed because of the broad scope of environmental pollution problems and the range of disciplines which must interact and contribute in the solution of these problems.

First year costs are estimated at $2 million, second year at $3 million.

e. The Federal Government should establish a policy to stimulate research workers in the field of environmental pollution to make use of training and retraining opportunities, to maintain and improve the competence and skills of its scientists and engineers. A system similar in intent and operation to the sabbatic leave program of universities should be initiated. Provision should be made for reimbursement to the host institutions for expenses incidental to the leave program. Items such as travel and subsistence in connection with scientific meetings and to and from training assignments should be included. Once established, the budgets for these activities should not be diverted to fund on-going operational programs.

Annual costs are estimated at $700,000.

f. The National Science Foundation and the Public Health Service should examine the adequacy of their present programs to provide for one-year fellowships allowing state and university research workers and teaching personnel to develop new skills and competence in pollution and related fields. The rapid pace of technologic advance and the emergence of new problem areas in environmental pollution make it essential to provide means for research workers and teachers to acquire sound additional training through fellowships at institutions with active research and training programs in pollution-related fields.

First year costs are estimated at $1,000,000.

g. The Public Health Service should increase its support to the Communicable Disease Center. Epidemiologists are in very short supply. The Communicable Disease Center is by far the leading training center for epidemiologists in this country, probably the world. This increase should allow its Epidemic Intelligence Service to accept an annual class of 50 professional officers a year, with an increase by 10 additional trainees a year so that by the end of five years each new group would consist of 100 trainees.

First year cost is estimated at $1,000,000.

The first year Federal expenditure for all of the recommended programs is estimated as $30,300,000.

3. "CLEAN RIVER" DEMONSTRATION PROJECTS

This proposal explores financial and organizational approaches for working cooperatively with States and local governments in demonstration efforts to deal with pollution on a river basin basis.

A. General Requirements

The general requirements of any financial and organizational approach adopted should be that it:

1. Assures comprehensive pollution control on a river basin basis in the way necessary to meet the President's pledge that "we are going to reopen the Potomac for swimming by 1975. And within the next 25 years, we are going to repeat this effort in . . . other rivers . . . ." to the maximum extent practicable.

2. Enables the Federal Government to move forward with financial assistance on the scale necessary to overcome the backlog of waste treatment needs, where the States and local governments are ready to do their part.

3. Moves towards placing pollution control on a self-financing basis after the backlog of needed facilities has been overcome, with the user rather than the general taxpayer paying the cost.

B. Federal Participation in Financing

Existing Federal participation in financing of municipal sewage treatment works is not adequate to overcome the national backlog of needs, nor is it directed specifically towards a river basin approach to pollution control. However, for the present, this grant aid should be continued on the existing basis. But in addition, Federal aid should be modified in a limited number of selected river basins to demonstrate means of overcoming the backlog and developing State and local self-sufficiency.

Limitations on the dollar amounts of individual grants would be removed in those river basins where comprehensive water pollution control programs have been adopted and are being carried out. Federal funds adequate to overcome the backlog of needed waste treatment measures

would be provided. The communities would be required to organize so that following elimination of the backlog they would be on a self-financing basis to keep pace with population growth and to replace obsolescent facilities.

C. Selection of Demonstration River Basins

In order for a river basin to be eligible for the Federal assistance described above, it would have to meet a number of specified requirements. This should lead to self-selection of a relatively limited number of river basins which would meet these requirements in the near future, to serve as demonstration projects.

These requirements are as follows:

1. Basin wide organizational arrangements adequate to assure implementation of a comprehensive water pollution control program developed under Section 3(a) of the Federal Water Pollution Control Act. Such arrangements are described in section D.

2. For each urban area within the river basin, adequate organizational arrangements to assure physically and economically efficient means of area-wide water and sewage distribution, collection, and treatment have to be present.

3. Adequate water quality standards, promulgated or approved by the Secretary of Health, Education, and Welfare in the case of interstate waters, to be incorporated as part of the comprehensive water pollution control program.

4. User charges to cover all costs incurred in water supply or waste treatment, including capital costs, to be levied by the local government entities operating water and sewage treatment plants. To the extent practicable, unified administration of water supply and waste disposal systems should be achieved.

5. Agreement by all parties involved in the river basin organization to participate in a study of the feasibility of levying effluent charges on entities discharging wastes into streams.

D. Organizational Requirements

A wide range of abatement measures is necessary in a comprehensive pollution control program, calling for concerted action by the various public

and private entities involved. Many of these measures, and therefore great improvements in pollution control, can be achieved within the existing organizational structure on the basis of cooperative arrangements, voluntary agreements, and ad hoc actions such as Federal enforcement. However, the comprehensive management of water quality in a river basin requires a more formal organizational structure, particularly as a systems approach is applied. For example, this might involve schemes which would vary waste discharges, waste treatment, and stream-flow regulation, according to certain specified conditions and needs.

The basic requirement for a regional pollution control organization is that it be able to reach decisions concerning priorities, objectives, and goals, and also be able to command a timely response by industries, municipalities, and State and Federal agencies in charge of constructing and operating specific water pollution control works.

In order to implement effectively a comprehensive water pollution control program a river basin organization should adhere to the following principles:

1. It must provide an organizational structure for achieving agreements and decisions, which could then be implemented by joint action or individual actions as might be warranted. For example, decisions as to when waste treatment plants should be built must be made by this group, but execution of such decisions could be done by individual municipalities.

2. It should identify those actions appropriate to each level of government and then provide an opportunity for that level to act first in exercising its rights and responsibilities. For those actions appropriate to the local level, local jurisdictions should be encouraged and given the opportunity to act first, State and interstate jurisdictions next in the event of inadequate response at the local level, and finally, the Federal government, as required, to provide full implementation of the comprehensive water pollution control program. Exercise of such prerogatives, however, should not be allowed to prevent timely responses.

3. It should include assurance in the form of final over-all authority in the Federal Government that the comprehensive water pollution control program will be carried out. This would involve utilizing the enforcement provisions of the Federal Water Pollution Control Act to assure compliance with the provisions of comprehensive water pollution control programs. To accomplish this, Federal jurisdiction should be extended to all navigable waters through amendment of the Federal Water Pollution Control Act.

4. It should provide a mechanism for continuous review, updating and management of comprehensive water pollution control programs. This should be performed with the direct participation or under the supervision of the Department of Health, Education, and Welfare to assure conformance with national pollution control policy and requirements.

E. Modification of Existing Organizations

Any organization meeting the above requirements would be satisfactory, and the exact form of the organization could vary from area to area. A number of forms of organization exist which, with some modifications, could meet these requirements.

1. Federal-interstate compacts such as the Delaware River Basin Commission would have the authority to undertake the items listed above. However, it is not likely that it will be politically feasible to establish many such organizations in the near future.

2. A number of interstate compact commissions relating to water pollution control exist (e.g., Ohio River Valley Sanitation Commission, Interstate Commission on the Potomac River Basin). However, such organizations as presently constituted have marked drawbacks:

(a) They have been largely dependent upon voluntary State cooperation for securing compliance with their decisions, and this would have to be modified. The functions of such interstate commissions would have to be extended to include supervising the carrying out of comprehensive pollution control programs, with the direct participation of the Department of Health, Education, and Welfare.

(b) They do not have representative membership from all Federal agencies involved in river basin development. Therefore, other mechanisms would be required in seeking agreement concerning related Federal programs, such as planning for construction and operation of Federal reservoirs.

3. River basin commissions established under the Water Resources Planning Act comply with many of the principles listed above. As these commissions are multiple-purpose in function, a specific subgroup chaired by DHEW would be required for purposes of water pollution control.

Since river basin commissions as authorized by the Water Resources Planning Act lack operational authority, the Act would have to be amended to provide any direct operational authority required, such as the ability to administer a system of effluent charges. In addition, effectiveness of the commission mechanism as a means of reaching agreement on decisions in cases of conflict among member agencies has not yet been demonstrated.

In addition to the utilization of a river basin commission for an entire basin, a series of sub-basin control organizations for individual tributary streams would be required in most cases. In each case the need for sub-basin or local organizations would be based upon those areas with common hydrology and water use goals. The membership of each local organization would be dependent upon the nature of the subarea to be served.

Functionally there could be significant differences among such local organizations. In some cases local organizations might also be empowered to construct and operate waste treatment and collection facilities, whereas in other cases they would merely act as supervisory or decision-making bodies. It would be important to allow for a wide range of local variations and local choices in this respect.

River basin commissions, or sub-basin organizations acting under the general supervision of such commissions, are considered the form of organization most likely to meet the requirements for selection as demonstration projects under the terms of this proposal.

4. A PROPOSED ACT TO AUTHORIZE A CHARGE FOR USING THE PUBLIC WATERS FOR WASTE DISPOSAL

Preamble. The pollution of the public waters by waste disposal and other means impairs all water uses, public health, and aesthetics. Therefore, this Act declares that monetary charges shall be levied to discourage such use and to abate pollution. The charges shall not be construed as granting, selling, or otherwise establishing the right of any entity to use the public waters for waste disposal.

Section 1. This Act amends the Federal Water Pollution Control Act to authorize the levy of a monetary charge on public and private entities that discharge wastes into the public navigable waters. Nothing in this Act, however, shall be construed to permit the violation of the water quality standards adopted under Section 10 of the Federal Water Pollution Control Act or to permit the discharge of raw or untreated wastes or other substances or materials causing a hazard to public health.

Section 2. The charge system is to be administered by the Federal Water Pollution Control Administration except in those instances where a governmental river basin agency is established with authority for this purpose and which the Federal Water Pollution Control Administration certified is capable of administering the charge within the objectives of this Act. Further, the Federal Water Pollution Control Administration must assure that such agencies are administering the charge within the objectives of this Act on a continuing basis. The Federal Water Pollution Control Administration, within six months after the passage of this Act, must issue regulations indicating the conditions for certification and acceptable performance. In cases of inadequate performance by these river basin agencies, the Federal Water Pollution Control Administration under procedures specified by regulation may assume the responsibility for administering the effluent charge system.

Procedures for appeal and protest in regard to the charges by an entity discharging wastes into the public waters must be established within six months after the passage of this Act by the Federal Water Pollution Control Administration in accord with the Administrative Procedures Act. Procedures for enforcement in cases of noncompliance in regard to the charge must be established by regulation by the Federal Water Pollution Control Administration also within six months.

Section 3. Any applicant for a grant for waste treatment plant construction under the Federal Water Pollution Control Act must demonstrate that it has a reasonable user charge system for commercial and industrial users of the municipal treatment system.

Section 4. The charges for waste disposal to the public waters set by or with the approval of the Federal Water Pollution Control Administration shall be commensurate with the costs from the deterioration in water quality imposed on other users for all purposes, aesthetic and otherwise, and with the administrative costs associated with setting the charges. Pertinent chemical, biological, and physical measures indicating the effect on water quality from a source of pollution shall be considered in setting the charge to be levied against that source.

Section 5. This Act requires that entities discharging wastes to the public waters shall file an annual statement with the Federal Water Pollution Control Administration reporting such information as the Administration may require for the purposes of this Act. Failure to report or false reporting shall be punishable by fine.

The effluent charges shall be established annually and may vary seasonally or by other appropriate factors. The charges may be subject to redetermination when necessary. The requirement for annual reporting shall not limit the Federal Water Pollution Control Administration from requesting additional information from time to time relative to enforcement or surveillance necessary to administer this Act.

Section 6. This Act authorizes technical and consultative assistance to States and local governments and river basin agencies in establishing and administering user charges for municipal treatment systems and to approved river basin agencies in establishing and administering the effluent charge systems.

Section 7. In any basin where an approved river basin agency exists, all monies collected pursuant to this Act in that basin shall be retained by that agency for use in that basin for water pollution control activities. Where no agency exists, the Federal Water Pollution Control Administration will collect the charge for deposit in the U.S. Treasury for appropriation for pollution control activities.

Section 8. This Act shall become effective immediately upon passage except for the sections authorizing the levy of the charges for use of the public waters which sections shall come into effect one year after passage.

5. RESEARCH AND DEMONSTRATION OF EFFICIENT RUBBISH AND GARBAGE DISPOSAL

Improper and inadequate disposal of solid wastes is widespread in the United States. There have been no recent advances in the technology of collection, treatment, or disposal which are commensurate with the growing volume of wastes or in keeping with the changing character of the materials discarded.

Improvements in solid waste disposal practices, however, can be initiated by developing and demonstrating high-quality operations.

A solid waste pilot and demonstration program of moderate size can be set up in cooperation with States and communities. The program would: A. initiate long-term basic data collection; B. intensify research, development, and demonstration efforts directed toward broadened and improved technology; C. accelerate adoption and application of known acceptable methods of solid waste disposal.

A. Basic Data -- Collection and Analysis

In view of the general lack of information on existing collection and disposal systems, HEW and DHUD should jointly finance a nationwide survey. This study will seek to ascertain the extent to which different solid waste disposal systems are operated by departments of general local governments, units of water and sewer districts, special solid waste disposal districts, or by private companies. The survey will also seek to develop data on the capital and operating costs of these waste disposal facilities and their means of financing -- user charges, special taxes, or general tax resources of the respective local public body. It can be financed out of available funds.

B. Research, Development and Demonstration

1. Research, Design and Pilot Studies

A series of contracts will be developed by HEW under P.L. 89-272 for formulation of design concepts including new technological approaches to the handling of solid wastes. A design competition could be used to stimulate high-grade technical effort by research and development organizations, engineering firms and other private enterprise groups. The essential elements of each design would include cost analysis, economic

evaluation, and technical procedures (including salvage, conversion, reuse, and conservation of natural resources), the design and plan for pilot testing, and a plan for demonstration and recommended criteria for evaluation.

2. Demonstration Projects -- New and Improved Methods and Facilities

In accordance with Title II, Public Law 89-272, the Solid Waste Disposal Act of 1965, HEW will finance grants or contracts for demonstration projects dealing with improved methods of collection or disposal. Each of these demonstration projects will be conducted on a scale model basis of sufficient size to determine which is efficient for possible use by various-size municipalities.

3. Plans and Specifications for Large-Scale Waste Disposal Facilities

For those collection systems or disposal facilities that show promise under the demonstration program, the Secretary of DHUD can undertake to finance the specific planning, out of funds available under the Public Works Planning Program authorized by Section 702 of the Housing Act of 1954, as amended. These advances are repayable, if construction is begun on the planned facilities. Through June 30, 1965, a total of 42 public works planning advances involving $1.3 million were made to finance the planning of incinerators and other solid waste disposal facilities having an estimated project cost of $68.9 million. This rate of expenditure can be accelerated.

4. Financing of Demonstration Facilities

When the systems or facilities have been planned, the Secretary of HUD will undertake to provide financial assistance to aid in their construction. Two categories of assistance are available for this purpose: a grant up to 50 percent of project development cost under the Community Facilities Program authorized by Section 702 of the Housing and Urban Development Act of 1965; loans for the remaining project cost under the Public Facility Loans Program authorized by Title II of the Housing Amendments of 1955 provided that the location has a population under 50,000 (or under 150,000 if it is in a designated redevelopment area). Funds necessary for this purpose are estimated to be $2 million. Total new expenditures on solid waste research should not exceed $5 million.

5. Promising Research Areas

The areas of technology in which research is promising include the following:

Processes for disposal after collection:

(1) Physical -- shredding, grinding, compaction, radiation, ultrasonic reduction.

(2) Biological -- bacterial and fungal digestion.

(3) Chemical -- oxidation and reduction.

Disposal at origin:

(1) Wet pulping or grinding.

(2) Automatic compression devices for high-rise buildings.

Recovery:

(1) The use of process steam from incineration for desalting water.

(2) Soil conditioners produced by composting

Materials Handling Systems:

(1) Hydraulic and pneumatic conveyance systems

(2) Ballistic, magnetic separation

Pilot Plant and Pilot Scale Testing:

(1) Size: large enough to be mechanized

(2) Test period: one-two years

(3) Sampling and instrumentation

C. Acceleration of the Adoption of Known Efficient Methods of Solid Waste Disposal

In order to stimulate local governments to eliminate open dumps and other hazardous or unsightly disposal facilities, Section 204 of Public Law 89-272 could be broadened to establish a federal-state-local partnership in financing demonstration grants directed toward accelerated application of present sanitary disposal methods. The new authorization would provide federal funds to match state projects that put to use what we already know, so that the total federal-state contributions would not exceed two-thirds of the total project cost. As a means of implementing section 205 on projects providing for regional waste disposal, the total federal-state contribution could be authorized at three-fourths of project cost.

Maximum demonstration benefits would be derived by an additional allocation amounting to 15 percent of the Federal grant to the State government for training and dissemination of information to officials of local governments throughout the State. On-site demonstrations, short courses, and consultations would be provided for these officials. These coordinated training and demonstration efforts would enhance visibility and strengthen motivation for other communities to abandon open dumps and replace them with facilities that exceed minimum health standards.

The collection of basic data could be advantageously coupled with such demonstration projects -- both to obtain information on a nationwide basis as part of the Federal program, and to calculate unit costs of operation. This is particularly useful in system design applications and would be essential in those projects aimed at the introduction of cost control methods in solid-waste management. It is proposed that six to eight contracts be made by the Department of Health, Education, and Welfare for such data collection.

Alternatively, this program could be carried out by DHUD. Authority to provide grants for solid waste disposal facilities is clearly implied by the language of both the Senate and House Reports explaining the provisions of Section 702 of the Housing and Urban Development Act of 1965. This authority would be made explicit by a request for appropriations for this purpose of up to $10 million.

D. The Special Case of New Communities

The 1966 legislative program for the DHUD will include a proposal for Federal financial assistance for "new communities." Should such new communities legislation be enacted by the Congress, the DHUD and HEW will support "new community" applications to install some of the new collection and disposal systems being developed under the research and demonstration program described above.

The foregoing program will not require any new legislative authorization. Instead, as noted above, it can be handled within the framework of existing legislation, except as noted. However, owing to the competing demands on these program funds, it is necessary to augment some of the fund authorizations or appropriations.

E. Estimated Cost

The solid waste programs described above are estimated to cost $15 million in their first year of operation.

6. NEW PROCESSES FOR DISPOSING OF JUNK AUTOMOBILES

Introduction

Automobiles abandoned by the highway or stripped in junk yards move to some extent into the scrap metal cycle to become new steel products. Most of the scrap is produced in the form of a "#2 bundle" which consists of the automobile folded by a baling press into twelve cubic feet of steel, copper, lead, zinc, and other materials; all nonferrous metals are contaminants in the steel-making process that cause #2 bundles to be considered inferior materials. It is necessary to find means for removing the contaminants.

There are three promising ways of doing so: A. shredding the automobile into small pieces and then picking out the steel scrap with electromagnetic devices; B. melting the scrap; C. using metallurgical processes. These are described below, in order of decreasing promise for removing large numbers of junk autos in the early 1970's. Shredding is the most promising because it has been tested and shown to be successful in removing large volumes of junk cars from the landscape. Melting and metallurgical processes may prove to be cheaper in the long run, but are not yet beyond the intermediate stages of research. There are further means which have yet to be evaluated by laboratory or market experimentation, and are probably a year or more away from being proposed as research projects. These are listed in the appended Commerce-USDI memorandum.

A. Shredding Processes

1. Construction of Shredding Plants.

Two corporations -- Proler Steel as the inventor and Luria as the imitator -- have constructed mills which pulverize an automobile, collect the ferrous remains onto a conveyer system by electromagnet, "bake" these remains to further remove contaminants, then compact the clean scrap into a loose bundle for shipment. This pulverized metal has been top-graded as steel scrap rather than lowest-graded in the #2 bundle category, since it is technically of the highest quality for electric furnace intake and in the newer oxygen furnace operations.

The demand for this output in Houston, Kansas City, Los Angeles, and Chicago has surpassed 1 million tons per year and indirectly has contributed to removing most of the junk autos from these cities. Surveys by the Bureau of Mines, preliminary to a junk census, have shown that Houston and Kansas City have less junk autos on a population basis than almost all cities in the country. A private survey of the Luria Corporation has indicated that the Proler and Luria operations in Los Angeles after three years have eliminated the backlog of junk autos accumulated since 1955.

These shredding mills should be installed where there are collections of junk autos sufficient to supply an intake of more than 150,000 cars per year. Where more than 300,000 cars are available, it can be presumed that private enterprise will construct plants -- and plans have been announced by Proler, Luria, or smaller companies to proceed with construction in New York, Philadelphia, St. Louis, Boston, Cleveland, Detroit, Buffalo. These should be supplemented by Federal construction and operation of two additional plants in regions with not enough junk cars to support a profitable venture. We recommend construction of a plant in the Minneapolis-St. Paul region that will draw junk cars from Minnesota, Iowa, the Dakotas, Kansas and Nebraska. More than 200,000 cars went out of service in this region in 1964 but only 60,000 were processed as #2 bundles. Five years' operation of a Minneapolis plant would eliminate the 1955-65 backlog. We recommend construction of a plant in the Atlanta region to process junk cars from Georgia, the Carolinas, Alabama and Florida. The accumulation in 1964 alone of cars out of service, net of the production of #2 bundles, was approximately 225,000; six or seven years' operation of this plant should clean out the excess junk in auto wreckers' yards collected from 1955 to 1965 throughout the Southeast. Construction should be a joint Government-industry venture with operation by private corporations. Federal grants should be made in the amount of roughly $2,500,000 (approximately 50 percent of the costs of construction of the two plants).

2. Transportation of Junk Autos to Shredding Plants.

Offensive junk yards close to the shredding plants are reduced to minimum size, but those farther removed continue to accumulate unscrapped cars. The car hulks at more distant and isolated locations can be channeled into scrap processing yards after flattening at the junk yard and transporting in lots of 12 to 18 in a railroad car or semi-trailor truck.

We recommend that two mobile vehicles be constructed to flatten automobiles. The Federal agency undertaking construction should use the vehicles for public demonstration purposes, one in the area extending north from Boston into Maine in an experiment to extend the scrap-haulage radius of the proposed Boston shredding mill, the other to operate within a 50-mile radius of selected Western national or State parks to clean up parkland approaches. We recommend that loans be authorized for the construction of six further operational mobile vehicles by private enterprise. The total expenditure for construction is estimated as $403,000, with the estimated recoverable value of the equipment equal to $110,000 after 18 months of service. Loans for private construction can be expected to total the approximately $1,200,000.

3. Further Studies of Transportation.

There is a lack of information on efficient means of transporting large volumes of junk autos to major shredding centers. We recommend that detailed analyses be made of operating costs for large value shipments by railroad, truck, river, and lake transporters. A study of such techniques by a consulting firm should include analyses of cost and product specifications, and research into the size of the market for large shipments of flattened automobiles. When the study is complete, policies should be formulated to reduce freight costs. It is estimated that approximately $100,000 is required for such economic and technical research.

B. Research on Melting Processes.

Several new melting furnaces have been designed which can accept junk autos as direct inputs for producing foundry metal. We recommend that research be carried out to estimate the potential size and location of markets for output from the foundry cupola processes. The limits to which one (Southeast) market can tolerate contaminants in the scrap can be estimated from operation of a private foundry in Alabama. We recommend that two additional plants be constructed in parts of the country having different demands for foundry output than those in Alabama. One plant should be constructed in the Northeast because of particular demands there for machine castings intolerant of certain contaminants, and another plant in the Middle-Atlantic region. These plants should be operated as demonstration and testing facilities, with auto scrap as a major input, after expenditure of $250,000 on market analyses and construction.

C. Metallurgical Research.

1. Removal by the formation of solid intermetallic compounds.

Melted batches of automobile scrap can be treated under laboratory conditions with additives to form solid separable intermetallic compounds. Indications are that the addition of sodium boride leads to the formation of copper compounds which can be separated from the ferrous compounds. Work of this nature started in FY 1966 at the College Park Metallurgical Research Center of the Bureau of Mines; we recommend that this research be accelerated and expanded during FY 1967 and 1968 so as to produce results leading to a demonstration plant in 1969-70. The amount presently available for this research is $458,000, and the expansion of the research would require total expenditures of $1,725,000.

2. Removal by slag treatment.

Melted scrap can be treated with slags that will selectively react with and absorb contaminants. Treatment methods include the passage of the slags over stationary baths, countercurrent flow of the slag and metal, and the use of rotating reaction vessels comparable to that in the Kaldo basic oxygen steel mill process. Careful determination of reaction times and temperatures is required in order to prevent reversal of the reaction, and considerable further research beyond that being carried out by private industry is necessary. We recommend that laboratory investigation of slag treatment be started in FY 1967 and completed in 1968. A pilot plant demonstration facility can be designed, constructed and subsequently operated in 1969-70. The estimated total of expenses are $1,425,000.

3. Removal of impurities by the addition of rare earth elements.

There are indications that the addition of rare earths to molten automobiles changes the physical structure of steel so that it can tolerate higher levels of contaminants. Laboratory research on the nature and extent of the toleration is required. We recommend that the physical metallurgy of resulting products be investigated. The research program should be completed in Fiscal Years 1968-69 with product evaluation in 1970. The total expenses are estimated to be $280,000.

4. Removal by vacuum treatment.

When scrap is melted under vacuum, dissolved metals with high vapor pressures such as copper, tin, chromium, and arsenic evaporate. Different temperatures and pressure are required for different types of automobile scrap and for different qualities of purified scrap. We recommend that equipment be designed for a demonstration plant, and research undertaken on the temperatures and pressures required to recover metals in pure form as evaporated from the scrap. It is estimated that construction and operation of a demonstration plant can take place in Fiscal Years 1968 and 1969 at a total expenditure of $1,000,000.

D. Other projects

1. Junk autos and fish.

The use of junk cars and other waste materials for creation of new fish habitat has been tried with some success in several locations. While not a solution to the junk car problem generally, the use of such cars where they now mar the beauty of the land and seascape in coastal areas offers a double benefit: improved fishing and decreased ugliness.

Before wide-scale use is attempted, a systematic evaluation of the effectiveness, design and costs of such reefs should be undertaken, the effectiveness of such planned breeding grounds in providing new fish stock, in increasing production of existing fish stock, and in attracting existing fish to such locations should be evaluated on a continuing basis. The proper design and costs as related to size, depth, orientation to current, materials for construction, protection for boats, etc. should be determined.

Because of the large stock of junk cars in New York and New Jersey and the availability of technical competence and equipment at the Sandy Hook Marine Laboratory, a pilot project should be undertaken by that laboratory. Annual costs are estimated at $500,000, for a five-year period -- with costs equally distributed between reef construction and evaluation efforts.

2. There are two processes -- oxidation and taconite induction -- which have been subject to extensive research by Federal and by private agencies and which might merit acceleration so that results will be

available before 1970. Expenditures to accelerate this research total $6.7 million, however -- an amount approximately equal to the outlay on all the promising projects above. These two research items are described in the appendix memorandum, but are not recommended as equal in importance to projects A through C.

E. Estimated Cost

The above proposals are estimated to cost $8.8 million in their first year.

Gardner Ackley

Gardner Ackley

Appendix Materials

1. Memorandum from Messrs. Quigley and Ross: "Eliminating or controlling pollution from Federal sources." (This memorandum was approved by HEW staff but has not been seen or signed by Mr. Quigley. It relates to item 1 of the report, pages 4-6.)

2. Report on Effluent Charge Study. (This report relates to item 4 of the main document, and is referred to on page 3.)

3. Letter from Messrs. Quigley and Schussheim on "a limited pilot and demonstration program for solid waste disposal." It relates to item 5 of the report, pages 28-32.

4. Memorandum from Edward K. Smith and Henry Caulfield on junk automobiles, with attachments. (The principal attachment referred to has been embodied in slightly revised form in the body of the report, as item 6, pages 33-38.)

EXECUTIVE OFFICE OF THE PRESIDENT

BUREAU OF THE BUDGET

WASHINGTON, D.C. 20503

MEMORANDUM FOR MR. ACKLEY

SUBJECT: Eliminating or controlling pollution from Federal sources

In response to your request of November 24, 1965, we have jointly developed a program to "put the Federal house in order."

1. Implementing Executive Order 11258

In addition to the general requirements on all Executive agencies, the Order levies specific requirements on the Department of Health, Education, and Welfare and the Bureau of the Budget to perform assisting and coordinative tasks. This discussion is in the nature of a report to you and Mr. Califano on the progress of the two agencies in the development of detailed plans for implementing the Order.

In order to carry out its responsibilities of providing technical assistance and to provide a contact point for agency inquiries, the Department of Health, Education, and Welfare plans a staff unit to be organized within the Federal Water Pollution Control Administration (to be officially established December 31, 1965) to work with the Federal agencies in implementing the Executive Order. Detailed policy guidelines and priorities for implementation of the Order are being developed. Consultation with Federal agencies at both headquarters and field levels concerning implementation of the Order has been initiated.

With regard to section 3, which requires cleaning up existing facilities, it should be pointed out that most Federal installations which are major dischargers of wastes have already been inspected by personnel of the Department of Health, Education, and Welfare and recommendations concerning needed improvements have been made. However, in order to comply with the provisions of the Executive Order dealing with existing facilities, considerable technical assistance will have to be provided by HEW during the next six months.

The adequacy of technical information concerning control of vessel pollution is being assessed, including ongoing technical studies within the Department of Health, Education, and Welfare. The work of the Interdepartmental Committee on Sewage and Waste Disposal from Vessels is being reviewed. On the basis of these reviews, a program to complete the study of vessel pollution and make recommendations for corrective or preventive action by January 1, 1967, will be developed by December 31, 1965.

In reviewing its own activities which may result in water pollution, the Department of Health, Education, and Welfare will develop a program of stringent requirements, to provide leadership and serve as an example to the entire Federal establishment.

The Bureau of the Budget is designated to receive the "phased and orderly plans" specified by section 3 to be developed to guide improvement efforts at existing installations. Accordingly, the Bureau plans to issue a Budget Circular (or other instruction) specifying the information required and laying down criteria to govern the inclusion of installations in the planning process. The content of the Circular will be developed in cooperation with HEW. We anticipate issuance of the Circular by the end of February.

The Order leaves the disposition of agency plans open, once they are submitted to the Bureau of the Budget by July 1, 1966. We believe that this is necessarily the case because currently we have no way of assessing what agency plans will be, how quickly they will contemplate completion, nor what costs would be entailed. In any event, there will be a review of agency plans by all appropriate BOB staff and probably a central review of the plans to determine instructions to the agencies on which items to include in their 1968 budget estimates.

In the absence of the agencies' plans, as called for in the Order, we have no way of estimating the cost of cleaning up Federal facilities.

2. Possible program for utilization of Federal facilities and buildings to demonstrate new pollution control technology

In addition to putting their own houses in order, Federal agencies could provide leadership in the national pollution control effort through installing and demonstrating new waste treatment and air pollution control technology at their installations.

There is a gap between the development of new and improved pollution control technology and its widespread practical application. This gap results from reluctance on the part of consulting engineers and municipal and industrial officials to invest in relatively untried devices, even though they have proved successful in pilot plant studies. Demonstration of full-scale operation of new technology at appropriate Federal facilities could contribute importantly to the bridging of this gap. The Department of HEW, in its technical assistance role, will seek to accomplish this by making tentative selections of appropriate Federal installations and processes and proposing appropriate action to the operating agency. The BOB will endeavor to provide whatever assistance is necessary to foster such an arrangement.

3. Air Pollution Executive Order

HEW and BOB staff have been jointly working on a proposed Executive Order on Air Pollution from Federal Activities. Initial drafts have been prepared and we expect that within three weeks a good working draft can be ready for circulation to the principal agencies for comment. We are working towards issuance of the order in February. A technical supplement which will accompany the order is now being written by PHS and should be completed within the same period.

The proposed order essentially parallels the one on water (E.O. 11258). It would cover both new and existing facilities. The procedure for new facilities is similar to that contained in the water Order except that HEW will not regularly review agency plans. HEW assumes that the agencies are technically competent to carry out the standards, and technical assistance is offered. The procedure for existing facilities is the same as the water Executive Order, except that changes in fuel specifications to minimize sulfur emissions are delayed pending further study. Agencies are required to submit a report on loan, grant, and contract activities to the BOB by January 1, 1967.

The standards contained in the draft order are expressed in nontechnical language. A separate section provides a procedure whereby HEW, with the concurrence of the BOB, can issue specific standards of performance and techniques of measurement to clarify or supplement the general standards contained in the order. As indicated above, it is contemplated that a fairly complete set of technical definitions to clarify and define the general standards will be issued simultaneously with the order, although they would not be appropriately included in the order itself. The standards are about as stringent as those contained in the water Order. Included is the statement that "Emissions to the atmosphere from Federal facilities and buildings shall not singly or in combination cause injury, detriment, nuisance, or annoyance to people, endanger their health or welfare, cause injury or damage to animals, vegetation, or property, or create a hazard to transportation."

There are several alternative approaches which could be taken to the Air Pollution Order. These include:

(1) The most sensitive subject contained in the order is that of sulfur emissions (sensitive because of its potential impact upon the coal and residual fuel oil industries). Such emissions could have been handled either more or less stringently. On the one hand, the sulfur standards could have been applied to existing installations without any modification or delay. Such an approach would generate intense opposition from the coal industry and its congressional representatives. On the other hand, we cannot ignore what is believed to be a significant health hazard in polluted air by exempting existing installations entirely from the sulfur provision. In the draft order, the sulfur standards are applied to new installations but existing installations are not to revise their fuel specifications with respect to sulfur content without further instruction from the Secretary of HEW. The Secretary of HEW, with the advice and assistance of the Secretary of the Interior, is to study the potential

Impact of such changes in fuel specifications. The technical and costing aspects of such a study will probably require from six months to a year to complete.

(2) Existing facilities could be excluded from all of the standards contained in the order. However, it was agreed by all concerned that there was no overriding reason--technical, economical, or political--why existing facilities should not be covered. On the other hand, the posture of Federal leadership would argue for inclusion of existing facilities.

(3) Reference to grants, loans, or contracts could be omitted. The application of standards to such indirect Federal activities would provide a means for cleaning up many of the most significant causes of air pollution in the country. Such a step would obviously have great political ramifications and should not be entered upon, or even considered, lightly. However, it was our judgment that calling for study and consideration of such a possibility was both feasible and desirable.

4. Related legislation

It should be noted that legislation (S. 560) designed to accomplish the same ends as the water and air executive orders passed the Senate last session. Briefly, this bill provides for: (1) The Secretary of HEW to establish standards for pollution control (both air and water) from Federal installations; (2) congressional authorization of funds for pollution control systems on Federal installations, and certification of such systems by the Secretary of HEW; (3) all new installations to meet standards of HEW; (4) Secretary of HEW to train pollution control personnel of other departments and agencies; (5) HEW to investigate and inspect waste discharge practices at Federal facilities; and (6) an annual report to Congress by HEW on pollution from Federal installations. S. 560 was not supported by the Administration, and it is unlikely that it will pass the House, particularly in view of the two Executive orders discussed herein. However, should it pass, it would supersede some portions of the orders.

James M. Quigley
Assistant Secretary
Department of Health, Education,
and Welfare

William B. Ross

William B. Ross
Alternate Task Force Member
Bureau of the Budget

REPORT ON EFFLUENT CHARGE STUDY

This study* of effluent charges was undertaken to gain some practical experience in effluent charges leading to improved water quality conditions. The study is limited in scope, but it does present some comparisons of alternative methods of abating pollution which invite further discussion of the feasibility of utilizing the effluent charge as a pollution abatement incentive.

Specifically the study estimated levels of effluent charges required to attain a specified average level of dissolved oxygen; investigated the impact of charges on regional economic activity; and compared the effluent charge method with other schemes of attaining quality goals.

In summary, the conclusions of the study are:

1. Effluent charges should be seriously considered as a method of attaining water quality improvement;

2. Costs of waste treatment induced by a charge level will approach the least costly treatment plan;

3. A charge level of 8 to 10 cents per pound of oxygen demanding material discharged appears to produce relatively high increases in critical dissolved oxygen levels;

4. Major regional economic readjustments from a charge of that level are not anticipated to occur in the study area;

5. Administrative costs and difficulties of managing an effluent charge method are greater than conventional methods of quality improvement, however, the problems are not insurmountable and are not sufficiently great to negate the advantages of the charge method;

6. Compared to a conventional method of improving water quality, the charge method attains the same goal at lower costs of treatment, with a more equitable impact on polluters. Also the charge provides a continuing incentive on the polluter to reduce his wastes discharge and provides a guide to public investment decisions;

---

* The study is based on experience and data from the water pollution control study of the Delaware River estuary by the Public Health Service of the Department of Health, Education, and Welfare. The firms and municipalities in the study are immaterial to the results and are not identified. Care must be exercised in relating the findings of this study to other water bodies with different physical characteristics.

7. More study is needed of the technical problems of coping with differential charges related to waste load discharge durations, to prediction of induced responses, administrative problems associated with sampling of discharges and damage estimation.

Assessment of effluent charges is theoretically undertaken by considering quality to be the dependent variable. Damages arising from the discharge of waste into a water body are assessed and charged against the waste discharges. In response, waste discharge is reduced until the cost of additional waste reduction equals the charge. For each unit of waste discharged, each polluter is made to bear a cost equal to his contribution to the damage produced by his wastes. Present techniques do not allow charges to be set in accord with this theory. It is not possible to estimate damages in such a manner that effluent charges are, in fact, equal to damage losses. Therefore, the problem of setting charges has been simplified to estimating charges which lead to a specified water quality goal in terms of dissolved oxygen. This goal, for example, might be determined by a consensus of the water users in the area.

The study does consider charges necessary to attain different levels of dissolved oxygen during summer months. Dissolved oxygen level is an important quality variable in that it relates to recreational opportunities, fish and shellfish populations, and, in this case is indicative of acceptable levels of many other quality variables. The problems of setting charges for other time periods, shorter, longer or periods in the future are not considered although they are of consequence in a practical application of charges.

Five goals are considered: (1) a minimum average dissolved oxygen of 2 mg/l; (2) a minimum of 3 mg/l; (3) a minimum of 4 mg/l; (4) a mixed goal consisting of 2 mg/l in the most critical reach of the water body and 3 mg/l elsewhere; and (5) a mixed goal of 3 and 4 mg/l in each of the two portions of the water body.

Four ways of attaining each of the specified quality vectors were considered:

1. Uniform treatment, (UT), in which each waste discharger removes an equal percentage of the wastes produced before discharging the remainder to the stream. This program may be considered typical of many current programs for improving water quality.

2. Least-Cost Linear Programming, (LC), which specifies levels of treatment which achieve the specified goal at the minimum economic cost. This method requires the most information to determine treatment levels. There are additional difficulties due to possible protests.

3. Single Effluent Charge, (SECH), in which a uniform unit price is charged throughout the basin to each waste source. The solution examines responses of individual dischargers and selects the minimum single charge which will result in waste removals which meet the quality goal.

4. Zone Effluent Charge, (ZECH), method is an extension of SECH in that a set of minimum charges is determined for several zones which induce a level of treatment which will meet the goal. The charge in each zone is selected so that the cost of induced waste removals are kept at a minimum. The effluent charge method induces waste treatment until the cost of the last unit of removal equals the damages avoided by such removal; remaining wastes discharged are paid for by the discharger at the charge level.

The zoned effluent charge method induces levels of treatment approaching least costly treatment plans by careful selection of zones. The method is also more equitable than the other methods. Charges are the same for each polluter if the waste discharges of each cause the same damages and are different if the polluters differ with respect to damages.

The effluent charge programs provide a continuing incentive for the discharger to reduce his waste load by placing him under the continuing pressure of monetary penalties. As new technology develops, in planning future production schedules and methods, he will be cognizant of the charge and attempt to reduce his payment. Physical specification of waste load reductions implicit in applying the uniform and least cost solutions have no such effect. Once the required removal is obtained, there is no incentive for further reductions in waste loads.

Table I presents the total economic cost of treatment resulting from the application of each of the models to the problem of attaining specific quality goals. The results provide an indication of the relative efficiency of each method in achieving the dissolved oxygen goal at least cost of induced treatment.

Consideration of a uniform removal method leads to the conclusion that it is neither capable of achieving a goal at the least cost nor of treating polluters in an equitable manner. There is a superficial equity in that all dischargers must remove an equal portion of their wastes, but further examination shows that this is not real equity. A zoned uniform removal method reduces costs, but will not improve equity. The chief virtue of this approach to water quality improvement is its simplicity. In addition, a physical specification of amount of waste to be removed by each polluter escapes the increased probability of effluent charge schemes that the goal will not be met because of misspecification of responses. However, by paying close attention to the conditions of goal attainment, the probability of missing the goal with the effluent charge method may be made extremely small.

Two methods, least cost and effluent charge provide valuable information for the guidance of public investment, providing costs in the private sector to which costs of public investment may be equated.

Historical discharges of waste have built up large sludge deposits which exert a demand on available oxygen. Removal of such deposits by dredging would permit attainment of a specified goal with less treatment than otherwise necessary. For example, it is estimated that a goal of 2 ppm minimum dissolved oxygen could be achieved by removing sludge deposits with no increase in treatment above current levels. However, continuation of current practices will lead to a renewal of sludge banks which will again need to be removed in the future. At this time it is not possible to estimate the need for dredging required after waste treatment. However, a single sludge removal is estimated to cost approximately $60 million, resulting in estimated annual costs with various dredging intervals of:

Sludge Removal Required Every X Years	Estimated Annual Cost $10^6
2	32.3
5	13.8
10	7.8
15	5.8
20	4.8
25	4.2

A high average removal of wastes discharges without sludge removal will produce an effluent and resulting quality in the water body which will tend to use up the oxygen-demanding material gradually over some future period, removing the sludge demand naturally. Thus, after 15 or 20 years, the solutions presented for "no sludge removal" become asymptotic to a "sludge removed" goal approximately 1 ppm higher than the "no sludge removal" solution.

The effluent charges provide a guide to public investment in sludge removal. If the unit cost of sludge removal is less than the charge required to attain the same improvement in quality, then sludge should be removed until the unit cost of removal equals the charge. The same principle applies to other public investment decisions.

An important consideration in evaluating an effluent charge plan is the level of the charge and its impact on industrial activity--will a charge capable of inducing a particular quality level be as high

as to result in major changes in the level of economic activity such as the closing of manufacturing plants? While it is not possible here to measure changes in output or production techniques as functions of charge level, it is possible to draw some general conclusions by comparing the increased cost induced by the charge with the value of output of waste dischargers. Such data are presented in Table 2. There is likely to be considerable error in the numbers presented. The order of magnitude for most industries, however, coupled with the fact that cost estimates of treatment are possibly on the high side, indicate that the cost burden is not likely to result in major industrial relocations for the levels of charges considered. Costs to firms in SIC 2631 and 2818 are relatively large compared to value of output and may have substantial effects on these firms' production.

Municipal costs in terms of dollars per year per capita served are presented in Table 3. The highest of these is estimated at less than $10 which does not appear an unreasonably high cost.

Note that in some cases, for example, Municipality 1 and SIC 2911, Industry 7, no treatment is induced even at high levels of the effluent charge. This is a result of these discharges already providing high degrees of removal, 80 percent or more for the specific examples mentioned, so that costs of additional treatment are high.

The per capita cost of municipal treatment provides an estimate of the incentive provided industrial waste producers to tie into municipal systems. An industry discharging 10,000 lbs per day of BOD (ultimate oxygen demand), produces the equivalent of a population of about 40,000 (0.24 lbs/capita = 1 population equivalent, P.E.). At a cost to industry of between $3 and $10 per year per P.E., the annual cost of tying to the municipal treatment plant is between $120,000 and $400,000. With a 20¢/lb fee for typical plants discharging this amount of waste, annual costs of treatment plus charge payments would run about $360,000 to $500,000. For a charge of 10¢ per pound costs of tying to a municipal system range from $60,000 to $320,000 per year while comparable individual treatment plus charge payments by industry ranges from $80,000 to $400,000 per year. Thus, it is evident that some industries now discharging directly to the stream will be induced to join a municipal system. The advisability of accepting them, however, must be related to the actual costs which they impose on the municipal system and the compatibility of their waste stream constituents with municipal treatment facilities.

The effect of effluent charge level on dissolved oxygen concentrations are summarized in Table 4. The incremental improvement gained falls off rapidly with increasing charges. This is partly because the in-

cremental dissolved oxygen improvement decreases as the amount of load removed approaches 100 percent of the load included in the analysis.*

In any study involving the representation of complex physical systems, the estimates of physical conditions in the stream, such as the reaeration rate, influence the difference between mathematical representations and real attainments in quality improvement. Such errors of estimation affect predicted physical specification of removals and effluent-fee-induced removals of waste equally. The results of this study are most sensitive to the reaeration rate, and not particularly sensitive to the value of decay rate or diffusion coefficient. Therefore, all calculations have assumed a reaeration rate r, of 0.2 per day, the most likely value and values of 0.1 per day and 0.4 per day to illustrate the upper and lower bounds on the possible outcomes.**

Tables 5 and 6 show the minimum effluent charges and the total cost of treatment to achieve a specified goal under assumptions as to sludge removal and for average and extreme levels of reaeration rate. A charge of 8-10 cents per pound of oxygen demanding material discharged appears capable of approaching the highest goals attainable given the physical properties of the basin and the total load produced by private dischargers included in the model.

Total costs of treatment for each method, with and without sludge removal and for the three values of reaeration rate are shown in Table 7.

Cost of treatment comparisons indicate that the zoned effluent charge method is capable of achieving a water quality goal at a cost close to the minimum economic cost. As previously stated it also provides for a more equitable treatment of polluters than any

---

* This indicates the need to remove loads other than municipal or industrial if further improvement is to be achieved. Such load items include tributary inputs, sludge deposits and storm water overflows. Public investment in low-flow augmentation, in-stream reaeration and other such schemes might also be considered to supplement private waste removals after appropriate unit cost levels are reached by the private sector or in any case must be considered to reach a goal higher than that attainable with removal of 100 percent of discharged load considered in the models.

** Note the effect of reaeration rate on the incremental improvements gained. Errors in estimating the physical parameters of the system can result in wide variations in estimated quality response to a given input of waste. Thus, even specification of required removals may fall far short of achieving a goal.

other method. In this case study, charges of 8 to 10 cents per pound of oxygen demanding material discharged to the stream are expected to attain a relatively high level of average dissolved oxygen at a cost to individual polluters which would not result in drastic re-adjustments of existing regional economic activity.

Effluent charge methods provide guides to public investment decision making and provide a continuing incentive to the polluter to reduce his waste load.

Administration of an effluent charge program is more costly than that of a well-run "conventional" program of quality improvement--a regulatory system with emphasis on treatment; however, advantages of the method should outweigh the additional costs. Fee payments appear sufficient to cover such costs. An important consideration in utilization of effluent charges is that an incentive be provided to stimulate advance reporting of unusual discharges.

The major technical problem remaining in the implementation of effluent charges involves the estimation of fees related to time of discharge. As discussed briefly in the Appendix, it is currently possible to relate time dependent depressions in quality to duration of discharge into any reach of the stream. The problem remains to estimate either costs of achieving reductions in these spike or transient inputs or to estimate the marginal damages which they create.

This study indicates that the effluent charge method is a feasible method for attaining water quality improvements. It provides an acceptable solution to water quality management which has many desirable properties and appears to have no insurmountable problems of application although more study of special aspects of effluent charge implementation is in order.

Table 1

Typical Economic costs of Treatment to Achieve specified Dissolved Oxygen Goals with Effluent Fees as compared with other methods.

Cost of Treatment*

	U.T.	SECH	ZECH	L.C.
2	5.0	3.3+	3.3	1.6
2-3	8.4	7.7	6.2	~~4.3~~ 5.8
3	11.2	~~9.0~~ 7.7	7.4	6.9
3-4	20.0	9.0	8.6	7.0
4	> 23.0	> 23.0	> 23.0	> 16.0~~**~~

* Cost in 10^6 per year for induced treatment .

~~** Indicates goal cannot be met with 100% removal of waste inputs explicitly included in model.~~

Table 2

Industrial Costs as a Percentage of Output Value*

SIC**	Firm No.	Cost of Treatment Induced by an effluent fee of:***						Total cost associated with a fee of:***					
		2	4	6	10	16	20	2	4	6	10	16	20
2631	1	0	1.0	1.0	1.0	1.0	1.9	1.2	1.4	1.7	2.1	2.8	1.9
	2	0	0	0	0	0	0	1.0	2.0	3.0	5.0	8.0	10.0
	Aver.	0	.6	.6	.6	.6	1.1	1.1	1.7	2.3	3.4	5.0	5.3
2816	1	0	0	0	0	0	0	.2	.4	.5	.9	1.4	1.8
2911	1	0	0	.06	.06	.06	.06	.05	.09	.09	.12	.15	.17
	2	0	0	0	.08	.08	.08	.04	.09	.13	.14	.17	.20
	3	0	0	0	.16	.16	.16	.07	.14	.22	.22	.25	.27
	4	0	0	.14	.14	.14	.14	.11	.22	.19	.22	.27	.30
	5	0	.03	.03	.03	.06	.03	.02	.04	.04	.05	.06	.06
	6	0	0	.06	.09	.09	.09	.05	.11	.08	.09	.09	.09
	7	0	0	0	0	0	0	.08	.15	.23	.38	.60	.76
	Aver.	0	0	.06	.08	.08	.08	.06	.11	.12	.13	.16	.18
2819	1	.14	.14	.14	.18	.18	.18	.18	.23	.28	.43	.55	.64
	2	0	0	0	0	0	.40	.06	.13	.20	.33	.52	.50
	3	0	0	.23	.31	.31	.31	.20	.39	.32	.31	.31	.31
	Aver.	.03	.03	.19	.25	.25	.29	.18	.33	.30	.32	.38	.40
2621	1	0	0	0	0	.17	.17	.07	.14	.21	.34	.31	.34
2818	1	1.0	4.0	4.0	4.0	4.0	4.0	5.6	4.0	4.0	4.0	4.0	4.0
	2	0	0	0	0	0	2.4	0.8	1.6	2.4	4.0	6.4	3.5
	Aver.	.27	1.1	1.1	1.1	1.1	2.8	1.9	2.3	2.9	4.0	5.8	3.6
2661	1	.08	.20	.20	.20	.20	.20	.44	.60	.80	1.2	1.8	2.2
Aver-all above		.01	.02	.10	.13	.14	.16	.12	.20	.21	.26	.33	.33

* Value of output is estimated from aggregate regional data for four-digit SIC's with adjustments made for individual firms in cases of sufficient data availability.

Continuation of notes to Table 2

** SIC represents the following Standard Industrial Classifications:

2631 Paperboard Mills.
2816 Inorganic Pigments.
2911 Petroleum Refining.
2819 Industrial Inorganic Chemicals, n.e.c.
2621 Paper mills, except building paper mills.
2818 Organic chemicals, n.e.c.
2661 Building paper and board mills.

*** Effluent fee in cents per pound of oxygen demanding natural (U.O.D.) discharged.

Table 3

Per Capita Costs of Municipal
Treatment and Treatment Plus Charge Payments
for Various Levels of Effluent Charge.
($ per capita per year)

Municipality	Per Capita Treatment Cost w/Charge of:*						Per Capita Total Cost w/Charge of:*					
	2	4	6	10	16	20	2	4	6	10	16	20
1	0	0	0	0	0	0	.16	.32	.49	.82	1.51	1.63
2	0	.28	2.07	2.07	2.07	3.25	1.28	2.41	3.13	3.83	4.89	5.49
3	2.00	2.00	2.00	2.00	4.90	5.65	2.50	3.00	3.52	4.53	5.43	6.25
4	0	0	0	1.45	1.45	1.45	.72	1.44	2.17	1.96	2.27	2.47
5	0	0	0	1.10	1.10	1.10	.71	1.42	2.13	1.59	1.89	2.08
6	0	5.06	5.06	5.06	5.06	9.39	4.30	6.12	6.66	7.72	9.32	9.39
Average	.10	.69	2.04	2.11	2.26	3.50	1.47	2.52	3.19	3.85	4.86	1.88

* Charge in cents per pound of oxygen demanding material (U.O.D.) discharged.

Table 4
Single Effluent Fee, D.O.
Improvement and Total Costs

Fee (¢/# of BOD)	D.O. Increase (ppm) for reaeration rate of:			Treatment Cost (10^3/yr)	Payments for waste discharg ($\$10^3$/yr)
	0.1/day	0.2/day	0.4/day		
2	.4	.2	.1	457	5,982.4
4	2.0	1.0	.5	2,447	8,686.2
6	3.4	1.8	.9	7,733	5,595.0
8	3.5	1.9	1.0	7,955	7,042.7
10	3.8	2.0	1.0	8,650	7,303.5
12	3.8	2.0	1.1	8,788	8,688.6
14	3.8	2.1	1.1	9,226	9,780.6
16	3.8	2.1	1.1	9,226	9,215.7
18	4.1	2.2	1.1	10,661	10,364.3
20	4.2	2.3	1.2	13,179	8,551.3
30	4.4	2.4	1.2	19,333	4,656.0
40	4.4	2.4	1.2	19,424	5,944.9
50	4.5	2.4	1.2	20,062	5,468.3
60	4.5	2.4	1.2	20,933	4,183.5
70	4.5	2.4	1.2	21,276	2,574.9
80	4.6	2.4	1.2	21,728	2,055.7
90	4.6	2.4	1.2	22,776	420.5
100	4.6	2.4	1.2	22,776	467.2

Table 5
Minimum Uniform Effluent Fee Estimated to Meet Specified
D. O. Goals and Cost of Associated Program

D. O. Goals	r[1]	Effluent Fee (¢/#) with Sludge[2]		Total Treatment Cost w/Sludge[2]	
		Removed	Not Removed	Removed* (10^6/yr)[3]	Not Removed (10^6/yr)
2	.1	0	4	0	2.45
	.2	0	6	0	7.73
	.4	0	6	0	7.73
Mixed 2-3	.1	2	6	.46	7.73
	.2	4	6	2.45	7.73
	.4	6	~~6~~	7.73	~~7.73~~
3	.1	4	6	2.45	7.73
	.2	4	6	2.45	7.73
	.4	6	~~6~~ 12	7.73	~~7.73~~ 9.00
Mixed 3-4	.1	4	8	2.45	7.96
	.2	6	12	7.73	9.00
	.4	—	N.S.	—	N.S.
4	.1	6	6	7.73	7.73
	.2	6	~~N.S.~~	7.73	~~N.S.~~
	.4	N.S.	N.S.	N.S.	N.S.

*Does not include cost of sludge removal.
N.S. Indicates goal impossible to attain even with 100% removal of load considered as removable in this problem.

1. Reaeration rate.
2. The lack of differentiation among many solutions is the result of solving an iterative problem with 2¢ increments. More differentiation could be obtained from smaller charge increments. A charge of 6¢ per pound for example indicates a charge in the range greater than 4¢ and less than or equal to 6¢.

Table 6

Minimum Zoned Effluent Fees Estimated to Meet Specified D.O. Goals and Cost of Associated Treatment Programs

D.O. Goal ppm	r[1]	Effluent fee (¢/#) with sludge: Removed Zone 1	Removed Zone 2	Removed Zone 3	Not Removed Zone 1	Not Removed Zone 2	Not Removed Zone 3		Total Cost of Treatment w/sludge Removed[2] (10^6/yr)	Not Removed (10^6yr)
2	.1	0	0	0	4	2	0		0	1.13
	.2	0	0	0	4	2	6		0	3.30
	.4	0	0	0	6	10	4		0	7.36
Mixed 2-3	.1	2	2	0	6	0	0		.42	3.00
	.2	4	0	0	4	8	2		1.01	6.26
	.4	6	0	0	[3]				3.00	
3	.1	4	2	4	6	0	4		2.45	4.32
	.2	6	2	4	6	6	6		3.32	7.36
	.4	4	8	6	10	10	10		5.96	8.65
Mixed 3-4	.1	4	2	4	6	12	4		2.45	7.50
	.2	4	10	10	10	10	10		6.66	8.65
	.4	20	0	20	NS	NS	NS		10.01	NS
4	.1	6	0	4	6	12	4		4.32	7.50
	.2	6	6	4	NS[4]	NS	NS		6.88	NS
	.4	NS	NS	NS	NS	NS	NS		NS	NS

1/ Reaeration rate.
2/ Cost of sludge removal not included.
3/ Blank indicate missing data.
4/ NS indicates it is impossible to attain the goal even with 100% removal of the load considered in this study.

Table 7

Cost of Treatment for Alternative Methods of Attaining Goal
(Cost in 10^6/gr)

D.O. Goal ng/L	r[1]	With Sludge Removal[2]				Without Sludge Removal			
		UT	SECH[3]	ZECH	L. C.	UT	SECH[3]	ZECH	L. C.
2	.1	0	0	0	0	3.26	2.45	1.13	.58
	.2	0	0	0	0	5.03	7.73	3.30	1.56
	.4	0	0	0	0	11.21	7.73	7.36	4.92
2-3	.1	.88	.46	.42	.31	5.03	7.73	3.00	1.48
	.2	3.26	2.45	1.01	.54	8.45	7.73	6.26	5.82
	.4	5.03	7.73	3.00	1.15	15.22	___[4]	___	___
3	.1	2.56	2.45	2.45	.57	6.11	7.73	4.32	2.30
	.2	3.75	2.45	2.32	1.51	11.21	7.73	7.36	6.91
	.4	15.22	7.73	5.96	5.32	20.04	9.0	8.65	___
3-4	.1	6.11	2.45	2.45	2.04	8.45	7.96	7.50	3.71
	.2	7.21	7.73	6.66	5.76	20.04	9.0	8.65	7.00
	.4	16.00	___	10.01	8.00	N.S.	N.S.	N.S.	N.S.
4	.1	7.21.	7.73	4.32	3.92	8.45	7.73	7.50	5.09
	.2	8.45	7.73	6.88	5.65	23.04	23.0	23.0	16.0
	.4	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

1. Reaeration rate
2. Cost of sludge removal not included.
3. Constancy of SECH costs results from an iterative solution utilizing 2¢ increments. A finer increment would result in better differentiation among levels of cost. A 1¢ increment was utilized in the solution of ZECH problems.
4. ____ Indicates data missing.
5. N.S. Indicates goal not attainable even with 100% removal of loads considered

APPENDIX A -- Administrative Aspects of Effluent Charge

Appendix Table A-1 summarizes the major items associated with a well run, conventional program of water quality management and with two schemes of administering effluent charges. The two effluent charge schemes differ in that Scheme A assesses a total bill computed on the basis of actual observations of discharged waste loads; whereas effluent Scheme B bills on the basis of an agreed upon load duration curve which may be recomputed upon petition of the discharger or by the administrative agency should conditions of discharge change. Either administrative Scheme A or B is equally applicable to zoned effluent charges.

The "Usual Program" envisions a command operation which specifies and enforces levels of waste removal in physical terms. It is envisioned that the program will provide for more public investment, and system control than is practiced in most present programs of the conventional type. That is, system responses to commands will be analyzed more thoroughly, short-run control will be applied and more complete surveillance programs will be carried out.

Of particular importance in operating an effluent charge program is that an incentive be provided to stimulate advance reports of unusual discharges. For a high-concentration, short-duration waste release, the unit charge may be expected to be high. However, if the discharge is made, reported on the next report and subsequently charged for, the administrative agency is likely to end up with a large sum of money and lots of dead fish. However, by inducing dischargers to report the potential discharge in advance if at all possible, the administrative agency may be able to circumvent the effects of the discharge by flow augmentation releases, by requesting increased treatment or short-term withholding of wastes by other dischargers, or possibly by providing movable treatment plants or barges which could handle the waste.

Such an incentive would be provided by charging at a reduced rate if the discharge is reported in advance and can be counteracted. For example, suppose the charge for dumping y lbs. of BOD in $\frac{1}{2}$ hour is $10.00 per pound based on damages to commercial fisheries. This might be cheaper than any alternative in the opportunity set of the individual discharger. However, at a cost of $8.00 the administrative agency has an alternative available to it which can prevent the damage to commercial fisheries. If the discharger provides warning of his impending release, and the administrative agency prevents damages, then the discharger should be charged only for the actual costs incurred, $8.00 y rather than the charge due if he in fact dumped the waste, $10.00 y.

Specific costs of operating each program could not be estimated, however, some idea of relative costs can be obtained by perusal of Table A-1. Any well run program requires approximately the same monitoring system for its control, thus no cost differential is expected in that area. Effluent sampling in the usual program could be conducted on a less frequent basis than for Effluent Charge A, serving only to detect long term trends in waste loads or efficiencies in operation of treatment facilities and to up date planning models. Since Effluent Charge A utilizes such sampling as the basis for its periodic billings, and due to the necessary graduated scale of charges, frequent sampling is required to determine time duration of discharge as well as total quantity. Where practicable, continuous sampling may be desirable.

Effluent Charge B would require no sampling by the dischargers, thus being less costly than either of the other programs. The discharger will undoubtedly sample in any case to prevent missing an opportunity to negotiate a reduced billing load.

Thus the cost of sampling imposed on the discharger will be higher for Effluent Charge A than the other programs. The amount of this differential depends upon the extent to which sampling techniques can serve to reduce sampling frequency.

Efficiency gains measured as the cost difference between a ZECH program and a U.T. program can be computed from Table 7, and range from $400,000 per year to over $4 million per year depending upon the goal to be attained.

Funds collected by the administrative agency at an effluent charge of 10¢ per pound are estimated at $7.3 million per year. Even half of this amount should be sufficient to administer the program. For comparison the annual budget of the Delaware Estuary Study runs less than 10% of the estimated collections.

Generally, the effluent charge schemes can be expected to be more expensive to operate than the usual program due to billing costs, an increased level of surveillance with charge scheme B, and need for additional analysis and data to initiate the program. In terms of anticipated gains in efficiency and equity as well as other favorable properties of zoned effluent charges, it appears that additional costs of operating an effluent charge system would not be sufficiently high to influence its adoption.

Table A-1

Comparison of Administrative Aspects of "Usual" and Effluent Charge Programs

Item	"Usual" Program	Effluent Charge Scheme A	Effluent Charge Scheme B
Stream Monitoring	Yes	Yes	Yes
Effluent Sampling	On order of weekly intervals by discharges	On order of daily intervals by discharges (or continuous monitoring)	Establish agreed-upon load for charge basis. Monitoring by administrative agency on request of discharges to estimate new charge basis.
Reporting by discharge to administrative agency	Weekly	Quarterly report W/ incentive for advance reporting of unusual conditions.	No scheduled reports. Incentive for advanced reporting of unusual conditions.
Billing costs	None	Billing expense including calculations of charge each quarter	Billing expense. No recalculation except if load conditions change
Surveillance by Administrative Agency	Required on regular basis	Same as "Usual" Program	Stepped up checking on effluent discharges to discover deviations from agreed load.

Item	"Usual" Program	Effluent Charge Scheme A	Effluent Charge Scheme B
Stream Monitoring	Yes	Yes	Yes
Establishment of Program (Starting costs)	Research into physical regime of water body, establishment of quality objectives, and allowable loads.	Same as "Usual" plus additional cost of determining economic functions on which to base charges	Same as "Usual" plus additional cost of determining economic functions on which to base charges
Reassement of Program Effectiveness	On Some regular basis for all programs		
	Redo analyses required for establishment of Program	Redo above and analyze growing body of information reflecting responses to charge levels, physical effects in order to evaluate charge structure.	

APPENDIX B -- Discussion of Models

Two schemes for the estimation of effluent fees were developed. The first applies a single charge to the entire basin for each unique set of parameters including flow, time-duration of discharge, and quality objective. The second method is similar to the first except that differentiation among dischargers is made on the basis of location along the water body with different charges in each of several zones.

Solutions were also obtained for: (1) a program of uniform percent levels of waste reduction by all dischargers in the basin enforced through legal or administrative means - a common current solution to the problem of water quality improvement; and (2) a least-cost linear programming solution which minimizes the total cost of a treatment program. These latter programs provide a basis of comparison of the effluent charge scheme with current practices in achieving improved water quality and with an efficient program respectively.

The problems are formulated as stationary, steady-state processes which abstract from transient effects and do not account for conditions in time periods other than that explicitly considered including future time and periods of longer and shorter duration. Charges to maintain a specified quality goal under other conditions of time and for different parameter values can be estimated by repeated application of the models with different inputs, parameters and quality improvement vectors and entails a straightforward extension of applications undertaken in this study.

It is assumed that water quality goals are arrived at independently of the determination of how they shall be attained. The models direct themselves only to the attainment of a specified goal.

Each of the programs considered differs in respect to meeting the objectives of simplicity, efficiency and equity. Efficiency, in the context of this report, does not imply overall economic efficiency but rather a more limited definition. Efficiency is defined as the property of meeting a specified water quality goal at the minimum economic cost.

Equity considerations are two-fold. First, a program must treat equals in a like manner. Equality is defined as being the same on the basis of a relevant criterion, namely, that the marginal damages caused by a unit waste input are equal. Second, parties which are different by that criterion should receive different treatment. For example, a waste discharger whose input causes no damage should not be assessed the same penalty as a discharger

whose wastes do cause damages. This second equity consideration is linked closely with the efficiency concept, in that neither can be satisfied without the other being satisfied.

Simplicity is considered as the ease of establishing and administering a program including consideration of the amount and quality of input data required to formulate a program capable of attaining a specified quality objective. Problems of administration and costs are discussed in more detail elsewhere in this report.

Additionally, certain other properties of each approach are of interest: (1) Do they provide a guide for public investment decisions? (2) Does a theoretical solution from one program have a higher probability of actually attaining the specified goal when applied to the physical situation than another? (3) Is a positive incentive put on each waste discharger to include pollution effects of his waste in his everyday decision-making process? (4) How flexible are programs to meet time-quality considerations? These considerations are discussed for each program.

In the discussion of the individual models, the following symbolic representations are used:

q = a vector of q_j's each of which represents a change in dissolved oxygen in reach j. Units are mg/l.

q^* = a prespecified minimum improvement vector.

f = a vector of waste removals in mg/l-day. Each f_i represents waste removal from waste source i.

A = a matrix of a_{ij}'s each representing the transformation of a change in waste load, f_i, discharged into reach i into a quality change, q_j, in reach j.

U = a vector of u_i's representing the maximum removal of waste produced by that source = 100% of waste produced.

c_i = the unit cost of removing a unit of BOD at source i and c_i is a function of f_i.

Uniform Treatment (U.T.): This program calls for a uniform percentage reduction in all waste discharges. The program may be specified as: Determine a vector f such that $Af \geq q^*$, $\frac{f_i}{U_i} = K$,

$$f_i \geq 0 \text{ and } U_i - f_i \geq 0$$

for all i, where K = a constant

determined in the solution. This program is typical of current practices in water pollution abatement as exemplified by standards and regulations requiring all discharges to practice, say, secondary treatment or its equivalent. The degree of removal to be attained by all discharges is that required to meet quality objectives in the most stringent area of the water body.

The program imposes different unit costs on different discharges, which are implicitly assessed with no consideration of incremental D.O. improvement per dollar expended. Treatment costs may be incurred which contribute nothing to water quality, and high cost removals may be required where equivalent removals in terms of stream improvement could be attained more economically. Thus, U.T. cannot be considered efficient in terms of attaining a quality goal.

Only under unusual assumptions can the program be considered equitable. To the extent that the program is applied uniformly to a wide area of the basin, it does not meet equity considerations since all dischargers are forced to the same level of removal whether or not they contribute to damage costs (e.g. have an effect on critical quality levels.)

In addition, the program arrived at through this model is inequitable in that two like dischargers located in close proximity and having the same effect on water quality are liable to incur different costs per unit of waste removed due to differences in type of waste. Thus, one discharger is implicitly charged $X per lb of BOD removed to reduce the damages he causes of $Y, whereas his neighbor pays $X + Z to abate the same damage of $Y. Zoning of the water body in terms of percent removals required will reduce the former type of inequity but not the latter. Consideration of zoned uniform treatment was not undertaken lacking an operational computer program at this time.

The major advantage of a uniform treatment program is simplicity. Having determined the degree of removal required in the most critical quality section, the program for the entire area is known and cost functions for dischargers need not be known. In addition, it is an easier program "to sell" because of its superficial equity in terms of equality of waste removals.

The probability of attaining a specified goal with a U.T. approach is high, being no lower than the distribution associated with the physical model producing the estimates of required treatment levels. No errors due to incorrect estimation of cost functions or response predictions enter between the mathematical solution and its physical attainment.

Another usual simplifying feature of this program, although not inherently required, is constancy of removal in all time periods. Once a level of removal is determined such that the quality objective is not violated during a short-run critical period, it is known with almost certainty that the goal will not be violated at any other time since the percent removal specified for the critical period is required at all times not merely during the critical period.

Once the program is formulated and enforced, there is no incentive on the waste discharger to further reduce waste. The burden is on the administrative agency to restudy the levels of removal necessary to meet changing circumstances and enforce them.

Single Effluent Charge (SECH):

This program calls for the attainment of a water quality objective by imposing a single fee per unit of waste discharged, such fee being applied throughout the entire basin. The problem may be formulated as determining a unit price, p, such that

$$Af(p) \geq q^*$$

$$f_i \geq 0 \text{ and } U_i - f_i \geq 0 \text{ for all } i.$$

Notice that removal is a function of the effluent fee charged, f(p). To determine the proper level of fee, it is necessary to know the response curves of each waste discharger to the charge or assuming the usual definition of rational economic behavior, the cost functions of each discharger must be known. Thus, to determine the fee an additional, and complex, set of data over and above that required for the U.T. scheme is necessary. However, since the problem is formulated in a manner of achieving at least a specified improvement in quality, the complete gamut of individual cost functions is not required, only a cost function which minimizes the probability of not meeting the goal. Of course, this leads to an increased possibility of greatly exceeding the quality goal resulting in marginal expenditures which may greatly exceed marginal benefits leading to an inefficient solution; however, it is felt that the cost of such inefficiency is less than the cost of not attaining the goal in the early years of a charge system. More effort into determining the precise cost functions will decrease the risk of committing both types of error.

The result of applying a uniform charge to all waste dischargers is inefficient in the same manner as the U.T. solution. It is possible, as in the previous program that the charge will induce

unnecessary treatment in order to escape the charge if treatment is less costly. Thus, resource inputs are drawn into the program which are not required to meet the stream quality goal.

Waste dischargers may be expected to equate marginal treatment costs to the effluent fee in each case, but given varying marginal pollution damages depending upon location of quality degradations relative to specific dischargers, it is impossible to equate marginal costs incurred by the individual (equal to the effluent fee) to the marginal damages produced by that individual, thus resulting in a solution which departs from efficiency. Only in cases where marginal damages are equal in all reaches of the water body will efficiency be achieved.

A useful property of SECH is that it provides a guide for the allocation of public investment. The fee charged is known to be the marginal cost of private investment and can be used to evaluate the decision to undertake public investments in regional treatment plants, low-flow augmentation or other such public schemes. Such investment should be undertaken to the point at which the marginal cost of public investment equals the marginal cost of private investment. If the marginal cost of public undertakings is greater than marginal private costs, the charge level should be increased. Such a guide is not provided by physical specification of removal rates.

In terms of the damages inputed to waste dischargers, the uniform fee system produces inequalities in that the same marginal cost is imposed on all dischargers regardless of the fact that they impose damages to different degrees depending upon the location of the discharger with respect to the damaged areas of the water body. Thus the program produced by this analysis is inequitable in the same manner as the uniform treatment program; parties who discharge wastes resulting in different damages are not treated differently. However, it does escape the second form of inequity involved in the Uniform Treatment Program in that dischargers causing equal damages must pay equal costs.

The method achieves simplicity in determining the charge level and provides the flexibility for a schedule of charges varying throughout the year to stimulate short-run or sustained waste reduction depending upon the particular seasonal nature of the problem.

For example, in a crude application, the total annual capital, operation and maintenance costs of a standard treatment plant may provide the basis of assessing charges, but rather than being applied to the annual load discharged the fee is concentrated in the critical period resulting in a higher unit charge applicable only during that critical period. At worst, the discharger will

provide a standard form of treatment plant since the cost of this will be less than or equal to the cost used in determining the charge. However, there is a high probability that he will concentrate his attention on a seasonal correction of waste discharge in order to escape economic cost, thereby approaching a more efficient quality improvement program.

More sophisticated estimates of short-run charges can be made thereby improving the selectivity of SECH in producing only that degree of waste reduction necessary to the attainment of a quality goal and thus, while not necessarily efficient, it has an inherent flexibility to closely approach efficiency.

Administrative problems will likely be eased after the first experience with charges since it no longer becomes necessary to approximate response functions by cost functions as empirical data on the response surface are observed. The uniform charge scheme circumvents the problems of justifying differential charges, which might make it more acceptable than differential charge programs.

Zoned Effluent Charges (ZECH):

This problem extends the concepts of SECH to improve upon the equity and efficiency attributes of the charge system. In effect, ZECH applies the single effluent charge problem to each of several definite reaches of the stream, and selects a set of charges on the basis of an additional constraint.

Ideally, damages in each reach should be computed resulting in an imputed charge to each zone. Fees can then be selected equal to or proportionate to marginal damages. In the absence of such damage estimates, many combinations of fees will conceivably result in meeting a specified quality vector. Whereas in the two previous models, the fee and the economic cost of the program are uniquely determined; this is no longer the case, and an additional constraint must be specified.

Any tie-breaking constraint may be used. For this report, the criterion selected was that economic costs of the program be minimized. This is not the best choice since it does not specifically reduce the inequity between costs imposed on polluters actually damaging the stream and those which do not. However, fees are more likely to be assessed against those waste dischargers so located along the water body as to contribute to the pollution in the critical reaches since it is these waste discharges which must be reduced to improve water quality. Dischargers in areas not affecting or insignificantly affecting the critical quality reaches would be situated in zones having a zero or relatively small charge since the inducement of treatment would not contribute to meeting the water quality objec-

tive but would increase the economic cost of the program. Thus, there is a significant gain in equity over the previous programs even with a less than optimal decision criterion.

The zone problem also preserves the equity characteristic of the uniform charge scheme in that dischargers causing equal damages are treated equally.

The problem posed in this report is to select a vector of effluent fees (p) applicable to each zone k (p_k) such that

$$A\, f_{ik}(p_k) \geq q^*$$

$$f_i \geq 0 \text{ and } U_i - f_i \geq 0 \text{ for all } i$$

$$\text{and } \sum c_{Ri} f_{Ri}(p_R) = \text{Min.}$$

The number of zones selected is arbitrary (in the case of the current investigation being limited to 3 for convenience) and need not be equal to the number of analytical sectors in the physical representation of the water body. However, the number of charge zones cannot exceed the number of analytical sectors.

This formulation, in order to achieve limited efficiency must meet the assumption that a unit of waste discharged into any zone results in the same unit damages as any other unit of waste discharged into the same zone at any point in the zone. In other words, any waste discharger in the zone causes the same marginal damages as every other discharger in the zone. In reality, it would be rare to find two such discharges which result in exactly the same marginal damages unless they are located at precisely the same geographical point. However, by appropriate selection of zones, such a condition may be as closely approximated as desired even if each zone consists of only one discharger. More realistically, zones should be made smaller only until the cost of determining charges, the probabilistic cost of missing the goal and the rising administrative costs of the smaller zones balance the incremental gain in efficiency.

Although the linear programming model discussed next leads theoretically to a more efficient solution, errors in cost measurements are likely to lead to a greater departure from efficiency in that program than in an effluent charge program. Errors in costs will affect the predicted responses of discharges to the charge levied, however, individual decision makers, faced with the charge can adjust in such a manner that an efficient, albeit different, removal allocation is realized. Administrative enforcement of an L.P. solution's physical removals for each discharge cannot achieve more efficiency than is built into the mathematical program.

The zone charge preserves properties of SECH of the ability to utilize the charge level as a guide to public investment and the relative easing of problems associated with charge setting as more is learned about the response surface. Actually, a zone charge scheme provides considerably more information than the single charge scheme in regard to responses, since each zone yields a point observation which can be used to predict response to that level of charge if applied in other zones.

Least-cost solution (L.C.):

The final program considered in this study is the least-cost linear programming model:

$\text{Min} \leq c_i f_i$ subject to the constraints

$Af \geqslant q^*$

$f_i \geqslant 0$ and $U_i - f_i \geqslant 0$ for all i.

The solution to this problem is efficient in allocating the treatment levels to be attained by each discharger in order to meet a specified goal in that no unnecessary treatment is called for and only those removals which produce an increment of quality at the lowest cost are incorporated into the solution.

The solution obtained from this problem is equitable in the sense that a party causing no damage (e.g. having no effect on critical water quality reaches) incurs no costs, since the program sees this as an infinitely high cost. The solution is likely to be extremely inequitable in the sense of not treating equals in a like manner. Two dischargers on opposite banks of the water body can be expected to cause equal marginal damages. Yet, if waste treatment costs of one firm are low and the other extremely high, it is possible that the discharger with low-cost removal capabilities will be asked to treat to extremely high removals and the other discharger to provide no removal whatsoever.

The data required for computation of a least-cost solution of this type is extremely complex and difficult to obtain. Whereas in previous models, solutions can be obtained with cost function representing the upper bound of costs or no costs function at all, a meaningful linear programming solution requires knowledge of the most efficient cost locus for each discharger. To specify this function, consideration must be given to such highly specialized topics as in-plant changes, time shifts in production of particular commodities in a

multiple product plant, multiple plant treatment facilities and costs of tying to a municipal system.

Although the L.C. model yields a more theoretically efficient solution to the problem of achieving a quality goal, the solution obtained in practical applications may depart significantly from efficiency. If the mathematical solution is applied by requiring each discharger to meet the physical removal specified by the program, it might well be the case that incorrect data inputs in terms of efficient individual cost functions have resulted in a more costly program than might be otherwise attained. With the need to cost all alternatives to determine the most efficient individual cost functions, it is highly probable that some undeterminable departure from efficiency will occur in every practical application of this model.

This solution provides, as do all but the uniform treatment problem, a guide to public investment decision. The dual of the least-cost linear programming problem provides estimates of the marginal cost of quality improvements which can be used to evaluate the tradeoffs between higher levels of removal by private dischargers and public investment in water quality improvement schemes.

Because of the unequal treatment of dischargers who are alike in all relevant respects, implementation of a solution derived from this model would be difficult if not impossible of attainment. Equity could be achieved through a system of subsidies and charges which results in equal economic treatment of equals, however, this leads in effect to an effluent charge scheme in which both positive and negative rather than only positive fees are permitted. It is also unlikely that the administrative agency can evaluate the necessary cost functions with sufficient accuracy to assure that economic efficiency was in fact being realized.

Closely approaching the L.C. model in terms of limited efficiency is ZECH. The treatment program specified by this model can approximate the L.C. solution as closely as desired by appropriate selection of zones. The solution has the added virtue of being more equitable than any of the other models in that the economic treatment of individual dischargers is the same if the waste loads cause the same implicit damages and are different if the dischargers differ with respect to damages.

SECH lacks the ability to achieve economic efficiency since many dischargers will be induced to provide treatment which does not reduce the potential damages by virtue of setting the single charge applicable to all discharges at the level necessary to induce the maximum removal required to meet the goal. For the same reason, SECH provides a solution which is equitable in that parties alike in the damages produced by their wastes are treated equally; however, those dischargers who are relevantly different in terms of damages caused are not treated differently, thus violating part of the equity criterion.

Table B-1 represents a summary ranking of each scheme as to the relevant properties discussed above and in Appendix B in more detail. While highly subjective, it serves to characterize the strong and weak points of each approach. Rankings are made on the basis of 1 indicating the method which best meets the property, thus the lowest total score indicates the best overall method. On this basis, zoned effluent charges ranks as the best approach to water quality improvement and the conventional uniform treatment program ranks last.

Table B-1.

Ranking of Programs to Achieve Specified Quality Goals

	U.T.	SECH	ZECH	L.C.
Efficiency	4	3	2	1
Equity	4	2	1	3
Data & Admins. Requirements (Increasing order)	1	2	3	4
Guide for Public Investment	4	3	2	1
Incentive on Polluter to adopt new techniques	4	1	equal 1	3
Ease of dealing with Time Differentiation	4	2	1	2
Reduced Probabilities of missing goal	1	4	3	2
TOTALS	22	17	13	16

APPENDIX C Computation of Costs

Costs of a pollution control program used as the optimizing criterion in a decision model or as estimates of the total cost of a program are the economic costs of the pollution control projects included in the program. They include only those cost items which reflect inputs of goods and services into the program and exclude cost items which represent transfer payments.

On the other hand, individual decision units will not take the same view of costs in their decision-making process because of such items as tax effects and Federal grants. Therefore, in simulating the decision of an individual discharger, costs were redefined in accordance with these effects to estimate the financial costs upon which waste dischargers base their decisions.

Each of the annual costs thus calculated were converted to a unit cost basis. Since linear approximations to the true cost functions are utilized in the computer programs, marginal cost is constant over a range of removal rates and

$$MC_{i-1,\,i} = \frac{C_i - C_{i-1}}{(U_i - U_{i-1})\,365}$$

where $MC_{i-1,\,i}$ = marginal cost applicable to removal rates from i-1 #/day to i #/day in $/lb removed;

C_j = annual cost of removing j lbs of BOD;

U_j = lbs of BOD removed per day;

365 = days per year.

Capital costs include estimates of construction costs of treatment plant proper, costs of repiping necessary to get wastes to the treatment plant, engineering, legal and administrative fees, contingency funds, insurance, and interest during construction. Studies by the PHS indicate that 80% of total capital costs are construction costs, thus estimates of construction costs made by PHS were escalated to estimate total capital costs on that basis.

For municipal plants, annual monetary costs are defined as:

$$C_M = K + OM$$

where C_M = annual cost of municipal waste treatment;

K = amortized capital cost adjusted for Federal grant available under Water Quality Act of 1965, 25 year life, 5% interest;

OM = annual operation and maintenance costs.

Consideration was given to the inclusion of taxes foregone on land employed for the treatment plant in view of its alternative use, but this item was neglected for several reasons.

1. The amount is likely to be small relative to other costs considering the type of land generally used for sewage treatment plants.

2. Several of the municipalities already have sufficient land for construction of the plants considered.

3. Discussions with members of the Fells Institute of Government, University of Pennsylvania indicate the municipalities do not, in fact, take into account such losses in their decision process.

For industrial dischargers' annual monetary costs are defined as:

$$C_I = K + (1 - r_F - r_S + r_F r_S)(OM + PT) - (r_F + r_S - r_F r_S) D$$

where C_I = annual cost of treatment for industrial dischargers;

K = amortized capital cost, 25 year economic life, 5% interest;

r_F = Federal corporate income tax rate = 0.48;

r_S = applicable state corporate income tax rate for Pennsylvania, New Jersey, and Delaware;

OM = annual operation and maintenance charges;

PT = property taxes on capital investment;

D = annual depreciation based on 25 year life, straight line method.

Land costs are excluded since the dischargers considered have sufficient land for the plants considered which may be employed at a zero opportunity cost in most cases.

Construction costs are estimated on the basis of installing a standard treatment plant at the end of the existing effluent line or lines. It does not consider many potential schemes of waste reduction open to industrial firms such as improved inplant housekeeping, process changes, separation of waste sources (except for separation of cooling and process water), and so forth. Measures such as these are likely to be less expensive than the alternative on which the responses in the current models are predicated. To the extent that the estimated costs are overstated, actual response to a given effluent charge will be greater than predicted. Since the objective of this study is to estimate a schedule of effluent fees that will produce at least a particular quality objective, estimates of quality on the conservative side minimize the probability

that the objective will not be met, whereas the probability that the objective will be exceeded is not taken as critical. Operation and maintenance costs were computed by PHS staff from generalized sources of information.

Tax effects include property tax payments, and effects of property tax payments, depreciation and operation and maintenance costs on Federal and State corporate income tax payments. Assessment rates and property tax rates were ascertained from communications with the Fells Institute of Government, University of Pennsylvania. Contacts at this organization stated that assessment rates are generally established by negotiation as far as industrial properties are concerned, whereas this study assumed rates equal to average rates for all taxable property in the political subdivision. To the extent that industrial assessment rates are lower than the political subdivision's equalization rate, which is usually the case, property taxes and income tax effects of property taxes will be overstated resulting in overstatement of industrial treatment costs. Property tax overstatement may be as high as 300% resulting in an overstatement of annual cost of less than 10%, which is not significant in light of other costs estimates.

State income tax rates are those reported in Facts and Figures on Governmental Finance (12 Ed., Prentice Hall, Englewood Cliffs, N.J., 1963) and Federal taxes are not deductible from State taxable income. Federal corporate tax rate is 0.48.

Depreciation is computed on a straight line basis for 25 years, the estimated life of a sewage treatment plant as indicated by HEW experience. Moody's Industrials indicate that 75 percent of the firms included in this study employ straight line depreciation; the remaining firms utilizing declining balances or sum of the year's digits. In the latter, the present value of depreciation effects will be understated resulting in an overstatement of effective treatment costs.

Consider a company constructing a treatment plant having a capital cost C. Assuming an interest rate of 0.05, the company incurs an equivalent annual cost of K over the 25 year life of the plant. However, for tax purposes they may charge off an amount D_t each year for T years. D_t being determined by their depreciation policy. The greater the writeoff in early periods, the greater the present value of such writeoffs and the greater the present value of tax savings received by the firm. This, however, is a deduction from the cash cost to the firm so to ascertain quality levels attained as a minimum, we are concerned with that depreciation policy yielding minimum deductions yet consistent with reality. Thus, the treatment cost is depreciated on a straight line basis (no unreal in light of current policy) over the anticipated 25 year project life. Any departure from this depreciation policy will increase the present value of tax savings resulting in a decreased monetary cost and higher degrees of treatment, thus, being consistent with the problem of estimating effluent charges which will provide an instream quality goal of at least X ppm of dissolved oxygen.

Similarly, interest expense is a potential deduction for tax purposes tending to decrease present value of cost to the firm in the same manner as depreciation. However, financing methods to be employed are not susceptible to prediction, therefore, tax deduction for interest expense is ignored as making the estimate of stream quality attained more conservative.

Cost estimates also do not include the operation of a sampling program necessary to compute periodic billing charges. Such costs are not expected to be significantly different in an effluent charge program as compared to a complete program founded on effluent standards or prespecified levels of waste removal.

APPENDIX D -- Time Related Considerations

The effluent charge method offers an unparallel opportunity for handling seasonal and other time related quality problems. Future improvements in the impact of industrial waste on water quality may be expected to arise from changes in processes, production scheduling, geographical reallocation of specific product production and similar adjustments rather than from the application of conventional treatment. Imposition of a physically specified effluent standard or percent removal applicable year around will cause no shifts in the time - phasing of production in multi product plants although seasonal effluent standards might. However, calculation of exactly specified time dependent effluent standards for each discharger is a major undertaking. As an example a requirement of 90% removal of oxygen demand before discharge may result in a stream quality of x ppm during the summer and x + 5 ppm during the winter given a load of y pounds in summer and y - 200 pounds in winter due to seasonal scheduling of the production of two different products. A reversal of production seasons would result in a level of quality x + d in summer when quality is more critical, and (x + 5 -d) in winter when it is not so critical. Such a readjustment can be induced by a high effluent charge in summer relative to winter. It is unlikely that a conventional treatment oriented program will achieve such differentiation as well as the effluent charge method.

A real example of a seasonal problem is dredging of a ship channel. This usually occurs during summer periods when it interferes with stream quality. By an appropriate charge, possibly determined crudely as the increased cost of winter dredging plus a penalty surcharge, dredgers could be induced to operate during winter periods when their effect would be negligable in terms of damages created.

Another time problem relates to short run discharges of high concentration loads. It obviously makes a difference whether a polluter discharges x pounds of oxygen demand over a month or in one hour. The latter discharge will result in a more severe depression of oxygen than the former and result. in a different discharge damage function than spreading the same amount of waste over a longer period. For example the Fish and Wildlife Service might say that an oxygen depression of 1 ppm from a mean of 4 ppm during spawning season will cause no damage if its duration is less than 2 hours. A depression of this magnitude of longer than 2 hours results in a fish mortality of 75 percent resulting in damages to the commercial fishery of $1 million. Thus any upstream discharge capable of causing this damage should be charged an effluent fee of $\frac{\$10^6}{x}$ where x is the discharge which he must make to cause the 1 ppm depression for more than 2 hours.

A dynamic model of the water environment enables the construction of functions relating quality level and duration at a critical point to a waste discharge and duration into any other reach of the water body.

Given the physical properties of the water body, a relation of the type in Figure D-1 may be derived for each reach into which wastes are discharged and for each level of damages in any reach.

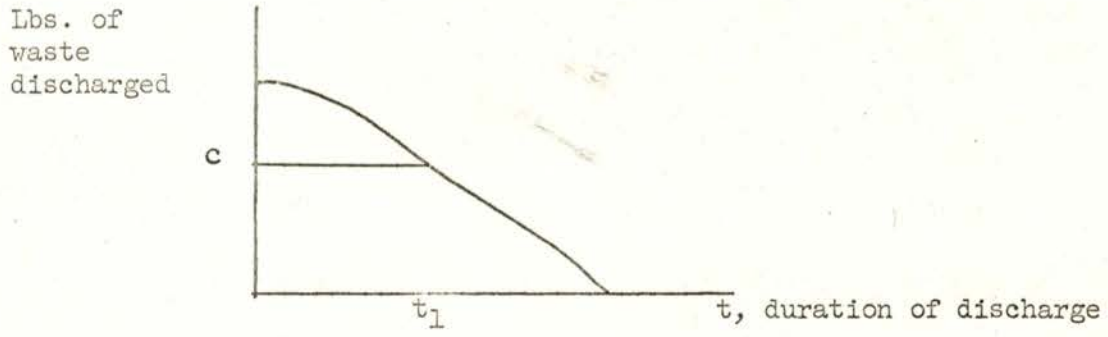

Figure D-1

Any waste discharge, 1, for a time period t_1 will result in the same damages, say a 1 ppm depression of D.O. resulting in $\$10^6$ economic loss. Then for any discharge (1, t_1) the polluter will be charged $\$10^6$. Similarly for other times load distributions resulting in different quality changes, a different charge will be applied to the polluter.

It is clear that a constant charge is not suitable for efficient control of the system; rather it is necessary to devise a schedule of charges which: (a) reflect seasonal variations in damages for a uniform discharge; and (b) reflect varying demands on the stream as a function of time of discharge of waste loadings.

Specifically, (a) requires an increase in seasonal mean values of quality improvement variables. Satisfying (b) requires estimates of damages of short run deviations from the mean quality variable.

Allocation of charges for various time periods may be done on the basis of mathematical representations of the physical system provided either the cost of preventing all or part of the discharge is known as damages caused by the discharge are known. In the former case, incremental charges are assigned equal to or greater than the incremental cost of reduction to induce the keeping out of the waste.

In the latter case, effluent charges are assessed on the basis of imputed steam damages. The charge C being $C = A^{-1} D$ where A^{-1} is the inverse of the matrix transforming waste imputs into quality changes and D is the incremental damage experienced if the waste were to be discharged. D is a vector with one element for each reach of stream representing the

incremental dollar value of damages for each reach.

The basic methodology of charge allocation is identical in either the mean quality improvement problem or the short run variation problem except that the former may be solved with sufficient accuracy by application of a steady-state, stationary specification of the model which abstracts from the time - duration of discharges. The short run problem requires application of a dynamic form of the transformation matrix, A, which explicitly considers time durations as well as magnitudes of discharges.

In the dynamic formulation, the coincidence of other time related occurrences with potential waste discharges requires consideration of the probability of occurrence of short run quality degradations rather than a specific discharge quality response function. This difficulty can be overcome by use of expected values, by establishing a charge such that the probability of the occurrence is less than some level or by employment of a stochastic model.

The techniques by which time dependent charges may be estimated are available, however, the importance of this problem requires more extensive research into methodology specifically adapted to the estimation of time dependent schedules of effluent charges and into the explicit estimation of damage functions needed for imput into the dynamic system.

Further analysis of effluent charges of a technical nature should be next directed toward these two areas.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
WASHINGTON, D.C. 20201

9 DEC 1965

OFFICE OF THE SECRETARY

DEC 9 1965

3

ADMINISTRATIVE CONFIDENTIAL

Dear Mr. Ackley:

This is in response to your memorandum of November 24, 1965, in which you requested that we develop a limited pilot and demonstration program for solid waste disposal in cooperation with State and communities.

Improper and inadequate disposal of solid wastes is wide-spread in the United States and causes hazards to public health, environmental pollution, community blight, and loss of natural resources. There have been no recent advances in the technology of collection, treatment, or disposal of solid wastes which are commensurate with the growing magnitude of the problem or in keeping with the changing character of the materials discarded. More than one-half of the United States cities are still using open dumps, illustrating the serious lag in the application of even presently available methods. In many communities, including some with populations of up to 25,000 local governments have not assumed responsibility for financing or the management of collection and disposal services.

Improvement in solid waste disposal practices throughout the nation needs to be stimulated by initiation of activities which will develop and demonstrate high-quality operations. Economies would be achieved through improved effectiveness in technology and management. Conservation of natural resources would be benefitted through conversion and re-use systems which would also provide modest cost-offsetting benefits.

A solid waste pilot and demonstration program of moderate size will be initiated in cooperation with States and communities. The program would: (1) initiate long-term basic data collection, (2) intensify research and development efforts directed toward broadened and improved technology, (3) accelerate adoption and application of known acceptable methods of solid waste disposal, (4) improve organizational arrangements for focusing responsibilities and eliminating conflict and overlap, and (5) clarify economic relationships between solid waste disposal costs, re-use, and methods of financing these operations, including user charges.

1. Basic Data - Collection and Analysis

In view of the general lack of information and statistics on the existing solid waste collection and disposal systems, the Departments of Health, Education, and Welfare and Housing and Urban Development will jointly finance, out of available funds, a nationwide survey. This study will be planned in relation to future studies and data collection activities by the Department of Health, Education, and Welfare and the Department of Housing and Urban Development. The data assembled would quantify the current number and types of garbage and trash collection systems and means of disposal. In particular, the survey will seek to ascertain the extent to which these solid waste disposal systems are operated by departments of general local governments, units of water and sewer districts, special solid waste disposal districts, or by private companies. The survey will also seek to develop data on the capital and operating costs of these waste disposal facilities and their means of financing--user charges, special taxes, or general tax resources of the respective local public body.

2. Research, Design, and Pilot Studies

A series of contracts will be developed by the Department of Health, Education, and Welfare under P. L. 89-272 for formulation of alternate design concepts that incorporate new technologic approaches to the handling of solid wastes. A design competition could be used to stimulate high-grade technical effort by research and development organizations, engineering firms and other private enterprise groups. The essential elements of each design would include cost analysis, economic evaluation, and technical procedures (including salvage, conversion, re-use, and conservation of natural resources), the design and plan for pilot testing, and a plan for demonstration and recommended criteria for evaluation. The areas of technology would include such as the following:

Types of Unit Processes

(a) Physical - shredding, grinding, compaction, radiation, ultrasonic reduction.

(b) Biological - bacterial and fungal digestion.

(c) Chemical - oxidation and reduction.

Methods of Handling Solid Wastes at Origin

(a) Wet pulping or grinding

(b) Automatic compression devices for high-rise buildings

Recovery

(a) Heat - use of process steam as a by-product of incineration (water-conditioning uses would be coordinated with Office of Saline Water and Federal Water Pollution Control Administration)

(b) Soil conditioners - produced by composting (PHS and TVA have initiated a joint project on the composting of refuse and raw sewage sludge)

Materials Handling Systems

(a) New conveyance systems: hydraulic, pneumatic

(b) Separation: ballistic, magnetic

Pilot Plant and Pilot Scale Testing

(a) Size: large enough to be mechanized

(b) Test period: one - two years

(c) Sampling and instrumentation

3. Demonstration Projects - New and Improved Methods and Facilities

In accordance with the authority provided under Title II, Public Law 89-272, known as the Solid Waste Disposal Act of 1965, the Department of Health, Education, and Welfare will finance grants or contracts providing for demonstration projects dealing with new and improved methods of solid waste collection systems or disposal facilities: Each of these demonstration projects will be conducted on a scale model basis of sufficient size to determine which, if any, appear to be feasible, efficient and economical for possible use by various size municipalities.

4. Plans and Specifications for Large-Scale Waste Disposal Facilities

For those types of waste collection systems or disposal facilities that show signs of promise under the two types of demonstration program, the Secretary of Housing and Urban Development will undertake to arrange with various size municipalities to finance the specific plans and specifications for such systems or facilities. To finance these plans, specifications, topography studies, and related matters, the Secretary of Housing and Urban Development will provide interest-free advances to the respective municipalities or other local public bodies out of funds available under the Public Works Planning Program authorized by Section 702 of the Housing Act of 1954, as amended.

These advances are repayable, if construction is begun on the facilities that are so planned. Through June 30, 1965, a total of 42 public works planning advances involving $1.3 million were made to finance the planning of incinerators and other solid waste disposal facilities having an estimated project cost of $68.9 million.

5. Financing of Construction

When the solid waste collection systems or disposal facilities have been planned, the Secretary of Housing and Urban Development will undertake to provide financial assistance to the respective municipality or other local public body to aid in their construction. Two categories of assistance are available for this purpose. One, is a grant up to 50 percent of project development cost that may be made under the basic Community Facilities Program authorized by Section 702 of the Housing and Urban Development Act of 1965. To finance the remainder of the project cost, the municipality or other local public body can borrow the requisite funds from Housing and Urban Development under the Public Facility Loans Program authorized by Title II of the Housing Amendments of 1955, as amended, provided that it has a population under 50,000 (or under 150,000 if it is located in a designated redevelopment area). It may be observed that under the Accelerated Public Works Program four grants involving $1.1 million were made to finance solid waste disposal facilities having an estimated project cost of $2.4 million.

6. Acceleration of Adoption and Application of Known Acceptable Methods of Solid Waste Disposal

Solid Waste Disposal

In order to achieve needed stimulation of local governments to eliminate open dumps and other hazardous and unsightly solid waste disposal practices, Section 204 of Public Law 89-272 could be broadened to include an authorization which would establish a federal-state-local partnership in financing of demonstration grants directed toward elimination of these open dumps and the accelerated application of presently-accepted methods for sanitary disposal of solid wastes. The existing authorization for grants under Section 204 is limited to projects which demonstrate new and improved methods of solid waste disposal. The new supplementary demonstration grant authorization would provide federal funds to match state funds for projects that put to use what we already know. The total federal-state contributions would not exceed two-thirds of the total project cost. As a means of implementing section 205, on projects providing for interjurisdictional or regional operations on solid wastes disposal, the total federal-state contribution would be authorized at three-fourths of the total project cost.

Maximum demonstration benefits would be derived from each project by an additional allocation amounting to 15 percent of the Federal grant to the

State government of the State in which the project is located--such fund to be used for training and dissemination of information to officials of local governments throughout the State. On-site demonstrations, short courses, and consultations would be provided for these officials. These coordinated training and demonstration efforts would enhance visibility and strengthen motivation for other communities to abandon open dumps and similar unsatisfactory solid waste disposal practices and replace them with facilities that meet or exceed minimum standards.

The collection of basic data could be advantageously coupled with such demonstration projects--both to provide necessary information on a nation-wide basis as part of the Federal program, and to calculate unit costs of operation of the demonstrations. Such detailed information would be particularly useful in system design applications and would be essential in those projects aimed at the introduction of cost control methods in solid-waste management. It is proposed that six to eight contracts be made by the Department of Health, Education, and Welfare for such data collection.

Alternatively, this program could be carried out by the Department of Housing and Urban Development. Authority to provide grants for solid waste disposal facilities is clearly implied by the language of both the Senate and House Reports explaining the provisions of Section 702 of the Housing and Urban Development Act of 1965. This authority would be made explicit by a request for appropriations for this purpose.

7. Pilot Projects

It is envisaged that the 1966 legislative program for the Department of Housing and Urban Development will include a proposal for Federal financial assistance for "new communities". Should such new communities legislation be enacted by the Congress, the Departments of Housing and Urban Development and Health, Education, and Welfare will seek to make appropriate arrangements with "new community" applicants to get them to install some of the new methods of solid waste collection and disposal systems that are being developed under the Health, Education, and Welfare demonstration program, as described above.

The foregoing limited pilot and demonstration program for solid waste disposal will not require any new legislative authorization. Instead, as noted above, it can be handled within the framework of existing legislation, except as noted. However, owing to the competing demands on the respective program funds for other purposes, it may become necessary to augument some of the fund authorizations or appropriations.

If the program outlined above is acceptable, we would be pleased to develop the necessary details that would put it into operation.

Sincerely,

James M. Quigley

James M. Quigley, Assistant Secretary
Department of Health, Education and Welfare

Morton J. Schussheim

Morton J. Schussheim
Assistant Administrator for Program Policy
Department of Housing and Urban Development

Honorable Gardner Ackley
Chairman
Council of Economic Advisers
Washington, D. C. 20506

THE ASSISTANT SECRETARY OF COMMERCE
WASHINGTON, D.C. 20230

December 13, 1965

MEMORANDUM FOR: Honorable Gardner Ackley
Chairman
Council of Economic Advisers

FROM: Edward K. Smith (Commerce)
Henry Caulfield (Interior)

Attached is a draft of a description of new processes for disposing of junk automobiles, prepared by P. W. MacAvoy. This draft was prepared after consultation with E. K. Smith, Paul Zimmer (Interior), James Rettie (Interior), Horace Reno (Interior), James Collins (Commerce), James Owens (BDSA), Jacob Levin (BDSA), Horace Callaway (BDSA), and two industry consultants.

After initial preparation of proposals submitted by the Bureau of Mines and BDSA, the two sets of proposals were combined into one set. A second all day meeting chaired by E. K. Smith was held to discuss each proposal and rank them in descending order of promise in removing junk autos by the late 1960's early 1970's. Each proposal was discussed in detail as to feasibility, ability to dispose of auto hulks, relation to existing research, usefulness as demonstration projects, scrap surplus areas, and costs. Projects were removed if it was felt they were or could be privately financed. In two cases, projects might be brought into being by loans rather than direct Federal financing and they are indicated in Table B. In two cases projects would also return funds to the government after disposal. These are indicated in parenthesis in Table B.

Table A shows the projects ranked in order of importance with the added costs to the government shown in the right hand column. In some cases the projects are already partially funded from existing Bureau of Mines funds. Only the added costs of speeding up the research and scaling it up are shown. The draft memo discusses the total costs of these projects.

Table C shows the appropriations which would be needed by fiscal years. Again, only marginal costs are shown for those projects already partially funded.

Table B also shows the cumulative costs of the projects so that the increase in costs may be compared to the descending order of promise for the projects and a cutoff point chosen. It should be noted, however, that even the "less promising" projects are worthwhile and that many other proposals were dropped before the final list was determined.

If all projects were to be funded, total costs would be $19,325,000. Loans might be made for $3,700,000 processes (1) and (2). Project (2) definitely contemplates loans of $1,200,000. Project (4) would construct two demonstration plants if the research proves out. No cost estimates are given here. These too might be loans. Net costs, after recovery by selling demonstration equipment would be $18,736,000. Fiscal year 1967 costs would be $9,096,000 contingent, of course, on following up with suceeding fiscal year appropriations.

We recommend that these projects, to be carried out by Interior and Commerce, be forwarded to Mr. Califano for determination of acceptance within present budget constraints.

Attachment

A. Projects Ranked by Order of Promise	Added Costs
1. Shredding Processes	
Two Proler-like process plants to be constructed with Federal loan or subsidy	$2,500,000
2. Transportation of Junk Autos to Shredding Plants	
Two mobile auto flatteners	403,000
Loans for six flatteners	1,200,000
3. Transportation Studies	
Analysis of transport costs for alternative transport modes	100,000
4. Research on Melting and Smelting Processes	
Estimation size and location of cupola process markets (and construction of two demonstration plants for foundry scrap if research proves feasible)	110,000 ---
5. Metallurgical Research on Removing Contaminats from Auto Scrap	
a. acceleration of research on formation of solid intermetallic compounds	1,267,000
b. removal by slag treatment - research and demonstration	1,425,000
c. removal by rare earth elements - research	280,000
d. removal by vaccum treatment - research, design and construction of demonstration plant	1,000,000
6. Promising Processes - Research Partially Completed and Funded	
a. Oxidation processes -scale up existing research and demonstration	4,500,000
b. Reduction of non-magnetic iron bearing ores - expansion of existing project	4,000,000

7. Less Promising Research and Demonstration Projects

a.	Cyrogenic process - development and demonstration	575,000
b.	Copper cementation	2,150,000
c.	Further research on shredding processes and demonstration of two operational shredders	1,016,000

B. Total Authorizations, Loans, and Cumulative Total of Authorizations by Rank of Projects

	New Authorization		Loans	Cumulative Total
1.	$ 2,500,000	or	$2,500,000	$ 2,500,000
2.	403,000 (net 293,000)		1,200,000	2,903,000
3.	100,000			3,003,000
4.	110,000			3,113,000
5.a.	1,267,000			4,380,000
b.	1,425,000			5,805,000
c.	280,000			6,085,000
d.	1,000,000			7,085,000
6.a.	4,500,000			11,585,000
b.	4,000,000			15,585,000
7.a.	575,000			16,160,000
b.	2,150,000			18,310,000
c.	1,016,000 (net 536,000)			19,326,000
TOTAL	19,326,000 (net 18,736,000)		3,700,000	

C. Appropriations on Spending by Fiscal Year

	Fiscal Years				
	1966	1967	1968	1969	1970
1.	---	2,500,000	---	---	---
2.	---	1,603,000	---	---	---
3.	---	100,000	---	---	---
4.	---	110,000	---	---	---
5.a.	58,000	75,000	125,000	200,000	---
b.	---	100,000	225,000	600,000	500,000
c.	---	50,000	50,000	50,000	50,000
d.	---	150,000	450,000	400,000	---
6.a.	---	500,000	500,000	1,000,000	1,000,000
b.	---	2,500,000	500,000	1,000,000	---
7.a.	---	500,000	50,000	20,000	---
b.	---	400,000	750,000	1,000,000	---
c.	---	508,000	508,000	---	---
TOTAL	58,000	9,096,000	3,158,000	4,270,000	1,550,000

Processes for scrapping junk autos on which Research is Partially Completed.

There are two processes which have been subject to extensive research by Federal and by private agencies and which appear to merit acceleration so that results will be available before 1970.

a. Oxidation processes.

The Bureau of Mines and industry sources have cooperated on experiments in controlled heating and oxidation which indicate that the copper contents in the scrap can be reduced by 50%. This program can be expanded to include construction of a full scale demonstration plant in which the preparation of scrap, controlled furnace treatment to remove low melting metals and combustible materials, are integrated with compaction and subsequent melting in a steel producing firm. We recommend that this full scale plant be constructed and begin operation in Fiscal Years 1967-68. The total costs of the project are expected to be $12,500,000, of which $9,800,000 are presently available; acceleration requires that additional $500,000 in 1967 and 1968 and additional $1,000,000 in each of 1969 and 1970.

b. Reduction of non-magnetic iron bearing ores.

A pilot testing facility now being constructed is for the purpose of testing the conversion of scrap automobiles or other ferrous scrap and unusable non-magnetic taconite ore into marketable iron oxide

concentrates. This project could be expanded from a level of expenditures equal to $9,350,000 to $13,350,000 for the purposes of completing construction earlier and for carrying out more extensive test efforts late in 1967 and early 1968.

Less Promising Research and Demonstration Projects.

Many further suggestions have been made for inexpensive processing of automobile bodies, but these can not be considered promising either because of lack of information or lack of a "break-through" to a cheaper technology.

a. Cryogenic processes; in theory, steel and other materials become brittle at low temperatures so that they may be more readily schattered.

Immersing an entire car body in an inert liquefied oxygen should make it more amenable for fragmentation. Preliminary estimates indicate that the cost of oxygen immersion are less than the cost savings on the power required for fragmentation. No experiments with this process have been undertaken however. Development and demonstration would require initial expenditures of $575,000.

b. Copper cementation processes.

Increased demand for shredded scrap would follow from its adoption by copper refining companies to leach copper ore in solution. Research needs to be undertaken to determine the most suitable form of iron for use as a replacement for the copper in solution; such techniques

as splat cooling, foaming, granulation with water and granulation or wooling with steam have to be investigated. Concentrated effort in 1967-69 would require expenditures of $2,150,000. The usefulness of the results from the project are limited to areas near copper mining facilities and to circumstances in which this type of scrap proves superior to scrap tin plate.

c. Production of magnetic oxides from automobile scrap.

A promising research program is now underway for the conversion of auto scrap to a magnetic oxide which can be separated from contaminating materials by magnetic separation. The oxide obtained can then be pelletized and fed to the blast furnaces as high quality synthetic ore. This project can be accelerated from appropriations of $50,000 in Fiscal Year 1966 to a total of $800,000 for 1967-69 for construction and operation of a demonstration plant. No information has been obtained as of yet, however, on the results of initial research now under way in the Bureau of Mines.

d. Further research on shredding processes.

A number of proposals have been made for carrying out research on processes similar to those of Proler Corporation. One proposal is to design and to build an operational portable or mobile low-capacity low-power scrap shredding unit. This requires some means of scaling down the large power utilization in the stage at which the automobiles are pulverized in a hammer mill. Another proposal is to "invent around" the most important claims in the patent for the Proler

process related to the "baking" and compacting of the ferrous scrap. Neither proposal need be put into effect as a research project unless expansion of private enterprise proves unsatisfactory in the near future. If patent suits outstanding against competitors of the Proler Corporation are decided so as to limit entry of new firms, then further research on the patented aspects would seem warranted. If projects of research on cheaper transportation prove to be unrewarding, then portable shredders may provide large amounts of (transportable) shredded scrap from processed junk in outlying regions. The estimated cost of these projects is $1,016,000, estimated recoverable of hardware value of $480,000 after 18 months of operation. These projects might be reviewed after 6 months of experience with some of the more promising ventures.

AGENDA FOR MEETING ON
POLLUTION ABATEMENT TASK FORCE REPORT

1. Strengthening of water pollution enforcement authority. (Recommendation IV.B.1 (a) through (i); pages 19-21 of the Task Force report.)

2. Means for bringing increased proportions of waste water under treatment:

   A. Grants and loans for waste collection and treatment facilities (principally recommendation IV.B.2.(a), page 22).

   B. Effluent fees (IV.B.3.(b), page 24).

   C. Other approaches to industrial waste disposal (IV.B.3.(a), page 24, and (c), page 27).

      (1) The Bendetsen proposal.

3. Construction aid for solid waste disposal facilities (IV.D, page 31).

4. Disposal of junk autos and financing thereof (recommendations IV.E.1, pages 34 and 35; and IV.E.2, pages 36 and 37).

5. Other Task Force report items.

13 DEC 1965
To GA

From Washington Public Relations Office
FORD MOTOR COMPANY
815 Connecticut Avenue, N.W.
Washington, D.C., 20006
Telephone: 298-8430

FOR RELEASE SUNDAY, DECEMBER 12, 1965

Ford Motor Company is initiating a project to consume a quarter-million junked cars annually in its Dearborn, Mich., foundry operations.

Henry Ford II, chairman of the board, said the company is working with Luria Brothers and Company, Inc., of Cleveland on a program which should contribute significantly to the nation's beautification effort.

He said Ford has agreed to negotiate a long-term agreement with Luria Brothers, a subsidiary of Ogden Corporation, to purchase substantial quantities of high-quality scrap steel resulting from "fragmentizing" of junked automobiles.

The agreement will enable Luria Brothers to begin construction of a $3.5 million fragmentizer plant in the Greater Detroit area.

The processing rate of a quarter-million scrapped automobiles annually is expected when the plant is in full operation.

Mr. Ford said the company has been looking for some time for at least a partial solution to the problem of unsightly junked cars.

"Ford metal engineers and Luria Brothers have worked to achieve a new standard of quality for scrapped steel used in producing cast iron," he said. "We expect the use of fragmentized scrap steel to streamline casting operations through improved quality levels, easier handling, and improved melting characteristics."

The company plans to use fragmented steel at its Dearborn iron foundry and Dearborn specialty foundry in the Rouge manufacturing area. The foundries produce a wide range of automotive castings, including engine blocks, rear-axle housings and crankshafts.

- more -

Carl S. Ablon, president of Luria Brothers, said his firm has property options in the Detroit area and will announce the new plant's location shortly. He estimated it will take 11 months to construct.

The new process produces various-sized fragments of approximately 99 per cent steel by passing scrapped autos through a hammermill and magnetic separators, all controlled by elaborate electronic devices. The resulting product is marketed by Luria Brothers under the trade name of "Lurmet." Luria Brothers has a small fragmentizer unit in operation at Los Angeles. The new unit will be larger and produce an improved product more efficiently.

# # #