Proceedings of the Seventh Annual

AIR AND WATER POLLUTION CONFERENCE

Lindon J. Murphy, P.E., Editor
Professor of Sanitary Engineering

April 15, 1962 Columbia, Missouri
Engineering Series Bulletin No 54 Engineering Experiment Station
The University of Missouri Bulletin

COLLEGE OF ENGINEERING
THE ENGINEERING EXPERIMENT STATION

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University of Missouri, Columbia, Missouri

November 14, 1961

THE SIGNIFICANCE OF THE 1961 FEDERAL WATER POLLUTION CONTROL LAW

Murray Stein, Chief Enforcement Branch, Division of Water Supply and Pollution Control, Public Health Service, Department of Health, Education and Welfare, Washington, D. C.

On July 20, 1961, the President signed H.R. 6441, the Federal Water Pollution Control Act Amendments of 1961. The anticipated impact of this far-reaching amendatory legislation on the Federal programs operated under the provisions of the Federal Water Pollution Control Act (P.L. 660—84th Congress) is described in connection with the changes and additions provided by the new law.

Administration

Under P.L. 660, the Surgeon General was responsible for the administration of the Act through the Public Health Service and under the supervision and direction of the Secretary of Health, Education, and Welfare. The program is organizationally located in the Bureau of State Services and functions as the Division of Water Supply and Pollution Control.

The 1961 Amendments vest the responsibility for the administration of the Act in the Secretary of Health, Education, and Welfare. The Secretary has designated Assistant Secretary James M. Quigley as his immediate representative in the administration of the Act's programs, while retaining the status of the Water Supply and Pollution Control Division in the Public Health Service.

Water Quality Control

All of the programs conducted under P.L. 660 have as their purpose the protection and maintenance of water quality for all legitimate uses.

The 1961 Amendments place additional emphasis on water quality control considerations by authorizing inclusion of storage for regulating streamflow for water quality control purposes in any Federally constructed reservoir. The releases for streamflow regulation and the storage are to supplement, and not substitute, for adequate treatment and other methods of controlling waste at the source. The advice of the Secretary is required in determining the need for and the value of storage for this purpose and his views are to be included in any report or presentation to the Congress proposing authorization or construction of any reservoir which is to include such storage. In effect, this Department's concern for maintaining water quality now extends into the entire field of water resources conservation and development.

Research

P.L. 660 broadened the authority to conduct and support research by including prevention as well as control of water pollution and by providing authority to make grants for research and training projects and demonstrations to public and private agencies including universities and other qualified institutions and to establish and maintain research fellowships.

The water supply and water pollution research program was substantially expanded under P.L. 660. Significant progress has been made through the application of the engineering, chemistry, physics, microbiological, biological, and related sciences to the problems of water supply and pollution control. An example is a greatly enlarged arsenal of tools now available for detecting new synthetic contaminants and their pollution characteristics and effects. Another is the initiation of a major research effort to develop entirely new processes for removing much more of the pollutants from waste waters than is possible by existing methods. The success of this latter project is of utmost importance with respect to the problem of increasing pollution and the need to reuse water over and over to supply demands.

The 1961 Amendments specifically authorize and direct the development and demonstration of practicable means of sewage treatment, improved methods and procedures to identify and measure pollution effects on water uses, and methods and procedures for evaluating effects on water quality and uses of augmented streamflow.

The establishment of field laboratory and research facilities, including but not limited to seven to be located in specified areas, is directed by the new law. These long-needed laboratories will support expanding programs in comprehensive program development, special field study projects on specific problems, basic data, and enforcement; and will make possible much needed increases in technical assistance to State and local agencies and in connection with projects and other Federal water resources agencies. Presently obstructive factors, such as distance and reliance on facilities of others will be overcome through establishment of these new laboratories. To date, the locations of two area laboratories have been announced: the Pacific Northwest at Corvallis, Oregon and the Southwestern at Ada, Oklahoma.

Additionally the new law directs the conduct of a continuing study of the quality of the waters of the Great Lakes. The Great Lakes constitute the largest single source of fresh water in this hemisphere. Their protection from pollution caused by population and industrial growth and increased shipping is necessary.

State and Interstate Program Grants

P.L. 660 provided authority to make grants for five years to State and interstate agencies to assist them in meeting costs of establishing and maintaining adequate water pollution prevention and control programs includ-

ing cost of training personnel and administration of programs in accordance with effective, comprehensive plans, subject to review and approval by the Surgeon General. The annual appropriation authorization was limited to $3 million.

Program grants to State and interstate agencies have served the purpose of improving and strengthening their water pollution control programs, and stimulating increased State appropriations. Since 1956 the level of State appropriations has increased from $4.2 million to $7.6 million for fiscal year 1960. Federal appropriations for this purpose were $2 million in fiscal year 1957 and have been $3 million each for fiscal years 1958, 1959, 1960, and 1961. State and interstate agencies have increased their technical and supporting staffs by nearly 50 percent. They have been able to initiate or expand pollution surveys, research, basic data collection, and more aggressive enforcement of State laws. Grants have made possible the purchase of major items of field and laboratory equipment needed to support the expanding programs.

The 1961 Amendments provide for improvement and extension of the State and interstate programs by increasing the amount authorized to be appropriated annually to $5 million and extending the authority for making the grants for seven years to June 30, 1968.

The State plans submitted as a prerequisite to receiving program grants are required, effective July 1, 1962, to include the criteria used by the States in determining priority of projects for Federal grants for construction of municipal treatment works.

Construction Grants

Federal grants to municipalities to assist them in the construction of waste treatment facilities were authorized by the Federal Water Pollution Control Act. An individual grant to a community was limited to 30 percent of the cost of construction, or $250,000, whichever was the lesser. Appropriations in the amount of $50 million annually up to an aggregate of $500 million were authorized for construction grants. For the nearly five years under the construction grants provisions of the Act, contract awards for construction averaged $360 million annually, and 2,600 projects costing over $1.2 billion were approved. This is a 62 percent increase in sewage plant construction and it is significant that each Federal grant dollar was met with $4.80 in local funds. The approved projects will serve 24 million people and will abate municipal pollution in 31,000 miles of streams.

Thus for the first time in many years the Nation has been able to keep up with sewage treatment needs caused by population growth and obsolescence of older plants. This increase in sewage plant construction has not, however, permitted any reduction of the present backlog of more than 5,000 needed facilities costing $2 billion.

In order to stimulate construction, the 1961 Amendments authorize an increase in the amount of the individual grant from $250,000 to $600,000, or 30 percent of the cost of construction, whichever is the lesser. A grant in excess of $250,000 may not be made, however, until all pending qualified applications and those filed for one year after enactment of the new law have first received grants.

To insure the full utilization of grants funds, provision is made for reallocation of funds unobligated by a State within 18 months after allotment. The reallocation shall be to those States having approved projects for which grants have not been made because of a lack of funds. Before realloting a State's unused funds, if the Secretary finds that the need for a project in a community in that State is due in part to a Federal institution or Federal construction activity, he may make an additional grant from the State's reallocable funds to the affected community, which will reflect an equitable contribution for the need caused by the Federal institution or construction activity.

Encouragement is given to communities who wish to join together in constructing a joint project to serve their common needs. An individual grant may be made to each participating community, within the limitations applicable to an individual grant, based on its pro rata share of the total cost of construction with an over-all limitation for the combined project of $2,400,000. Application of Davis-Bacon Act provisions in regard to rates of wages paid to laborers and mechanics employed by contractors or subcontractors on grant-assisted projects is made mandatory by the new law.

Substantial increases in the amounts authorized to be appropriated for the purpose of making construction grants are provided: $80 million for fiscal year 1962; $90 million for fiscal year 1963; and $100 million annually for the succeeding four fiscal years.

Enforcement to Abate Pollution

The Federal Water Pollution Control Act provided authority for Federal enforcement action to abate the pollution of interstate waters, which endangered the health or welfare of persons in a State other than that in which the pollutional discharges originated.

Fifteen Federal enforcement actions have been taken to date. A total of 23 States and the District of Columbia have been parties to these actions. They involve some 250 municipalities and about the same number of industrial plants. Large metropolitan areas, such as New York City, St. Louis, the Kansas Cities area, and Portland, Oregon, and large corporations, such as General Motors, Standard Oil, Shell Oil, Swift, Armour, Crown-Zellerbach, Olin-Mathieson Chemical, and the Vanadium Corporation of America have been covered in these actions. Over 4,000 miles of 12 major water bodies are affected.

These Federal enforcement actions have had important secondary benefits also since many other communities and industries in the vicinity of cities involved in enforcement cases have been stimulated to proceed with construction of treatment facilities on their own initiative.

Expanded and strengthened jurisdiction to abate the

pollution of interstate or navigable waters of the country, including coastal waters, through the application of enforcement procedures is provided by the 1961 Amendments. In interstate pollution situations, initiation of Federal enforcement action is made mandatory upon the request of a Governor or State water pollution control agency or a municipality in whose request the Governor and water pollution control agency of its State concur. Enforcement action in these same situations is also mandatory without State request when the Secretary has reason to believe on the basis of reports, surveys, or studies that interstate pollution is occurring

Federal enforcement action to abate intra-state pollution may only be taken at the request of the Governor of the State. Latitude is provided to the Secretary in initiating the requested Federal action in that he may use his judgment as to whether the effects of the intra-state pollution on legitimate water uses are sufficiently significant to warrant the application of Federal powers.

The existing three-stage enforcement procedures—conference, public hearing, and court action—are unchanged except that the Secretary may ask the Attorney General to initiate court action after a public hearing without State consent or request. The Secretary is required, however, to have the written consent of the Governor of the State in order to bring court action on intra-state pollution.

Discharges from Federal installations contributing to pollution situations are made subject to the conference and hearing stages of the enforcement procedure.

THE INDUSTRIAL WASTE CONTROL PROGRAM OF KANSAS CITY, MISSOURI

Glen J. Hopkins, Director, Pollution Control Department, Kansas City, Mo.

Kansas City, like other major cities along the Missouri River, is now actively engaged in a program geared to provide, within reasonable time, waste treatment to the extent necessary to safeguard the quality of the water of the Missouri river for its many uses. Actually Kansas City is behind most of its upstream neighbors in such a program. Sioux City and Council Bluffs, Iowa, and Omaha, Nebraska, already have pollution abatement works under construction. Numerous smaller communities, including Blair, Belleview, and Plattsmouth, Nebraska, and Atchison and Leavenworth, Kansas, already have treatment plants in operation.

Along the lower river, Kansas City, Kansas, St. Joseph, North Kansas City, and Kansas City, Missouri, have each voted bonds to finance their treatment works, but at Kansas City, Missouri, has detailed planning reached an advanced stage. Independence is the first of our downstream neighbors to place its treatment plant under construction, with other communities between Kansas City and St. Louis in various stages of preliminary planning.

The Missouri river is a regulated stream. Mammoth reservoirs in the upper reaches of the basin have sufficient storage capacity to assure a minimum flow at Kansas City of 30,000 cubic feet per second during the navigation season (March through November) and 10,000 cubic feet per second during the remainder of the year. This regulation of river flow is not from water stored specifically for purposes of low flow augmentation as outlined by the preceding speaker, but pursuant to agreement reached by the Missouri Basin Inter-Agency Committee in recognition of the riparian rights of the lower basin states.

The Missouri river "clean-up" program is based upon the water quality objectives as adopted cooperatively by the Federal Government, through the U. S. Public Health Service, and the official water pollution control agencies of the five states concerned with the reach of the Missouri river between Gavins Point reservoir near Yankton, South Dakota, and the confluence of the Missouri and Mississippi Rivers at St. Louis. These objectives provide that:

(a) Minimum treatment for municipal wastes will be effective removal of floatable and settling solids, with equivalent treatment for industrial wastes comparable to domestic sewage.

(b) Substantial reduction of those industrial wastes that would not be materially changed by primary treatment, and virtual elimination of toxic substances.

Program objectives also include agreement that the five state water pollution control agencies and the Public Health Service will initiate and maintain a continuing program of water quality monitoring as necessary to: facilitate evaluation of the improvement in water quality which results from the program as outlined above; permit determination as to when secondary treatment will be required; and provide sufficient notice to municipalities to permit orderly planning for this additional expenditure.

It is thus important to each city and industry that the maximum feasible reduction in industrial waste be obtained through a combination of in-plant control and primary treatment. Each and every reduction in waste will tend to delay the date that secondary treatment will be required, and will contribute to the maximum improvement in water quality that is feasible without secondary treatment. Expenditure of additional millions of dollars must be faced by municipalities and industries when and if the requirement for secondary treatment is established.

Industrial wastes constitute an important segment of the total waste discharge of the Kansas City metropolitan area. Industrial waste discharges substantially exceed domestic waste discharges, as measured either by biochemical oxygen demand or suspended solids. It is known too that industrial wastes are a major factor in the taste and odor problems encountered by downstream water supplies. Without question, certain industrial wastes can be more effectively and economically controlled within the industrial establishment than at the municipal treatment plant.

Kansas City's program is being financed from the sale of revenue bonds which will be retired with funds derived from sewer service charges, based upon the volume of water used. Certain industries discharge highly concentrated wastes, which place a burden upon the sewerage system that is totally out of keeping with a sewer service charge based upon water use.

Certain industries also discharge waste materials to the sewer system that may cause damage to the system or interfere with treatment processes.

Consideration of these several factors led to the conclusion that Kansas City needed an ordinance that would enable it to police and otherwise regulate the discharges of waste from commercial and industrial establishments to the city sewers. Such an ordinance should invite reduction in the waste load placed upon the treatment works and the receiving stream, permit regulation of the discharge of any wastes believed to be deleterious to the sewer system or to interfere with the treatment processes, and insure payment to the city for the handling of concentrated industrial wastes commensurate with the load placed upon the public system.

The first step in developing an ordinance for consideration by the city council was a thorough review of several ordinances now in effect in other cities. Ordinances were obtained from approximately twenty major cities that had already enacted an ordinance of this general type. Particular review was given to the ordinances of those cities that were comparable in size to Kansas City and discharging wastes to a major river.

Also studied carefully was the model ordinance developed by the Federation of Sewage and Industrial Waste Associations, now the Water Pollution Control Federation. Because of the substantial experience gained with this model draft, through its use by numerous cities as a framework for developing their ordinances, we guarded against any variation from the suggested ordinance of the Water Pollution Control Federation. Effort was also made to insure reasonable consistency with the ordinance previously adopted by the adjacent City of Kansas City, Kansas.

The initial draft was developed as the combined effort of myself and Mr. E. W. Mockobey, the employee of our Department principally concerned with our industrial waste control program. (Note: Effective December 1961, Mr. Mockobey was appointed to the position of Chief, Division of Industrial Waste Control, Department of Pollution Control) The original draft was submitted to other City Departments directly or indirectly interested in this problem, to selected consulting engineers, and to a few other individuals known to be personally interested in such a program. Comments from the several reviewers were duly reflected in the final draft developed by our Department and presented to the City Counselor for incorporation in an ordinance for formal consideration by the City Council.

On Friday, September 1, the ordinance was introduced, received first reading and referred to the appropriate committee. It received the customary hearing by the Finance Committee and was reported favorably on Thursday, September 7, received its second reading by the Council on September 8, and was finally passed by unanimous vote of the Council on September 15, 1961. The ordinance became fully effective ten days after passage, except that the surcharge provisions were specified to be effective May 1, 1962. This was considered necessary to give reasonable time for commercial and industrial establishments to study their waste discharges and to plan for any waste reduction programs considered feasible.

The ordinance as adopted constitutes Chapter 68 of the City Code. It delegates full authority to the Director of the Pollution Control Department. It also authorizes him to use discretion and judgment in administering certain provisions of the ordinance.

The definition section of the ordinance follows closely the definitions contained in the model ordinance developed by the Water Pollution Control Federation. "Normal Sewage" is defined as sewage which contains not over 400 parts per million of suspended solids and not over 300 parts per million of BOD by weight, and which does not contain any of the materials or substances listed in another section of the ordinance in excess of the allowable amounts specified in said section. This allows some service for industrial waste, as compared to domestice sewage, before a penalty in the form of a surcharge is established.

The owner of any commercial or industrial establishment within the city and having a public sewer available is required to provide facilities to convey all sanitary sewage and industrial wastes into the public sewer, except that commercial and industrial wastes may be discharged directly into a natural water course. In this case, the owner of said establishment must possess a valid permit from the Missouri Water Pollution Board specifically authorizing such discharge.

The ordinance further requires that no person shall discharge wastes, except normal sewage as defined above, from any commercial or industrial establishment into the public sewers without a valid permit so to do from the Director of the Pollution Control Department. Any establishment which makes application for such a permit shall provide certain prescribed information relating to the nature, volume and characteristics of the waste to be discharged. A great number of commercial and industrial establishments discharge only normal sewage, and we

did not desire to subject these establishments to the trouble and expense of measuring sewage flows and obtaining laboratory analyses to reflect the characteristics of the sewage. To minimize this needless effort, the ordinance stipulates that application for a permit to discharge commercial and industrial wastes need to filed only upon the Director's request.

Provision is included for the revocation of permits, after due notice, in those cases where the stipulations contained in the permit are not adhered to.

As previously stated, an objective of our ordinance is to invite reduction in the waste materials discharged to the public system, particularly those substances which would not be appreciably reduced in a primary treatment plant. The most effective means of inducing this reduction appeared to be a surcharge based upon the pounds of BOD or suspended solids reflected in wastes appreciably stronger than normal sewage. Such a charge was not visualized as a source of revenue, but as an invitation to reduce excessive waste discharges through improved housekeeping, waste salvage and related programs. The ordinance establishes a surcharge of 0.75 cents per pound for suspended solids in excess of 400 parts per million and 0.4 cents per pound for BOD in excess of 300 parts per million. The surcharge is not applied to both constituents, but does apply to the one which effects the greatest charge to the establishment. If both constituents are above the concentration subject to surcharge, the reduction of either constituent may well be reflected by reduction in the other constituent.

The surcharges will be added to the water bill as such, as an item separate and apart from the sewer service charge. The Pollution Control Department will furnish the Commissioner of Water Collections a charge in cents per 100 cubic foot of water that is to be effected as a surcharge for a specific establishment. The industry is responsible for determining the volume and quality of its discharges, and the city will run check tests only as necessary to police the program. As with any industrial waste surcharge program, real effort will be required to insure that the revenue from surcharges is not essentially negated by administrative costs.

Certain wastes may be prohibited from discharge to the public system. These include wastes having a temperature above 150 deg. F.; a pH under 6 or over 10; garbage unless properly shredded; insoluble oils, fats and greases; materials conducive to fire or explosion; and materials likely to cause obstruction in the sewers. Wastes may be precluded from the sewers if they contain phenols over 10 parts per million, cyanides over 2 parts per million, sulphides over 10 parts per million, or chlorinated solvents.

Limitations on discharge of radio-active wastes follow principles laid down in the Atomic Energy Act of 1954 (68 STAT. 919), part 20, sub-part D, Section 20.303.

Wastes which are unusual in composition, to the extent that they defy evaluation by conventional standards, are subject to review by the Director who is authorized to determine whether such wastes shall be prohibited from or may be admitted to the city sewers, or shall be modified before being admitted.

Where deemed necessary by the Director, any commercial or industrial establishment shall have installed and shall maintain at his own expense, a suitable control structure in the building sewer to facilitate observation, sampling, and measurement of wastes. The ordinance authorizes any duly authorized representative of the Director, possessing proper credentials, and identification, to enter all properties at reasonable times for the purpose of inspection, observation, sampling, measurement, and testing.

Violation of the ordinance is deemed a misdemeanor, subject to a fine of not to exceed $200 for violation. Each day that such violation occurs is deemed a separate offense. In cases of repeated violations, the Director may revoke the permit for the discharge of wastes into the sewer system, and effect the discontinuance of water or sewer service, or both. Any person violating the ordinance may be held liable to the city for any expense incurred as a result of the violation.

The Industrial Waste Control Ordinance takes precedence over the Building Code or other earlier ordinances or sections thereof which may be in conflict.

The ordinance has been distributed widely to commercial and industrial establishments within the city, and a form to serve as "Application for Permit" has been developed. Initial contacts are now being made with management, and our target date provides that applications and supporting data shall be filed by January 1, 1962. The surcharge provisions of the ordinance do not become effective until May 1, 1962, in order to provide reasonable time for the collection of data and the formulation of waste reduction programs. The ordinance has to date been well received, with a minimum of adverse comment or complaint from the establishments subject to regulation.

In summary, copies of the ordinance are available for any interested person. We do not represent it as a perfect ordinance, and we seriously doubt if a perfect industrial waste ordinance will ever be developed. It has been patterned to meet the needs as they appear to exist in Kansas City, and we have confidence that the new ordinance will be a useful tool in our over-all Pollution Abatement Program. We hope that it will encourage considerable reduction in the amount of waste materials currently being discharged to the city sewer system.

Our industrial wastes problem is not yet under control, but we have every confidence that the new ordinance will provide a satisfactory basis for the program we are developing. Without doubt, experience in working with the ordinance a reasonable time will reflect ways in which it can be improved. These experiences are expected to guide the city council in any future deliberations to be given our program of Industrial Waste Control. At that time, I have every confidence that the city fathers

will give the Water Pollution Control Program the full and unqualified support the program has continuously received during my tenure with the Pollution Control Department.

If experience with the ordinance is unsuccessful, I must assume full responsibility, as I got exactly what I asked for in the way of an Industrial Waste Control Ordinance.

RECLAMATION AND WATER CONTROL OF STRIPPED COAL LANDS

James A. Deane, Planning & Reclamation Engineer, Peabody Coal Company, St. Louis, Mo.

Strip mining, or open pit mining, is the removal of the overlaying strata to remove a certain mineral—in our case, coal. In removing this overlaying strata, or overburden, material is mixed together. This spoil is rich in minerals and contains all the necessary elements for plant growth, except nitrogen. Usually trace elements are present which were not in the soil before mining.

In stripping the overburden, pyritic materials are aften present. Pyritic material, when exposed to air and water, causes the soil to be acid when planting is done. When this matter is present in shales, it usually breaks down and leaches out in two to five years. If it is in sandstone, it may be five to fifteen years before it leaches out.

Before any reclamation is begun, tests must be made on this new soil to determine the acidity; then, a land use study is made. In carrying out this study, we try to match the planting with the ultimate use of the land. If the spoil is good and will support pasture—and we plan to use it for pasture—it is seeded for that purpose. When it will not support pasture or will not be used as such, we plant it in trees. In recent years, since the pressure of public demand for recreation areas increased, we have incorporated in our program a plan for recreational use of stripped coal land.

The trees we have planted are species that will produce a future timber crop—either as pulpwood or saw timber. The types of trees to be planted on different kinds of spoil are determined by studying experimental plantings which we have tested during recent and former years. Most of these studies were made by the Central States Experiment Station of the U. S. Forest Service and by the U. S. Department of Agriculture. Purdue University also has conducted surveys on the types of trees best suited for strip mine lands.

Various types of trees being planted during our reclamation program are: red oak, white oak, walnut, Chinese chestnut, sycamore, black locust, cottonwood, black alder, soft maple, ash, yellow poplar, sweet gum, birch, and red cedar. The pines are white and red, shortleaf, loblolly, jack, and Virginia. Of course, all of these trees are not included in one mixture. Suitable species are chosen for the kind of spoil to be planted and are mixed before planting, so that there are no solid blocks of one species. I feel that we, thus, are creating conditions like those found in the woods. During the Spring this year, we planted three and a half million trees. Our most successful plantings, thus far, have been hardwoods; whereas, the pine plantings have not been too promising. The only pines which are progressing satisfactorily are the white, loblolly and the shortleaf.

Since most of our company's reclamation work is being done in the midwestern states we are working in an area that is predominantly forested with hardwoods. Some of our older pine plantings have been completely crowded out by hardwoods which have seeded in voluntarily. For this reason, our recent plantings have been mostly hardwoods.

Some of the trees planted at the beginning of our reclamation project are already being cut for pulp. Contrary to belief that the roughness of spoil would make it difficult to log, little or no trouble has been encountered. The sharp "V's" which are formed by mining are filled in with soil and leaves and round out to make it relatively easy to skid out of the valleys. We are still experimenting with different species and mixtures. In 1960, we collected river birch seed and had it raised. It was combined with European black alder and three native trees on an area considered too acid to plant. Up to this date, it appears as if we may have developed five species that are acid-tolerant. The U. S. Forest Service is presently running an experiment to see how long it takes the acid to leach out of different type spoils.

When an area is to be seeded for pasture, we try to decide what grasses and legumes will thrive best in the proposed planting location. The types we generally use are: orchard grass, brome grass, tall fescue, alfalfa, sweet clover, and Korean lespedeza. Most of our mixtures are chosen through experiments which have been made on spoil banks. We found that tall fescue and Korean lespedeza will tolerate a greater amount of acid spoil than other grasses and legumes. Last year, our company planted 24,000 pounds of seed.

During the past few years, we have included a plan for recreation areas on stripped coal land. We have accomplished this by stocking our water with fish and by planting game foods and cover plants. Some of this land, which is close to heavily populated cities, has been developed solely for recreational purposes. At these locations, we have planted trees around the water and in scattered groups within the area, seeding the remaining land. These recreation spots have been leased or sold to

clubs or individuals. We have found that it is easier to develop a recreation area if it is not completely covered with trees—as the use of water for pleasure activities is the most attractive feature.

Eight years ago, when our company became concerned about acid mine water and suspended solids which were polluting our streams, they decided that a Reclamation Department was needed to handle water control at the mine locations. Being a forester, and having some technical knowledge in the field of water pollution, I was glad to accept the responsibility for such a project.

When our water pollution problem was first attacked, we agreed that the company and the public would both benefit if additional pollution could be prevented from entering our streams. Working on this theory, our program was set up to start an immediate system of water pollution abatement. We began this at our active or new mine sites.

Solving the problem of suspended solids in our streams was not too difficult. At that time, most of the Midwest was suffering from drought conditions. Some areas were hard-pressed for water to wash coal. It was decided that we could build impoundments and pump our slurry into them. In this manner, the suspended solids were allowed to settle out and, also, we could reuse the water. The overflows from these impoundments were located as far as possible from the place where solids entered. Since that time, we have had no suspended solids going into the streams from our washing plants.

The amount of siltation into streams, due to exposure of raw earth, is very slight. Most erosion which occurs in a newly stripped area is internal. By this, I mean that eroding soil goes into the valleys between the spoil or into the final pit. Only a small amount of this soil ever reaches the stream. Because of the looseness of such spoil, and the fact that the hardpan of original soil has been broken, most rainfall is absorbed. Loose soil conditions act as a sponge in absorbing and retaining water.

When we began to tackle the problem of acid mine water, I found that I knew little about such a situation—also, I found that very few other people knew how to handle the problem. Mellon Institute was one organization that was conducting an experiment relating to acid mine water, under the sponsorship of the National Coal Association.

We knew that our company's biggest headache from acid mine water had developed from old refuse piles. This refuse is composed of coal which has too many impurities to be salable. It contains such matter as rock and dirt, and its sulphate impurities become sulfuric acid when exposed to air and water. We realized that our greatest difficulty lay at old mine sites where little had been planned for the disposal of mine wastes.

In a discussion with the chief organizers of our company, it was determined that the Reclamation Department would participate in the development stages of all new mines. Since nearly 90 percent of our acid mine water came from old refuse piles, we pointed out that it was most important, in planning new mine sites, to eliminate growth of such piles at the very beginning. The company set up a plan to haul our refuse, wherever possible, back to active pits and then cover it with spoil. When this was impracticable, the refuse should be hauled back to an old pit and, when the pit was almost full, should be covered with surrounding spoil. Through experiments at our various mines, we have learned that three to four feet of soil will seal off such refuse.

At several of our operations, we do not haul the refuse back to the pit. Instead, it is crushed and pumped back to our closed-circuit areas. This method of disposal has proved to be efficient in the areas where it can be employed. Drainage, or diversion ditches are dug above our active pits to keep the run-off water from getting into the mine workings. Any water that happens to enter the pit should be pumped out as quickly as possible; as, the less time water is in contact with acid-bearing material, the less chance there is for concentration of the acid.

At our inactive pits—and where pits had been left to drain—we are faced with a problem of acid mine water. These pits are able to support fish whenever the pit is below drainage and filled with water. Knowing this, we constructed dams on a few of our drained pits. The ensuing discovery was phenomenal: when water covered the exposed coal face and the bottom of the pit, good water resulted.

If one of three components required to form sulfuric acid could be eliminated (i.e. water, oxygen, or pyritic material), our water problem would be solved. I found that oxygen was the easiest of the three to eliminate from the cycle, by covering it with either water or soil. We learned we could conserve water and slow down flash flooding by impounding the final cuts and, at the same time, correct the water pollution. Incidentally, we were pleased to find that impounded pits also created a good basis for additional recreation areas.

As our program continued, we impounded old pits and covered refuse wherever possible. At some mines, it was not practical to cover the refuse; so, we graded the spoil to a uniform slope and stopped the pooling of run-off from the refuse. We knew that streams were usually able to handle such run-off. Where acid water is allowed to pool, it has a tendency to pollute streams with "slugs" of acid mine water. Therefore, we try to keep such pools from forming, so that the run-off comes during periods of precipitation when the streams are at high flow. We are still beset with problems regarding stream pollution, but our experience over the last eight years has taught us a great deal, and we hope to arrive at a system which will benefit the coal industry and the public and, at the same time, eliminate water pollution.

I should add, here, that all of our water problems are not concerned with pollution. Pollution abatement is

the big problem but, when the answer is found on how to prevent acid mine water from getting into streams, we will be able to concentrate on a more pleasant task. That is the creation of lakes. From the unpolluted mine areas, we have been able to create an oasis—a series of lakes which are clean and attractive and are used more and more by growing numbers of people for swimming and boating. The lakes are stocked with fish and are enjoyed by pleasure-seeking groups who are able to fish where, a few years ago, there was only a stripped mine area.

In the whole picture of reclamation—of which I have tried to give you glimpses and ideas from our experience in this field—we do find notes of encouragement. It is rewarding to see, little by little each year, the growth and revitalization of stripped coal land. As we work hard to achieve an efficient plant for redevelopment, we see gradually emerging a more cheerful outlook towards Midwest reclamation. We see it in the heavier growth of trees on reclaimed land; it is in the variety and usefulness of grasses and legumes on revived pasture land. It is creeping into the recreational life of the public through the lakes and new play areas. With such encouragement, we hope to continue our reclamation program so that the stripped land will be useful and the streams will be free of pollution.

During the past several years, our company has learned—through various studies made with the aid of State, Federal and local reclamation groups—that constant supervision and planning are necessary for a successful reclamation program. But, as the stripped land is reclaimed, we are also planning to use prevention and forethought as key factors in any new mining operation; so that the problem of abatement will be lessened and we will, in the future, be able to renew the land at the same time it is being used for industry.

That is the aim of our reclamation and water control program. It is a big task and will take the combined efforts of company planning, the help of State and Federal organizations, and the interest of local reclamation groups. It requires the continuous development of new methods and ideas for channeling the natural resources of the Midwest toward their best use, now, and their protection and conservation in the future.

IN-PLANT WASTE CONTROL TO MINIMIZE TREATMENT AND COST

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The first steps toward pollution abatement in the St. Louis area were initiated prior to 1950 under the 1948 Federal Water Pollution Control Act. Since that time, local pollution abatement programs, administered under the State and local agencies, have progressed to various stages of completion. Several communities and industries in the area already have treatment works in operation, and almost all have at least progressed well into the investigation phase.

With large receiving streams, such as the Missouri and Mississippi Rivers, and their relatively great capacity for recovery, the initial aims of the pollution abatement programs that have been established by the Missouri Water Pollution Board and the Illinois Sanitary Water Board are not as stringent as those defined for areas tributary to smaller streams. The aims for the St. Louis area generally can be summarized as follows:

1. Substantially complete removal of floating and settleable solids
2. Removal of not less than 45 percent of the total suspended solids.
3. Removal of toxic materials and substances causing undesirable taste, odor, or unsightly conditions downstream from the St. Louis area.

Under a public pollution abatement program, the first two of these aims can be achieved by the application of conventional primary sewage treatment plants. However, the removal of toxic materials and taste and odor producers requires the cooperation of the industries contributing such wastes. Fortunately, the number of plants contributing wastes of these types appears to be few.

With these general aims in mind, the administration of the current public pollution abatement programs in the St. Louis area is being pursued substantially in accordance with the following plan:

1. The public agency will construct primary treatment facilities, and will accept, in addition to all domestic sewage, all industrial wastes which can be treated satisfactorily in such facilities.
2. Industry will eliminate from the public sewers, or reduce as required by the public agency, the contribution of all wastes which cannot be handled and treated satisfactorily in the public treatment plants or which may cause hazard or damage to the system, objectionable wastes, such as toxic materials, phenols, and taste and odor producers which cannot be discharged to the river even after primary treatment, and all clean waste water, such as cooling water, which can be discharged directly to the river or streams without treatment.
3. The public agency will establish an equitable schedule of charges for treatment services rendered, which will allow Industry to pay its fair share of the cost of treating its wastes in the public facilities.

One significant outgrowth of this general plan of treatment is the ruling, concurred with by both the Missouri Water Pollution Board and the Illinois Sanitary Water Board, that industries may discharge certain wastes directly to either the Missouri or Mississippi River, providing that such wastes are comparable to the effluent of a primary sewage treatment plant treating domestic sewage. It must be understood, however, that this ruling still would not permit the discharge of floating or settleable solids, nor of toxic or taste and odor producing materials. Under this premise, if an industry were located so that it could discharge wastes directly into a major stream, or into a closed conduit such as a storm sewer, wastes with a suspended solids concentration on the order of 100 milligrams per liter could be disposed of by this means. This, of course, presumes permission by the local public agency. Obviously, the discharge of wastes with a concentration of this magnitude cannot be condoned if discharged to a small stream or to a storm drainage channel which normally is dry.

In order to achieve effective cooperation between the public agencies and Industry, more often than not Industry must have some incentive to provide the funds and manpower needed to undertake in-plant waste control. The most common of such incentives include:

1. The willingness to assume responsibility for correcting conditions that are hazardous or that create nuisances for others.
2. Recognition that in-plant waste control might allow savings to be effected, either by more careful use of raw materials, or by the recovery of reclaimable materials.
3. The realization that production costs might be increased because of additional operating expenses accruing through the payment of sewer service charges.

Discussions with industrialists will show that all of these incentives are given consideration. However, of the three, the most effective appears to be the possibility of increased operating expense due to sewer service charges. It should be recognized that a well-designed service charge rate structure will reflect a fair charge for services rendered by the public agency, and there is never any intent to impose unfair penalties upon anyone. Sewer service charges based upon both the quantity and strength of the wastes contributed usually will reflect a reasonably high degree of equity in the distribution of costs, and this method of deriving sewage treatment plant operating revenue has been recommended for the St. Louis area.

There is nothing unusually difficult in the development of an effective in-plant waste control program for most industries. For the most part, the exercise of imagination and common sense will solve many of the problems. Obviously the most positive way of effecting waste control is to keep unnecessary quantities of waste water and pollutants out of the sewers. In the St. Louis area, the cost of water for industrial use is relatively low, and there has been little incentive to date to economize on the water bills. Similarly, the large combined sewers which exist in most parts of the area have had the effect of encouraging the disposal of materials into sewers to a greater degree than in many other parts of the country. As has been implied, the relative economics of these practices is bound to change with the initiation of sewer service charges, and in-plant waste control inevitably will become increasingly important.

Water conservation in industrial plants may be effected in a number of ways. As has been pointed out, relatively unpolluted water may be discharged directly to a major stream, or in some cases, to a separate storm sewer. Disposal by this means could prove to be quite economical in many cases, since service charges for the treatment of the waste water would not be applicable. The reuse of water by the application of cooling towers or spray ponds is common, and usually has the effect of reducing water costs as well as of minimizing sewer service charges. Temperature control valves installed in heat exchanger piping often will allow more efficient water use. In those cases in which production personnel will use all the water made available to them, whether they need it or not, the installation of orifices or throttling valves in the supply lines often will effect considerable economy.

The rate structure proposed for the St. Louis area includes provision for a surcharge to be applied to wastes with a suspended solids concentration in excess of 350 milligrams per liter. Since the recommended surcharge is over $20 per ton of dry solids, it will be advantageous to a number of industries to find ways of reducing the suspended solids concentration in their waste streams. In reducing suspended solids loadings, the first matter to consider is whether it is really necessary to discharge the solids to the sewer. It often will be found that a dry process will be as effective a production facility as a wet process. If it is determined that the wet process must be used, and the suspended solids concentration is great enough to be of concern, consideration should then be given to the removal of at least some of the solids. There are a number of readily available proprietary devices that will reduce the suspended solids concentration to reasonable limits. Vibrating or rotary screens and wet type cyclones are among the simpler pieces of equipment available for this purpose. If the solids removed from the waste stream are inorganic in nature, and if they have no reclaim value, they may be hauled to a dump along with other solid refuse from the plant. If the solids are organic in nature, and might create a nuisance or hazard if disposed of by dumping, disposal by landfill or incineration might be appropriate. Some industries have found it expedient and economical to burn such materials in their boilers. A number of industries have found that solids separation and/or reclamation can best be effected by sedimentation, which allows the heavier solids to be collected at the bottom of the tanks and the lighter ma-

terials, such as grease, to be skimmed from the water surface.

There are almost as many variations in in-plant waste treatment as there are industries. Since such processes are more in the category of treatment than waste control, they will not be discussed here.

As an aid to Industry in developing programs of in-plant waste control, particularly for those industries without prior experience in pollution abatement, a suggested procedure for conducting an industry waste survey has been developed for the Metropolitan St. Louis Sewer District. Without going into all of its details, the main provisions of this suggested procedure cover the following.

1. Assessment of present water usage.
2. Assessment of pollution load.
3. Consideration of methods of disposing of waste water and pollutants other than by discharge to public sewers.
4. Investigation of possibilities of materials reclamation.
5. Economic evaluations of various methods of waste control and disposal.
6. Development of a plan for corrective action.

This procedure, or some variation of it, has been used by a number of industries in the St. Louis area as the initial step in the development of a waste control program. In some of the cases outlined in the following, corrective measures will cost the industries very little. In others, the costs will be relatively high, primarily because little or no attention was given the problem in the past. Older facilities generally have a greater problem than the newer ones.

An initial survey of a moderately-sized meat packing plant showed that the total waste flow to the public sewers (not including clean cooling water that was discharged to a storm drainage channel) was about 350,000 gallons per day. This flow contained about 7,000 pounds of suspended solids, of which about 2,000 pounds were grease, and a large proportion of the remainder was paunch manure. During the initial survey, a breakdown occurred in one of the pieces of equipment used in a reclaiming process. The breakdown forced the adoption of a different procedure of operation which included a different means of disposal of certain of the less usable of the animal parts. A visual observation of the plant effluent during the breakdown showed the plant effluent to be of a much different character than before. When new samples were taken, it was found that the total amount of total suspended solids discharged to the sewer was less than 3,000 pounds per day, of which less than 600 pounds per day was grease. Further, it was found that reclaimed grease production increased with no appreciable deterioration in quality. Needless to say, the broken-down equipment was not returned to service. In this case, partially by accident, it was found that potential sewer service charges could be reduced by about $1,000 per month as a result of the change in operation, and an additional savings on the order of $800 per month was realized by the increased amount of salvaged grease. Continued investigations at this same plant disclosed that further savings could be effected by water conservation and by further improvements in solids and grease reclamation. The conclusions of the entire waste water study indicated the probability that the potential sewer service charges could be reduced from about $2,100 per month to about $400 per month, in addition to the savings due to increased grease salvage. Thus, the waste water study in this case demonstrated that the plant was not being operated at peak efficiency, and even after the initiation of sewer service charges, plant profits could be increased due to the more efficient reclamation of grease.

A comprehensive waste water study of another industry in the St. Louis area indicated an average daily waste water discharge of over 10,000,000 gallons, containing about 56,000 pounds of suspended solids. The initial estimate of sewer service charges for wastes of the quantity and strength was on the order of over $500,000 per year. During the course of the study it was found that at least half of the total waste flow was relatively clean water that it would be possible to discharge directly to the river without treatment. It also was found that the increased use of cooling towers would result in additional savings. Other investigations showed that reasonably minor modifications in certain of the processes would result in the reclamation of large quantities of organic solids, which then could be either returned to the process or disposed of other than by discharge to the public sewers. At the time of the initial study, this industry was discharging considerable quantities of spent caustic to the sewers. It is understood that plant modifications are contemplated that will allow a major portion of the caustic to be reclaimed. Since the initial waste water study was conducted in 1958, this industry has undergone many changes and expansions. It is understood that water conservation and pollution abatement have been included in the design considerations of the expanded facilities. When public sewage treatment facilities become a reality in the area, it appears that this industry will have discharged much of its responsibility with regard to pollution abatement, and will have its waste problems well under control.

Another industry, recognizing its responsibilities, is combining an investigation of water borne pollution with a parallel investigation of air pollution. One of this industry's processes, from which a waste water flow of about 1,000,000 gallons per day is discharged, containing about 3 tons of suspended solids, also emits large quantities of dust to the atmosphere. The investigations include consideration of converting the present wet process to a dry process which shows some promise of virtually eliminating both the water borne pollution problems, as well as the air pollution condition. This study also includes some experimental work on a wet cyclone separator.

One of the industries in the area presently discharges large quantities of cooling water containing heavy inorganic solids into the public sewers, and also discharges wastes containing cyanides and phenols to a natural waterway. It is understood that after considerable study this industry has decided to essentially divorce itself from the public sewer system, and plans the construction of large lagoons, one of which is expected to function as an oxidation pound, and the other as a simple type of sedimentation basin. The outlets from these lagoons would be into a natural watercourse and would bypass entirely the public sewage treatment facilities.

The cumulative effects of in-plant pollution control can be of considerable significance when applied to public treatment facilities. One preliminary report, prepared in 1959, estimated the quantitative design basis for public treatment facilities for an industrial complex to be 68.9 mgd. This estimate reflected the best guesses of the industries as well as the consulting engineers at that time, but was made prior to any waste water studies by the individual industries. A recent re-study of the same complex indicated that the comparable design basis could be reduced to about 45.3 mgd, principally as a result of studies of in-plant waste control by Industry. Anticipated reductions in the suspended solids loadings are of even greater magnitude.

The potential benefits of candor and mutual trust between Industry and the local and State agencies cannot be minimized. Repeatedly, the public agencies have demonstrated their ability to recognize an industrial waste problem and their willingness to cooperate in finding a mutually satisfactory solution. One of the most striking examples of this cooperation was in the case of an industry located near a major stream. This industry produces many tons per day of an inorganic waste material which is discharged to the river along with some sanitary sewage and other organic wastes. Since the industry is in a location such that the discharge of the inorganic wastes would cause no nuisance to downstream areas, the State agency indicated that if the organic wastes were separated and treated, the industry for the present could continue to dischrge the inorganic wastes to the river. In this case, if the industry had blindly followed a previous general directive, which required the complete abatement of pollution, their costs of waste disposal would have been very high, and little benefit would have accrued to anyone.

In the St. Louis area, the construction of pollution abatement facilities is generally considered to be inevitable. It will be to most industries' advantage to make as much use of the public facilities as they can, since the public works will be large enough to minimize the unit costs of treatment. However, not all of the responsibility for pollution abatement can be borne by the public agencies, because of the nature of some of the industrial wastes that will not be amenable to treatment in the public facilities. The industries, therefore, have a definite responsibility to effect in-plant waste control, not only to reduce their own operating costs, but also to prevent the discharge of undesirable pollutants and to prevent the unnecessary overloading of the public treatment plants.

PLANNING AND ZONING FOR AIR POLLUTION CONTROL

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Planners and air pollution control specialists are interested in the same thing, namely a better environment for the conduct of human life. The planner is primarily concerned with an appropriate arrangement of things physical on the land. Your interest as air pollution specialists lies with the condition of the air mass which covers and surrounds our physical arrangements. Surely the planner has stopped short of his duty if he too does not properly consider this aspect of the environment he is trying to create.

Our parallel interest stretches far back in time, but only recently has either group developed reasonably effective tools with which to accomplish the common goal. Some of our earliest writings indicate an interest in the quality of the air, though the source of the pollution may have been a great fire or a volcano. The poet Horace (65 B.C.) noted that the shrines of Rome were blackened by smoke. More than 600 years ago the people of London were much disturbed by the smoke and fumes produced by coal in furnaces which formerly used wood or wood charcoal. The king could do something about this, just as in ancient times he could determine the plans of his cities, but now our history has moved into a period which recognizes certain restraints on governmental dealing with the rights and property of individuals. The city planner who strives for adoption of his plans must convince a great many people that his ideas are sound. A great many mistakes had to be made before city planning received widespread legislative sanction some 40 years ago. Similarly, air pollution control was subject to much heated debate before legislators became convinced of the need for controls and that really practical means existed for putting the control program into effect.

The struggle to create a better environment is far from won, but certain tools of progress are now at hand. Most states have adopted enabling acts for planning and zoning, and air pollution control, and most of our larger

cities have city plans, zoning ordinances and smoke control ordinances. We may never achieve an "ideal" environment, for our ideas as to what this consists of change continuously, but surely we can strive, and it would seem that the groups represented here today can make an increasingly significant contribution to the state of human affairs if we take more trouble to find out how our talents and training may be used together.

Two main areas appear most eligible for our joint concern:

1. Planning the location of industries to minimize the effects of air pollution, and
2. Control of the characteristics of industries in particular locations by means of zoning regulations.

Merely to state these two basic problem areas evokes a certain amount of wonder that either the planner or the air specialist could accomplish much in these areas without the help of the other. If the planner has been remiss in his duty, it may be that he has been too busy becoming a genius in all things to learn what he should in this part of his field. If the air pollution specialist has been negligent, perhaps he has been too busy measuring small particles to learn of the larger scale preventive measures at his disposal.

Planning the Location of Industries

As approached by our office, and by most professional city planners, a comprehensive plan consists of a land use plan, a plan for major thoroughfares and community facilities and a program for carrying out the plan —actually accomplishing its recommendations over a period of years. The plan for physical facilities, streets, utilities, schools, parks and public buildings is based on an analysis and estimate of growth potential and usually looks 20 to 25 years into the future. The program for carrying out the plan includes necessary financial planning and the control measures, laws, ordinances or resolutions, and administrative procedures needed to insure both public and private compliance with major elements of the plan.

The land use plan is a more important element. Design of this part of the plan requires a thorough knowledge of many factors. Location of industrial areas within the plan has a strong influence on the form of the future city and on the arrangement of its components, particularly transportation arteries and utilities. Although the planner is usually dealing with an existing community which has industry already in it, located well or poorly, he must nevertheless be alert to the land needs of new industrial developments at new locations not extensions of the existing industrial complex. Much of the industry which has been built in this country in recent years has been built on outlying sites not related at all to the older central industrial districts. In addition to this, we are becoming accustomed to urban renewal procedures which make possible the correction of past mistakes.

In his recommendations for the industrial parts of the land use plan, the planner presumably has determined what kind of community he is trying to build and what kind of industry would be most appropriate for the future. If his plans include industries or other uses which are likely to produce influences objectionable to neighbors, he should attempt to plan locations for these uses where their objectionable characteristics will cause the least damage. Sometimes this may be accomplished by distance, locating the source of the objection far enough away from neighbors to reduce the possibility of complaints. A public open space, preferably one containing foliage, may be interposed to buffer one area from another. In some instances, topography may be used to advantage to provide a physical separation or barrier between a potentially objectionable use and its neighbors. If the objection may be air-borne, then an area must be found suitably located with respect to prevailing winds.

Even though this land use plan is based on a somewhat vague knowledge of the characteristics of certain land uses, and even if the meteorologic data assembled by the planner consists of no more than a wind rose obtained from the local weather bureau, the plan should offer an improvement over the unplanned, haphazard growth with which we are all experienced.

In this area of basic land use planning, your specialized knowledge can be of great assistance to the planner. You can tell him of air pollution problems attendant upon the land uses with which he must deal, and you can pass on to him your best knowledge of significant meteorological conditions affecting the area for which he is attempting to plan. Quite possibly you can present your knowledge in such a way as to convince many more planners of its practical applications.

At the same time, I suggest that you should become aware of what planners are doing and can do, and that there *are* possibilities for air pollution control inherent in land use planning and the legal means available to put the plan into effect.

Control by Zoning Regulations

The legal means are the zoning regulations which have been adopted by virtually every major city in the country since the first such regulations were adopted by New York in 1916. In recent years, this field has experienced some promising developments directly related to air pollution control.

Traditionally, a zoning ordinance or resolution is passed by the local legislative body and divides a city or county into zones, or districts, with regulations applying to the use and development of property in each district. The use regulations usually consist of a long list of uses permitted in each district. There is often more than one industrial district and the list of permitted industrial uses can become quite lengthly. A list in general use in our office contains 107 types of "light" industries and 125 "heavy" industries. The text of any ordinance in which

this list appears recognizes that, though lengthy, it is not complete and permits "any similar uses which are not likely to create any more offensive noise, vibration, dust heat, smoke, odor, glare, or other objectionable influences than the minimum amount normally resulting from other uses permitted."

Older ordinances than this "permissive" type listed and excluded certain industries or uses known to have objectionable characteristics, and permitted "all *other* industries and uses not in conflict with the laws of this city and the State."

More recently, in the last five to ten years, there has been a trend to regulation of uses by *performance standards.* These ordinances recognize that the *name* of the use is not nearly so important as the manner in which it is conducted. Performance standard ordinances attempt to regulate the same objectional influences as the older types, but do so in a more positive way, establishing definite standards for each characteristic. If a particular industry can convince the municipal authorities that it will comply with the standards of a particular zoning district, then a permit will be issued for location in that district regardless of the name of the industry.

This approach has a definite advantage in that many uses or processes having the same name or description may show a wide variation in the creation of nuisances. Technological advances are constantly creating new industries, new products, and improved methods of production and processing so that a use list is soon out of date. Further, without definite standards it is often difficult to determine what is "objectionable" and what is not.

The industrial nuisances which can be controlled by performance standards include noise, vibration, smoke, dust and other particulate matter, radiation hazards, fire and explosive hazards, heat humidity and glare. Noise is controlled by establishing maximum permitted decibel levels for designated octave bands. Steady state and impact vibrations may be measured at lot lines or district boundaries. The Ringelmann chart is commonly used to measure maximum permitted emission of smoke. Particulate matter limits may be set in pounds per hour, pounds per thousand pounds of flue gas, grains per cubic foot, pounds per thousand pounds of steam generated, pounds per thousand pounds of raw material, pounds per acre per hour, and so on.

Even though the merits of the system are generally recognized, adoption of performance standard zoning regulations has so far been limited mainly to the larger cities. Since 1951, performance standard ordinances have been adopted by perhaps 100 communities, including New York, Denver and Chicago, the latter being the most comprehensive at the time of adoption in 1957. Such regulations have been proposed for Johnson and Wyandotte Counties (Kansas) in the Kansas City Metropolitan Area, but are not yet adopted. The principal objections to this type of regulation are lack of enforcement equipment and trained personnel and lack of faith in the efficacy of the standards themselves. The average building inspector cannot picture himself running around listening to industrial noises with a sound meter. To him, a decibel is an unfamiliar unit. Mere mention of a Scentometer is apt to bring smiles to the faces of a hard boiled city council reviewing the planners proposal for a new zoning ordinance, and admittedly, the planners themselves are relectant to become involved in highly technical complications of a field where heretofore they have felt pretty much at home.

In spite of these problems, the logic of the approach is clear enough that performance standards will increase in popularity. Improvement of the standards and measuring devices presents a continuing challenge to you as air pollution specialists, and a new opportunity to bring about universal application of adequate air pollution control measures. The zoning ordinance is a working device whereby you may control the trouble before it starts, and, in cooperation with planners, you should be successful in establishing preventive measures in a jurisdiction which might not otherwise be interested in conventional smoke control legislation simply because there had thus far been no evidence of a problem.

In addition to the possibilities offered by a performance standard ordinance, there are other provisions in a "conventional" zoning ordinance which can be of assistance in air pollution control. Location of industrial districts on the zoning map should take into account the conditions of topography and meteorology mentioned before. Concentration of certain types of air pollution sources can be prevented and certain types of activities can be prohibited altogether from inappropriate locations. Buffer zones of various types can be established to encourage a diffusion of harmful effects as approach is made to the boundaries of districts containing "higher" uses, residences, for example. Encouraging judicial support has been given to the exclusion of residences from industrial districts where air pollution problems are most acute. Use list ordinances often contain a list of uses generally known to have accompanying hazards and which may be located in the industrial districts only by special approval of the legislative body following a report by the planning commission, the board of zoning adjustment or other administrative agencies. Municipal facilities as well as private facilities should be subject to this careful review, including the city dump or incinerator, sometimes the worst offender in a smaller city.

Each of these offers an opportunity for application of your specialized knowledge, and all of it applies as well to rural areas as to urban areas. The farmer's principal interest in zoning is often the protection of his land and crops from possible blighting by industry.

There should never be any interdepartmental rivalry between the planner or the building inspector and the air pollution specialists as to who is to administer what. The planner may offer helpful suggestions as to objectives, but he should recognize that the research needed

to draft the standards and design the measuring devices is outside his field, and that more and more he must rely on the specialist, either in another department of government or in private industry. In addition to conducting this research, a major part of your effort should be directed toward educating the public in general, and planners in particular, as to what can be done, and what is practical to do *now* in establishing more widespread use of effective air pollution control measures through zoning.

In summary, land use planning, and control of land uses by zoning, can contribute more and more to the objective of clean, clear air as you find out more about what needs to be done, and together we work out better ways to do it. I look forward to seeing more of you in the future.

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