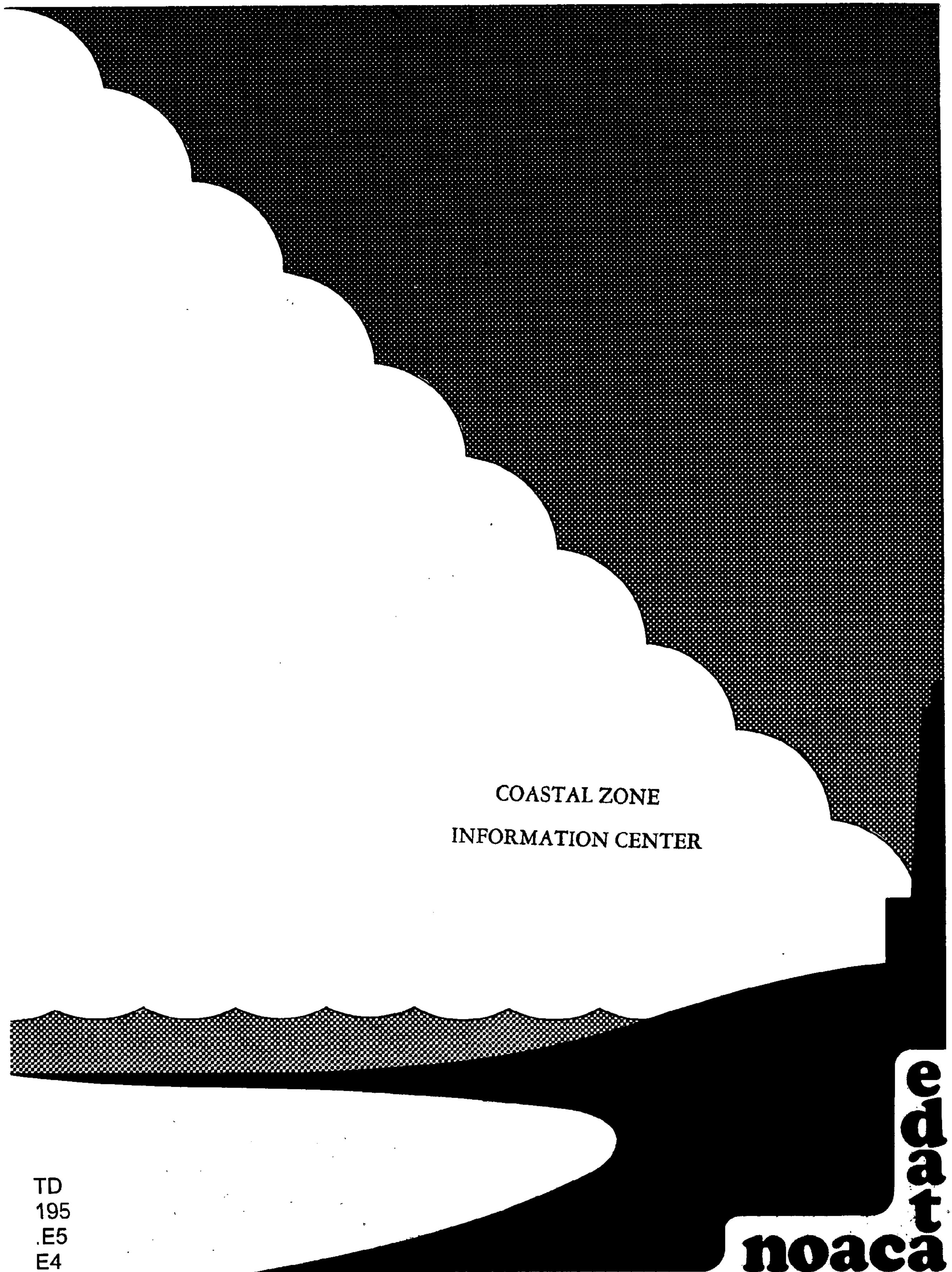

noaca

coastal zone energy impact program

EDATA/NOACA COASTAL ENERGY IMPACT PROGRAM PROJECT

The preparation of this study was financed by the Ohio Department of Energy. The Eastgate Development and Transportation Agency, and the Northeast Ohio Areawide Coordinating Agency through a grant from the National Oceanic and Atmospheric Administration Office of Coastal Zone Management

Prepared By:

EASTGATE DEVELOPMENT AND TRANSPORTATION AGENCY

and

NORTHEAST OHIO AREAWIDE COORDINATING AGENCY

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INTRODUCTION

On December 1, 1978, the Eastgate Development and Transportation Agency (EDATA) entered into an agreement with the Ohio Department of Energy (ODOE) (Contract 78-40) with a sub-contract with Northeast Ohio Areawide Coordinating Agency (NOACA), and an examination of energy projects and their impacts in the Coastal Zone of Northeast Ohio.

1. Assessment of the environmental impacts of energy development taking place in Ohio's Coastal Regions.
2. Identification negative environmental impacts.
3. Implementation of programs to mitigate negative environmental impacts.

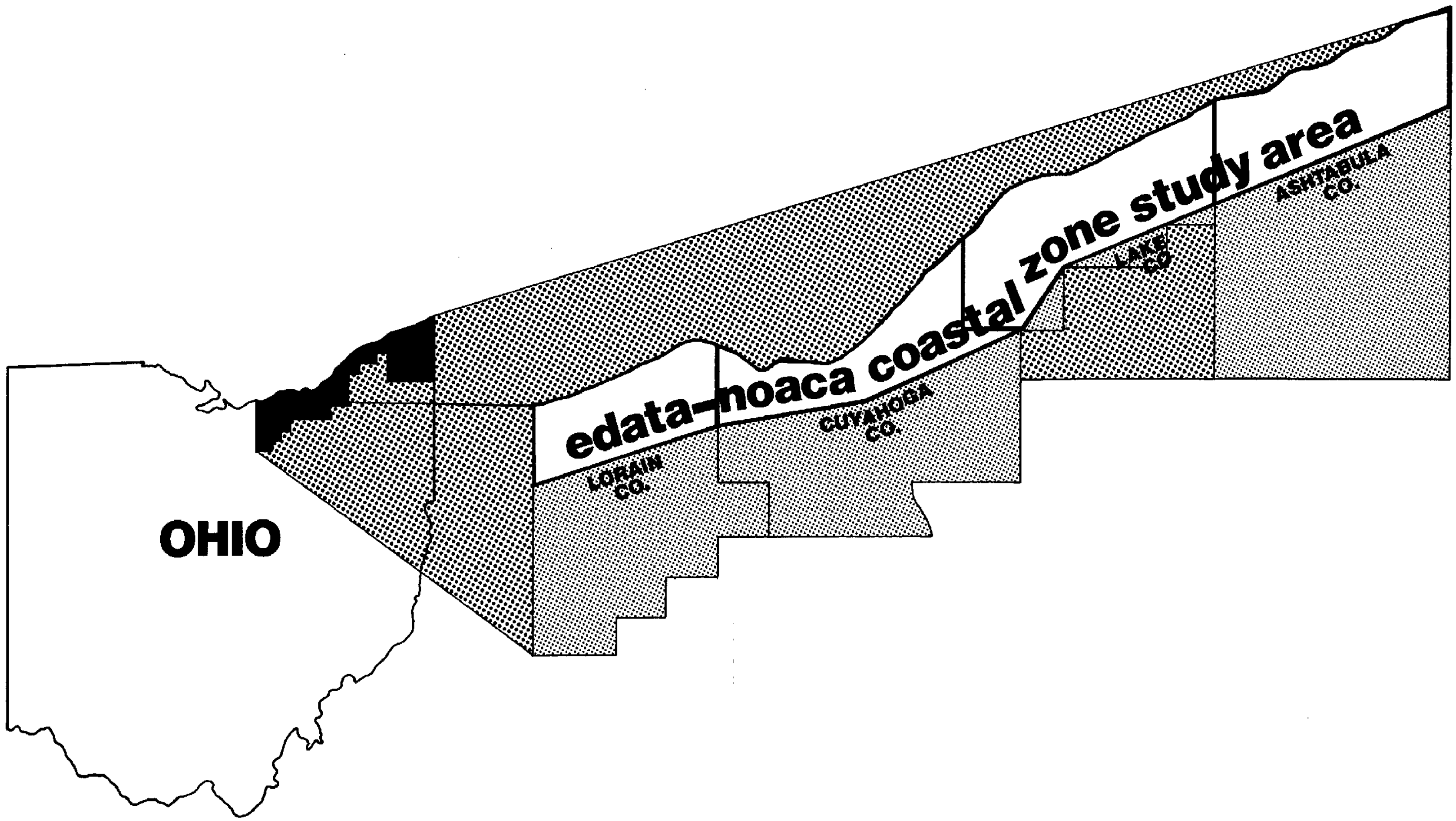
The Planning services to be provided by EDATA were grouped under the following:

TASK A	Energy Transmission lines and Right/Away.
TASK B	Resource Recovery Assessment
TASK C	Fly Ash Study
TASK D	Assistance Local CEIP Projects
TASK E	Assistance to Local Governments

In addition to technical and management studies, work activities under these five tasks were to include a public participation program component which would involve public officials and citizens, of the coastal areas of Ashtabula, Cuyahoga, Lake and Lorain Counties.

The study area was defined in the agreement as follows:

Ashtabula County	- North of Interstate 90
Cuyahoga County	- North of Interstate 90
Lake County	- North of Interstate 90
Lorain County	- North of State Route 2


OHIO
edata–noaca coastal zone study area
LORAIN CO.
CUYAHOGA CO.
LAKE CO.
ASHTABULA CO.

With this broader definition of the planning area, the following local jurisdiction fell within the category of impacted communities:

COUNTIES	MUNICIPALITIES	TOWNSHIPS
Cuyahoga	Vermillion	Brownhelm
Lorain	Lorain	Sheffield
Lake	Amherst	Concord
Ashtabula	Sheffield Lake	Painesville
	Sheffield	Perry
	Avon Lake	Madison
	Avon	Ashtabula
	Bay Village	Austinburg
	Westlake	Geneva
	Rocky River	Harpersfield
	Lakewood	Kingsville
	Cleveland	Plymouth
	Bratenahl	Saybrook
	East Cleveland	
	Euclid	
	Willowick	
	Wickliffe	
	Lakeline	
	Timberlake	
	Eastlake	
	Willoughby	
	Mentor-on-the-Lake	
	Mentor	
	Grand River	
	Fairport Harbor	
	Painesville	
	North Perry	
	Perry	
	Madison	
	Ashtabula	
	Conneaut	
	Geneva	
	Geneva-on-the-Lake	
	North Kingsville	

The list of impacted local communities provided the basis for determining the local communities to which energy planning assistance should be offered and the local officials and citizens who should be involved in the public participation program.

HISTORY-PAST-TO-PRESENT

European explorers happened upon Lake Erie in the seventeenth century on their way to the "Orient". The American colonists finally gained dominance of the land, ending Indian influence in their 1794 victory at Fallen Timbers near the present site of Toledo. The fiery battle of Lake Erie was a decisive victory for Americans. The International Peace Memorial at put-in-bay memorialized this battle that ended all war on the Great Lakes, declared by the 1817 Rush-Bagot Agreement.

By 1900, the population of the Lake region (bordering countries) had not yet reached one million. The 815,000 settlers had brought considerable changes to the land, the lake and its resources. Twenty-five million acres of woodland were cleared in 50 years in the lat 1800's. The lake soon became the dumping grounds for raw sewage from scores of small towns and large cities along the lake shore. In time, the U.S. and Canada began to recognize the serious threats to the Great Lakes region. It became apparent to all concerned that degradation at any point on the Lakes could have widespread effects upon the Lakes and their shoreline residents. Thus, in 1909 the U.S. and Canada joined in signing the Boundary Waters Treaty, under which the International Joint Commission (IJC) was established in 1912.

But the problems have not been easily resolved and new conflicts have frequently arisen. The conflicts inherent in developing the regions shorelands peaked as the 1960's came to a close. Public concern was inflamed when oil on the Cuyahoga River burned in 1969 and high coliform bacteria counts closed beaches.

This public outcry stimulated a massive governmental response. Numerous organizations, task forces, agencies and federal, state local and provincial laws were created to respond to the multifaceted conflicts.

With many structures in existence today, the U.S. and its states and Canada and its provinces now have the framework within which to address the multiplicity of Great Lakes' problems. Development of Ohio's Coastal Zone Management Program under the guidelines of PL 92-583 has been directed toward utilizing this framework to effect sound and rational decisions regarding its coastal resources.

COASTAL ZONE ENERGY

BACKGROUND

The coastal area of Lake Erie is the single most valuable land water in Ohio. Proper management is essential for the wise use of its resources.

The Coastal Zone Management Act was enacted by Congress in 1972 to encourage coastal states to develop and implement programs to protect resources, address coastal problems and provide for management of coastal development. The overall goals of the Coastal Zone Management Program are:

To preserve, protect, develop, and where possible, to restore or enhance the resources of Ohio's coastal area for this and succeeding generations.

To achieve these goals, in the (CZM) Coastal Zone Management Program recommends specific policies within the following six issue areas:

(A) Coastal erosion and flood hazard areas,

(B) Air and Water quality,

(C) Recreation and public access,

(D) Environmental sensitive areas,

(E) Energy and mineral resource, and

(F) General development.

The energy and mineral resources policy is necessary for the following reasons: to assure that the development and utilization of the coastal region's energy resources and supplies occurs in a wise and responsible manner. The Ohio Department of Energy, through the Coastal Energy Impact Program, will provide for the assessment and analysis of anticipated energy facility impacts in the coastal area.

SUMMARY

The Lake Erie shoreline continues to be one of Ohio's major energy facility sitings areas. Numerous major coal-fired and nuclear generating facilities area located in the coastal area.

Three principal factors causing greater demand on coastal locations for energy facility siting are: large coastal urban areas, competitive shipping advantages of Lake Erie and the nearly unlimited supply of water for cooling. Some of these facilities are inherently lake dependant; their successful functioning in some way requires that they be sited on the coast of a large body of water.

Growth in energy demand is a dominant factor in determining the number of facilities to be considered in the future for the coastal energy impact area.

The seacoasts of the United States are some of the most vital and productive ecosystems on earth. Commerce and industry's water dependence and the desireability of nearshore living have attracted fully half of the U.S. population to the coastal areas.

Our nation's "fourth seacoast" extends 4,600 miles along the southern shores of the Great Lakes, the largest and most important "inland sea" in the world. Along these Lake Erie shores and within and beneath its waters, a wealth of natural, scenic and economic resources exists.

Task A: Energy Transmission Lines Inventory and Assessment

Energy Transmission Lines/Rights of Way

I. Introduction

The original work program for the Energy Transmission Lines/Utility Rights of Way component of the EDATA/NOACA Coastal Energy Impact Program Project called for separate studies of energy transmission lines and utility rights of way. The two were separated conceptually because of the possibility that it might be found that utilities hold or plan to hold rights of way which they are not using for existing energy transmission lines or do not intend to use for energy transmission lines which they currently plan to build. However, the data which have been gathered on energy transmission lines and utility rights of way show that this is not the case. The current practice is that utility companies make easement agreements with property owners rather than purchase land for their transmission lines. Thus, they do not hold unused strips of land in anticipation of future development. When development is imminent and a transmission line is planned, the right of way is acquired through easement agreements. The net result is that existing and planned rights of way do not exist separately from existing and planned energy transmission lines.

This means that energy transmission lines, existing and planned, and utility rights of way, existing and planned, coincide and can be mapped together. It also means that the report which goes along with the maps can deal with both. Accordingly, maps have been prepared which show energy transmission lines and utility rights of way, existing and planned, as one line, and the information contained in these maps is analyzed in the single report which follows.

II. Mapped Information

Existing and planned energy transmission lines/rights of way are displayed in two ways on the attached maps. The detailed maps show the energy transmission lines/rights of way which are found within the coastal region of Lorain, Cuyahoga, Lake, and Ashtabula Counties. The general maps show the energy transmission lines/rights of way which are found within the boundaries of each of the four counties. The mapped information is presented at these two levels because of the fact that the energy transmission lines/rights of way which lie in the coastal region do not constitute a separate network but are part of a larger network which extends beyond the coastal region. That larger network, in fact, runs through a large part of Northeastern Ohio but, in order to keep the mapping task within practical limits, it is necessary to draw a boundary line short of the entire region. The county was selected as a reasonable boundary for the larger network.

The detailed maps present a complete picture of the energy transmission lines/rights of way within the coastal region because this is the focus of attention in the Coastal Energy Impact Program. The county-level maps are less complete because they are not intended to show the details of the energy transmission lines/rights of way within the entire county but rather the way in which the coastal region network fits into the county network. At the same time, it has become apparent that detailed mapping of the entire county network would enhance the usefulness of the mapped information." Accordingly, a proposal to do detailed county-level mapping will be included in the FY '80 CEIP application which will be presented to the Ohio Department of Energy.

Another deficiency in the mapped information will also be included in the FY '80 CEIP proposals. That is the absence of a map showing the energy transmission lines/rights of way network in Geauga County. Since Geauga County does not abut on Lake Erie, it was not included in the FY '79 coastal region planning area, and no map for this county was prepared. Yet, the energy transmission lines/rights of way data which was gathered showed that the Lake County coastal region network is actually part of a two-county network which includes Geauga County as well as Lake County. Because of Geauga County's position as part of the geographic, if not part of the political hinterland of Lake County's coastal region, this coastal region's energy transmission lines/rights of way network has to be seen in relation to the Lake/Geauga County network rather than the Lake County network alone. Providing this more complete picture will be one of proposed work tasks to be performed during FY '80.

III. Analysis of Mapped Information

The first important point which emerges from the data which were gathered for mapping purposes and which is displayed in Tables I and II is that the energy transmission lines/rights of way network within the coastal regions and remaining portion of Lorain, Cuyahoga, Lake and Ashtabula Counties will not undergo a major expansion during the next decade. There are no plans for building additional natural gas transmission lines, despite the increasing demand and the increasing supply from natural gas wells which are being drilled in Ohio. As Table III shows, none of the four counties included in the CEIP planning area is among those in which the new natural gas wells are concentrated. Moreover, the natural gas which these new wells produce can be handled by existing transmission lines. To be sure, the increasing demand will necessitate additions to the system of distribution lines, but these additional distribution lines can be supplied without adding to the transmission line network.

So far as electricty transmission lines are concerned, the only major additions scheduled for completion by 1985 are the Perry-Inland line and the Perry-Hanna line which will connect the Perry Nuclear Power Plan to the Central Area Power Coordination Group (CAPCO) grid. The Ohio Power Siting Commission (OPSC) has already approved the application for the Perry-Inland line, and that line is now under construction. The application for the Perry-Hanna line is now before the OPSC. It will not be known until the OPSC hands down its decision whether the "preferred" or the "alternate" or some other route will be followed, but it is almost certain that the line will be built. Given the fact that the Nuclear Regulatory Commission has approved the building of Perry Plant Unit II and construction is now underway, the OPSC can hardly refuse to sanction the building of a line to connect it with the distribution system which Unit II will serve.

The Perry-Inland and the Perry-Hanna transmission lines will run for a considerable distance through the coastal region and other portions of Lake County and for an even greater distance through parts of Cuyahoga, Summit, Geauga and Portage Counties which lie outside the coastal region. Undeveloped as well as developed land will be negatively impacted, and it is important that ways and means of mitigating these negative environmental impacts be explored. It is also important that this be done for the entire impacted area, not just that portion which is within the coastal region of Lake County.

One of the proposals which will be included in the FY '80 CEIP project will be to do exactly that; namely, to bring together all of the parties involved -- Cleveland Electric Illuminating, Ohio Edison, County and local officials, citizens of impacted communities, Ohio Department of Natural Resources -- to work out a program for mitigating the negative environmental impacts of the Perry-Inland and Perry-Hanna transmission lines. One line of approach will be to explore the potential which these transmission line corridors have for "multiple" use. The Ohio State Comprehensive Recreation Plan (1975-1980) identifies energy transmission lines/rights of way as "open space" which can be used for recreation purposes. They are particularly suited as self-contained trails or as trails which link park and recreation areas... Accordingly, the Plan recommends that "utility companies be encouraged to open their rights of way when feasible for trail purposes and that future rights of way be acquired in fee simple title or include a use easement which would permit trail establishment." The Recreation Needs assessment contained in the Plan shows a deficiency of facilities for bicycling, hiking, horsebackriding, and trailbiking in Northeast Ohio, and this deficiency could be met in part by using portions of the Perry-Inland and Perry-Hanna transmission lines corridors for such "trail" purposes. In addition, those areas under the transmission lines which abut on residential areas, where suitable, could be converted into sports fields and playgrounds.

Recreation is not, however, the only use to which these transmission line corridors could be put. Electricity transmission line corridors have been used for years as gardens for adjacent homeowners, and, with the growing popularity of home gardening, in response to rising produce prices, the potential for this particular "multiple" use is on the increase. Another possible "multiple" use arising out of the current situation of inflation and escalating energy costs which merits consideration in providing parking space so that commuters can use mass transit and paratransit for part of their work trips. In order to ride buses and participate in vanpools, commuters need to have a place to park their cars and transfer to buses and vans. One of the major problems in providing such parking places is finding the necessary vacant land. The extensive areas of open land under electricity transmission lines provide one possible answer to this problem.

While the foregoing discussion of potential "multiple" use of electricity transmission line corridors has focused upon the Perry-Inland and Perry-Hanna transmission lines, it is obvious that it could also apply to any energy transmission lines which may be built at a later date and also to certain existing transmission lines. It might well be, therefore, that the mechanisms developed and the experience gained during the FY '80 program for exploring the possible "multiple" uses of these two new transmission line corridors could be used effectively in doing the same thing for other new transmission lines and even for some older transmission line corridors. To be sure, a number of the older transmission line corridors are already being put to "multiple" use, but new needs also produce new possibilities. No one would argue that all that can be done to mitigate the negative environmental impacts of existing transmission lines has been done.

Energy transmission lines located within the coastal area have negative environmental impacts. Some are clear Coastal land, which is particularly valuable for industrial, commercial, residential and recreational use, has to be sacrificed for transmission line corridors. Transmission line corridor land use is often incompatible with land use in adjacent portions of the coastal area. Electricity transmission lines detract from the otherwise high aesthetic qualities of the coastal areas through which they run. In some cases, wetlands and natural and wildlife habitats are damaged by the intrusion of energy transmission lines. The existence of other negative environmental impacts, such as health hazards resulting from proximity to high voltage electricity transmission lines, is as yet unclear, but the possibility that they do exist cannot be ignored.

On the other hand, energy transmission lines are essential for distributing energy, and, since much of that energy is produced and consumed in the coastal region, energy transmission lines must be located within the coastal region. The prudent course, therefore, is to offset their negative environmental impacts with environmental benefits which can be realized from their presence within the coastal region. One way of doing that is to put energy transmission line corridors to "multiple" use. The net result will be, then, that their negative environmental impacts, while they will not be eliminated, will be reduced.

The second important point which emerges from the data which have been gathered is that, with the exception of four pipelines, existing energy transmission lines are being used. The most significant unused pipeline is the coal slurry pipeland which originates in Cadiz and terminates in Eastlake. This coal slurry pipeline, built in 1957 with a capacity of 1.3 million tons per year, was the first of its kind. For six years after its construction, it carried coal a distance of 108 miles from mines in Eastern Ohio to CEI's Eastlake power plant. At the end of this period of activity, the pipeline was shut down because coal could be delivered to the CEI plants by less experience means.

Portions of this coal slurry pipe lines are still in place, and, although a substantial capital investment would be required, the system could be made operational once again. A substantial capital investment will not be made, however, unless two conditions are met. First, the CEI plant must use Ohio coal, and, second, the cost of shipping that coal by rail must increase to the point where it becomes cheaper to use the pipeline. In fact, events are moving in a direction where both of these conditions might be met. Recent decisions by USEPA on air quality standards have opened the way to using Ohio coal to fire the CEI plant. In addition, freight rates for moving coal are increasing. It may well be, therefore, that events will develop in such a way as to create a situation in which it will be economical to reopen the coal slurry pipeline.

The result would be the elimination of the negative environmental impacts which result from supplying coal to CEI's Eastlake plant by rail. Coal trains not only create noise and dust, but they also impede the flow of motor traffic. Delivering coal through the pipeline would avoid these forms of environmental damage without creating environmental problems which would more than offset the positive results. Since most of the existing pipeline could still be used, only a small amount of land would have to be sacrificed to make the system operational. Moreover, the coastal area through which it runs would not be subjected to the environmental damage associated with the construction of an entirely new pipeline.

Two of the other three unused pipelines were built to carry refined petroleum products from Summit County to Cleveland. The 4" ARCO pipeline served an Atlantic-Richfield terminal which is no longer operating. The 6" Sun Pipeline Company pipeline supplied a Sunmark Industries terminal which is also inoperative. The remaining unused pipeline is the SOHIO 6" line which carried liquid petroleum gas from Cleveland Bradley Road to the 49th Street terminal. None of the three companies plans to reopen its pipeline, and ARCO's pipeline is up for sale.

Although neither ARCO, nor Sun Pipeline, nor SOHIO plan to reopen these unused pipelines, they represent valuable energy transmission facilities which could be used by other companies to transport refined petroleum products to the Cleveland area. Doing so would necessitate some alterations in the existing pipeline network, but th e negative environmental impacts associated with modifying the pipeline transmission system would be much less than building new pipelines through land which is highly developed. Every effort should certainly be made to find alternative uses for existing pipelines like the ARCO, SOHIO and Sun Pipeline pipelines which run through major metropolitan areas, for two reasons: In the first place, it would avoid the environmental disruption which would result from adding new pipelines to carry petroleum products which could be carried in existing pipelines. Secondly, economic considerations would not conflict with but, rather, would reinforce environmental considerations because it would be much cheaper to modify the pipeline transmission system to make it possible to use the existing pipelines than to build new pipelines through a highly developed area.

IV. Management Situation and Problems

Under Ohio law, decisions on the siting of energy transmission lines within the coastal region are made by the Ohio Power Siting Commission. The process by which these decisions are made is described in the following excerpt from the Ohio Department of Energy report entitled "Ohio Coastal Energy Facility Planning Process (1978):"

> "The Ohio Power Siting Commission (OPSC) was created October 24, 1972, to establish a "one-stop" state commission for gas and electric utility companies seeking to locate major utility facilities within Ohio. OPSC's basic function is to issue certificates of environmental compatibility and public need for the location, design, construction and initial operation of major utility facilities.
>
> OPSC has jurisdiction only over major utility facilities. These major facilities are defined as generation units which produce 50 megawatts of electricity or more, electric transmission lines that carry 125 kilovolts or more, and gas or natural gas transmission lines which can operate at pressures in excess of 125 pounds per square inch. Replacement of an existing facility with a like facility of similar output does not constitute construction of a major utility facility and needs no certificate. However, a certificate is required for any "substantial addition" (50 megawatts or more) to an existing facility already in operation. Any facility not designated as a major power facility is not certificated by OPSC, but is still subject to all other state/local laws and regulations.
>
> Chapter 4906 of the Ohio Revised Code (ORC) states that the Commission shall be composed of the Directors of the Ohio Environmental Protection Agency (who serves as chairman of the OPSC), the Department of Economic and Community Development, the Department of Energy, the Department of Health, the Department of Natural Resources, the chairman of the Public Utilities Commission of Ohio, a public member who must be an engineer, and four nonvoting members of the Ohio Legislature. Commission staff are chosen from these agencies to ensure a thorough evalua-

tion of all aspects of site developments and to represent the diversity of interests involved. This composition is designed to insure a balanced decision on an application for construction of a major facility.

Any entity intending to construct a power plant must submit a Letter of Intent to OPSC one year before the submission of the formal application. OPSC conducts a completeness review to determine whether the preapplication complies with requirements thus far. A schedule is formalized for the next year to include the several steps outlined in the diagram. The formal application must identify two viable sites for both the power plant and any transmission line corridors, one site designated "preferred" and the other site "alternate".

The OPSC process is designed to include input from citizens, interest groups, governmental units, and utilities at various stages throughout the investigation period. Additionally, the OPSC is statutorily empowered to act in conjunction or concurrence with any agency of any state or of the United States.

Subsequent to initial OPSC staff review, the applicant is required to file copies of the application in designated Ohio public libraries. Additionally, the applicant is required to give public notice of the OPSC hearing to be held on the application. It is possible for affected parties to testify at the Adjudication Hearing by filing a Petition for Leave to Intervene to the OPSC Administrative Law Judge. This opportunity is usually restricted to those persons who are parties to the application. The Petition must show good cause and contribution toward resolving the Hearing issues.

Separate applications are required for a power plant and for the transmission lines that would accompany that plant. Although the applications for the plant and the lines are generally considered together, it is possible for the OPSC to approve one application and not the other. Also, the OPSC does have the option of modifying the sites of a facility.

The OPSC makes a decision to grant a certificate of environmental compatibility at an open meeting, stating its reasons for taking such action. The final decision is based on the following criteria:

1. The basis of the need for the facility;

2. The nature of the probable environmental impact;

3. That the facility represents the minimum adverse environmental impact, considering the state of the available technology and the nature and economics of various alternatives;

4. In the case of an electric transmission line, that such facility is consistent with regional plans for expansion of the electric power grid of the electric systems serving Ohio and interconnected systems; and that such facilities will serve the interests of electric system economy and reliability;

5. That the facility will comply with all air and water pollution control and solid waste disposal laws and regulations;

6. And that the facility will serve the public interest, convenience and necessity."

As the attached "Ohio Power Siting Commission Application Process" diagram shows, there are points at which parties to a decision on siting an energy transmission other than the utility concerned and the OPSC can and do participate. Public notice that an application has been filed has to be given, and a public hearing has to be held at which anyone can give oral or written testimony. Parties who have "standing" because they would be impacted by the siting of the energy transmission line can participate as "intervenors" in an adjudication hearing. These access points provide opportunities for county and local officials and citizens from the coastal region to bring to the attention of the OPSC any negative environmental impacts which they would experience and to suggest ways of mitigating them. These "intervenor" inputs then become a part of the data which the OPSC uses to make its decision.

The problem with the existing decision making process is that the views of coastal area officials and citizens on negative environmental impacts and ways of mitigating them are introduced only after the utility company has finalized its application and submitted it to the OPSC. This is not to say that environmental impacts are not considered at any earlier stage. As a matter of fact, the energy transmission line application must include an environmental impact assessment, but it is made by the applicant or a consultant who is hired to do the job. Thus, it reflects the point of view and interests of the applicant rather than the point of view and interests of all parties which would be directly affected by building the transmission line. To be sure, the point of view and interests of local officials and citizens of impacted communities are brought into the process after the application is submitted, but as the term "intervenor" implies, the result at this stage is that they come into conflict with those of the applicant.

For two reasons: First, the applicant has put a great deal of time and money into preparing his application and is naturally reluctant to spend more time and money changing it. Second, the application contains an environmental impact assessment which the applicant has to defend in order to maintain the position that it was done "objectively". Thus, at the public and adjudication hearings, the applicant and representatives of the impacted coastal communities adopt adversarial roles, each side maintaining its own position against the other rather than listening to each other and attempting to arrive at compromises which both sides can accept. In the end, it is left to the OPSC to choose between the conflicting points of view and interests of the contending parties.

A good example of the conflict which arises under the OPSC's present procedures is provided by the struggle which is taking place over building the Perry-Hanna transmission line. CEI and Ohio Edison have spent a great deal of time and money preparing, on their own and with the help of consultants, an application which contains "preferred" and "alternate" routes which run in a southerly direction across Lake and Geauga Counties and end in northern Portage County. This application is now pending with the OPSC, and the public and adjudication hearings are about to be held. Already it is clear that officials and citizens of all of the Counties and most of the township which will be impacted are going to object to the "preferred" and "alternate" routes which have been proposed. Some "intervenors" are even taking the position that the transmission line should not be built at all. On the other hand, CEI and Ohio Edison have invested so much time and money in planning and assessing the environmental impacts of the "preferred" and "alternate" routes that they can be expected to defend them. The battle lines will be drawn at the public and adjudication hearings, and the OPSC will have to decide the relative weight to be given to the positions of the contending parties. It is unlikely, given the conflict situation which has arisen and the difficulty which the OPSC will have arriving at a compromise which does justice to the interests of the various parties to the dispute, that the Perry-Hanna transmission line which will be built will be the one with the least negative environmental impact on the communities through which it runs.

To a certain degree, this kind of conflict cannot be avoided because utility companies and impacted officials and citizens will never be in complete agreement. But the area of disagreement could be narrowed if conflicting points of view and interests could be brought to the surface and an attempt made to resolve them before the energy transmission line application is finalized and submitted to the OPSC. This would happen if the OPSC insisted that the applicant include "public participation" in the application preparation process. In other words, the OPSC would require that, as soon as a utility company decides on building an energy transmission line within the coastal region and has identified the feasible alternative routes which might be followed, company representatives meet with officials and citizens of the communities which would be impacted, ascertain from them the negative environmental impacts which they would experience, and discuss with them potential ways of mitigating them. When these negative environmental impacts had been identified and their potential for mitigation assessed, the parties involved would attempt to reach as much agreement as possible on the "preferred" and "alternate" routes which the utility company would study in depth for inclusion in its application. To the extent that agreement was not possible, it would be left to the utility company to select the "preferred" and "alternate" routes, but its application would have to state the opposing views of local officials and citizens and explain the reasons why they were not followed. As a result of this "public participation" process, the application which reached the OPSC would be one which the applicant had finalized with full knowledge of the views of officials and citizens of impacted coastal communities and after making an attempt to resolve differences to the extent possible.

No doubt, it would take some time to follow this "public participation" route, but the processing of an application for an energy transmission line is complicated and time consuming under any circumstances. This fact is recognized by the requirement in existing OPSC procedures that the applicant file a Notice of Intent a full year prior to submission of an application. Surely, the year which must elapse between the filing of the Notice of Intent and the application itself would provide ample time for the applicant to involve officials and citizens of the impacted communities in the application preparation process. Doing so would certainly make this initial stage more complex then it is at present, but this increase in complexity could be offset by a reduction in the amount of conflict which now arises at the public and adjudication hearings stage. Moreover, it could increase the cooperative and decrease the adversarial element in the application process, with the result that the OPSC would have an easier time arriving at a decision which would be environmentally acceptable to public interests as well as economically acceptable to private interests.

LIST OF
COASTAL ZONE ENERGY
UTILITIES AND
OIL AND GAS PIPELINE CO.

A portion of the Coastal Zone Energy Grant requires the completion of such tasks as: (a) an inventory of used and unused pipelines in the study area, (b) an update of right-of-way listings within the study area, (c) a requirement to utilize the information from (a) and (b) above in order to investigate the impacts of utilizing existing or currently unused pipelines for the transmission of natural gas and other energy resources in the study area.

LIST OF

RESPONDENTS

AND

CONTACT PERSONS

American Telephone and Telegraph Co.	10 S. Canal St. Rm. 24E Chicago, Illinois 60606	C. A. McJohnston Dist. Engr-Const.	312- 614-8441
Arco Pipe Line Co.	(General Office) Arco Building Independence, Kansas 67301	John R. Sebastian Mgr.R/W & Claims	316- 331-1300 Ext.220
	(District Office) P.O. Box 8225 Toledo, OH 43605	H.D. Wilson, Dist. Mgr.	419- 726-7231
Ashland Pipe Line Co.	Box 3104 Lexington, OH 44904	Earl B. Newman Division Supt.	419- 884-0800
Ashtabula Telephone Co., The	4616 Park Avenue Ashtabula, OH 44004	See Western Reserve Tel. Co.	216- 998-5151
Ashtabula Water Works Co., The	4540 Park Avenue Ashtabula, OH 44004	J.V. Armstrong Manager	216- 998-2627
Buckeye Pipe Line Co.	P.O. Box 368 Emmaus, PA 18049	G.W. Flarida Pipeline Modification Coordinator	215- 967-3131 Ext. 399
City of Cleveland Div. of Utilities Engrg.	Rm. 514 1201 Lakeside Ave. Cleveland, OH 44114	Richard Labas, Commissioner	216- 694-3346
Cleveland Electric Illuminating Co.	P.O. Box 5000 Room 477 Cleveland, OH 44101	Robert R. Hoherz Project Designer	216- 623-1350 Ext. 591
Columbia Gas of Ohio, Inc.	99 North Front St. Columbus, OH 43215	Walter A. Perrin Mgr. Land Service	614- 460-2613
Columbia Gas Transmission Corp.	P.O. Box 1273 Charleston, W.VA.	Leroy H. Hoppe, Mgr. Liaison Operations	304- 346-0951 Ext. 445
Conneaut Telephone	224 State Street Conneaut, OH 44030	Ray Rapose, General Manager	216- 593-1181
Diamond Crystal Salt Co., The	2065 Manchester Rd. P.O. Box 149 Akron, OH 44314	Frank J. Licause Office Engineer	216- 745-3181
East Ohio Gas Co., The	1717 East Ninth St. Cleveland, OH 44114	Chalmer E. Stewart Senior Engineer	216- 623-4709

Ohio Bell Telephone Co.	820 Superior Ave. N.W., Room 215 Cleveland, OH 44113	H. L. Barber Joint Relations Section (Great Cleveland Area)	216-822-6141
	2525 State Rd. Room 100 Cuyahoga Falls, OH 44223	R.A. Meyer Dist. Mgr. Fac. Akron	216-384-2489
	832 McKinley Ave. NW Room 01 Canton, OH 44703	G.G. Wuchter Dist. Mgr. Fac. Canton	216-489-2489
Ohio Edison Co.	76 South Main St. Akron, OH 44308	R.L. Buchanan General Planning Engineering	216-384-5234
Ohio Electric Utility Institute	P.O. Box 1247 Courthouse Plaza SW Dayton, OH 45401	J.E. Scheubler Asst. to Supvr & Hywy Coordinator	513-224-6000
Ohio Water Services Co.	6650 South Ave. Youngstown, OH 44512	Edward H. Heineman	216-726-8151
Standard Oil Co.	P.O. Box 189 Vandalia, OH 45377	I.L. Henman General Supt.	513-898-3971
Sun Pipe Line Co.	7155 Inkster Road Taylor, MI 48180	David Zimmerman, Area Engineer	313-292-8850, 8851
United Telephone Co.	(General Office) 665 Lexington Ave. Mansfield, OH 44907	General Outside Plant Engineer	419-755-8431
	(Warren Division) 220 S. Park Avenue P.O. Box 311 Warren, OH 44482	Rita C. Dunning, R/W Engineer	216 841-1214
Utilities Protection Service	106 W. Ryan, RM. 227 Youngstown, OH 44503		1-800-362-2764
Western Reserve Telephone	245 N. Main Street Hudson, OH 44236	See Mid-Continent Telephone Corp. Herbert G. Riedel, Engr. Const. Mgr.	216-653-8487, 9622
	37 S. Forest St. Geneva, OH 44041	Gordon J. Gatien, Plant Superintendent	216-466-4611
	P.O. Box 188 Quaker City, OH 43773	George Shaffer, Southern Dist. Mgr.	614-679-2111

General Telephone Co. of Ohio	117 N. Sandusky St. Bellevue, OH 44811	J.W. Simonis Div. Engrg. & Const. Mgr.	419-483-8190
	100 Executive Dr. Marion, OH 43301	George R. Ghearing Engr. & Const.Mgr. OSP	614-383-0271
	1300 Columbus-Sandusky Rd., North Marion, OH 43302	R.D. Hackenbracht, Div. Engr. & Const. Mgr.	614-383-0434
	1121 Tuscarawas Ave. N.W. New Philadelphia, OH 45663	G. H. Bosler Div. Engr. & Const. Mgr	216-364-0332
	1315 Albert Street Portsmouth, OH 45661	Donald C. Hoke Div. Supply & Trns. Trans. Mgr.	614-354-4528
Gulf Regining Co.	301 Crestwood Bank Building 9705 Highway 66 St. Louis MS 63126	District Manager	
Home Telephone Co. The	P.O. Box 338 Middlefield, OH 44062	Gary Hunt President	216-632-8121
Kingsville Telephone Co.	Kingsville, OH 44048	Russel McConnell General Manager	216-293-6301
Laurel Pipe Line Co.	P.O. Box 426 Camp Hill, PA 17011	J.E. Johnson Engineering Supvr.	717-737-8611
Mahoning Valley Sanitary District, The	P.O. Box 4149 Youngstown, OH 44515	John E. Tucker Secretary & Chief Eng.	216-799-6315
Marathon Pipe Line Co.	Mktg. Engr. Dept. 539 S. Main St. Findlay, OH 45840	Len McNanness Supvr. Engr. Dept.	419-422-2121
Miami Valley Corp.	P.O. Box 189 Vandalia, OH 45377	I. L. Henman Gen. Supt.	513-898-3971
Mid-Continent Telephone Corp.	100 Executive Pkwy Hudson, OH 44326	Fred Griech Dir. Tech. Svcs.	216-653-7153
Eastern Div.	Western Reserve Telephone Co. 245 N. Main St. Hudson, OH 44236	W. R. Dickerson, Plant Manager	216-653-5151 Ext. 224
Western Div.	Elyria Telephone Co. 363 Third Street Elyria, OH 44035	JOhn Mudrak Outside Plant Engineer	216-322-4681

TABLE I

CUYAHOGA COUNTY

Cleveland Electric 1

EXISTING TRANSMISSION LINES

LINE NAME	IDENT. NUMBER	LINE ORIGIN	LINE TERMINATION	KV	LENGTH	MAX. WIDTH	MIN. WIDTH	NUM. CIRC	COMMENT
Juniper-Star (OE)	CEI - B-II	Juniper Substation	Point of intercon-nection w/OE in Summit County	345	11.3	200	200	1	Double circuit lattice tower single circuit lattice tower single circuit lattice H frame 1968 - a second tower line - CEI-B VII (UC) Avon Juniper line will use 11.3 miles of right of way
Juniper-Canton (Ohio Power)	CEI - B-III	Juniper	Point of intercon-nection w/Ohio power	345	54.6	185	185	1	Single circuit lattice tower - 1963
Juniper-Eastlake	CEI - B-VI	Juniper	Eastlake	345	36.9	185	170	1	Single circuit lattice tower double circuit lattice tower - 1972
Avon-Juniper (UC)	CEI - B-VII	Avon	Juniper	345	29.1 14.9	110 200	90 200	1	double circuit lattice tower double circuit lattice H frame double circuit 2 poles H frame Single circuit lattice tower Scheduled - 1978
Harding Supply (UC)	CEI - B-VIII	Juniper	Harding	345	7.8	160	100	2	double circuit lattice tower double circuit lattice H frame double circuit Delta tower double circuit (undefined) scheduled to be completed 1979
Harding-Fox	CEI - B-IX	Harding	Fox	345	5.2	90	90	2	double circuit steel pole double circuit steel tower, 1975
Galaxie Supply	CEI - B-X	Fowles	Hudson	oper. 132 design 132 345	13.6 .6	110 N/A	90 N/A	2	double circuit lattice H frame double circuit 2 pole H frame single circuit wood pole 2nd circuit scheduled 1979

TABLE I

CUYAHOGA COUNTY (continued)

LINE NAME	IDENT. NUMBER	LINE ORIGIN	LINE TERMINATION	KV	LENGTH	MAX. WIDTH	MIN. WIDTH	NUM. CIRC	COMMENT
Perry-Macedonia Inland Line (UC)	CEI - B-XII	Perry	Inland	345	55.2	110	90	2	Double circuit lattice double circuit steel pole portion energized 1977 complete energization 1981
Inland-Harding Line	CEI - C-XIII	Point on Perry-Macedonia Inland Line	Harding	345	2.1	110	90	2	Double circuit steel pole double circuit 2 pole structure double circuit lattice 1977
Juniper Star relocation	CEI - B-XV	Juniper	Point on Juniper Star line	345	.6	200	200	1	Double circuit lattice towers scheduled 1978
Avon-Lorain Fowles	CEI - A-1	Avon Lake	Fowles	132	17.9	255	210	4	Double circuit lattice tower 1928 - Astor substation on line Crystal substation planned 1986
Avon-Lorain Fowles (Berea cutoff)	CEI - A-2	Avon Lake	Fowles	132	18.4	255	210	2	Double circuit lattice tower double circuit steel pole, 1926 substation: Clifford planned Crystal; shared ROW with CEI-A1
Dawson Supply-Avon	CEI - A-3	Point on Avon-Lorain Fowles line	Dawson	132	9.0	85	40	2	Double circuit lattice tower 1965 - double circuit single steel poles, substations: Crestwood, Dawson
Dawson Supply-Clague	CEI - A-4	Dawson	Clague Road & North & West Right of Way	33	1.4	44	40	2	Double circuit steel pole substation: Dodge
Fowles-NASA	CEI - A-6	Fowles	NASA Customer station	132	6.6	150	150	4	Double circuit lattice tower 1943 - substation: Dunkirk
Cadillac Supply	CEI - A-7	Point on Fowles-NASA Line	Cadillac Customer Station	132	1.2	150	90	2	Double circuit lattice tower 1943 - double circuit steel pole at Customer station

TABLE I

CUYAHOGA COUNTY (continued

LINE NAME	IDENT. NUMBER	LINE ORIGIN	LINE TERMINATION	KV	LENGTH	MAX. WIDTH	MIN. WIDTH	NUM. CIRC	COMMENT
Fowles-Clinton	CEI - A-8	Fowles	Clinton	132	9.0	150	150	4	Double circuit lattice tower 1926 - substation: Clinton, Elden, Essex, Fox, Furlong, Graham, Grovewood, Hummel
Ford Tap	CEI - A-9	Point on Fowles-Clinton Line	Ford Customer Station	132	2.0	90	90	2	Double circuit lattice tower 1953
General Motors Supply	CEI - A-10	Point on Fowles - Clinton Line	General Motors Chevrolet Customer Station	132	.3	298	88	2	Double circuit steel pole 1968
Fowles-Mayfield	CEI - A-11	Fowles	Mayfield	132	33.9	150	150	4	Double circuit lattice tower 1926 - double circuit steel poles substations: Faber, Krick Griffin, Imperial, Juniper, Mayfield, Northfield, Nelson, Norway
Pleasant Valley (Ohio Edison)	CEI - A-12	Pleasant Valley	Point of intercon-nection w/Ohio Edison Summit Co.	132	6.2	100	100	2	Double circuit lattice tower 1924 - substation: Hickory, line continue to OE West Akron sub-station
Pleasant Valley Jennings	CEI - A-13	Pleasant Valley	Jennings	132	9.3	185	150	4	Double circuit lattice tower 1933 - substations: Grant Hancock Harding
Republic Steel supply	CEI - A-14	Point on Pleasant Valley Jennings	Republic Steel Customer Station	132	.3	300	165	4	Double circuit lattice tower 1968
Jennings-Clark	CEI - A-15	Jennings	Clark	132	.2	N/A	N/A	3	Lattice tower, 1944
Jennings-J & L Steel	CEI - A-16	Jennings	Jones & Laughlin Customer Station	132	.1	N/A	N/A	3	Lattice tower, 1955

TABLE I

CUYAHOGA COUNTY (continued)

LINE NAME	IDENT. NUMBER	LINE ORIGIN	LINE TERMINATION	KV	LENGTH	MAX. WIDTH	MIN. WIDTH	NUM. CIRC	COMMENT
Jennings-Hazel	CEI - A-17	Jennings	Hazel Terminal Structure	132	2.1	90	85	2	Double circuit lattice tower 1959
Hazel-Lakeshore	CEI - A-18	Hazel Terminal Structure	Lake Shore Step up Station	132	4.5	N/A	N/A	2	Underground 1958 substation: Hamilton
Jennings-Oak Tap Structure	CEI - A-19	Jennings	Oak Tap Structure Village Cuyahoga Heights	132	5.1	40 pole 100 tower	40 100	2	Double circuit lattice tower 1965 - double circuit steel pole; substation: Linde customer station; 2nd Republic steel customer station
Pleasant Valley-Oak Tap Structure	CEI - A-20	Pleasant Valley	Oak Tap structure	132	6.5 Over head .2 under ground	90 25	90 25	2	double circuit lattice tower 1926 - underground Oak substation removed 1976
Juniper-Hillside	CEI - A-21	Juniper	Hillside structure	132	2.9	60	60	2	Double circuit lattice tower 1969
Juniper-Lloyd	CEI - A-22	Juniper	Lloyd	132	23.5	90(tower) 52(poles)	90 35	2 2	Double circuit lattice towers, 1957 - double circuit single poles; substations: Inland, Ivy Irwin, Jordan, Judi, Juniper, Kipling, Lloyd, Newburgh; 132 KV Inland line completed as part of the line 12/77
Cadillac-Ford Line	CEI - A-31	Point on Fowles-CAD line	Ford Customer Station	132	3.3	80	50	2	Double circuit single steel pole double circuit lattice tower double circuit steel 2 poles H structure, 1975 substation: Eaton
Dell Supply	CEI - A-32	Point on Fowles-NASA line	Dell	132	.9	60	50	2	Double circuit single steel pole 1976

TABLE I

CUYAHOGA COUNTY (continued)

LINE NAME	IDENT. NUMBER	LINE ORIGIN	LINE TERMINATION	KV	LENGTH	MAX. WIDTH	MIN. WIDTH	NUM. CIRC	COMMENT
Edgewater Supply Fremont	CEI - A-33	Clague Rd. Rail-road	Fremont	33 Oper. 132 design	6.1	60	36	2	Double circuit single steel pol 1975 Substation: Edgewater
Fowles-Dunbar	CEI - A-34	Fowles	Dunbar	132	4.2	60	44	2	Double circuit single steel pol 1975
Garfield-Supply	CEI - A-35	Point on Jennings Line	Garfield	132	2.3	90	50	2	Double circuit single steel pol 1976 - double circuit lattice tower
1-271 Line	CEI - A-36	Point on Kedall-Kelly Line	Point on Eastlake Lloyd Line	132	16.8	60	35	2	Double circuit single steel pol substations: Keith, Kenyon, Lar Kepler; scheduled 1979
Kendall-Kelly-Lester Supply	CEI A-23	point on Fowles-Mayfield line	Kelly	132	7.6	60	40	2	Double circuit steel poles, 1976 Substations: Kendall, Kelly, Lester

TABLE I

CUYAHOGA COUNTY

PLANNED TRANSMISSION LINES

LINE NAME	IDENT. NUMBER	LINE ORIGIN	LINE TERMINATION	KV	LENGTH	MAX. WIDTH	MIN. WIDTH	NUM. CIRC	COMMENT
Icon Supply	CEI - A-121	Inland	Planned Icon Substation	132	.2	60	60	1	Icon substation to be located on Inland site; planned completion 6/83
Jill Supply	CEI - A-131	Kelly	Planned Jill Substation	132	2.2	N/A	N/A	1	Planned completion 5/83
Inland-Hope	CEI - A-134	Planned Icon	Planned Hope	132	4.0	N/A	N/A	1	Planned completion 5/88
FMC Tap Reconductor	CEI - A-140	Ford Tap Structure	Ford Customer Serv. Station	132	2.0	90	90	1	Planned completion 3/86
Fox-Clinton Reconductor	CEI - A-141	Fox	Clinton	132	2.2	150	150	2	Planned completion 3/79; Use existing double circuit lattice towers
Harding-Republic Steel Reconductor	CEI - A-143	Harding	Republic Steel Tap Structure	132	1.8	150	150	2	Planned completion 5/79; RPS tap structure located at point on Pleasant Valley - Jennings Line
				132	1.8	150	150	2	
Pleasant Val. Huxley Reconductor	CEI - A-145	Pleasant Valley	Planned Huxley Substation	132	2.4	150	150	2	Planned completion 3/82
Fox West #2 Circuit	CEI - A-146	Fox Substation	Not defined	345	N/A	N/A		1	Planned completion 1/88 Additional info available 1979
Fox West #1 Circuit	CEI - A-147	Fox Substation	Not defined	345	N/A	N/A		1	Planned completion 1/86; will utilize common structure with Fox West #2 for portion of length

TABLE I

CUYAHOGA COUNTY (continued)

LINE NAME	IDENT. NUMBER	LINE ORIGIN	LINE TERMINATION	KV	LENTH	MAX. WIDTH	MIN. WIDTH	NUM CIRC	COMMENT
Emily Supply	CEI - A-150	Point on Avon-Juniper Line	Planned Emily Substation	132	1.94	50	50	1	Planned completion 5/79
Republic Steel Jennings Reconductor	CEI - A-154	Republic Steel Tap Structure	Jennings Switching Sta.	132	1.4	150	150	2	Planned completion 5/79 - Use existing double circuit lattice tower
Garden Supply	CEI - A-155	Point on Fowles-Clinton Line	Planned Garden Substation	132	2.8	N/A	N/A	1	Planned completion 6/82
Lakeshore-Inland	CEI - A-157	Lakeshore Substation	Inland Substation	132	6.4	N/A	N/A	1	Planned completion 6/84
I-90 West Line	CEI - A-158	Dawson	Lorain Switching Station	132	8.5	N/A	N/A	1	Planned completion 6/84
Jill-Irma Line	CEI - A-160	Planned Jill Substation	Planned Irma Substation	132	2.8	N/A	N/A	1	Planned completion 5/86
Hope Supply	CEI A-129	Hazel Terminal Structure	Planned Hope Substation	132	.2	N/A	N/A	1	Planned completion 6/84

TABLE I

LAKE COUNTY

EXISTING TRANSMISSION LINE

LINE NAME	IDENT. NUMBER	LINE ORIGIN	LINE TERMINATION	KV	LENGTH	MAX. WIDTH	MIN. WIDTH	NUM. CIRC	COMMENT
Eastlake-Ashtabula	CEI - B-V	Eastlake Sub.	Tap point to Ashtabula	345	41.8	200	200	1	Single circuit lattice towers 1971 - double circuit lattice with both sets of conductors
				345	41.8	200	200	1	strung.
Juniper-Eastlake	CEI - B-VI	Juniper Sub.	Eastlake Sub.	345	36.9	185	170		Double circuit lattice tower with both sets of conductors strung, single circuit lattice tower; 1972
Perry-Macedonia-Inland	CEI - B-XII	Perry Sta.	Inland Sub.	345	55.2	110	90	2	Double circuit lattice tower double circuit steel pole 1977
Perry Tap (UC)	CEI - B-XIV	Point on Eastlake Ashtabule Line	Perry Station	345	1.1	535	535	2	Double circuit lattice tower scheduled 1979. 75% of line in Perry Plant boundary
Juniper-Lloyd	CEI - A-22	Juniper Sub.	Lloyd Sub.	132	23.5	90 towers 35 poles	90 35	2	Double circuit lattice towers 1957 - double circuit single steel poles; substations:Irwin, Inland, Ivy, Jordan, Juniper, Judi, Kipling, Lloyd, Newburgh
Mayfield-Lloyd	CEI - A-24	Mayfield Sub.	Lloyd Sub.	132	15.7	185	150	4	Double circuit lattice tower 1942 - substations: Lamont, Lloyd, Marble, Mayfield, New-port
Leroy Ctr. Eastlake Plant	CEI - A-26	Leroy Center	Eastlake Plant	132	21.3	200	90	2	Double circuit lattice tower 1942 - double circuit steel pol substations: Nash, Nathan, Nursery

TABLE I

LAKE COUNTY (continued)

Cleveland Electric

LINE NAME	IDENT. NUMBER	LINE ORIGIN	LINE TERMINATION	KV	LENGTH	MAX. WIDTH	MIN. WIDTH	NUM. CIRC.	COMMENT
1-271 Line	CEI A-	Point on Kendall-Kelly Line	Point on Eastlake-Lloyd Line	132	16.8	60	35	2	Double circuit single steel pole scheduled 1979; substations: Keith, Kenyon, Lark, Kepler
PLANNED TRANSMISSION LINES									
Perry-Hanna (OE)	CEI - B-108	Perry Sta.	Point of intercon-nection Geauga Portage County Line	345	31.5	150	150	1	Planned completion 3/83
Phillips Supply	CEI - A-124	Point on Mayfield-Ashtabula Line	Planned Phillps Sub	132	5.6	90	90	1	Planned completion 6/86
SN-LC Reconductor	CEI - A-156	Planned Sanborn Sta. Ashtabula	Leroy Center Switching Stn.	132	19.9	210	210	2	Planned completion 4/87
Nursery-Nursery Twp.	CEI - A-159	Nursery Substation	Point on Eastlake Leroy Ctr. Line	132	1.0	N/A	N/A	1	Planned completion 6/81

TABLE I

ASHTABULA COUNTY

EXISTING TRANSMISSION LINES

LINE NAME	IDENT. NUMBER	LINE ORIGIN	LINE TERMINATION	KV	LENGTH	MAX. WIDTH	MIN. WIDTH	NUM. CIRC	COMMENT
Ashtabula-Erie West	CEI - B-IV	Ashtabula Station	Interconnection with Pennsylvania Electric Company	345	14.9	200	200	1	Single circuit lattice towers 1966
Eastlake-Ashtabula	CEI - B-V	Eastlake Station	Tap point to Ashtabula	345	41.8	200	200	1	Single circuit lattice tower double circuit lattice tower both sets of conductors strung - 1971
Mayfield-Ashtabula	CEI - A-25	Mayfield Sub.	Ashtabula plant transmission station	132	43.4	330	210	4	Double circuit lattice tower substation: Sanborn - 1928
Ashtabula-Conneaut	CEI - A-29	Ashtabula Plant	Pittsburgh and Conneaut Docks	132	17.8	200	200	2	Double circuit lattice tower double circuit single steel po substation: Zenith
Ashtabula-Generation tie	CEI - A-30	Ashtabula Plant	Ashtabula C Plant transmission station	132	.5	90	70	1	Wood pole H frame
PLANNED TRANSMISSION LINES									
AT-SN Reconductor	CEI - A-138	Ashtabula plant transmission sta.	Sanborn Sub.	132	8.0	330	330	2	Planned completion 11/83

TABLE I

ELECTRICITY TRANSMISSION LINES IN NORTHEAST OHIO

LORAIN COUNTY

Ohio Edison Company 1

EXISTING TRANSMISSION LINES

LINE NAME	IDENT. NUMBER	LINE ORIGIN	LINE TERMINATION	KV	LENGTH	MAX. WIDTH	MIN. WIDTH	NUM. CIRC	COMMENT
	OEB 1	Avon (CEI)	Beaver	345	9.74	200	200	1	Steel tower - 1970
	OEB 2	Beaver	Star	345	49.47	500	150	1	Steel tower - 1968
	OEB 40	Davis-Besse	Beaver	345	43	150	150	1	Steel tower - 1975
	OEB 43 (UC)	Avon (CEI)	Beaver	345	9.74	200	200	1	Steel tower - 1979
	OEB 43 (UC)	Avon (CEI)	Beaver	345	3.0	150	150	1	Not determined - 1979
	OEA 209	Beaver	Brookside	138	38.72	100	100	1	Steel tower - 1968
	OEA 209	Beaver	Brookside	138	38.72	100	100	1	Single wood pole - 1968
	OEA 210	Beaver	Greenfield	138	29.94	100	100	1	Steel tower - 1968; intermed-ate substation, Ford.
	OEA 211	Beaver	Johnson	138	13.14	100	100	1	Steel tower - 1968
	OEA 211	Beaver	Johnson	138	.19	100	100	1	Wood H frame - 1968
	OEA 212	Beaver	NASA	138	28.27	100	100	1	Steel tower - 1968
	OEA 212	Beaver	NASA	138	.18	100	100	1	Single wood pole - 1968
	OEA 238	Edgewater	Beaver	138	12.13	100	100	1	Steel tower - 1968
	OEA 238	Edgewater	Beaver	138	.19	100	100	1	Wood H frame
	OEA 239	Edgewater	US Steel (Lorain)	138	3.0	100	100	1	Steel tower - 1924
	OEA 230	Lorain SWST (CEI)	Johnson	138	3.48	400	75	1	Steel tower - 1971

TABLE I

LORAIN COUNTY (continued)

LINE NAME	IDENT. NUMBER	LINE ORIGIN	LINE TERMINATION	CV	LENGTH	MAX. WIDTH	MIN. WIDTH	NUM. CIRC	COMMENT
	OEA 249	General Mtrs.	Johnson	138	.10	100	100	1	Wood frame - 1964 Substation on line - Murray
	OEA 249	General Mtrs.	Johnson	138	5.06	100	100	1	Wood frame - 1964 Substation on line - Murray
	OEA 259	Johnson	US Steel (Lorain)	138	3.3	100	100	1	Wood frame - 1924
	OEA 259	Johnson	US Steel (Lorain)	138	1.61	100	100	1	Steel tower - 1924
	OEA 356	Johnson	Lorain (CEI)	138	1.8	100	100	1	Steel pole - 1974
	OEA 287	Wellington-Brookside	Wellington	138	4.22	200	200	1	Wood frame - 1952
	OEA 287	Wellington-Brookside	Wellington	138	20.06	100	100		Steel tower - 1952
			PLANNED TRANSMISSION LINES						
	OEA 341	Point on Johnson-Lorain (CEI 356)	Planned Carlisle substation Carlisle Township	138	12.5	60	60	1	Wood pole expected to be in service 5/79
	OEB 46	Point on Beaver Star Line #2	Planned Carlisle substation Carlisle Township	345	1.47	150	150	1	Double circuit steel tower expected to be in operation 12/79
	OEA 259	Johnson	US Steel (Lorain)	138	4.9	100	100	1	Structure replacement required line to be reconductored to be in operation 6/84
	OEB 45	Planned Carlisle substation	Erie Generating plant Erie County Berlin Twp.	345	23.0	150	150	1	Double circuit steel tower to be in operation 1/86

TABLE I

LORAIN COUNTY (continued) - Ohio Edison 3

LINE NAME	IDENT. NUMBER	LINE ORIGIN	LINE TERMINATION	KV	LENGTH	MAX. WIDTH	MIN. WIDTH	NUM. CIRC	COMMENT
	OEB 41	Erie Generating Sta.	Beaver	345	15.1	150	150	1	Open circuit side of existing double circuit steel tower to be in operation 1/88
	OEA 343	Point of 6M Shinrock Line #247A	Planned Carlisle Substation	138	8.05	60	60	1	Wood pole to be in operation 12/79
									Cleveland Electric
CLEVELAND ELECTRIC EXISTING TRANSMISSION LINES									
Avon-Beaver (West Lorain Ohio Edison)	CEI - B-I	Avon	Point of interconnection with OE Sheffield Twp.	345	6.4	200	200	1	Single circuit lattice towers CEI-BVII share 3.6 miles of right of way
Avon-Juniper (UC)	CEI - B-VII	Avon	Juniper	345	29.1	110	90	1	Lorain portion
					14.9	200	200	1	Cuyahoga - Supporting structure double circuit lattice tower, double circuit lattice H frame, double circuit 2 poles H frame, single circuit lattice tower
Avon-Lorain Fowles	CEI - A- /	Avon	Fowles	132	17.9	255	210	4	Double circuit lattice towers substation: Astor Joint use CEI-A2
Avon-Lorain Fowles (Berea cutoff)	CEI - A-2	Avon	Fowles	132	18.4	255	210	2	Double circuit lattice towers double circuit steel poles Substation: Clifford
Dawson Supply-	CEI - A-3	Point on Avon Lorain Fowles Line	Dawson	132	9.0	85	40	2	Double circuit lattice tower double circuit steel pole Substations: Crestwood, Dawson

TABLE I

LORAIN COUNTY (continued) Cleveland Electric

LINE NAME	IDENT. NUMBER	LINE ORIGIN	LINE TERMINATION	KV	LENGTH	MAX. WIDTH	MIN. WIDTH	NUM. CIRC	COMMENT
Lorain-Ohio Edison I	CEI - A-5	Lorain switching Station	Point of interconnection w/Ohio Edison	132	5.1	100	100	1	Lattice tower - 1926 connected with OEA 230
Lorain-Ohio Edison II	CEI - A-38	Lorain	Point of interconnection w/Ohio Edison	132	3.0	90	50	1	Double circuit lattice tower single circuit wood pole - 1974 shares lattice tower w/CEI A#5 connects w/OEA 356 to Johnson
Avon-Beaver (OE) Line (WC)	CEI - B-XI	Avon	Point of interconnection Avon Beaver Row	345	3.6	200	200		Double circuit lattice & frame schedule - 1979
PLANNED TRANSMISSION LINE									
Dawson Line-Avon	CEI - A-111	Avon	Point on Dawson supply Avon Line	132	.2	60	60	1	Double circuit lattice tower to be in service 4/81

TABLE II

EXISTING TRANSMISSION PIPELINES IN NORTHEAST OHIO

Company	County	Line #	Line Name	Origin	Termination	*Size	Operating Capacity	Contents	ROW or Easement	Total Length	Year Installed	Comments	Sources
ARCO	CUY.		4" Cleve. Line	Summit	Former Atlantic Richfield products terminal at W. 3rd Cleveland	4"		Unused (was used for refined petroleum products)	Permanent easements on private property, lease of RR ROW along Cuyahoga River			Line now for sale; no plans for further use or new pipeline facilities	3/6/79 letter to NOACA OUPS map circa 1968 USGS at 1" = 2000'
Buckeye Pipeline	CUY. MEDINA LORAIN		415	Mantua Pump Station	Wakeman (via Aurora and Brecksville Terminals)	10"		Refined liquid petroleum products	Easement, same alignment as 425			Lines previously abandoned have been physically removed; no new lines anticipated	Buckeye Pipeline Co. System map 1/79 2/27/79 letter to EDATA Company aerial at Mantua office OUPS map circa 1968 USGS @ 1"=2000'
	CUY. MEDINA LORAIN		425	Mantua Pump Sta.	Wakeman (via Aurora and Brecksville Terminals	12"		"	Easement, same alignment as 415				
	CUY. GEAUGA		590/ 591	Mantua Pump Sta.	Drydock St. Terminal, Cleve. (via Ashland Terminal, E. 146 Cleveland)	12"		"	Easement & lease from N&W RR				
	CUY. LORAIN		786/ 787	Toledo	Bradley Rd. Terminal, Cleve. (via Wakeman)	12"		"	Easement				

Diameters vary. Cited diameter represents the major portion of the line.

TABLE II

EXISTING TRANSMISSION PIPELINES IN NORTHEAST OHIO

Company	County	Line #	Line Name	Origin	Termination	*Size	Operating Capacity	Contents	ROW or Easement	Total Length	Year Installed	Comments	Sources
Columbia Gas Transmission Corp.	LORAIN	L-150		L-920 S. of Grafton Eastern Rd., Grafton Twp.	Grafton Eastern & Chamberlain Rds., Grafton Township	4"		Natural gas	Easement			Potential abandoned 4" line between L-2542 (S. of Oberlin) & Elyria, not shown on map	2/5/79 letter to EDATA System map 12/77 at 1"=24 miles
	CUY. LORAIN	L-500		L-920 at Sprague Rd. Olm. Twp.	Sprague near Fernwood, Columbia Twp.	6"		"				All lines welded & treated with protective coating.	Plot maps-Columbia Gas circa 1976 @ 1"=800'
	MEDINA CUY.	L-501		York Compressor Station, Medina Co.	Redfern & Big Creek Parkway Strongsville	8"		"	"			No significant unused capacity improvements in gas supply will produce full use of system.	USGS at 1"=2000'
	LORAIN	L-609		Osborne & River Rds. Columbia Twp.	South of Columbia Center Rd. at River Road	4"						No plans to add capacity	
	LORAIN	L-662		L-920 at Sprague Rd., North Ridgeville Limit	Route 76, North Ridgefield	8"		"	"			Company operates gas storage area in southern Lorain County	
	MEDINA LORAIN	L-722		Medina County	Northeast Wellington	4-8"		"	"				
	LORAIN MEDINA	L-920		Medina Compressor Station	Sheffield/Ely. Corp. Limit at L&WV RR	12-20"							
	LORAIN	L-1206		Terminus L-500	Osborne & River Rds., Columbia Township	6"							

TABLE II

EXISTING TRANSMISSION PIPELINES IN NORTHEAST OHIO

Company	County	Line #	Line Name	Origin	Termination	*Size	Operating Capacity	Contents	ROW or Easement	Total Length	Year Installed	Comments	Sources
Columbia Gas Transmis-sion Corp. (cont.)	LORAIN MEDINA	L-1507		Medina Compres-sor Sta.	Penfield, Lorain County (Rt. 301 & 18)	4"		Natural gas	Easement				
	LORAIN	L-1947		Penfield, Lorain County	Indian Hollow & Webster Rds., LaGrange Twp.	4"		"	"				
	LORAIN	L-2042		Welling-ton Com-pressor Station	Lorain/Amherst Corp. Limit at Oberlin Avenue	16"		"	"				
	LORAIN	L-2121		Pavonia Compres-sor Sta-tion, Richland Co.	Wellington Com-pressor Station	16"		"	"				
	LORAIN CUY.	L-2305		Lorain/ Cuyahoga limit at Root Rd.	Redfern & Big Creek Parkway, Strongsville	20"		"	"				
	LORAIN	L-2360		Welling-ton Com-pressor Station	Lorain/Cuyahoga Limit at Root Rd.	16-20"							
	LORAIN	L-2376		L-2360 @ Indian Hollow Road	Vicinity of Ely. Airport .	16"		"	"				
	LORAIN	L-2525		Lorain/ Cuyahoga Limit at Root Rd.	Redfern & Big Creek Parkway, Strongsville	16"		"	"				

TABLE II

EXISTING TRANSMISSION PIPELINES IN NORTHEAST OHIO

Company	County	Line #	Line Name	Origin	Termination	*Size	Operating Capacity	Contents	ROW or Easement	Total Length	Year Installed	Comments	Sources
Columbia Gas Transmission Corp. (cont.)	LORAIN	L-2542		Wellington Compressor Station	Sandusky County via Norwalk	20"		Natural gas	Easement				
	LORAIN	L-3120		Eaton Twp. E. of Brentwood Lake	Sheffield/Ely./Avon/N. Ridgeville corp. Limit	16"		Natural gas	Easement				
	LORAIN	L-3121		Pavonia Compressor Station Richland County.	Wellington Compressor Station	20"		"	"				
	LORAIN	L-3290		L-2360 @ Biggs & SR 301 LaGrange Twp.	Eaton Twp. E. of Brentwood Lake	24"		"	"				
Consolidation Coal Company	LAKE GEAUGA			Cadiz, Ohio (Georgetown Preparation	Eastlake Generation Station	8"	4 million tons during lifetime of operation	Unused coal slurry operated 1958-1964	Easement	108 mi.	1957	Cannot be used as as coal slurry at this time, drying plant at Eastlake has been dismantled. Some interest at Consolidated Coal in restoring service. Cast iron pipe, still in good condition.	Mr. Ralph Patton, V.-Pres., Marketing, Consolidation Coal USGS at 1"=2000'

TABLE II

EXISTING TRANSMISSION PIPELINES IN NORTHEAST OHIO

Company	County	Line #	Line Name	Origin	Termination	*Size	Operating Capacity	Contents	ROW or Easement	Total Length	Year Installed	Comments	Sources
East Ohio	CUY.	202	TPL #2	Belmont County	Willow Valve Station, Independence	18-30"	MOP* 340 psi	Natural Gas	ROW, average width 60'	123 mi.	1903 with subsequent replacements	No plans for new major transmission lines at present	East Ohio Gas - "10 Yr. Forecast" 12/77. East Ohio Gas map of transmission system 11/77 at 1"=4 mi.
	CUY.	203	TPL #3	Monroe County	Willow Valve Station, Independence	18-30"	MOP 350 psi	"	Recorded blanket easements on burdened property average width 60'.	108 mi.	1906 & 1907 with subsequent replacements		OUPS maps c. 1968 USGS at 1"=2000'
	CUY.	211	TPL #7	Belmont County	Dunham Valve Station, Maple Heights	18-20"	MOP 800 psi	"	ROW average width 60'.	142 mi.	1946 with subsequent replacements		
	ASHTABULA	241	Lake Shore Line	Ohio-Pa. State Line, Ashtabula Co.	Wade Avenue Valve Station, Saybrook Twp.	10-3/4	MOP 750 psi	"	Recorded blanket easements on burdened property avg. width 60'.	20 mi.	1952 with subsequent replacements		
	GEAUGA LAKE	265	TPL #14	Portage County	Charon Rd., Valve Station, Kirtland	26"	MOP 550 psi	"	"	23 mi.	1961 with subsequent replacements		
	CUY. LAKE	1181 & 1699	Chardon to Euclid Ave. Line	Chardon Rd. Valve Station, Kirtland	Euclid Ave. and E. 204 Valve Station, Euclid	24"	MOP 150 psi	"	"	12 mi.	1961 with subsequent replacements		

TABLE II

EXISTING TRANSMISSION PIPELINES IN NORTHEAST OHIO

Company	County	Line #	Line Name	Origin	Termination	*Size	Operating Capacity	Contents	ROW or Easement	Total Length	Year Installed	Comments	Sources
ast Ohio as Co. cont.)	LAKE	1182	Chardon to Fair-port/ Wil-loughby Line	Chardon Road Valve Station, Kirtland	Mentor Regulator Station	20"	MOP 260 psi	Natural gas	Recorded blanket easements on burdened property avg. width 60'.	8.6 mi.	1961		
	CUY.	9517	Twins-burg to Lee Road Line	Summit County	Lee Road Sta., East Cleveland	26"	MOP 300 psi	"	"	17 mi.	1957 with subsequent replace-ments		
	CUY.	13405	30" C.H.P.	"	Willow Valve Station, independence	30"	MOP 305 psi	"	"	12 mi.	1953 with subsequent replace-ments.		
	CUY.	15,79	Willow to West 14th & C'ark Line	Willow Valve Station	W. 14 & Clark Ave. Station, Cleveland	20-30"	MOP 250 psi	"	"	5 mi.	1957 with subsequent replace-ments		
aurel ipeline ompany	CUY. SUMMIT			Alluippa Station, Beaver County, Pa.	Cleveland Terminal: Bradley Road Cleve. Gulf Cleve. Texaco Cleve. Meter Bank	14"	High Pressure	Refined petroleum products	Probably easement	13.5 mi. within Cuy. Co.		One line only in area Steel pipe No plans for future expansion or abandonment	2/9/79 letter to NOACA with map @ 1"=5,280' OUPS map c. 1968 USGS @ 1"-2000'
OHIO* Standard il of hio)	CUY.	SO-1*	8" Shell Bradley Road	Bradley Road Terminal Cleve.	Shell Terminal Cleveland	8"		Refined petroleum products	Probably easement			No plans for future construc-tion connections to Toledo via lease of Buckeye line former SOHIO @ E. 26 Cleve. has been torn down.	1/30/79 letter to EDATA 2/21/79 letter to NOACA w/map OUPS map c. 1968 USGS @ 1"=2000'

*SOHIO line numbers arbitrarily assigned by EDATA/NOACA staff

TABLE II

EXISTING TRANSMISSION PIPELINES IN NORTHEAST OHIO

Company	County	Line #	Line Name	Origin	Termination	*Size	Operating Capacity	Contents	ROW or Easement	Total Length	Year Installed	Comments	Sources
SOHIO* (cont.)	CUY.	SO-2	8" Campbell Rd. Shell Terminal	Campbell Rd. Cleve.	Shell Terminal Cleveland	8"		Refined petroleum products	Probably easement			No plans for future construction connections to Toledo via lease of Buckeye line former SOHIO plant at E. 26 Cleveland has been torn down	1/30/79 letter to EDATA 2/21/79 letter to NOACA w/map OUPS map c. 1968 USGS @ 1"=2000'
	CUY.	SO-3	8" Bradley Rd. 49th St.	Bradley Road Terminal	49th St. Terminal, Cleveland	8"	1250 bbl/hr.	"	"				
	CUY.	SO-4	6" Bradley Rd. 49th St. OPG	Bradley Road Terminal	49th St. Terminal, Cleveland	6"		Unused liquid petroleum gas	"				
	CUY.	SO-5	6" Hopkins Airport Sat	SO-6	Hopkins Airport Cleveland	6"		Jet fuel, bulk Marketing satellite to SO-6	"				
	CUY.	SO-6	6" Bradley Rd. Hopkins Airport	Bradley Road Terminal	Hopkins Airport Cleveland	6"		Jet fuel					
	CUY.	SO-7	10" Bradley Mogadore	Bradley Road Terminal	Mogadore, Summit County	10"		Refined petroleum products					

*SOHIO line numbers arbitrarily assigned by EDATA/NOACA staff.

TABLE II

EXISTING TRANSMISSION PIPELINES IN NORTHEAST OHIO

Company	County	Line #	Line Name	Origin	Termination	*Size	Operating Capacity	Contents	ROW or Easement	Total Length	Year Installed	Comments	Sources
SOHIO (cont.)	CUY. SUMMIT	SO-8	6" Bradley Mogadore	Bradley Road Terminal	Mogadore, Summit County	6"	630 bbl/hr.	Refined petroleum products.	Probably easement.				
	CUY.	SO-9	8" Union Line	Bradley Road „ Terminal	Union Oil Co. Terminal	8"		"	"				
	CUY.	SO-10	10" SUN Line	Bradley Road Terminal	SUNOCO Terminal Cleveland	10"		"	"				
	CUY.	SO-11	12" Bradley Road Broadway Storage	Bradley Road Terminal	Broadway Avenue Storage facility	12"	2100 bbl/hr.	"	"				
SUN Pipe* Line Co.	CUY. SUMMIT	SUN-1		Summit County	Sunmark Industries terminal	6"		Unused oil pipeline	Probably easement	14.75 mi. (within study area)		No plans for new line construction or reopening of unused line	1/30/79 letter to EDATA USGS at 1"=2000' 1"=2000'
	LORAIN	SUN-2		Fostoria	Hudson, Ohio via Wellington	8"		Refined petroleum products	Majority on easement			Subsidiary to SUNOCO	8/79 interview with N.J. Boyett, Sun Pipe Line Co. King of Prussia. Pa.

*SUN line numbers arbitrarily assigned by EDATA/NOACA staff.

TABLE III

TOP -10- RANKED OHIO COUNTIES
FOR NEW GAS/OIL WELLS (1974-1978)

Rank	County	1974	1975	1976	1977	1978	TOTAL
1	Muskingum	255	127	169	189	235	975
2	Coshocton	184	125	150	245	168	867
3	Tuscarawas	232	90	155	236	189	713
4	Portabe	27	70	135	119	216	567
5	Mahoning	94	31	177	114	140	556
6	Guernsey	60	50	161	130	255	556
7	Perry	118	81	101	132	111	543
8	Trumbull	49	73	116	114	140	490
9	Washington	6	14	66	180	181	447
10	Carroll	75	96	96	102	75	444

COASTAL ZONE COUNTIES
NEW GAS/OIL WELLS 1974-1978

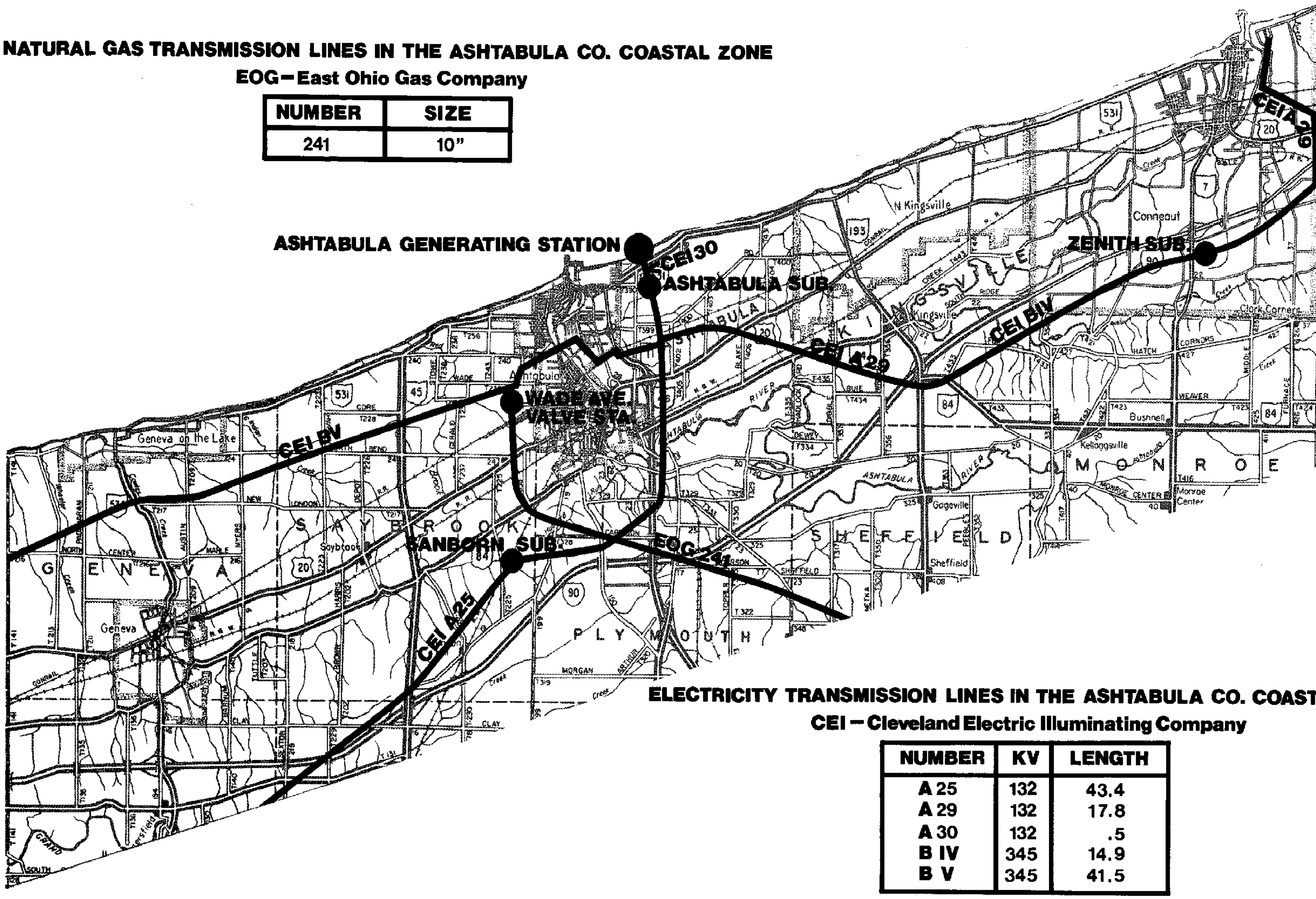
Ashtabula	46	24	35	97	62	264
Cuyahoga	7	0	5	18	18	45
Lake	1	1	3	2	3	10
Lorain	5	5	3	4	2	19

Source: Ohio Department of Natural Resources
(Division of Oil and Gas)

NATURAL GAS TRANSMISSION LINES IN THE ASHTABULA CO. COASTAL ZONE

EOG—East Ohio Gas Company

NUMBER	SIZE
241	10"



ELECTRICITY TRANSMISSION LINES IN THE ASHTABULA CO. COASTAL ZONE

CEI—Cleveland Electric Illuminating Company

NUMBER	KV	LENGTH
A 25	132	43.4
A 29	132	17.8
A 30	132	.5
B IV	345	14.9
B V	345	41.5

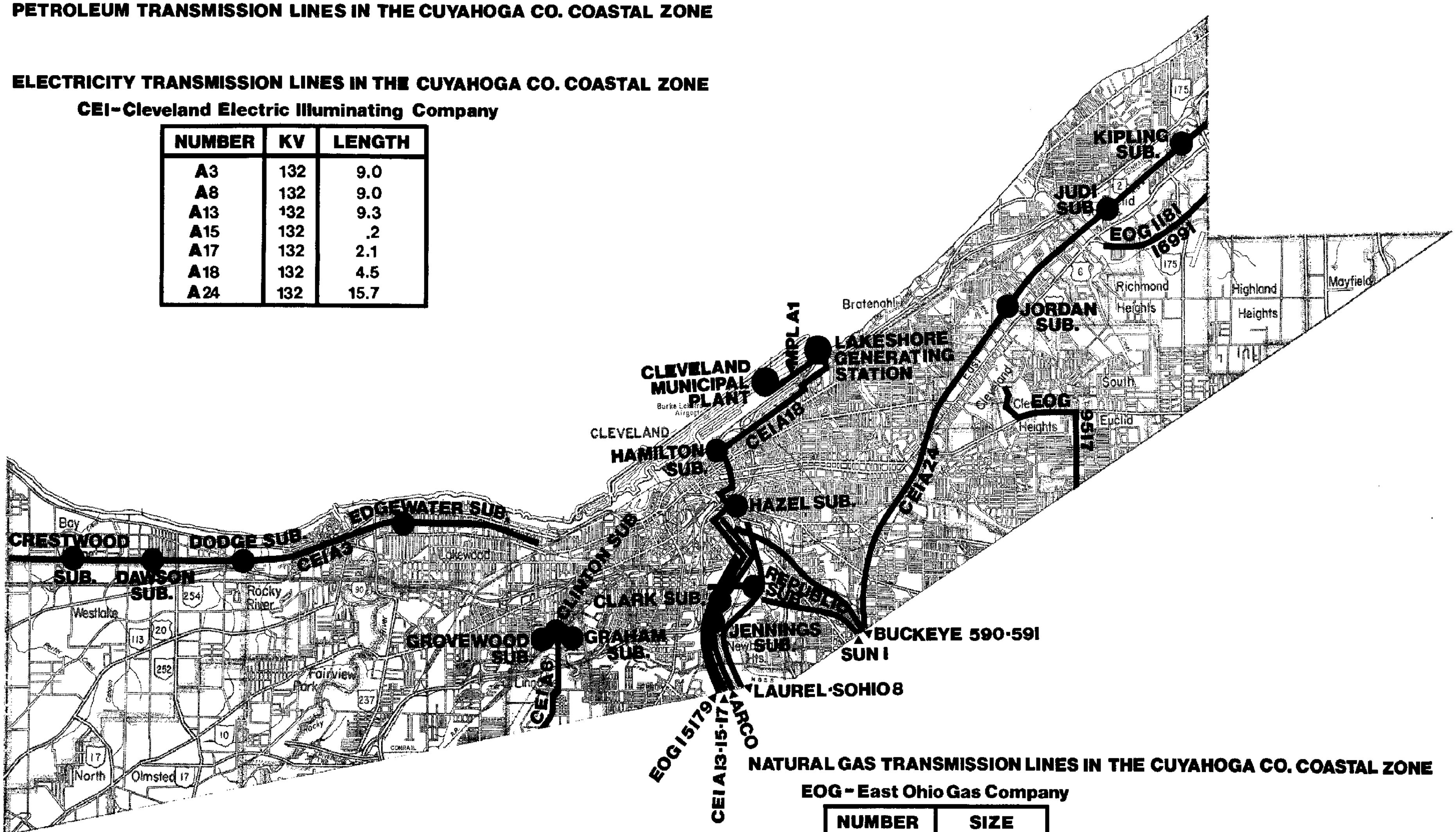
Ashtabula County Coastal Zone Area

PETROLEUM TRANSMISSION LINES IN THE CUYAHOGA CO. COASTAL ZONE

ELECTRICITY TRANSMISSION LINES IN THE CUYAHOGA CO. COASTAL ZONE

CEI–Cleveland Electric Illuminating Company

NUMBER	KV	LENGTH
A3	132	9.0
A8	132	9.0
A13	132	9.3
A15	132	.2
A17	132	2.1
A18	132	4.5
A24	132	15.7



NATURAL GAS TRANSMISSION LINES IN THE CUYAHOGA CO. COASTAL ZONE

EOG – East Ohio Gas Company

NUMBER	SIZE
1181	24"
9517	26"
15179	20"-30"
16991	24"

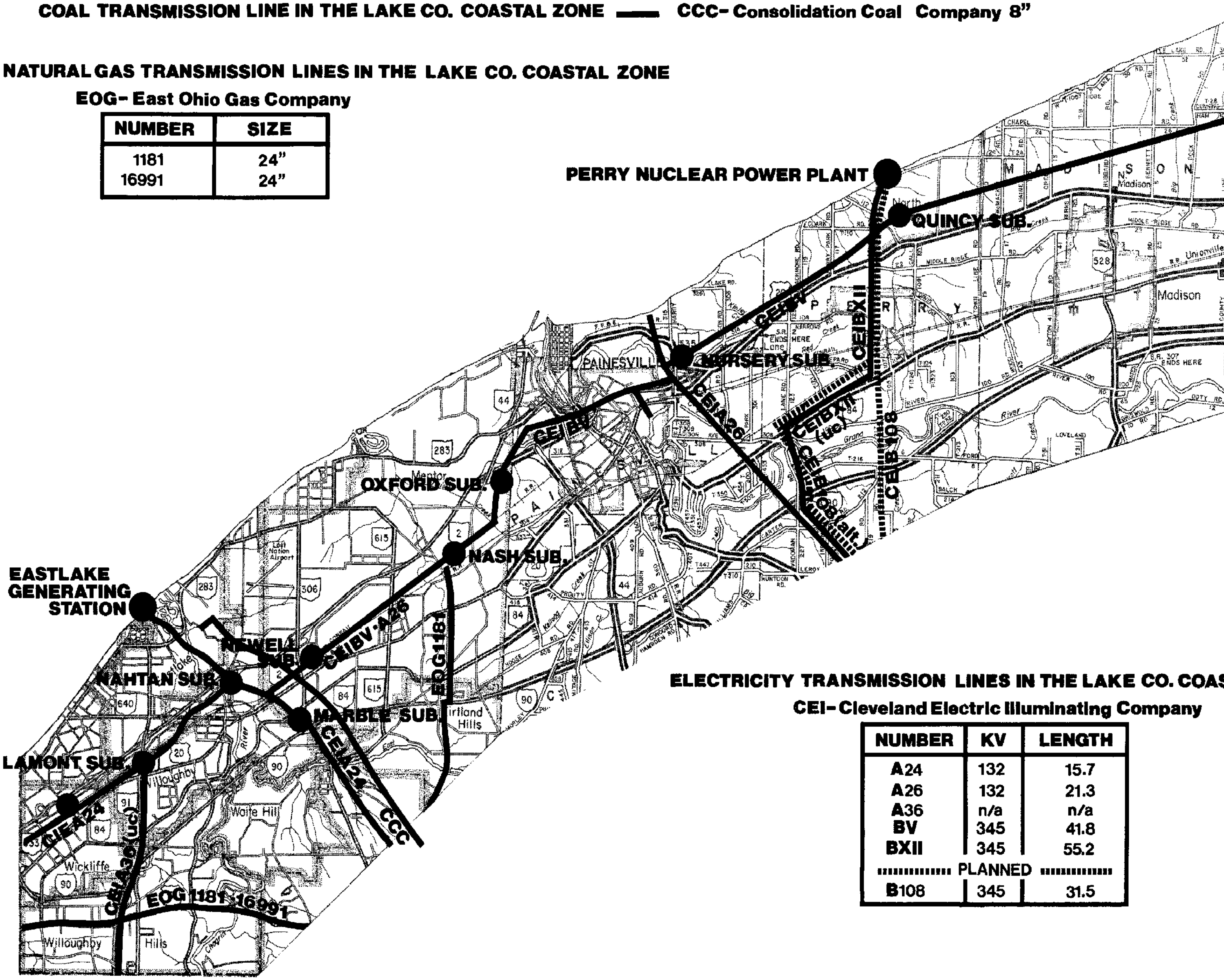
Cuyahoga County Coastal Zone Area

COAL TRANSMISSION LINE IN THE LAKE CO. COASTAL ZONE ▬ CCC- Consolidation Coal Company 8"

NATURAL GAS TRANSMISSION LINES IN THE LAKE CO. COASTAL ZONE

EOG- East Ohio Gas Company

NUMBER	SIZE
1181	24"
16991	24"



ELECTRICITY TRANSMISSION LINES IN THE LAKE CO. COASTAL ZONE

CEI- Cleveland Electric Illuminating Company

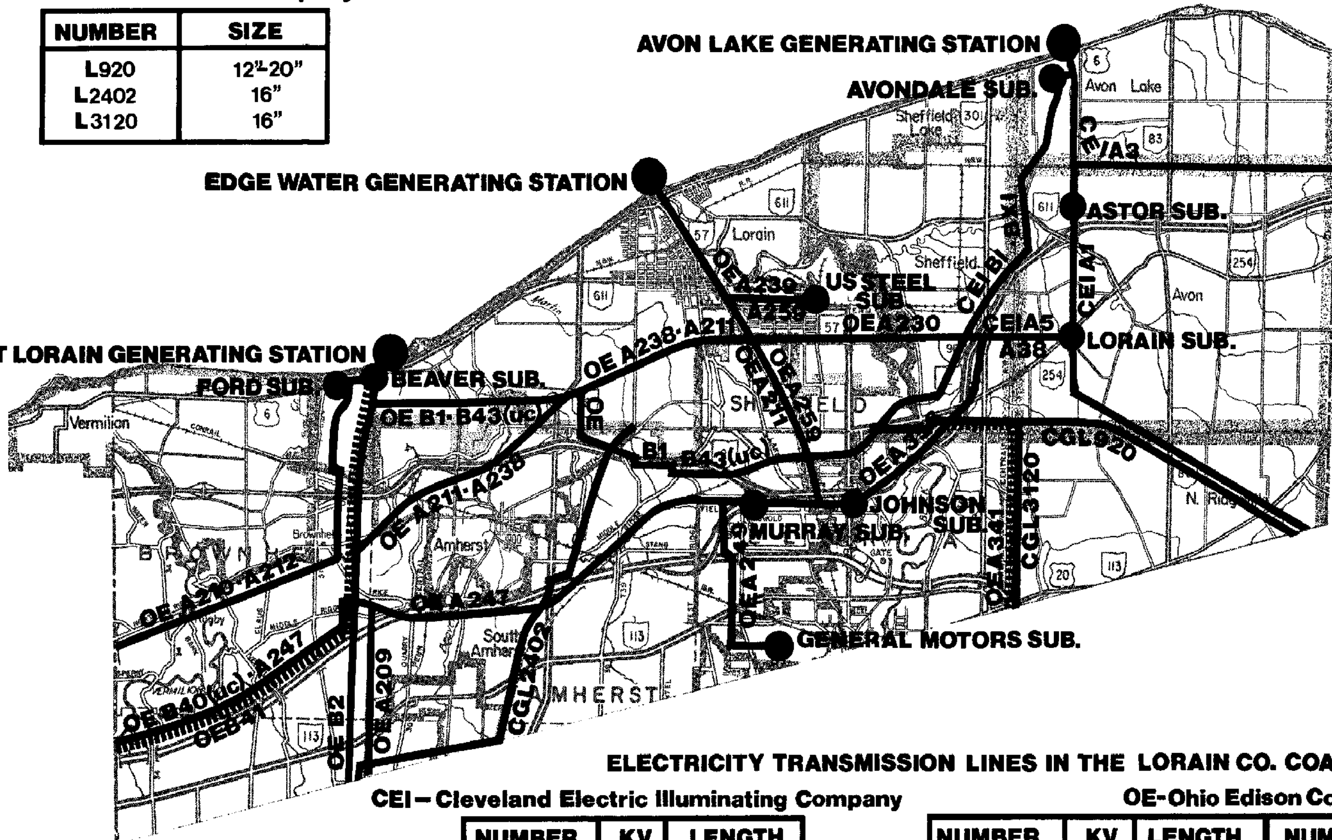
NUMBER	KV	LENGTH
A24	132	15.7
A26	132	21.3
A36	n/a	n/a
BV	345	41.8
BXII	345	55.2
PLANNED		
B108	345	31.5

Lake County Coastal Zone Area

NATURAL GAS TRANSMISSION LINES IN THE LORAIN CO. COASTAL ZONE

CG–Columbia Gas Company

NUMBER	SIZE
L920	12"-20"
L2402	16"
L3120	16"



ELECTRICITY TRANSMISSION LINES IN THE LORAIN CO. COASTAL ZONE

CEI–Cleveland Electric Illuminating Company

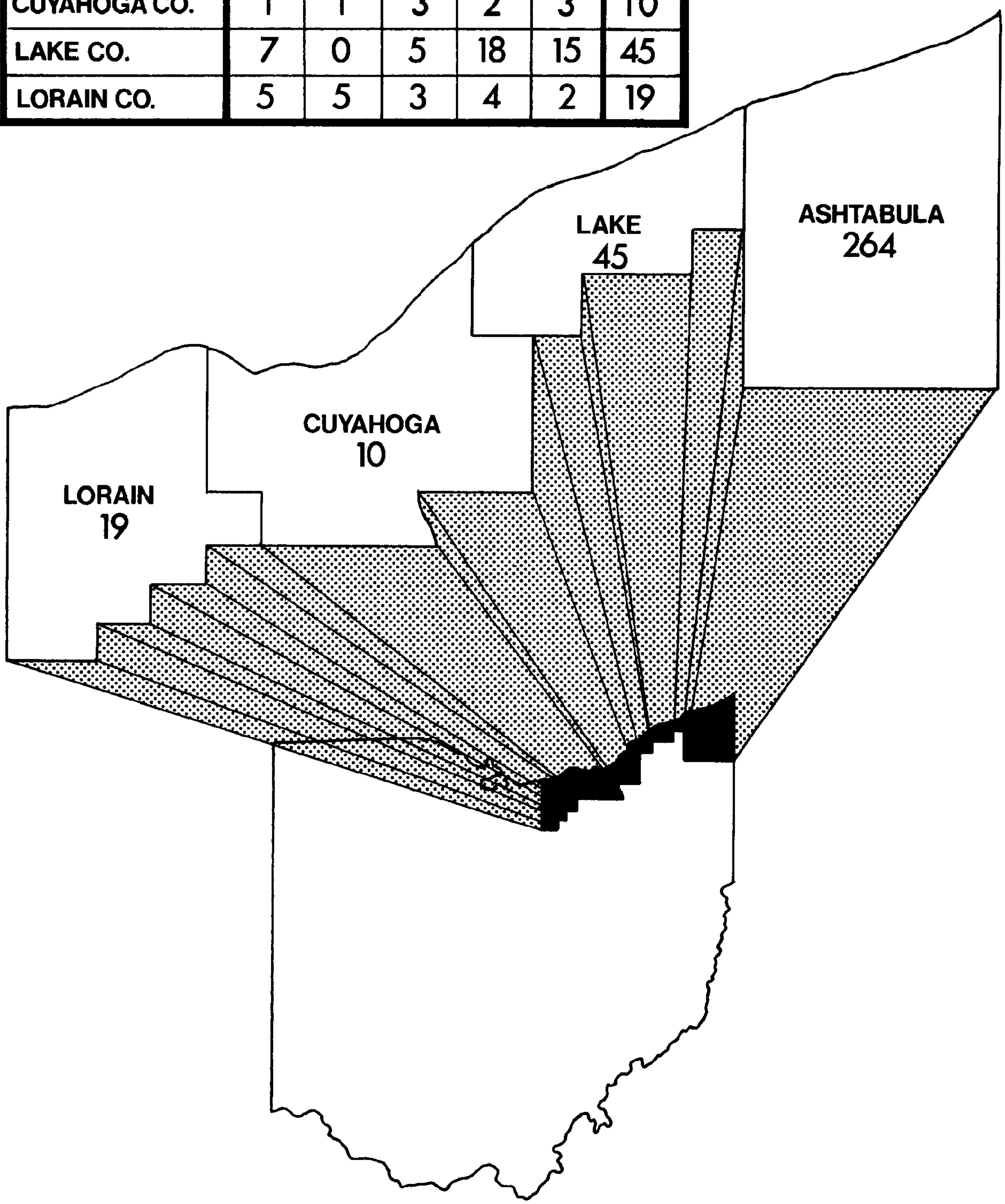
NUMBER	KV	LENGTH
A1	132	17.9
A2	132	18.4
A3	132	9.0
A5	132	5.1
A38	132	3.0
BI	345	6.4
BVII	345	44.0
BXI	345	3.6

OE-Ohio Edison Company

NUMBER	KV	LENGTH	NUMBER	KV	LENGTH
A209	138	38.72	A259	138	4.91
A210	138	29.94	A356	138	1.80
A211	138	13.33	B1	138	9.74
A212	138	28.45	B2	345	49.47
A230	138	3.48	B40	345	43.00
A238	138	12.32	B43	345	11.74
A239	138	3.00	PLANNED		
A247	n/a	n/a	A341	138	12.50
A249	138	5.16	B41	345	15.10

Lorain County Coastal Zone Area

Gas & Oil Wells Drilled 1974-78		YEAR					
		1974	1975	1976	1977	1978	Total
COUNTIES	ASHTABULA CO.	46	24	35	97	62	264
	CUYAHOGA CO.	1	1	3	2	3	10
	LAKE CO.	7	0	5	18	15	45
	LORAIN CO.	5	5	3	4	2	19



Task B: Resource Recovery

Resource Recovery in Ashtabula, Cuyahoga, Lake and Lorain Counties

I. Introduction

The storage, collection, transportation and disposal of solid waste, collectively referred to as solid waste management, has traditionally been in response to the need for the protection of public health and the environment. However, rapidly increasing waste management costs, more stringent disposal regulations, and problems with securing adequate energy supplies are now causing more attention to be focused on the potential value of certain solid waste components.

These components may be divided into two basic types of resources. The first resource type represents the materials that can be recovered from waste, and the second type of recoverable resource is energy. Since energy recovery from waste is the primary interest of the Coastal Energy Impact Program (CEIP), this report will deal with the second type of recoverable resource.

Recent legislation passed by the Ohio General Assembly [S.B. 266, Section 1(e)] defines solid wastes as ". . .such unwanted residual solid or semi-solid material as results from industrial, commerical, agricultural, and community operations, excluding earth or material from construction, mining, or demolition operations, or other waste materials of the type which would normally be included in demolition debris, non-toxic fly ash, and spent non-toxic foundary sand, and slag and other substances which are not harmful or inimical to public health, and includes, but is not limited to, garbage, combustible and non-combustible material, street dirt, and debris." From this definition of solid wastes, and from subsquent sections of the same law that prescribe and proscibe various activities relating to solid waste management, it is clear that both public and private sector interests will be affected by solid waste disposal regulations. In response, local governments in the coastal area of Northeast Ohio have begun to examine their solid waste management practices and, in particular, to assess the potential for resource recovery from solid waste.

The discussion which follows analyses the technical characteristics of solid waste, quantitatively and qualitatively, surveys the current status of solid waste management, and assesses the feasibility of implementing resource recovery facilities within the coastal regions of Ashtabula, Cuyahoga, Lorain and Lake Counties. Unless otherwise indicated, the technical data given in II Technical Analysis of Solid Waste) are taken from US EPA Engineering and Economic Analysis of Waste to Energy Systems, May 1978. Other literature sources are individually indicated in the text of the report.

II. Technical Analysis of Solid Waste

A. Solid Waste Characteristics

1. Municipal Wastes. Municipal wastes may be divided into two components: municipal solid waste (MSW) and sewage. MSW includes household waste, commerical and institutional waste, and city street sweepings and prunings. MSW does not include industrial process wastes, agricultural and animal wastes, construction and demolition wastes, mining wastes, abandoned automobiles, and bulky tree waste.

Various estimates show a significant range of MSW per capita generation rates, with 3.10 lbs. per person per day indicated for Ohio in the Ohio EPA Community Practices Survey. Of this amount, about one-fourth of the weight is natural moisture, and another fourth is glass, metal, and other incombustibles. The remaining half is mainly dry, combustible MSW, of which paper is the most common material. Yard and food wastes make up the remainder of the combustible component.

Converting wastes into energy values has shown raw MSW to contain an estimated 4500 BTU/lb. This heat value is sufficiently high to permit unprocessed waste to be used as a fuel. When a portion of the moisture and incombustibles is removed, the heating value of the remaining fraction rises to approximately 5900 to 6200 BTU/lb. Various processes exist for the isolation of the combustible fraction of MSW, although, under various circumstances, more energy may be consumed producing a dry, combustible fuel from MSW than can be justified on the basis of the amount of energy produced. On the other hand, the above energy values are significantly affected by the inclusion of certain commercial or industrial wastes capable of combustion in a waste to energy system. Primarily due to increasing amounts of plastics, the heating value of MSW is expected to increase in the future.

In addition to MSW, municipal waste is comprised of sewage, which contains organic and inorganic materials such as human wastes, ground garbage, and industrial wastes. The solids extracted from sewage when it is treated become sewage sludge. Due to legislation requiring more thorough sewage treatment and the expanding practice of disposing of food and other wastes in sewage, the per capita generation rates of sewage sludge are rising. One frequently used figure shows a per capita generation rate of 0.34 lb per day. However, a common design coefficient for domestic dry sewage sludge generation is 0.20 lb. per person per day. As is the case with MSW, these generalized generation rates do not reflect local conditions which varv substantially from place to place. Some examples of local conditions that can increase sewage generation rates are extensive use of garbage grinders and a generally high standard of living.

Energy can be produced by burning sewage. The dry solids have a heating value of approximately 10,000 BTU/lb, but, unless the sludge is processed to remove much of the water, a supplemental firing is usually required. Another approach to reclaiming energy from sewage is methane production through anaroebic action. One operating facility using this technique produces 4.5×10^6 cubic feet per day of a methane-carbon dioxide gas mix which has a heating value of 600 BTU per cubic foot.

As the following figures show, sewage sludge generation in Ashtabula, Cuyahoga, Lake and Lorain Counties can be expeced to increase somewhat because of the higher standards of wastewater treatment which have to be met.

Estimated Sewage Sludge Generation
(dry tons/day)

	1975	1990	2000
Cuyahoga	311	318	324
Lake	10	17	21
Lorain	25	37	42
Ashtabula	14	18	22

These estimates are based upon sewage flow data gathered by EDATA/NOACA from municipal, county and Northeast Ohio Regional Sewer Board sewage treatment plants and do not include sewage processed in package plants and private plants. Moreover, they were arrived at by using a per capita quantity commensurate with the generally accepted generation rate for the particular type of waste treatment system used in each plant. The result is that they represent rough figures based upon generalized calculations rather than refined estimates based upon on-site measurements.

Nevertheless, even if they are taken as rough figures, they show clearly that projected increases in dry tons per day do not constitute a substantial addition to the amount of municipal waste that would be available as feedstock for a resource recovery facility. Moreover, only Cuyahoga County produces enough sewage sludge to justify its consideration as a source of resource recovery facility feedstock. As will be seen later, however, Cuyahoga County produces more than enough MSW to feed the 2000 tons per day resource recovery facility which is being planned there, and the plan for this facility does not call for using sewage sludge as a feedstock. For these quantitative reasons, then, as well as for the qualitative reasons associated with using it as a feedstock, sewage sludge will not be considered in assessing the adequacy of the solid waste stream for implementing an economically viable resource recovery facility.

2. Agricultural and Industrial Wastes. Industrial and agricultural wastes have an energy value that should be considered under some circumstances in areas assessing resource recovery potential. Since comprehensive data are not available, the volumes and types of industrial waste potentially available to a resource recovery facility must be determined on a site-specific basis. These industrial wastes can be solid, liquid, gaseous, or sludges. They have heating values ranging from approximately 4000 to over 20,000 BTU/lb.

Agricultural wastes include crop, livestock and forestry wastes, all of which can be converted to some form of energy. The heating values of dry, combustible solid agricultural wastes range from 6000 to 8350 BTU/lb. Livestock waste accounts for an estimated 73 percent of agricultural wastes, on a wet basis, and crop wastes represent most of the remainder.

Generally speaking, industrial and agricultural wastes are not viewed with a great deal of interest in the evaluation of resource recovery potential because of the limited production of wastes of this nature which are suitable for conversion to energy and the environmental problems associated with handling them. However, agricultural and industrial wastes can be good sources of energy under certain conditions. Conversion of such wastes to energy should be included in any comprehensive assessment of the potential for resource recovery in those areas where site specific data indicate that they are generated in suitable form and sufficient quantity.

B. MSW Generation and Composition

As indicated above, MSW is by far the most important and most practical type of solid waste for use in the recovery of energy. Therefore, the discussion which follows will be based on the premise that MSW is, unless otherwise stated, the sole feed stock for resource recovery activities.

Two techniques can be used in estimating MSW quantities. first technique, known as the materials flow or input approach, involves calculating from production data the amount of each material that enters the waste stream and substracting from this figure the amount which is recycled to arrive at the net waste for disposal. This approach requires estimates of the time interval between producing and discarding each material, as well as the amount recycled. In addition, sample collection data are necessary to estimate food, yard, or miscellaneous waste that must be added to the total.

The second technique used to estimate waste quantities, known as the output approach, is based upon a survey of the material which is discarded into the waste stream. The estimate produced by this technique does not represent the actual amount of waste discarded, but rather the lesser amount of waste which is collected for disposal. The difference between the quantities discarded and collected is due to on-site incineration, burying, indiscriminate dumping, highway littering, and selective source separation for recycling.

Per capita figures are useful for quickly estimating total quantities of waste generated, but compositional data are necessary for determining how best to dispose of or utilize the waste. The techniques used to calculate waste compositions are material flows and collection data as described above. Preparing collection data involves handsorting samples of municipal waste and weighing each component. This method gives an accurate picture of the waste composition as it is actually received, which is important when planning resource recovery systems. However, the samples must be carefully chosen to represent accurately the seasons of the year and the localities from which the collections are made. As stated earlier, material flows analysis involves calculating from production data the amount of each material that enters the waste stream, plus estimates of food, yard, or miscellaneous wastes.

There is one other important difference between compositions of waste calculated on material flows and on a collection data basis, and that is moisture content. Flows analysis provides an estimate of waste on an "as-generated" basis. The result is that the percentage of moisture which it contains is the percent that was present immediately prior to disposal. Providing a measurement of waste after it is disposed of and mixed with other waste allows for the gain or loss of moisture which is associated with the disposal process. Such "as-disposed" figures are often used for designing resource recovery facilities where it is important to know the characteristics of the materials handled.

Figure 1 displays the heating value and compositional analysis of typical MSW. The low sulfur and chlorine percentages which emerge from the analysis are evidence of two characteristics that encourage the use of MSW as a fuel. Although content percentages may vary under certain circumstances, MSW in the United States has a consistent average sulfur content of 0.1% to 0.2% in contrast to the 2.5% to 3.5% for typical power plant coals. The chlorine content is in the high end of the range for coals now burned, but early tests with air-classified shredded combustibles have shown that two-thirds of the chlorine is in the form of inorganic chlorides that normally would not react in a furnace to form harmful air pollutants.

The carbon content of the combustibles is low with respect to usual commerical levels because of the cellulosic character of the combustibles, where half the weight is oxygen. Such items as rubber and plastics contain little or no oxygen and are high in carbon. The energy per unit weight depends on the quantity and chemical characteristics of the individual components and the amount of moisture present. The dry, organic portion of MSW has been estimated to have a value of 8300 BTU/lb, but the inorganics, which have very low heating value and which contains water, which has no heating value, reduce the overall heating value to the range of 4300 to 4600 BTU/lb

Figure 2 displays the composition of MSW in Ohio in terms of percent by weight and pounds per ton. These figures were derived through an Ohio EPA study, which also estimated the per capita generation rates and the aggregate county generation rate per day. However, before analyzing these generation rate figures, some discussion is necessary on the reliability of per capita generation rates and waste generation projections.

There are a number of studies estimating the per capita generation rate of municipal solid waste. Those most often cited place the generation rate between 3.31 to 7.0 pounds per person per day. Some of this variation is accounted for by the "as-disposed" versus "as - generated" moisture content and the differences between material flows analysis and the collection data estimation technique. Other factors affecting the per capita generation figures are:

FIGURE 1: ULTIMATE ANALYSIS AND HEATING VALUE FOR TYPICAL MIXED MUNICIPAL SOLID WASTE

Component	Analysis (as received) % by Weight	Analysis (dry basis) % by Weight
Moisture	25.1	0.0
Carbon	25.2	33.5
Hydrogen	3.2	4.3
Oxygen	18.1	25.2
Nitrogen	0.4	0.5
Chlorine (organic 0.16), (inorganic 0.14)	0.3	0.4
Sulfur	0.1	0.1
Metal	8.7	11.6
Glass, ceramics	12.2	16.3
Ash	6.0	8.1
TOTAL	100.0	100.0
Higher heating value, HHV	4,400 BTU/lb	5,600 BTU/lb

Source: U. S. Environmental Protection Agency

FIGURE 2:

Component	Percent (by Weight) in MSW	Lb./Ton of MSW
Metals	8.0	160
Ferrous	7.1	142
Aluminum	0.7	14
Other Non-ferrous	0.2	4
Glass	8.0	160
Paper	40.0	800
Newspaper	7.2	144
Writing and printing	8.0	160
Packaging	21.2	424
Other	3.6	72

Source: Ohio Environmental Protection Agency

- variations in yard waste due to differences in climate, length of growing season, and amount of yard space available.

- demographic factors: Studies have shown that single family dwellings generate 2.5 to 3 times as much refuse as the average apartment.

- economic factors: More affluent households tend to generate more paper and more total waste.

- life style factors: Solid waste generated by farm households has been shown to be significantly less than that generated by urban households.

From the above discussion, it can be seen that estimates of per capita generation rates based upon generalized figures are not accurate for a particular locality because they do not allow for these variations in yard waste and demographic, economic, and life style factors. In order for an estimate of per capita generation rates to be accurate for a particular locality, it must reflect the state of these variables which obtains in that particular locality. Therefore, any assessment of the potential for a viable resource recovery facility in a particular locality must use site-specific rather than generalized per capita generation rates.

III. Municipal Solid Waste (MSW) Volumes

A. Cuyahoga County. Ohio EPA, with the assistance of the Cuyahoga County Regional Planning Commission and the Office of the Cuyahoga County Sanitary Engineer, inventoried municipalities and private solid waste system operators in 1978 using a questionnaire. The returned community questionnaires represented about 99 percent of the estimated 1975 population of Cuyahoga County. Thirty-two communities, representing 24.2 percent of the county population, reported estimated solid waste volumes equivalent to 154,211 tons per year or 2.18 per capita per day. Eighteen communities, representing 74.2 percent of the county population, reported weighed quantities of 676,375 tons per year, or the equivalent of 3.11 pounds per capita per day. The balance of the county, representing a population of 28,800, was estimated to have a generation rate of 15,000 tons of residential solid waste per year. Figure 3 shows details of the data gathered on volumes and rates of community waste generation in Cuyahoga County.

FIGURE 3: MUNICIPAL SOLID WASTE QUANTITIES IN CUYAHOGA COUNTY

Communities	Population 1975 Estimate	Type[1]	Annual Solid Waste Quantity Reported (yd^3)	Calculated[2] (tons)	Weighed (tons)	Generation Rate (p/c/d)[3]
Bay Village	19,000	R, C	--	--	20,000	5.77 (3.75
Beachwood	10,900	R	18,885	4,721	--	2.37
Bedford	16,300	R	20,000	5,000	--	1.68
Bedford Heights	13,500	R	19,990	4,998	--	2.03
Bentleville	400	----------------	Not Available	----------------		
Berea	21,400	R, C, I	30,400	7,600	--	1.95
Bratenahl	1,700	R	--	--	450	1.45
Brecksville	9,000	----------------	Not Available	----------------		
Broadview Heights	12,900	R, C, I	--	--	16,300	6.92
Brooklyn	13,800	R	--	--	11,600	4.61
Brooklyn Heights	1,700	R	3,380	845	--	2.72
Brook Park	30,400	R	--	--	14,144	2.55
Chagrin Falls	4,800	R	9,000	2,250	--	2.56
Chagrin Falls Twp.	100	R	192	48	--	2.63
Cleveland	638,000	R	--	--	364,000	3.13
Cleveland Hts.	59,000	R, C	--	--	25,025[5]	2.32 (2.07)[4]
Cuyahoga Hts.	800	----------------	Not Available	----------------		
East Cleveland	38,100	R, C	--	--	15,700[5]	2.26
Euclid	64,500	R, I	--	--	30,600	2.60
Fairview Park	20,600	R	30,360	7,590	--	2.02
Garfield Hts.	38,200	R	59,540	14,885	--	2.14
Gates Mills	2,300	----------------	Not Available	----------------		
Glenwillow	500	R	1,040	260	--	2.85
Highland Hts.	6,500	R	14,983	3,746	--	3.16
Hunting Valley	700		2,600	650	--	5.09
Independence	6,600	R	13,255	3,314	--	2.75
Lakewood	65,400	R	--	--	48,000	4.02
Linndale	200	----------------	Not Available	----------------		
Lyndhurst	20,000	R, C	35,700	8,925	--	2.45
Maple Heights	31,800	R	48,580	12,145	--	2.09
Mayfield	4,100	----------------	Not Available	----------------		
Mayfield Heights	21,800	R	32,000	8,000	--	2.01
Middleburg Hts.	15,200	R, C, I	--	--	15,200	5.48 (1.86
Moreland Hills	3,500	R	3,100	775	--	1.21
Newburgh Hts.	3,400	----------------	Not Available	----------------		
North Olmsted	37,400	R, C, I	--	--	21,156	3.10
North Randall	1,200	R	1,040	260	--	1.19
North Royalton	13,600	R	18,816	4,704	--	1.90
Oakwood	4,000	R	7,280	1,820	--	2.49
Olmsted Falls	6,000	R	--	--	3,330	3.04
Olmsted Twp.	6,900		--	--	4,000	3.18
Orange	2,300	----------------	Not Available	----------------		

FIGURE 3: MUNICIPAL SOLID WASTE QUANTITIES IN CUYAHOGA COUNTY (cont.)

Communities	Population 1975 Estimate	Type[1]	Annual Solid Waste Quantity: Reported (yd)[3]	Calculated[2] (tons)	Weighed (tons)	Generation Rate (p/c/d)[3]
Parma	94,400	R	--	--	54,525	3.01
Parma Heights	25,100	R	--	--	6,915	1.51
Pepper Pike	5,800	R	10,000	2,500	--	2.36
Richmond Hts.	10,200	R	10,000	2,500	--	1.34
Riveredge Twp.	600	Not Available				
Rocky River	22,700	R	--	--	9,430[5]	2.28
Seven Hills	14,000	R	22,880	5,720	--	2.24
Shaker Heights	35,000	R	--	--	16,000	2.50
Solon	12,600	R	38,000	9,500	--	4.13
South Euclid	28,600	R, C, I	40,000	10,000	--	1.92
Strongsville	21,500	R	34,320	8,580	--	2.19
University Heights	17,200	R, C, I	32,000	8,000	--	2.55
Valley View	1,500	R	2,600	650	--	2.37
Walton Hills	2,700	R	5,200	1,300	--	2.64
Warrensville Hts.	17,800	R, C	24,900	6,225	--	1.92 (1.52)[4]
Warrensville Twp.	2,100	Not Available				
Westlake	17,500		26,000	6,500	--	2.04
Woodmere	1,100	R	800	200	--	1.00
Cuyahoga County Total	1,603,900	---	---	154,211	676,375	2.34

[1]R - Residential, C - Commercial, I - Industrial.

[2]Tons calculated using 500 pounds per cubic yard.

[3]p/c/d - pounds per capita per day.

[4]Residential portion.

[5]1977 data.

Source: Ohio Environmental Protection Agency

Since these reported community volumes represent primarily residential solid waste, they under-estimate the total volume of municipal solid waste generated in the county. On the other hand, about 75,000 tons per year of solid waste comes in from outside the county, while an estimated 34,000 tons per year of residential waste is disposed of outside of the county. So far as the amount of solid waste disposed of in Cuyahoga County is concerned, this surplus in inter-county movement counterbalances the underestimated figure for solid waste generation within the County.

A current estimate (1980) and future projections of MSW generation for each community in Cuyahoga County and for the County as a whole can be arrived at by multiplying the per capita generation rates given for each community in Figure 3 by the Cuyahoga County population projections prepared by NOACA and the Cuyahoga County Regional Planning Commission. The results of this procedure are shown in Figure 4.

FIGURE 4

MUNICIPAL SOLID WASTE PROJECTIONS
FOR CUYAHOGA COUNTY

(Figures given as tons/per day)

COMMUNITY	1980	1990	2000
Bay Village	54 24	57.7	57.7
Beachwood	14.22	16.53	17.78
Bedford	13.o9	12.68	12.6
Bentleyville*	0.57	0.57	0.57
Berea	20.67	20.48	20.48
Bratenahl	1.16	1.16	1.16
Brecksville*	13.49	18.46	24.14
Broadview Heights	45.67	55.36	69.2
Brooklyn	32.27	32.27	32.27
Brooklyn Heights	2.31	2.31	2.31
Brook Park	38.25	39.53	39.53
Chagrin Falls	6.14	6.14	6.14
Chagrin Falls Twp.	0.13	0.13	0.13
Cleveland	917.03	845.1	805.98
Cleveland Heights	64.96	68.44	68.44
Cuyahoga Heights*	1.14	1.14	1.14
East Cleveland	40.68	36.16	33.90
Euclid	81.38	81.90	81.90
Fairview Park	20.20	21.21	21.92
Garfield Heights	38.95	36.38	35.51
Gates Mills*	3.41	3.41	3.41
Glennwillow	0.71	0.71	0.71
Highland Heights	11.06	12.64	15.80
Hunting Valley	1.78	1.78	1.78
Independence	9.63	13.75	20.63
Lakewood	130.65	130.65	130.65
Linndale*	0.28	0.28	0.28
Lyndhurst	24.26	25.73	26.95
Maple Heights	32.19	32.40	32.40
Mayfield*	6.39	7.81	8.52
Mayfield Heights	21.41	23.12	24.12
Middleburgh Heights	43.84	49.32	54.80
Moreland Hills	2.24	2.72	2.72
Newburgh Heights*	4.83	4.54	4.26
North Olmsted	62.62	68.2	69.75
North Randall	0.71	0.71	0.71
North Royalton	13.87	21,81	26.6
Oakwood	5.60	6.23	6.23
Olmsted Falls	9.12	10.64	11.40
Olmsted Township	11.93	15.42	19.08
Orange	3.41	5.68	7.10
Parma	150.5	158.03	161.04
Parma Heights	18.65	19.63	19.63

FIGURE 4 (cont.)

COMMUNITY	1980	1990	2000
Pepper Pike	7.08	8.26	9.44
Richmond Heights	7.37	8.71	9.38
Riveredge Township*	0.85	0.85	0.85
Rocky River	25.08	26.22	27.36
Seven Hills	16.13	17.92	19.04
Shaker Heights	43.75	43.75	43.75
Solon	29.32	45.43	57.82
South Euclid	26.59	27.36	27.84
Strongsville	28.47	43.80	52.56
University Heights	22.31	22.31	22.31
Valley View	1.90	2.37	3.56
Walton Hills	3.83	4.09	4.36
Warrensville Heights	16.70	17.47	17.28
Warrensville Twp.*	2.98	3.27	3.27
Westlake	19.38	31.62	35.70
Woodmere	0.60	0.60	0.60
Total/tpd	2241.28	2287.1	2330.5

*Where local p/c/d was not available, the County average of 2.84 p/c/d was used.

B. Lake County

The recent studies performed for Ohio EPA dealing with solid waste indicate a MSW generation rate of 3.50 pounds per capita per day in Lake County. Using this rate of waste generation in conjunction with the NOACA population projections for Lake County and all the communities therein, the tons per day of MSW generated by each community and by the County as a whole can be calculated. Figure 5 displays the results of these calculations as the current (1980) tons per day of MSW generated and anticipated future MSW quantities.

FIGURE 5

MUNICIPAL SOLID WASTE PROJECTIONS
FOR LAKE COUNTY

(Figures given as tons/per day)

COMMMUNITY	1980	1990	2000
Concord	16.98	32.2	50.75
Eastlake	38.15	36.93	36.23
Fairport	5.60	5.60	5.60
Grand River	1.06	1.06	1.06
Kirtland	10.85	14.7	19.95
Kirtland Hills	0.88	1.05	1.05
Lakeline	0.35	0.35	0.35
Leroy	3.85	5.08	6.3
Madison Township	28.35	40.78	55.65
Madison Village	3.50	5.25	6.83
Mentor	77.35	88.55	91.88
Menton-on-the-Lake	12.95	12.43	12.25
North Perry Village	1.40	1.23	1.23
Painesville	30.45	30.98	31.85
Painesville Township	23.45	32.73	41.83
Perry Township	8.40	11.38	17.33
Perry Village	2.45	5.25	5.95
Timberlake	1.75	1.58	1.58
Waite Hill	0.88	1.05	1.05
Wickliffe	30.63	29.23	28.70
Willoughby	38.15	44.63	46.55
Willoughby Hills	13.83	15.23	19.43
Willowick	32.20	29.93	29.40
Total t/p/d	**383.46**	**446.95**	**512.40**

In addition to the MSW generated within Lake County, a substantial quantity of MSW generated in Geauga County is disposed of in Lake County. A 1979 estimate of the quantity of Geauga County MSW brought into Lake County put the figure at approximately 100 tons per day. This volume of MSW is presently being disposed of at the Lake County Land Development Company's landfill in Kirtland Township. If this landfill were to be closed, Geauga County's MSW could be handled by the Lake County baler near Painesville. Geauga County has no plans at present to develop solid waste disposal facilities within the county; consequently, the current practice of exporting 90% of Geauga County MSW to Lake County can be expected to continue. This means that, in addition to the MSW generated in Lake County, Lake County will have available for disposal or other use more than 100 tons of MSW from Geauga County.

C. Lorain County

Using the per capita generation rates for Lorain County developed by Stanley Consultants for Ohio EPA in 1976, and the population estimates developed in 1978 by NOACA and the Lorain County RPC, current estimates and future projections of MSW volumes for each of the jurisdictions within the County and the County in aggregate can be developed. These figures are displayed in Figure 6.

Many western Cuyahoga County municipalities have historically exported their solid wastes to landfills in the Cities of Lorain and Elyria. Currently, a number of these communities use the Oberlin facilitv from time to time. Figure 7 shows the Cuyahoga County communities which are potential suppliers of solid waste to communities in Lorain County and, therefore, might be users of a Lorain County resource recovery facility. In addition to the potential solid waste contributors in western Cuyahoga County, Medina and Huron Counties are known to export solid waste to Lorain County facilities. However, because the areas involved rely entirely upon private haulers, documented information concerning generation rates and disposal practices is not available. Due to this absence of information, no estimate can be given of the amount of solid waste which comes into Lorain County from Medina and Huron Counties.

In assessing all of the foregoing figures on solid waste generation, it should be kept in mind that they are based upon population projections and per capita generation rates for residential waste. Consequently, they do not include the substantial amounts of commercial waste which are generated in all three Counties and should not be taken as measures of all of the solid waste which would be available to fuel a resource recovery facility. On the other hand, since residential waste constitutes the bulk of the fuel which would go into a resource recovery facility, they do represent rough approximations of the amount of fuel which would be available. Moreover, a resource recovery facility needs a minimum of 500 tons per day of solid waste feed stock in order to operate economically. When attempting to ascertain whether or not the minimum feed feed stock requirement is met, one can look at the amount of residential waste generated and know that it represents a minimum rather than a maximum figure. If that amount meets the minimum volume requirement, then one can be sure that the resource

FIGURE .6: LORAIN COUNTY MUNICIPAL SOLID WASTE GENERATION FORECASTS*
*Rate is given as tons per day

	1980	1985	1990	1995	2000
Amherst City	20.125	23.5	26.95	29.05	31.85
Amherst Township	8.75	9.1	9.275	9.8	10.15
Avon City	14.175	15.05	15.4	16.625	17.675
Avon Lake City	24.5	27.475	30.975	33.25	36.225
Brighton Twp.	1.225	1.225	1.4	1.4	1.575
Brownhelm Twp.	1.575	1.75	1.925	1.925	2.1
Camden Township	1.925	2.1	2.1	2.275	2.45
Carlisle Township	14.525	15.4	17.675	18.725	19.95
Columbia Twp.	11.375	12.775	14.35	15.575	16.8
Eaton Township	12.425	13.475	14.525	15.75	16.8
Elyria City	106.225	117.95	132.65	142.8	154.7
Elyria Twp.	8.575	9.45	10.15	10.85	11.725
Grafton Village	3.5	3.675	3.85	4.2	4.375
Grafton Township	2.45	2.625	2.625	2.8	2.975
Henrietta Twp.	2.975	3.325	2.5	3.675	4.025
Huntington Twp.	1.575	1.575	1.75	1.925	2.1
Kipton Village	0.7	0.7	0.7	0.875	0.875
LaGrange Village	2.1	2.275	2.45	2.625	2.8
LaGrange Twp.	2.975	3.15	3.325	3.5	3.675
Lorain City	151.9	165.9	178.5	192.15	205.8
North Ridgeville City	38.675	47.6	53.725	63.875	72.45
Oberlin	16.975	18.2	19.425	20.825	22.225
Penfield Twp.	1.575	1.75	1.75	1.925	1.925
Pittsfield Twp.	2.275	2.45	2.625	2.8	2.975
Rochester Twp.	0.7	0.7	0.7	0.7	0.875
Russia Twp.	3.5	3.85	4.025	4.275	5.725
Sheffield Twp.	12.425	12.6	12.775	13.125	13.475
Sheffield Village	3.325	3.675	4.025	4.2	4.55
Sheffield Lake City	17.325	19.425	21.875	23.275	24.85
South Amherst V.	5.95	7.0	8.4	9.1	9.975
Vermillion City	8.925	10.325	12.075	12.95	14.175
Wellington V.	8.225	8.925	9.8	10.675	11.375
Wellington Twp.	2.275	2.45	2.625	2.8	2.975
TOTAL* TDP	515.9	571.375	628.425	683.725	736.225

recovery facility will have at least enough feed stock to run on an economic basis. Any commercial waste which becomes available will be over and above its minimum requirements.

FIGURE 7:

Community	Residential Solid Waste Estimates*		
	1980	1990	2000
Bay Village	35.25	37.5	37.5
Fairview Park	20.2	21.21	21.92
North Olmsted	62.62	68.2	69.75
Olmsted Falls	9.12	10.64	11.4
Olmsted Twp.	11.925	15.423	19.08
Rocky River	25.08	26.22	27.36
Westlake	19.38	31.62	35.7
TOTALS	183.575	210.813	222.71

*Estimates are given as tons per day.

D. Ashtabula County

The recent studies performed by the Ashtabula County Planning Commission, the Ohio Environmental Protection Agency dealing with solid waste, indicate a M.S.W. generation rate of 3.20 pounds per capita per day in Ashtabula County. Using this rate of waste generation in conjunction with the population projections for Ashtabula County, obtained from the study, "Alternative Futures for Ashtabula County", the tons per day of MSW generated by each community can be calculated. Figure 8 displays the results of these calculations for actual (1976) tons per day of MSW generated, and (1990) anticipated future MSW quantities, with or without the construction of a steel mill proposed by U.S. Steel in Conneaut.

FIGURE 8: ASHTABULA COUNTY MUNICIPAL SOLID WASTE GENERATION FORECASTS
RATE IS GIVEN AS TONS PER DAY

	1970	1976	without U.S. Steel impact 1990	with U.S. Steel impact 1990
Cities and Villages				
Andover	1.89	1.97	2.10	2.10
Ashtabula	38.90	40.48	41.6	42.46
Conneaut	23.28	24.36	25.91	34.33
Geneva	10.31	10.96	11.91	11.91
Geneva-on-the-Lake	1.40	1.42	1.43	1.43
Jefferson	3.96	4.68	5.90	6.18
North Kingsville	3.93	4.88	6.66	7.88
Orwell	1.54	1.72	2.08	2.08
Rock Creek	1.17	1.18	1.23	1.23
Townships				
Andover	1.54	2.13	3.24	3.24
Ashtabula	11.83	12.51	13.52	16.22
Austinburg	2.38	2.88	3.52	3.52
Cherry Valley	1.01	1.28	1.65	1.65
Colebrook	1.17	1.32	1.48	1.48
Denmark	1.24	1.44	1.65	1.65
Dorset	1.42	1.58	1.76	1.76
Geneva	6.04	6.59	7.48	7.48
Harpersfield	2.53	3.20	4.21	4.21
Hartsgrove	1.44	1.89	2.42	2.42
Jefferson	2.67	3.18	4.02	4.19
Kingsville	2.76	3.19	3.90	4.61
Lexox	1.89	2.20	2.72	2.72
Monroe	2.74	3.32	4.19	4.48
Morgan	1.23	1.72	2.47	2.47
New Lyme	1.40	1.58	1.81	1.81
Orwell	1.22	1.53	1.85	1.85
Pierpont	1.56	1.87	2.21	2.39
Plymouth	3.56	3.91	4.45	4.64
Richmond	1.26	1.48	1.78	1.78
Rome	1.13	1.58	2.22	2.22
Saybrook	10.52	11.22	12.18	12.61
Sheffield	1.86	2.29	3.04	3.20
Trumbull	1.54	2.08	2.94	2.94
Wayne	.95	1.10	1.25	1.25
Williamsfield	1.58	2.06	2.77	2.77
Windsor	2.32	2.61	3.04	3.04
TOTAL	157.18	173.42	196.53	212.19

SOURCES
Planning Resources Inc.
Ashtabula Planning Commission
Eastgate Development and Transportation Agency
United States Environmental Protection Agency
Ohio Environmental Protection Agency
Burgess and Niple, Ltd.

IV. Solid Waste Management

A. Cuyahoga County

Except for about 200 tons per day which can be handled by the incinerators operated by Lakewood and Euclid, the solid waste (MSW) generated in Cuyahoga County has to be disposed of in landfills. Fifteen licensed landfills located within the County are now in active use. Details of these landfills and the quantities of solid waste which they receive are given in Figure 9. Figure 10 identifies the type, location, and ownership of all Cuyahoga County solid waste management facilities, including transfer stations and incinerators. In addition to the landfills located in Cuyahoga County, a large landfill in Portage County already receives about 100 tons per day of MSW from Cuyahoga County. These landfills are used by both municipal and private haulers, but municipal haulers handle about 95% of the total.

The Cuyahoga County Board of County Commissioners estimate that the Cuyahoga County landfills will reach their present capacities within two to four years. Moreover, it has proved to be difficult if not impossible in Cuyahoga County to expand existing landfills or open new landfills because of opposition by local residents. This means that, unless some alternative means of disposal is found, more and more of Cuyahoga County MSW will have to be hauled to distant places like Portage County, with the result that disposal costs will increase substantially. As a result of these factors, the County Commissioners have initiated a plan to build a resource recovery facility which would function under the umbrella of a Cuyahoga County Garbage and Refuse Disposal District.

According to this plan, a resource recovery facility would be located in Newburgh Heights, and, with a capacity of 2000 tons per day, will be able to process most of the MSW generated in Cuyahoga County. The municipalities which generate the bulk of Cuyahoga County MSW, including Cleveland, have agreed to send their MSW to the Newburgh Heights facility. Thus, the resource recovery plant would be assured of receiving the quantity of MSW which it is designed to process. The Newburgh Heights City government has given its approval of locating the facility within its jurisdiction, and the Cuyahoga County Commissioners have already advertised for

FIGURE 9: FACILITY SOLID WASTE QUANTITIES

Facility Number[1]	Facility Name	Type[2]	Solid Waste Quantity (Seven-Day Week Basis) (yd^3/day)	(ton/day)[3]
1	Warner Hill Improvement, Inc.	C, I	3,988[4]	997
2	Inland Reclamation	R, C, I	3,018[4] (1,058 Res)[4]	754 (265 Res)
3	Cleveland Land Development	C, I	1,430	357
4	Cleveland Land Development	--------------not in use----------------		
5	Boyas Excavating, Inc.	-------construction debris only----------		
6	Glenwillow Works, Austin Power	R, C, I	1,453[4] (1,065 Res)[4]	363 (266 Res)
7	Royalton Road Sanitary Lanfill	R, C, I	1,430	357
8	Rockside Reclamation, Inc.	R, C, I	3,380[4] (2,083 Res)[4]	845 (521 Res)
9	Ridgewood Sanitary Landfill	R	---------unknown------------	
10	Solon Sanitary Landfill	R, C, I	243	61
11	Brooklyn Landfill	R		32
12	Bedford Landfill	----------Street Dept. use---------------		
13	Shaker Heights Landfill	---Street Dept., City Const., etc.-------		
14	Strongsville Landfill	--------------little use-----------------		
15	Westlake Landfill	R, C, A	71	18
16	Euclid Incinerator	R, C, I		83
17	Cleveland Land Development	-----presently not in operation----------		
18	Lakewood Incinerator	R		132
OOC[5]	Lake County	-------	73	18
OOC	Lorain County	-------		79

[1] Facilities identifed in Table 3 and located on Figure 4.

[2] R - Residential; C - Commercial; I - Industrial; A - Agriculture.

[3] When cubic yard reported, tons are calculated on the basis of 500 pounds per cubic yard.

[4] 1977 data.

[5] OOC - Out of County.

Source: Ohio Environmental Protection Agency

Figure 10: Solid Waste Management Facility Identification

Facility No.	Facility Type[1]	Facility Name	Facility Location	Facility Mailing Address	Ownership[2]
1	L	Warner Hill Improvement, Inc.	4720 Warner Rd., Garfield Hts.	4699 Commerce Ave., Cleveland	P
2	L	Inland Reclamation	6705 Richmond Rd., Glenwillow	6705 Richmond Rd., Glenwillow	P
3	L	Cleveland Land Development	7720 Harvard Ave., Cuyahoga Heights	4900 Woodland Avenue, Cleveland	P
4	L	Cleveland Land Development	1329 E. Schaaf Rd. Brooklyn Heights	4900 Woodland Avenue, Cleveland	P
5	L	Boyas Excavating, Inc.	6700 Grant Ave., Cuyahoga Heights	4100 Brookpark Rd., Cleveland	P
6	L	Glenwillow Works, Austin Powder	30300 Pettibone Rd., Glenwillow	3735 Green Road, Cleveland	P
7	L	Royalton Rd. Sanitary Landfill	3401 Royalton Rd., Broadview Heights	7500 Exchange, Valley View	P
8	L	Rockside Reclamation, Inc.	5661 Canal Rd. Garfield Hts.	4100 Brookpark Rd., Cleveland	P
9	L	Ridgewood Sanitary Landfill	2221 W. Ridgewood, Parma	6611 Ridge Road, Parma	G
10	L	Solon Sanitary Landfill	6600 Cochran Rd., Solon	6315 S.O.M. Center, Solon	G
11	L	Brooklyn Landfill	9400 Memphis Ave., Brooklyn	7619 Memphis Ave., Brooklyn	G
12	L	Bedford Landfill	Krick Road, Walton Hills	65 Columbus Road, Bedford	G
13	L	Shaker Heights Landfill	Bartlett & Columbus	3400 Lee Road, Shaker Heights	G
14	L	Strongsville Landfill	Mill Hollow Rd., Strongsville	18688 Royalton Rd., Strongsville	G
15	L	Westlake Landfill	741 Bassett Rd., Westlake	27216 Hilliard Rd., Westlake	G
16	L	Euclid Incinerator	27700 Lakeland Blvd. Euclid	585 E. 222nd Street, Euclid	G
17	L	Cleveland Land Development & Harry Rock & Co.	7720 Harvard Avenue, Cleve.	4900 Woodland Avenue, Cleve.	P
18	I	Lakewood Incinerator	12920 Berea Road	Same	G
19	T	Rocky River Transfer Station	22401 Lake Rd., Rocky River	21012 Hilliard Rd., Rocky River	G
20	T	Ridge Road Transfer Station	3727 Ridge Road, Cleveland	601 Lakeside, Cleveland	G
21	T	East Cleve. Transfer Sta.	1610 Eddy Rd., E. Cleve.	14340 Euclid Ave., E. Cleveland	G
22	T	Cleve. Hts., Transfer Sta.			G
23	T	Shaker Hts. Transfer Sta.			G

[1] L - Landfill; I - Incinerator; T - Transfer Station. [2] G - Government; P - Private

Source: Ohio Environmental Protection Agency

construction bids. It is expected the work will begin in 1981 and that the facility will be operational by 1985.

The Newburgh Heights resource recovery facility would be owned by Cuyahoga County but would be designed, constructed and operated by a private company. Its estimated capital cost is $120-130 million, to be financed by revenue bonds issued by the Ohio Water Development Authority. The revenue bonds will be paid off from revenue generated by the tipping fees paid by participating communities and by the sale of the steam which will be generated by burning MSW.

It is estimated that revenues from steam sales will provide 80% of the funds needed to service and retire the revenue bonds issued to cover construction costs. Steam production is estimated at 500,000 pounds per hour on a continuous basis. The energy equivalent would be approximately 20 million BTU's per day. Major users of the steam would be steel and chemical companies located in the Cuyahoga Valley "Flats" -- Alcoa, Jones & Laughlin, Republic, U.S. Steel, Harshaw Chemical, and McGeon Chemical. Since these plants are close to the proposed facility site and since the steam which would be produced would represent a substantial part of the 2.3 million pounds per hour steam supply which they need for their operations, all six companies have indicated that they would be customers. Their combined purchases would constitute a continuing market for all of the steam which the facility would generate.

Although the primary purpose of the Newburgh Heights resource recovery facility is to provide a means of disposing of Cuyahoga County solid waste which will replace existing landfills, it has been planned so as to make sure that improvement on the solid waste front is not offset by damage to other aspects of the environment. This intention is made clear in the County Commissioners' statment of purpose. "The purposes of the Cuyahoga County Resource Recovery Program are to provide cost effective and environmentally acceptable solid waste disposal for all participating municipalities in Cuyahoga County and to provide energy supplies which will help to maintain the industrial base of Cuyahoga County." A preliminary and general assessment of the environmental impact of the Newburgh Heights facility indicates that the Commissioners' purpose to provide "environmentally acceptable solid waste disposal" will be realized.

Construction and operation of the Newburgh Heights facility will have both a local and a regional environmental impact. Since Newburgh Heights is not within the coastal region of Cuyahoga County, the local environmental impact is not a concern of the Coastal Energy Impact Program. The regional environment impact, however, does extend to the coastal region, and here the environmental results will be positive. In the first place, the resource recovery facility would replace existing solid waste disposal facilities which have had a negative environmental impact within the coastal region -- the Westlake landfill, the Lakewood and Euclid incinerators, and transfer stations in Cleveland, East Cleveland and Rocky River. Secondly, operation of the facility would lead to improvements in air quality within the air shed which extends into the coastal region. MSW would be burned at such a high temperature - 1400° - that no odor and little smoke would enter the flue steam. Those particulates and other air pollutants which did enter the flue stream would be captured by electrostatic precipitators before they escaped into the air. In addition, the industries which purchased steam from the facility would be able to shut down some of coalfired boilers which they presently use to produce steam. The result would be less air pollution from industries operating in the "Flats." Finally, the phasing out of the Lakewood and Euclid incinerators will have a beneficial effect on the coastal region's air quality. Since these incinerators have had continuing difficulties meeting air quality standards, shutting them down will remove two significant point sources of air pollution.

In addition to its positive impact on the coastal region's physical environment, implementation of the Cuyahoga County resource recovery project will have a positive impact on the human environment. While the Cuyahoga County economy remains strong, the economy of Cleveland is on the decline. The unemployment rate is high and the personal income level if falling. Durable goods industries, which have been the backbone of Cleveland's economy, have been particularly hard hit. Prominent among these durable goods industries are steel and chemicals. As the Cuyahoga Commissioners' statement of purposes indicates, providing an additional energy source in the form of steam for the steel and chemical plants located in the "Flats" is one way of encouraging them to continue operations there, especially when the cost of other forms of energy is increasing. The immediate result will be that the chances of retaining for Cleveland the jobs and income which these plants provide will be enhanced. The secondary result will be that the City of Cleveland will be able to maintain the revenue which these plants presently generate through property and payroll taxes and thus prevent a further deterioration in its fiscal base.

From both the physical and human points of view, then, the proposed Cuyahoga County resource recovery facility will be an energy development which, while it will not be located within the coastal region, will impact the environment of the coastal region in a positive way. Since no significant negative environment impacts within the coastal region appear likely to result from its construction and operation, there does not seem to be a need to plan ways and means of mitigating them. Nor will Cuyahoga County or the communities within Cuyahoga County's coastal region be subjected to financial burdens to provide additional public facilities or to compensate for environmental losses as a result of this energy development's taking place. All things considered, the Cuyahoga County resource recovery facility is not one of Ohio's coastal energy developments which needs the assistance of the Coastal Energy Impact Program to make good environmental loss or to provide financial assistance to the impacted local government.

B. Lake County

Most of the MSW generated within Lake County is disposed of in a county baling facility located near Painesville, where MSW is compacted into bales which are subsequently buried in an adjoining landfill. This baling facility is presently processing about 475 tons of MSW per day. Several local communities operate landfills, and there is a privately operated landfill in Kirtland Township. The latter handles the MSW generated in Geauga County.

The baling facility is owned by Lake County and operated by the Lake County Sanitary Engineer. The Lake County Health Department is responsible for seeing to it that it meets public health standards. A number of operational problems have plagued the baling facility during recent months, and it has had to be closed down on more than one occasion. The principal difficulty has been that solid waste bales have been compacted at a faster rate than they have been buried. The result has been that the bales have piled up above ground and have attracted insects and rodents. However, private contractors have been hired to speed up the burying process, and the Health Department has recently given the baler a clean bill of health.

Because of these operating difficulties, the Lake County Commissioners are exploring the option of contracting with a private firm to operate the baler. If the County continues to manage it, a substantial amount of heavy equipment will have to be purchased to make it possible to bury bales as fast as they are compacted. It may be that it would be cheaper to contract with a private party who would supply his own heavy equipment, and it is this possibility which the County Commissioners are now reviewing. However, whether the County owns and operates the baler or merely owns it, the County Commissioners intend to continue to use it as the principal means of disposing of Lake County MSW.

In addition to the County's Painesville baler, the City of Willoughby operates a shredding plant which processes Willoughby's MSW. The shredded MSW is disposed of in a landfill located within the City. The shredding plant was closed down for over a year because of operating problems, but repairs have been made and the plant is now functioning again. Because of the cost of these repairs and the considerable hauling distance from Willoughby to Painesville, Willoughby officials intend to continue using their shredder/landfill disposal system rather than the Painesville baler for some time to come. However, if and when the Willoughby shredder/landfill is closed down, the Painesville bailing facility would be able to handle Willoughby's MSW. Although the proposal has been under discussion for some time, a County Garbage and Refuse Disposal District has not yet been established. Moreover, neither the County nor the municipalities are willing to take primary responsibility for hauling MSW to disposal sites. In fact, only Willoughby, Eastlake, and Painesville provide these services. For the most part, collecting and hauling are done by private contractors who are free to dispose of the loads wherever they can do so at minimum cost.

According to the Lake County Sanitary Engineer, the Painesville baling facility will be able to handle the bulk of Lake County MSW disposal for the next 15 years. It is designed to handle up to 1000 tons per day, more than twice its present volume. If necessary, this 1000 tons per day capacity can be increased. The County is now negotiating with local communities to obtain their support for a County Garbage and Refuse District and has obtained consent resolutions from all 11 cities and 5 townships. If this District is set-up, it would take responsibility for regulating MSW collection and disposal within its jurisdiction. However, the District would not do the actual work of collecting and hauling MSW but would continue to rely on municipalities and private haulers to perform this service, following District regulations. According to the Lake County Sanitary Engineer, regulation of collection and hauling by a County Garbage and Refuse District and stepped-up operation of the Painesville baler will provide adequate Lake County MSW management for the next 15 years.

C. Lorain County

The urbanized areas which generate the bulk of MSW are concentrated in the northern portion of Lorain County. Formerly, most of the urban MSW was disposed of within this northern portion itself, principally in landfills located near Lorain and Elyria. These landfills are now closed, with the result that urban MSW from the northern portion of the County is hauled south for disposal in a single privately owned and operated landfill located in Oberlin. This landfill has a life expectancy of only seven years.

Theoritically, the problem of finding future disposal sites for Lorain County's urban MSW could be solved by opening new landfills in the southern part of the County. This southern portion is largely rural, with a sparce population and plenty of open land. In practice , however, this solution is not feasible because the residents of the southern townships are firmly opposed to having their lands used as a dumping grounds for the "garbage" of the cities to the north.

Even if Lorain County's southerners could be persuaded to abandon their opposition, there would still be the problem of the high cost of hauling MSW from the northern portion to the southern portion of the County. These costs have already increased as a result of the shift in landfill location from Lorain and Elyria to Oberlin. They would go even higher if landfills were opened further south.

In short, Lorain County is not in a position to continue its present solid waste managment arrangements beyond the seven year period during which the Oberlin landfill will still be open. The County Commissioners and officials of the Cities of Lorain and Elyria have recognized this fact and have officially endorsed the idea of studying the feasibility of constructing and operating a resource recovery facility in which most of the County's MSW would be burned. Since most of the County's MSW is generated in the urbanized northern area, such a resource recovery would need to be located there in order to minimize hauling costs. Moreover, the industries that would be potential purchasers of the steam which would be produced are also located in this region.

Within this northern portion of the County, the coastal area appears to be the most likely location. The major population and industrial concentrations are located along or near the Lake Erie shoreline, and a facility operating near the Lake would create fewer air pollution problems than one located inland. One specific site within the coastal area whicn is already under discussion is a plot adjacent to the BF Goodrich plant in Avon Lake. The City of Avon Lake has indicated that it would give its approval to building and operating a resource recovery facility on this site, and the BF Goodrich Company has indicated that it would buy all of the steam which such a facility would produce.

D. Ashtabula County

Ashtabula County has the largest land area of the four counties in this study containing 706 square miles or about 452,000 acres. With an estimated population of 108,000 persons, the average density is almost 4.2 acres per person. This low average is due to the majority of the county being rural and agricultural. The greater concentration of people occur along Lake Erie in the coastal zone area. The Proposed U.S. Steel Plant in Conneaut, located in the coastal zone, would promote the population to increase the existing urban area.

In 1969 the "Study of Present Garbage and Refuse Disposal and Recommendation", prepared by the Ashtabula County Regional Planning Commission, documented seven landfills and six open dumps were in operation.

There is now only one (1) privately owned and operated licensed landfill. This licensed landfill, Doberty Landfill in Geneva Township is in good operating condition, yet this 100 acres site is nearing capacity. There have been attempts to expand the operations, however public opposition has caused two injunctions against the opening of an expanded site. There is a desire on the part of the Ashtabula County Commissioners to investigate a possible resource recovery plant in Ashtabula County.

In assessing the foregoing figures on solid waste generation, it should be kept in mind that they are based upon population projections and per capita generation rates for residential waste. Moreover, a resource recovery facility needs a minimum of 500 tons per day of solid waste feed stock in order to operate economically.

Since Ashtabula County does not generate this amount of solid waste, a facility of this type would be unfeasable without additional feedstock from adjacent areas or until such time as the County were generating more waste.

V. Preliminary Assessment of Resource Recovery Potential in Cuyahoga, Lake, and Lorain and Ashtabula Counties

As Stanley Associates point out in the report on Resource Recovery From Municipal Solid Waste in Ohio, which they prepared for Ohio EPA, the first step in assessing the potential for implementing a resource recovery project is a preliminary feasibility study. The objective of such a preliminary feasibility study is to determine whether or not the general conditions which are necessary for a viable project are present in a given area. This determination will provide a basis for judging the advisability of proceeding to the next, more costly step, the detailed, site specific feasibility study leading to a "go/no go" discussion on building a facility

According to Stanley Associates, the following general factors should be taken into account in making the preliminary feasibility assessment:

1. Solid waste quantity.
2. Alternative disposal
3. Recovered resource market
4. Institutional factors
5. Resource recovery technology feasibility.

Since it has been demonstrated that the technology for converting MSW into energy is available, one can take it that this factor is positive for all of the three Counties which are being assessed. It remains, then, to see in each case whether the other four factors are positive or negative.

1. Cuyahoga County

Given the fact that a resource recovery project is already being implemented in Cuyahoga County, it goes without saying that the four factors in question are positive. The County generates a sufficient quantity of MSW to feed a 2000 ton per day facility. No alternative means is available for disposing of the County's MSW at a reasonable cost. There is a market for the steam which the facility would produce. Institutional factors are favorable because the County Commissioners have taken the initiative to implement a resource recovery project, most of the municipalities within the County have agreed to participate, and, since these municipalities collect and haul their MSW, the facility will be assured of receiving the feedstock which it needs to operate continuously at its designed capacity.

2. Lake County

Lake County generates and imports from Geauga County enough MSW to feed a 500 ton per day resource recovery facility. However, it does have alternative means of disposing of its MSW at reasonable cost for the next 15 years. Most of the County's MSW is produced in urban concentrations which are located in the northwestern and northcentral portions of the County, but neither of these urbanized areas presently contains the heavy industry which could use the steam which a resource recovery facility would produce. Institutional factors are not favorable because, although there is movement toward organizing a county-wide MSW disposal system, county and local officials are planning to continue to use existing MSW disposal facilities for some time to come. Moreover, since most MSW is collected and hauled by private operators, there is no way of assuring that it would be disposed of in a resource recovery facility.

Taking all four factors into account, a preliminary feasibility assessment for a Lake County resource recovery facility indicates that the potential for implementing a project does not presently exist. The only positive factor is the availability of enough MSW to supply a 500 ton per day facility. All of the remaining factors are negative.

3. Lorain County

Lorain County produces MSW in a quantity sufficient to feed a 500 ton per day facility. The Oberlin landfill is good for another seven years, but, when that period comes to a close, no alternative will be available for disposing of the County's MSW at reasonable cost. Heavy industries -- B.F. Goodrich, U.S. Steel, American Shipbuilding, Ford, -- which could use the steam produced by a resource recovery facility are located in or near the Lorain-Elyria urban area which generate most of the County's MSW. Institutional factors are favorable for implementing a resource recovery project. One industry has already indicated its willingness to purchase all of the steam produced by a 500 ton per day facility. The County Commissioners and officials of the two largest municipalities are in agreement that a resource recovery facility could provide the answer for the County's MSW disposal problem and have expressed their eagerness to explore this possibility. Since the two largest municipalities collect and haul their MSW, their support for such a facility would assure that it would receive the feedstock which it needs for continuous operation.

4. Ashtabula County

Theoretically, the problems of finding future disposal sites for Ashtabula County are countless. The County has only one operating landfill and life expectance is close to seven years.

The County is not in a position to continue its present solid waste management arrangements with the one and only landfill. The County Commissioners and officials of the cities within the county have recognized this fact. They have endorsed the idea of studying the feasibility of construction and operating a resource recovery facility in which most of the County's MSW would be burned.

Since the County does not generate the MSW that is needed, they must explore the idea of transporting MSW from adjacent areas to the County. There is a good transportation system of highways within the County that make this idea feasible. Also there are some interested local industries within that frame work. Since most of the population and MSW is within the coastal zone area. This area has to be a potential site for further study. There is also a combined project with the Ashtabula County Planning Commission and the Eastgate Development and Transportation Agency in determining alternative sites for solid waste disposal.

VI. Need for Site-Specific Assessment of Resource <u>Recovery Potential in Lorain and Ashtabula Counties</u>

1. Identification of the Waste Stream

   o Identify waste (composition and weight) generated and disposed.

   o Identify waste generation fluctuations.

   o Develop waste generation projections.

2. Analysis of Waste Collection Responsibilities and Controls

   o Analyze waste collection practices and regulations and calculate cost for collection and disposal.

3. Market Analysis

   o Identify potential users of energy produced.

- o Identify type of refuse derived fuel needed.
- o Identify market locations.
- o Identify range of price acceptability.
- o Identify, by user, volume of demand for energy products.
- o Project energy supply vs demand according to varied potential solid waste quantities.

4. Review Alternative Technologies Based on Performance in Other Locations.
5. Review Compatibility with Other Waste Disposal or Waste Reduction Programs.
6. Determine Responsibilities (public sector or private sector) for Facility Construction and Operation.
7. Develop Procedure and Criteria for Site Selection.
8. Compare Costs and Benefits of Resource Recovery vs Landfilling Outside Lorain and Ashtabula Counties.
9. Assess Transport Alternatives for Delivery of Solid Waste and Supply of Energy.
10. Assess Environmental Impacts of Implementing Resource Recovery Project.
11. Identify negative environmental impacts.
12. Formulate ways and means of mitigating negative environmental impacts for factoring into facility planning process.

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Task C: Fly Ash Study

Fly Ash Management

I. Introduction

One of the by-products of using coal as a fuel for the generation of electric power is the production of ash. Since more and more coal has been put to this use during recent decades, the amount of ash produced has been on the increase. (See Figure 1.) In 1975, about 60 million tons of ash were produced nation-wide, and it is projected that the figure will reach 75 million tons by 1980. This makes coal ash the seventh most abundant solid mineral in the country. For some years after World War II, it was thought that ash production would decrease substantially with the passage of time. This prognosis was based on the expectation that nuclear fission would replace coal as a primary energy source for generating electricity. During recent years, however, this expectation has changed dramatically. On the one hand, economic, regulatory, and safety problems have slowed down nuclear power development. On the other hand, the need to make the nation less dependent on foreign oil has led to the realization on the part of the Federal Goverhment that more rather than less of America's electricity should be generated from coal. These developments have combined to make it clear that ash production, far from decreasing, is going to increase during coming years.

Approximately 70 percent of the ash produced by coal-fired electric power plants is fly ash.[2] Fly ash is a powdery particulate found in the flue gases in power plant smoke stacks. To the extent that it is not captured before it emerges, this powdery particulate enters the air stream and becomes an air pollutant. Before the implementation of the national "clean air" program, large quantities of fly ash did enter the air stream. No doubt, this was a cheap way of disposing of fly ash, but the price that was ultimately paid was the creation of a substantial air quality problem. When EPA air quality regulations placed severe limitations on the amount of fly ash that could be discharged into the air stream, power plants began to install equipment which captures almost all of the fly ash before it emerges from the smoke stack. The result was that the fly ash problem became less an air quality problem and more a use/disposal problem.

To be sure, as residents of communities adjacent to coal-fired power plants can attest, fly ash is still a significant air quality problem. But, as an air quality problem, the fly ash problem is moving toward a solution. A regulatory program is already in place to eliminate fly

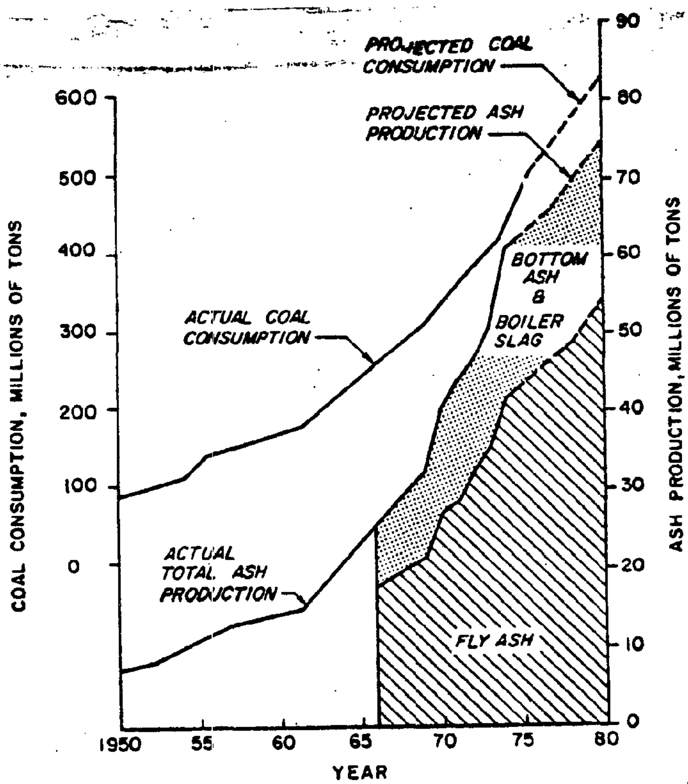


FIGURE 1 COAL CONSUMPTION AND ASH PRODUCTION BY U.S. ELECTRIC UTILITIES

Source: A.M. DiGioia, J.F. Meyers, and J.E. Niece, "Design and Construction of Bituminous Fly Ash Disposal Sites," Engineering Societies Library, American Society of Civil Engineers, p. 268.

ash discharges into the air stream. The technology exists for coal-fired power plants to approach a zero-discharge standard, and this technology is being put to work. Within the not-too-distant future, the air quality aspect of the fly ash problem will be under control.

A good example within the coastal regions of Northeast Ohio of the way in which this is happening is provided by the Cleveland Electric Illuminating Company's (CEI) Eastlake Plant. Local residents are still being subjected to fly ash fall-out, but CEI is in the process of installing electrostatic precipitators, which, when they become fully operative in 1981, will capture 99.8 percent of the fly ash. For the time being, fly ash continues to be an air quality problem in Eastlake and surrounding communities and one that, because of the cost involved and the need to maintain power generation while the work of installing the electrostatic precipitators goes on, cannot be solved overnight. But it is on the way to a solution which will be completed in little more than one year's time.

At the same time, however, as is usually the case in matters environmental, the solution of one problem causes another problem to become worse. As less fly ash escapes into the air from smoke stacks, more fly ash remains behind, to be disposed of in ways other than discharging it from the smoke stack. Thus, the fly ash use/disposal problem has become more difficult to solve as the air quality problem has come closer to a solution.

There are two very good reasons, therefore, why fly as management concerns should focus on this use/disposal problem. More fly ash is going to be produced as more coal is burned to produce electrical energy, and more of the fly ash produced will become a residual from air quality control processes. But these are not the only reasons. So far as fly ash use/disposal is concerned, the regulatory and technical picture is very different from the situation with respect to fly ash as an air quality problem. There is no effective program to regulate fly ash use/disposal, and ways and means of using and disposing of fly ash have to change substantially if this is to be done in a manner which does not cause environmental damage.

For all these reasons, this study of fly ash management in the coastal regions of Lorain, Cuyahoga, Lake, and Ashtabula Counties will focus attention on fly ash as a use/disposal problem. It will begin with an assessment of the magnitude of the problem in quantitative terms. This will be followed by a description of the current technical and management situation with respect to fly ash use disposal. Then, the technical and management potential for improving the current situation will be identified and evaluated. Finally, proposals will be made for a continuing study of fly ash use/disposal with a view to formulation of an effective fly ash management plan for the coastal region of Northeast Ohio.

II. Fly Ash Production, Use and Disposal

For reasons which will become clearer when reading the section of this Report which deals with management problems, it is difficult to obtain complete and accurate statistical information on the production, use and disposal of fly ash from the coal-fired power plants which produce over 95% of the Northeast Ohio coastal region's fly ash. The only data which operators of most of the power plants are ready to supply are figures for total coal ash, which includes both fly ash and bottom ash. Fly ash haulers are also reluctant to supply information regarding the amount of fly ash which they transport or the location and characteristics of disposal sites. Nor are there any regulations mandating that this information be reported to public agencies or made available to the general public. Consequently, producers and haulers of fly ash are free to share as little or as much information as they choose, with the result that only a limited amount of information becomes available.

The information which it was possible to obtain from producers and disposers of coal ash located within the coastal regions of Northeast Ohio is displayed in Table I. This information, limited as it is, is sufficient to provide a rough picture of the current coal ash situation. It can be summarized as follows: As of 1978 coal ash production totaled 1,026,846 tons/year. Of this amount, approximately 121,829 tons/year, 11.9%, was used. (This compares with a national average figure for coal ash use of 15-16%.) Almost all of the coal ash used went for snow and ice control on roadways. The remainder of approximately 905,017 tons/year, 88.1%, was disposed of in land fills. Landfills disposal sites were situated in or near the communities in which the power plants were located. The farthest distance was 17 miles, and the average distance was just over 10 miles.

From this rough picture of the current coal ash situation in Northeast Ohio's coastal region, supplemented by information obtained from other sources, one can construct a rough picture of the fly ash situation. Since, on the average, approximately 70% of coal ash is fly ash, one can estimate the coastal region's 1978 fly ash production at 718,792 tons. This estimate can be refined slightly by

TABLE I

COAL ASH INVENTORY FOR THE NORTHEAST OHIO COASTAL ZONE
ASHTABULA COUNTY (1978)

Producer of Coal Ash	Coal Utilization (Tons/Year)	% Ash	Ash Production (Tons/Year)	% Utilization	Method of Utilization	% Land Fill	Disposal Costs $/Ton)	Distance to Disposal Site (Miles)
Cleveland Electric Illuminating Co.	1,143,208	10.3	118,225	7	Snow and Ice Control on Roadways	93.0	-	10
G & W Natural Resources - Titanium	20,000	10.0	2,000	0	-	100.0	2	-
				CUYAHOGA COUNTY				
Cleveland Electric Illuminating Co.	666,583	13.0	86,656	39	Snow and Ice Control on Roadways	61.0	-	9 10 13
NASA	17,600	7.0	1,232	-	-	-	-	-
Republic Steel	77,396	12.6	9,752	0	-	100.0	5	-
Medical Center Co.	23,000	7.8	1,794	0	-	100.0	10	-
Ford Motor Engine Div.	80,026	9.6	7,682	*	Snow and Ice Control	*	0	-
Chase Bag Co.	8,000	9.5	700	0	On Roadways	100.0	-	-
Aluminum Co. of America	32,760	11.2	3,639	0	-	100.0	-	-
Addressograph Multigraph	11,864	7.1	842	0	-	100.0	4	-
Lincoln Elec.	7,790	8.0	623	0	-	100.0	5	-
Lear Siegler Inc.	500	8.4	42	0	-	100.0	-	-
Cheverolet Motor Div.	38,753	10.5	4,069	*	Snow and Ice Control on Roadways	*	-	-

TABLE 1 (cont.)

CUYAHOGA COUNTY (cont.)

Producer of Coal Ash	Coal Utilization (Tons/Year)	% Ash	Ash Production (Tons/Year)	% Utilization	Method of Utilization	% Land Fill	Disposal Costs ($/Ton)	Distance to Disposal Site (Miles)
Ford Motor Stamping Plant	13,437	6.4	860	*	Snow and Ice Control On Roadways	*	$ -	-
LAKE COUNTY								
Uniroyal Chemical Division of Uniroyal Inc.	20,000	10.0	2,000	0	-	100.0	$ 2.5	-
Lincoln Electric Co.	1,505	8.9	134	*	Snow and Ice Control on Roadways	*	$ 5.0	-
Painesville Muni. Electric Plant	71,820	11.6	8,300	0	-	100.0	$ 2.0	1
Cleveland Electric Illuminating Co.	2,680,464	13.6	365,738	20.0	Snow and Ice Control on Roadways	80.0	-	2 16 17
Ohio Rubber Co.	16,223	11.6	1,882	0	-	100.0	-	-
LORAIN COUNTY								
Cleveland Electric Illuminating Co.	2,215,021	15.3	339,760	0	-	100.0	-	10 17
Fisher Body, Div. GMC	16,584 16,584	10.0 10.0	1,658 1,658	* *	Snow and Ice Control on Roadways	*	$ 1.40	-
Ohio Edison, Edgewater Plant	405,074	16.3	66,093	10.0	-	90.0	4.00	7
Ford Motor Co.	20,100	7.5	1,507	-	-	-	-	-

*Percentage utilized as snow and ice control on roads not identified.

Sources: (1) Ohio EPA Emissions Inventory System Point Source Report, 1978.
(2) Correspondence between NOACA staff and producers of Coal Ash.

virture of the fact that Ohio Edison has reported that its Edgewater Plant produced 42,130 tons of fly ash, rather than the 46,265 tons which is the figure arrived at by taking 70% of its total ash production of 66,093 tons.[2a] With this refinement, the estimate of total fly ash production becomes 714,657 tons.

Only bottom ash can be used for snow and ice control on roadways; consequently, almost all of the coal ash used was bottom ash. The only coal ash producer which did not indicate that its coal ash was used for snow and ice control on roadways was the Ohio Edison Edgewater Plant. This was because the plant sold approximately 6800 tons of fly ash for use in producing construction and chemical materials.[2a] 6800 tons becomes, then, the total figure for fly ash use. This figure amounts to less than 1% of total fly ash production. The remaining 99% plus was disposed of in landfills.

Breaking down fly ash production by counties produces the following statistical picture in terms of tons/year:

Ashtabula County

Cleveland Electric Illuminating Company	82,758
G & W Natural Resources - Titanium	1,400
	84,158 -
	11.8% of total

Cuyahoga County

Cleveland Electric Illuminating Company	60,660
NASA	862
Republic Steel	6,826
Medical Center Company	1,256
Ford Motor Engine Division	5,377
Chase Bag Company	490
Aluminum Company of America	2,547
Addressograph-Multigraph	589
Lincoln Electric Company	436
Lear-Siegler, Inc.	29
Chevrolet Motor Division	2,848
Ford Motor Stamping Plant	602
	82,522 -
	11.5% of total

Lake County

Uniroyal Chemical	1,400
Lincoln Electric Company	94
Painesville Municipal Electric Plant	5,810
Cleveland Electric Illuminating Company	256,017
Ohio Rubber Company 1,317	1,317
	264,638 -

37% of total

Lorain County

Cleveland Electric Illuminating Company	237,832
Fisher Body Division	1,161
General Motors Company	1,161
Ohio Edison Edgewater Plant	42,130
Ford Motor Company	1,055
	283,339 -

39.6% of total

The above figures show that a disproportionately large amount of fly ash is produced in Lake and Lorain Counties, 37.0 percent and 39.6 percent of the total, respectively, while Cuyahoga and Ashtabula Counties account for only 11.5% and 11.8% of the total, respectively.

The only County which produces fly ash which is used is Lorain County, where 6,800 tons of the total County production of 283,339 tons, 2.4 percent, is sold for use. The remainder of Lorain County's production and all of the production of the other Counties is disposed of by landfilling or other means.

An analysis of the fly ash production picture according to producers reveals that 685,207 tons/year, 95.9 percent, are accounted for by power plants which supply electricity for public consumption. These power plants and their fly ash production and disposal characteristics are shown in Table II:

This breakdown of public power plants by capacity and location makes it obvious that the basic reason for the relative concentration of fly ash production in Lake and Lorain Counties is that the largest Northeast Ohio coastal power plants are located there. A secondary reason is that the fly ash production of these largest plants is supplemented by the production of smaller power plants which are located in the same County. Ashtabula and Cuyahoga Counties have only one public power plant each, and each plant's capacity is in the 500 MW range. A final reason for the relatively low fly ash production in Cuyahoga County is that only one unit of CEI's Cleveland

TABLE II

Company	Location	Capacity	Fly Ash Produced (Tons/Yr.)	Fly Ash Disposed (Tons/Yr.)	Fly Ash Used (Tons/Yr.)
Cleveland Elec. Illuminating Company	Ashtabula County (Ashtabula)	456 MW	82,758	82,758	0
Cleveland Elec. Illuminating Company	Cuyahoga Co. (Cleveland)	514 MW	60,660 (including fly ash produced by CEI steam plant)	60,660	0
Cleveland Illuminating Company	Lorain Co. (Avon Lake)	1275 MW	237,832	237,832	0
Cleveland Elec. Illuminating Company	Lake Co. (Eastlake)	1202 MW	256,017	256,017	0
Ohio Edison	Lorain Co. (Lorain)	1749 MW	42,130	35,330	6,800
Painesville Municipal	Lake Co. (Painesville	63 MW	5,810	5,810	0
TOTAL			685,207	678,407	6,800

plant is coal-fired.

The fact that public power plants account for approximately 96 percent of fly ash production has important implications for the future of the fly ash problem in Northeast Ohio's coastal region. Whether that problem becomes more or less serious will be determined almost exclusively by the increase or decrease which takes place in the number and/or capacity of coal-fired public power plant units. Present indications are that the number and/or capacity of coal fired public power plant units are likely to increase rather than decrease during the coming decade. Recent regulatory actions taken by USEPA and Ohio EPA encourage the use of coal as fuel for public power plants because they ease the air quality standards which have stood in the way of burning low cost Ohio coal. In addition, the cost of fuel oil, which presently fires all but one of the units of CEI's Cleveland plant, is rising rapidly, and the U.S. Department of Energy is pressuring power companies to use coal rather than fuel oil. Finally, the likelihood that more coal will be used as an energy source for generating electricity is enhanced by the serious questions that have been raised regarding the future of nuclear power plants.

The prognosis that the number and/or capacity of coal-fired public power plant units are likely to increase is supported by the Ohio Department of Energy's "Ohio Energy Status Report" for 1979, which projects an 18% increase in coal-fired electricity generating capacity during the next decade. No doubt, the use of improved boiler technology in additional coal-fired power units that will be built during this period will mean that the increase in the amount of coal burned will be less than the increase in generating capacity, but coal consumption can still be expected to rise by 10-15%. Since the amount of fly ash produced is proportional to the amount of coal burned, this will result in an increase of 10-15% in fly ash generation. Based on the 1978 figure of 714,657 tons, the additional annual quantity of fly ash that will have to be used or disposed of can be reasonably estimated in the range of 70-105,000 tons.

The future increase in fly ash production due to the expansion of coal-fired electricity generating capacity will be supplemented by the increase resulting from the use of the more efficient electrostatic precipitators which will be installed within the next few years. While it is not possible to make a precise estimate of what that supplementary increase will be, it is clear that it will amount to a significant figure. CEI has stated that the electrostatic precipitators which are going on line in its

Eastlake Plant will capture 800 to 1000 tons of fly ash which now enters the air stream each year. Based on this figure for one plant, one can safely predict that, when all of the coal-fired plants in Northeast Ohio's coastal region are using electrostatic precipitators with an efficiency rating of 99.8%, the result will be cleaner air but several thousand tons per year of additional fly ash.

III. Technical Characteristics and Problems

The burning of coal produces a residue which is derived from non-burnable inorganic mineral constitutents in the coal and the organic material not completely burned. In coal burning utility boilers the ash residue collected from the bottom of the boiler unit is called bottom ash. The ash collected from the air pollution equipment through which the stack gases pass is called fly ash. Since a study of the specific technical characteristics of Northeast Ohio fly ash must await the carrying out of an in-depth fly ash management planning project, the chemical and physical properties of fly ash will be discussed in general terms.

The coal ash residues recovered from the boiler units are primarily iron aluminum silicates, with additional amounts of lime, magnesium, sulfur trioxide, sodium oxide, potassium oxide and carbon. Table III shows typical chemical constituents of coal ash. The specific chemical composition of a coal ash is primarily dictated by the geography of the coal deposit and the operating parameters of the boiler units. About 8-14 percent of the coal burned in Northeast Ohio's coastal region is recovered as coal ash residue.

Advancing boiler design technology and the establishment of stricter air pollution standards for boiler facilities can alter the nature of the coal ash produced in future years. Also, the various proposed desulfurization processes, coal fractionation processes, and new designs for electric generating facilities can result in coal ash and slag products considerably different from those currently being produced. Table IV shows changes in fly ash composition resulting from various processes for controlling SO emissions.

One expected type of modified fly ash is that resulting from the injection of limestone or dolomite into boilers to fix gaseous sulfur oxides as solid calcium and magnesium sulfates. Both dry and wet collection processes are being developed. The wide spread use of these processes would result in a significant increase in the expected

TABLE III

CHEMICAL CONSTITUENTS OF COAL ASH

Constituents	Range (%)	Average (%)
Silica (SiO_2)	20 - 60	48
Alumina (Al_2O_3)	10 - 35	26
Ferric Oxide (Fe_2O_3)	5 - 35	15
Calcium Oxide (CaO)	1 - 20	5
Magnesium Oxide (MgO)	0.25 - 4	2
Titanium Dioxide (TiO_2)	0.5 - 2.5	1
Potassium Oxide* (K_2O)	1.0 - 4.0	2
Sodium Oxide* (Na_2O)	0.4 - 1.5	1
Sulfur Trioxide (SO_3)	0.1 - 12	2
Carbon (C)	0.1 - 20	4
Boron (B)	0.01 - 0.6	trace
Phosphorus (P)	0.01 - 0.3	"
Manganese (Mn)	0.01 - 0.3	"
Molybdenum (Mo)	0.01 - 0.1	"
Zinc (Zn)	0.01 - 0.2	"
Copper (Cu)	0.01 - 0.1	"
Mercury (Hg)	0.0 - 0.02	"
Uranium (U) and Thorium (Th)	0.0 - 0.1	"

*Alkalies

Source: N.L. Hecht and D.S. Duvall, "Characterization and Utilization of Municipal and Utility Sludges and Ashes." USEPA, Cincinnati, Ohio, May, 1975.

TABLE IV

CHANGES IN FLY ASH COMPOSITION RESULTING FROM OPERATION OF SO_2 EMISSION CONTROL SYSTEMS (22)

PROCESS	REACTANT	FLY ASH REMOVAL MECHANISM	FLY ASH CHARACTERISTICS
I. Fly ash Characteristics Unchanged			
A. Catalytic Oxidation			
1. Kiyoura	Vanadium, pentoxide catalyst, ammonia	Dry hot electrostatic precipitators(ESP)	Dry fly ash - characteristics unchanged
2. Monsanto	Vanadium, pentoxide catalyst	Dry hot electrostatic precipitators (ESP)	Dry fly ash - characteristics unchanged
B. Dry SO_2 Absorption			
1. Atomics International	Molten carbonate	Dry ESP (hot or standard)	Dry fly ash - characteristics unchanged
2. Hitachi	Activated carbon	Dry ESP (hot or standard)	Dry fly ash - characteristics unchanged
3. Reinluft	Activated charcoal	Dry ESP (hot or standard)	Dry fly ash - characteristics unchanged
4. Alkalized Alumina U.S. Bureau of Mines	Alkalized alumina	Dry ESP (hot or standard)	Dry fly ash - characteristics unchanged
5. Esso-Babcock & Wilcox	Proprietary	Dry ESP (hot or standard)	Dry fly ash - characteristics unchanged
6. Lignite Ash	Lignite ash, calcium hydroxide	Dry ESP (hot or standard)	Dry fly ash - characteristics unchanged
7. DAP-Mn (Mitsubishi)	Manganese dioxide	Dry ESP (hot or standard)	Dry fly ash - characteristics unchanged
C. Wet SO_2 Absorption			
1. Sulfacid (Lurgi)	Sulfuric acid	Dry ESP (hot or standard)	Dry fly ash - characteristics unchanged

Table prepared by Tennessee Valley Authority

Source: N.L. Hecht & D.S. Duvall," Characterization & Utilization of Municipal and Utility Sludges and Ashes," USEPA, Cincinnati, Ohio, May 1975.

TABLE IV (continued)

CHANGES IN FLY ASH COMPOSITION RESULTING FROM OPERATION OF SO_2 EMISSION CONTROL SYSTEMS (22)

PROCESS	REACTANT	FLYASH REMOVAL MECHANISM	FLY ASH CHARACTERISTICS
II. Minor Changes to Fly ash Characteristics			
A. Dry SO_2 Absorption			
1. Grillo	Manganese dioxide, manganese hydroxide	Fly ash collects in reactant bed and is separated by decantation during regeneration of the reactant	Dry fly ash plus small quantities reactant and products
B. Wet SO_2 Absorption			
1. Showa Denka	Ammonia	Alternatives:	
		1. Dry mechanical, ESP, or combination of mechanical plus ESP preceding scrubber	Dry fly ash - characteristics unchanged
		2. Wet scrubber	Wet fly ash only (possibly small quantities of reactants and products also present)
2. Potassium Formate (Consolidation Coal Co.)	Potassium formate	Alternatives:	
		1. Dry mechanical, ESP, or combination of mechanical plus ESP preceding scrubber	Dry fly ash - characteristics unchanged
		2. Wet scrubber	Wet fly ash only (possibly small quantities of reactants and products also present)
3. Ionics Inc., Stone & Webster Inc. (Alkaline Scrubbing)	Sodium hydroxide	Alternatives:	
		1. Dry mechanical, ESP, or combination of mechanical plus ESP proceding scrubber	Dry fly ash - characteristics unchanged

TABLE IV (continued)

CHANGES IN FLY ASH COMPOSITION RESULTING FROM OPERATION OF SO_2 EMISSION CONTROL SYSTEMS (22)

PROCESS	REACTANTS	FLY ASH REMOVAL MECHANISM	FLY ASH CHARACTERISTICS
		2. Wet Scrubber	Wet fly ash only (possibly small quantities of reactants and products also present)
4. Sodium or Potassium Sulfite Scrubbing (Wellman-Lord)	Sodium sulfite or potassium sulfite	Alternatives:	
		1. Dry mechanical, ESP, or combination of mechanical plus ESP preceding scrubber	Dry fly ash - characteristics unchanged
		2. Wet scrubber	Wet fly ash only (possibly small quantities of reactants and products also present)
III. Fly ash Contains Significant Reactants or Solid Diluents			
A. Dry SO_2 Absorption			
1. Dry Limestone Injection	Calcium carbonate or magnesium carbonate	Dry mechanical, ESP, or combination of mechanical plus ESP	Dry fly ash plus reactants (unreacted and deadburned limestone) and products[3]
2. Foster-Wheeler (Chemical Dihydrate Injection)	Calcium hydroxide	Dry mechanical, ESP, or combination of mechanical plus ESP	Dry fly ash plus reactants (unreacted and deadburned limestone) and products[3]
B. Wet SO_2 Absorption			
1. Chemico-Basic	Magnesium oxide	Wet scrubber	Wet fly ash reactants and products

TABLE IV (continued)

CHANGES IN FLY ASH COMPOSITION RESULTING FROM OPERATION OF SO_2 EMISSION CONTROL SYSTEMS (22)

PROCESS	REACTANT	FLY ASH REMOVAL MECHANISM	FLY ASH CHARACTERISTICS
2. Lime/Limestone Wet Scrubber			
a. Limestone injection into furnace			
(1) Limestone (or dolomite) scrubbing (Combustion Engineering)	Calcium carbonate or magnesium carbonate	Wet Scrubber	Wet fly ash plus reactants (unreacted and deadburned limestone or dolomite and products[2,4]
b. Limestone (or dolomite) to scrubber circuit			
(1) Limestone (or dolomite) scrubbing (TVA)	Calcium carbonate or magnesium carbonate	Alternatives:	
		1. Dry mechanical, ESP, or combination of mechanical plus ESP preceding scrubber	Dry fly ash - characteristics unchanged (possibly small quantities of reactants present as a result of boiler injections to control boiler corrosion or improve ESP efficiency)
		2. Wet Scrubber	Alternatives:
			1. If first stage scrubber is used for fly ash scrubbing only and is discharged to a segregated pond: Wet fly ash only[1,5].

TABLE IV (concluded)

CHANGES IN FLY ASH COMPOSITION RESULTING FROM OPERATION OF SO_2 EMISSION CONTROL SYSTEMS (22)

PROCESS	REACTANT	FLY ASH MECHANISM	FLY ASH CHARACTERISTICS
			2. If first stage scrubber or pond is used for combined fly ash and SO_2 removal: Wet fly ash plus reactants[2] and unreacted limestone[4,5]

NOTE:

1. Wet scrubbing often subjects the fly ash to very acidic scrubbing liquors which could leach out some of its alkaline components (e.g. Ca, Mg, Na, K).

2. Limestone wet scrubber reactants can possibly include: CaO, $Ca(OH)_2$, $CaSO_3$, $CaSO_4$, MgO, $Mg(OH)_2$, $MgSO_3$, $MgSO_4$ plus small quantities of other compounds and impurities.

3. Dry limestone injection reactants can possibly include: Same as for NOTE 2 except for less sulfites. Also, if the ash is removed dry (e.g., not sluiced to a settling pond), $Ca(OH)_2$ and $Mg(OH)_2$ will not be present.

4. Fly ash and solid diluents will exist in about equal quantities; exact ratio dependent on sulfur and ash content of coal, stoichiometric addition of limestone, etc.

5. Possibly small quantities of reactants and products also present as a result of additives to control pH and to promote the dissolution or otherwise increase the effectiveness of the reactant.

quantities of coal ash. The use of dolomite or limestone injection processes can increase the ash generated by a power plant by a minimum of 50 percent. In more recent designs, electrostatic precipitators are used before the scrubbing unit. This results in the generation of two separate waste products: fly ash and calcium sulfate.

Table V shows ash compositions generated by the combustion of bituminous coal and lignite coal as compared with the ash obtained in the limestone and dolomite injection process. The impact of limestone and dolomite processes are difficult to assess since these processes are currently being utilized primarily in pilot studies, and conclusive information is not yet available. However, with technological improvements and the lower costs of these technique when compared with other sulfur control processes, it is possible to assume that large quantities of modified ash will be produced in the future. The chemistry of this modified ash is considerably different from bituminous ash and may not be useable in many of the same applications. Disposal of this modified ash may also create new problems because of the increased arsenic and mercury content reported in the sulfate sludge caused by the scrubbing action.

Table VI shows the solubility of the different chemical elements found in coal ash. The primary water soluble elements are calcium, magnesium, and sulfur.

Coal ash is collected in two forms: fly ash and bottom ash. Both fly ash and bottom ash have basically the same chemical composition, except that the bottom ash is lower in carbon content. Figure 2 illustrates the variations in chemical composition of fly ash produced in the U.S. It shows graphically that the principal constituents of fly ash are silica (SiO_2), alumina (Al_2O_3) and iron oxide (Fe_2O_3), with smaller amounts of calcium, magenesium, sulfur, and unburned carbon also present. The constituents most likely to affect the physical properties of the fly ash are free lime and unburned carbon. Free lime influences the hardening qualities of the fly ash, while unburned carbon affects the compaction and strength characteristics. The primary water soluble concentrations exceed those found in the earth's crust.

Fly ash generally occurs as fine sperical particles, while bottom ashes are quite angular and have a porous surface texture. Table VII show typical physical properties of fly ash from pulverized coal-fired plants. Table VIII and IX show typical fly ash and bottom ash sieve analyses. About 20 volume percent of fly ash is composed of very

TABLE V

COMPARISON OF ASH COMPOSITIONS*

Constituent	Bituminous Ash	Lime Modified Ash	Dolomite Modified Ash	Lignite Ash
SiO_2	49.10	30.85	30.81	32.60
Al_2O_3	16.25	13.70	12.54	10.70
Fe_2O_3	22.31	11.59	10.72	10.0
TiO_2	1.09	0.68	0.42	0.56
CaO	4.48	33.58	17.90	18.00
MgO	1.00	1.49	14.77	7.31
Na_2O	0.05	1.12	0.72	0.87
K_2O	1.42	0.71	0.99	0.68
SO_3	0.73	2.20	8.09	2.60
C	2.21	1.12	1.76	0.11
H_2O soluble	2.51	22.11	----	8.55

*Percent of Composition.

Source: N.L. Hecht and D.S. Cuvall, "Characterization and Utilization of Municipal and Utility Sludges and Ashes." USEPA, Cincinnati, Ohio, May, 1975.

TABLE VI

COAL ASH SOLUBILITY IN DISTILLED WATER

Soluble Elements	Range (for 1-1.7% dry solids)
Calcium	200-850 ppm
Magnesium	185-400 ppm
Sulfur	200-250 ppm
Potassium	Trace
Sodium	Trace
Phosphorous	0-5 ppm
Boron	0-10 ppm

Source: N.L. Hecht and D.S. Duvall, "Characterization and Utilization of Municipal and Utility Sludges and Ashes." USEPA, Cincinnati, Ohio, May, 1975.

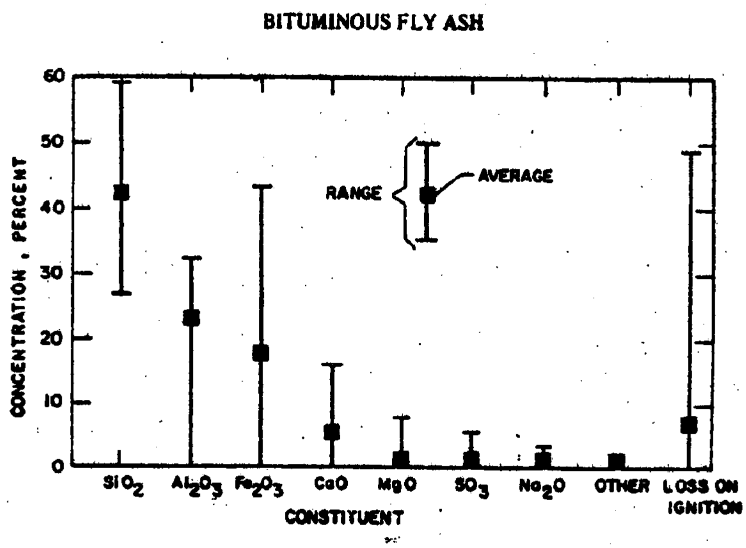


FIGURE 2. VARIATION IN CHEMICAL CONSTITUENTS OF BITUMINOUS FLY ASH

Source: A.M. DiGioia, J.F. Meyers, and J.E. Niece, "Design & Construction of Bituminous Fly Ash Disposal Sites," Engineering Societies Libraries, American Society of Civil Engineers, p. 281.

TABLE VII

TYPICAL PHYSICAL PROPERTIES OF FLY ASH FROM PULVERIZED COAL FIRED PLANTS

Constituent		Range
Range of particle size	microns	0.5-100
Average percent passing No. 325 sieve (44u)	percent	60-90
Bulk density (compacted)	lb/cu. feet	70-80
Specific gravity		2.1-2.6
Specific area/gram	cm^2/g	3,300-6,400

Source: N.L. Hecht and D.S. Duvall, "Characterization and Utilization of Municipal and Utility Sludges and Ashes." USEPA Cincinnati, Ohio, May, 1975.

TABLE VIII

TYPICAL FLY ASH SIEVE ANALYSIS

Mesh	Percent
60	1-2
60 to 100	2-5
100 to 150	2-4
150 to 200	4-8
200	81-91

Source: N.L. Hecht and D.S. Duvall, "Characterization and Utilization of Municipal and Utility Sludges and Ashes." USEPA, Cincinnati, Ohio, May, 1975

TABLE IX

TYPICAL BOTTOM ASH SIEVE NALYSIS

Mesh	Percent
10	12-60
10 to 16	10-30
16 to 20	8-26
20 to 48	8-25
48 to 100	1-5
100	1-5

Source: N.L. Hecht and D.S. Duvall,"Characterization and Utilization of Municipal and Utility Sludges and Ashes." USEPA, Cincinnati, Ohio, May, 1975.

light weight particles which float on water surfaces. These lightweight particles have a density of about 0.5 g/cc and are termed cenospheres. These cenospheres are carbon dioxide and nitrogen filled miscrospheres of silicate glass.

Fly ash is characterized by low specific gravity and uniform gradation.[3] The specific gravity of fly ash particles varies with chemical composition. The results of 46 tests conducted on a bituminous fly ash from Western Pennsylvania indicate that the specific gravity will generally vary from about 2.3 to 2.6, with an average of about 2.4. In contrast, the specific gravity of most soils ranges from about 2.6 to 2.8.

The range of grain-size distributions for fly ash is shown in Figure 3, which also indicates the relatively uniform grain-size distribution of fly ash as compared to several types of soil. Because of its sperical shape, small surface area, and uniform silt size of individual particles, fly ash has no plasticity.

Tests show that the compaction characteristics of fly ash are generally similar to those obtained for cohesive soils.[4] The shear strength of fly ash depends upon the degree of compaction. In addition, it has been shown that fly ash possesses significant cohesive strength due to capillary stresses in the pore water, and that the shear strength of fly ash can change significantly with time due to age hardening or pozzolanic behavior. Age hardening has been best correlated to the amount of free lime present in fly ash.

Fly ash behaves very much like a cohesive soil with respect to consolidation. Laboratory consolidation tests have indicated that compaction can significantly reduce the compressibility of fly ash.

The coefficient of permeability for fly asy depends upon its degree of compaction and the pozzolanic activity. The coefficient of permeability for fresh Western Pennsylvania fly ash has been found to range from 1×10^{-4} to 5×10^{-4} centimeters per second.

The chemical and physical characteristics of fly ash are such that a number of problems have to be overcome in order to use it or dispose of it in an environmentally acceptable manner.

Specifically:

1. Its chemical and physical characteristics vary with the particular coal and boiler design used in a power plant.

FIGURE 3

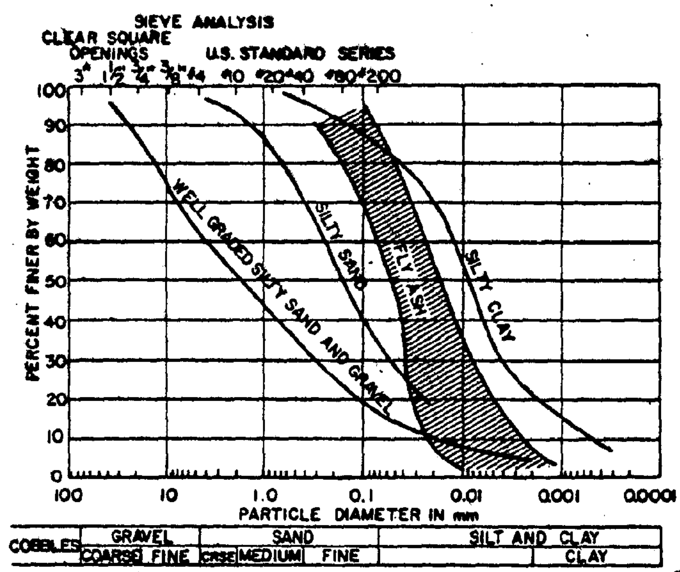


FIGURE 3 GRAIN SIZE DISTRIBUTIONS FOR BITUMINOUS FLY ASH

Source: A.M. DiGioia, J.F. Meyers, and J.E. Niece, "Design and Construction of Bituminous Fly Ash Disposal Sites," Engineering Societies Libraries, American Society of Civil Engineers, p. 283.

2. Its chemical characteristics are changed by injecting chemical compounds into the flue gas stream in order to increase the efficiency of air pollution control equipment.

3. It contains chemical compounds which are soluble in water and, consequently, can leach into surface and ground water.

4. It contains trace metal concentrations which can contaminate surface and ground water supplies.

5. It has a high degree of permeability to water unless well compacted for a considerable period of time.

6. Its fine particles and low-specific gravity make it susceptible to being carried by the wind and on water surfaces.

7. The spherical and uniform, nature of its particles, coupled with their lack of plasticity, give it a low shear strength unless well compacted for a considerable period of time.

Added to these technical problems associated with the chemical and physical characteristics of fly ash are the technical problems which grow out of the engineering means which are used to create, capture, and store fly ash. Fly ash has been viewed traditionally as a worthless by-product of coal-fired power plants. To be sure, boilers are designed and operated to minimize the amount of fly ash produced because this means that more coal is being converted into useable energy. But design and operation considerations do not include the degree to which the fly ash produced can be used or disposed of in an environmentally acceptable manner.

If it is cheaper to store fly ash from several units in a single silo, even though the fly ash produced in the different units varies in the degree to which it can be used and the degree to which its disposal creates environmental problems, the fly ash from all units is stored in one silo and becomes homogenized in the process. The result is that the degree of utility and environmental acceptability of all the fly ash is reduced to the level of the least useable and the most environmentally damaging fly ash which goes into the silo. If it is cheaper to inject chemical compounds into the flue gas stream in order to make inefficient air pollution control equipment operate more efficiently than it is to install efficient air pollution control equipment, even though the injection process makes the fly ash less useable and more damaging environmentally, the chemical compounds are injected. If it is cheaper to burn a coal which makes it easier to meet air quality standards, even though the fly ash which the coal produces cannot be used, that coal will be burned.

Putting the matter in general terms, engineering decisions made in designing and operating coal-fired power plants are made without taking the complete fuel cycle into account. Instead of including the production of fly ash which can be used or disposed of in an environmentally acceptable manner as the final stage in the fuel cycle of an efficiently designed and operated coal-fired power plant, prevailing engineering thinking and action stops short of giving serious consideration to this criterion. The consequences of this limited engineering perspective is that the quality of the fly ash produced is whatever happens to result from designing and operating decisions made without regard to the impact which they have on fly ash quality.

IV. Management Situation and Problems

In contrast to the British and European tradition of using the bulk of fly ash produced by their coal-fired power plants, the American tradition has been to dispose of most fly ash by landfilling. Table X shows the American coal ash utilization picture from 1966 to 1972. Fly ash utilization increased from 7.9 percent to 11.4 percent during this period. More recent data indicate that current utilization of coal ash remains near the 16 percent level. One can infer from this figure that, while the utilization of fly ash may have continued to increase between 1972 and 1978, it has not gone substantially above the 11.4 percent recorded for 1972.

1978 utilization figures for Northeast Ohio's coastal region are below the national figure for coal ash and substantially below the national figure for fly ash. This means that the overwhelming bulk of Northeast Ohio coastal region fly ash is being disposed of by landfilling.

Until very recently, fly ash disposal sites and methods were almost exclusively the product of economic considerations.[4a] Fly ash was disposed of in the cheapest possible manner, and this practice was defended by the electric power companies on the ground that their job was to deliver electric power to the general public at the lowest possible price. Since the cost of fly ash disposal was one of their operating costs which had to be covered by the price which they received for their electricity, electric power company officials sought to keep this cost as low as possible. This least-cost approach to fly ash disposal made sense from an economic point of view, but it was subject to serious objection from the environmental and equity point of view. By limiting the cost calculation for producing electric power to economic costs, the least-cost approach did not take environmental costs into account. But these environmental costs had to be paid. Least-cost disposal produced environmental damange, at both the human and natural levels. Moreover, while the general public benefitted from lower electricity rates, the residents of communities through which the fly ash was trucked and in which fly ash was land-filled had to pay whatever environmental price was involved in carrying out least-cost disposal practices.

Northeast Ohio coastal region disposal sites were selected mainly on the basis of their proximity to the power plant, since, the shorter the distance the fly ash had to be trucked, the lower would be the transport cost. A

TABLE X

COMPARATIVE ASH UTILIZATION
1966 THROUGH 1972

Produced (tons)	1966	1967	1968	1969	1970	1971	1972
Fly Ash	17,123,144	18,409,854	19,813,747	22,304,513	26,538,019	27,751,054	31,808,065
Bottom Ash	8,065,683	9,131,453	7,259,212	8,042,017	9,890,951	10,058,967	10,672,860
Boiler Slag	----------	----------	2,554,569	3,020,282	2,801,475	4,970,786	3,781,660
TOTAL	25,188,827	27,541,307	29,627,528	33,366,812	39,230,445	42,780,807	46,262,585
Total Utilized	3,050,669	3,794,714	5,194,016	5,306,764	5,095,659	8,603,720	7,575,503
Percent	12.11%	13.78%	17.53%	15.90%	13%	20%	16.3%
Fly Ash	7.9%	8.2%	9.6%	9.6%	8.13%	11.7%	11.4%
Bottom Ash	21.0%	25.0%	25.0%	25.0%	18.63%	16.03%	24.3%
Boiler Slag	--------	--------	57.8%	57.8%	39.06%	75.21%	35.3%

Source: N.L. Hecht and D.S. Duvall, "Characteristics and Utilization of Municipal and Utility Sludges and Ashes," USEPA, Cincinnati, Ohio, May, 1975.

secondary consideration was the disposal site's potential for being converted to developable land by land-filling it with fly ash. Thus, low-lying and water-logged sites became attractive because their use-value could be greatly increased by landfilling operations. Since the power plants were located along the lakeshore, proximity and land-value considerations combined to locate most of the disposal sites in the coastal region's wetlands and flood plains. In the case of the Painesville Municipal Power Plant, according to a suit filed by the Ohio Attorney General, fly ash is dumped straight into the Grand River.

Landfilling the coastal wetlands and flood plains produces two major forms of environmental damage. Rainwater and flood water draining through fly ash fill causes certain of the chemicals contained in the fly ash, including trace metals, to leach into and contaminate surrounding surface and ground waters. When fly ash is dumped into a stream, the damage to water quality is increased manyfold. Filling areas which formerly acted as retention basins to cushion the impact of increased stormwater results in increases in the peak flow rates in rivers and streams which drain into Lake Erie, thereby exacerbating drainage and flooding problems.

The least-cost approach to fly ash disposal also produces air quality problems. Fly ash haulers, in response to the electric power company's policy of minimizing disposal costs, seek to minimize their costs. Instead of taking care to cover their trucks, they haul fly ash in open dump truck, with the result that fly ash spills along the public roads through which they truck. Instead of paving access roads to fly ash disposal sites, they use unimproved dirt tracks, resulting in more fly ash spillage, as well as dust from pulverized soil. Instead of shoveling out the fly ash which sticks to the bottom of the dump truck as a result of fly ash compacting while in transit, the driver bangs the lift portion against the truck bed in order to clear the truck more quickly and thus decrease turn around time. Instead of covering the fly ash with earth after it has been dumped, the fly ash is disposed of by open dumping methods. Thus, exposed, the fly ash, given its physical characteristics, is subject to high rates of wind and water erosion.

The air quality problems caused by these least-cost transport and disposal practices are significant because fly ash is so light and powdery that it is easily stirred up and carried by the wind. The result is that the air along fly ash hauling routes and over disposal sites is polluted by substantial quantities of fly ash. This fly ash polluted air is a nuisance to the people living in these areas. Not only do they have to breathe it, but they have to put up with the ash coating which results when it comes in contact with natural and manmade surfaces.

Finally, least-cost truck hauling of fly ash causes noise, traffic, and safety problems in communities through which the trucks pass. Since large quantities of fly ash are moved, many truck trips are involved, and since the trucks take the shortest possible route, these numerous truck trips take place over the same roads. Thus the noise, traffic, and safety problems are concentrated in certain limited areas and, for the people who live there, constitute significant nuisances.

Because the environmental costs of the least-cost approach to fly ash disposal is being paid by Northeast Ohio coastal region residents living near transport routes and disposal sites and because these transport routes and disposal sites are located in communities close to electric power plants, it is not surprising that attempts have been made by citizens of these communities to defend their interests. It is not possible or necessary to describe all of these attempts, but a few will be cited in order to illustrate the potential and limitations of citizen action as a way of solving the problems involved.

Citizen action has taken the direction of influencing officials of local governments to refuse to grant land use permits to open or extend fly ash disposal sites. When the Cleveland Electric Illuminating Company requested that the City of Eastlake grant a land use permit to landfill fly ash on a site on the east bank of the Chagrin River at the Willoughby-Eastlake boundary, the League of Women Voters and the Sierra Club opposed the granting of the permit. This opposition helped to induce the City of Eastlake to turn down CEI's application. CEI took the case to the Lake County Court of Common Pleas and later to the Court of Appeals, but both courts decided in favor of the City.

Subsequently, in 1977, CEI applied for a land use permit to land fill fly ash in a pond area bordering the Chagrin River. The League of Women Voters opposed the granting of the permit, on the ground that, because the National Flood Insurance Program's Flood Insurance Rate Map for Eastlake, identified the pond area a flood hazard area, it should not be land filled. In order to discuss this issue, a meeting was arranged between the Mayor of Eastlake and representatives of the Ohio Environmental Protection Agency, the Ohio Department of Natural Resources, the Army Corps of Engineers, the Department of Housing and Urban Development, and the League. The agency representatives agreed that National Flood Insurance Regulations do not prohibit filling in a flood fringe area unless fill would raise the flood stage by more than 1 foot and that the proposed fill would not have this effect. As a result of this agreement, the fly ash landfill permit was approved despite the potential adverse environmental effects of locating it in a flood plain.

A similar citizen sponsored effort to lessen the environmental damage caused by least-cost fly ash hauling and disposal took place recently near Lorain. Ohio Edison had proposed doubling the size of its fly ash disposal site in Sheffield Township. A citizen group interceded with the Township Trustees in an attempt to persuade them to disapprove Ohio Edison's land use application on the ground that enlarging the landfill would constitute a public nuisance for adjacent homeowners. The Township Trustees responded by arranging a meeting with citizen group members and Ohio Edison officials in order to work out mutually agreeable terms under which the permit could be granted. Ohio Edison officials agreed to pave the access road and to insure that fly ash would not spill from trucks or be allowed to blow from the disposal site. Seeing that these concessions were the most that they could hope to gain from the meeting, citizen group members accepted these terms and withdrew their objection. Accordingly, the expansion of the fly ash disposal site was approved.

These instances of citizen action show that citizen action, while effective to some degree, is not an overall solution to the problem of dealing with the adverse environmental impact of least-cost fly ash hauling and disposal. It works in some cases, it works to some degree in others, and it does not work in others. Even if citizen action were effective in all cases in which it was used, it would still be an ad hoc approach. In other words, citizen action would be initiated on a case-by-case basis, and only where citizens felt strongly that their interests were being damaged and where able to organize themselves for defense. It cannot be relied upon as a comprehensive management mechanism for regulating fly ash hauling and disposal in the public interest.

These instances of citizen action also point to the fact that local government land use controls are not an effective regulatory device. While they do insure that a land use permit is obtained in all cases where a fly ash disposal site is opened or expanded, local governments do not have available accepted or authoritative performance standards for deciding whether or not to grant a land use permit. Nor do most local governments have available the expertise to make an informed judgment based upon the specific circumstances of individual cases. Moreover, except in cases where the environmental damage which would result from granting the permit is so obvious, that the local government has no other course but to turn it down, the degree to which it takes environmental impact into account will depend to a significant degree upon whether or not opposition from citizens or some other quarter develops. If there is opposition, environmental impact may get scant attention. Finally, local governments are limited in their land use powers by the rights which owners of private property have to use their land as they see fit. These private property rights are given considerable weight by Ohio courts, with the result that local governments must be able to establish a clear "public purpose" in limiting private property rights if they are to avoic a court ruling that they have "taken" private property and must compensate the owner accordingly.

While local governments do not play a limited role through their land use controls powers in regulating the location of fly ash disposal sites, they do not regulate fly ash hauling. In some instances, they license fly ash hauling trucks along with other vehicles which haul solid waste, but this is done for revenue purposes, not for the purpose of regulating fly ash hauling. But whether or not they license fly ash hauling trucks, they do not adopt and enforce fly ash hauling performance standards.

Another type of local government agency which, under Ohio law, could but does not regulate fly ash hauling and disposal are local boards of health and health departments. These agencies are charged with protecting public health, but they have neither the regulations nor the staff to deal with the environmental consequences of least-cost fly ash hauling and disposal as a public health problem. They are also empowered to investigate and prosecute complaints brought by citizens that least-cost fly ash hauling and disposal causes health problems which constitute a public nuisance. But for the same reasons that they do not take the regulatory initiative themselves, they do not act on the citizen complaints.

In summary, the traditional approach to regulation of fly ash hauling and disposal in the public interest has been to rely upon local governments and their citizens. This approach has not been effective. Recently, however, the focus of regulatory action has shifted to the Federal level and, through the Federal level, to the State level. In 1976 Congress passed the Resource Conservation and Recovery Act. This Act provided for the adoption and implementation of performance standards to regulate the transportation and disposing of solid and hazardous wastes. Since performance standards for hazardous wastes were to be more stringent than those for solid wastes, the two types of waste had to be carefully distinguished. USEPA was given eighteen months in which to do the job of preparing a list of hazardous wastes. In the meantime, regulation of solid waste could proceed. This would be done by replacing open dumping with environmentally acceptable disposal methods.

The Resource Conservation and Recovery Act provided that the Federal regulatory program could be carried out by states, if they adopted standards and procedures which were as stringent as those laid down by USEPA. Ohio chose to assume this responsibility, but since USEPA had not yet promulgated its list of hazardous wastes, its initial program covered only solid waste. Fly ash was considered to be a solid waste as defined by the Resource Conservation and Recovery Act; consequently, it was brought under OEPA's regulatory program, but only to a limited extent. OEPA required that a permit be obtained to open or expand a fly ash disposal site, but, because of a staff shortage did not inspect or regulate existing fly ash disposal sites. Neither did it adopt and enforce performance standards for transporting fly ash.

In addition to the authority granted it under the State's solid waste control program, OEPA could use general public nuisance legislation to abate environmental damage caused by fly ash transport and disposal site operations by investigating and prosecuting citizen complaints. But, like local boards of health and health departments, OEPA does not have the regulations or the manpower to deal with these aspects of the fly ash management problem. All in all, then, OEPA's fly ash regulatory program is limited to permitting of fly ash disposal sites. Once a permit is issued, OEPA does nothing to monitor operations at disposal sites or enforce permit conditions. Thus, it is not surprising that the Division of Land Pollution Control of OEPA's Northeast Ohio District Office, which is responsible for the coastal region, does not have a staff member responsible for compliance with fly ash disposal permits.

Although it is impossible to review in a comprehensive manner OEPA's performance in granting fly ash disposal permits, an investigation of one case revealed that it may very well be wanting. This case involved an industrial firm in Fairport Harbor which wanted to use fly ash as a fill to raise the level of the rear portion of its property to the point where it could be used for industrial purposes.[4c] Since this rear portion consisted of a gully which ran down to the Grand River, the firm retained the services of an engineering consultant to prepare a plan for the fly ash land fill. This plan called for the construction of a clay dike, 10' wide at the top and 65' wide at the bottom, fertilized, seeded and mulched according to Ohio Department of Transportation specifications, which would be built between the fly ash and the River. 155,000 cubic yards of fly ash from CEI's Eastlake plant would be filled behind this dike, covered with 12 inches of soil, and fertilized, seeded, and mulched according to Ohio Department of Transportation specifications to prevent wind and water erosion. As an additional water erosion control device, all grades steeper than five percent were to be protected with 12 inches of rip-rap. In order to prevent leaking of the chemicals contained in the fly ash, no fly ash was to be deposited within 5' of the ground water table and positive drainage was to be maintained at all times. The engineering consultant also ascertained that filling the gully would not increase flooding of the Grand River either upstream or downstream of the site.

Having obtained a plan for a land fill in which fly ash could be disposed of in what appeared to be an environmentally acceptable manner, the president of the industrial firm applied for a disposal permit from OEPA. OEPA responded by asking for a leachate analysis of the fly ash that would be landfilled and for test borings within the site to determine sub-soil materials and ground water conditions. After this additional information was supplied, two OEPA staff members visited the firm, supposedly to make an on-site inspection. But instead of walking over the entire site right down to the River bank, they merely stood behind the firm's building, looked at the site from a distance and left. Sometime later, the firm's president was informed that OEPA had denied his permit application, on two grounds. In the first place, the site was a wetland, and OEPA could not allow fill in a wetland. Secondly, the mercury leaking from the fly ash into the Grand River would be more than could be allowed in drinking water.

Even though these two OEPA standards are reasonable in general terms, it is questionable that they were applied reasonably in this particular case. A careful inspection of the site reveals that only the small portion immediately adjacent to the River bank is a wetland and that, for the most part, it is a flood plain. While fill could not be allowed in the wetland portion, it could be allowed in the flood plain provided it did not increase the flood stage, and the engineering study had revealed that this would not happen. Thus, the wetland problem could have been solved by building the dike along the boundary of the wetland portion instead of along the River bank.

As regards the water quality issue, site-specific conditions were such that there was no basis for using drinking water as the standard for measuring how much mercury leaching could be allowed. For a considerable distance upstream of the site, the right bank of the Grand River consists of soda ash deposited by the Diamond Shamrock plant. Chemicals from this soda ash have been leaching into the Grand River for years. Near the bank is an abandoned chemical disposal site from which highly toxic chromite is leaching into the River in quantities sufficiently great to require investigation by OEPA. Within a few hundred yards of the site, two sewage treatment plants discharge their effluent into the River. Given this situation, the quality of the water in this reach of the River is so low that it cannot be used for drinking water. This fact is admitted by OEPA itself. On page 85 of its Water Quality Management Continuing Planning Process it states that "industrial and wastewater discharges in this segment (of the Grand River) seriously depress water quality" and that water quality standards are violated with respect to ammonia, dissolved solids, fecal coliform, sulfonate detergents, phenols and chlorides. Obviously, water as badly polluted as this cannot be used for drinking purposes. One wonders, therefore, how OEPA could use violation of its drinking water standard as a ground for denying the fly ash disposal permit.

Without trying to second guess OEPA as to the ultimate wisdom of its action, it seems clear that it decided this case on the basis of general principles rather than on the basis of the site-specific situation. Whether or not one defends OEPA's decision, one cannot defend its procedure. Given this procedure, is it any wonder that potential applicants for fly ash disposal permits are discouraged from applying when they see that their applications are judged on the basis of general principles without regard to how these general principles apply in their particular cases? One can surmise that this is one of the reasons why, according to one informant, most fly ash disposal sites are presently operating without OEPA permits. Why run the risk of applying for a disposal permit when OEPA may well turn down an application on the basis of general standards which may or may not apply in the applicant's particular case, especially when OEPA does not have personnel assigned to monitor the fly ash disposal situation? When fly ash disposal sites can be operated without asking OEPA's permission but cannot be operated if that permission is requested and denied, is it any wonder that a party which wishes to operate a disposal site would shy away from requesting permission?

All things considered, the current fly ash situation in the coastal region of Northeast Ohio is riddled with management problems. They can be summarized as follows:

1. Almost all of the fly ash is disposed of in landfills.

2. Fly ash disposal is carried out on a least-cost basis, and this least-cost approach produces significant environmental costs.

3. No effective regulatory program is operational to counteract the least-cost approach and thereby reduce environmental costs.

Within the last year, however, certain developments have taken place which could bring about improvements in the present highly unsatisfactory management situation within the not too distant future. In December 1978, USEPA, after a long delay, finally issued Proposed Regulations on hazardous wastes. These Proposed Regulations contained the first list of hazardous wastes, identified on the basis of ignitability, corrosivity, reactivity, and toxicity. Fly ash was not included in the list of hazardous wastes. It was, however, placed in a category of special wastes. These special wastes are products which have a high volume but a low degree of potential hazard because only a portion of the product is hazardous. Their high volume and low potential hazard make it inadvisable to regulate them by ways and means which are appropriate for hazardous waste. Accordingly, USEPA proposed to issue at a later date separate special waste regulations.

Fly ash was placed in the category of special wastes because of the heavy metal trace elements which it contains. Heavy metals are identified as toxic, which the Proposed Regulations define as chronic toxicity to humans. Presumably, then, only that portion of fly ash which contains a concentration of heavy metal trace elements high enough to be chronically toxic to humans is to be regulated as a special waste. The Proposed Regulations do not state what that portion is because, as USEPA is frank to admit, it is presently an unknown quantity. The non-toxic portion of fly ash will not be subject to special waste regulations but will be subject to solid waste regulations.

While USEPA's Proposed Regulations deal mainly with hazardous wastes, they also contain some revisions in the definition of solid waste. So far as fly ash is concerned, these revisions are significant. A waste product which is used is not classified as a solid waste. If a solid waste product is disposed of in a landfill, it is to be treated as a solid waste. This means, presumably, that fly ash which is used is not subject to regulation as a solid waste, while fly ash which is landfilled is subject to such regulation.

Since Ohio's regulatory program for solid and hazardous wastes is based upon USEPA standards, the March 1979 legislation giving effect to the State program classifies non-toxic fly ash as a solid waste. As such, it is to be regulated according to solid waste performance standards which prohibit open dumping, defined as depositing on land without compacting and without providing suitable cover. This means that, with respect to non-toxic fly ash, the Director of OEPA is authorized to establish regulations and issue licenses for disposal sites and to inspect their operation so as to ensure that they do not "create a nuisance, cause or contribute to water pollution, or create a health hazard." Any person establishing a fly ash disposal site after the Director's regulations become effective must obtain a permit. Existing fly ash disposal sites are to be licensed and inspected by boards of health or health departments. OEPA will review the manner in which boards of health and departments carry out this responsibility, and, in cases where it does not meet OEPA standards, OEPA will take charge.

So far as transporting fly ash is concerned, the March 1979 legislation provides that OEPA will establish regulations governing the issuing of licenses but does not require that licenses be obtained. Nor does the legislation lay down any performance standards for transporting fly ash similar to performance standards for fly ash disposal.

The result is that the present practice of leaving the issuing of fly ash transportation permits to local option will continue, except that those local sub-divisions which do issue licenses will have to do so according to State standards.

These recent regulatory developments are certainly steps in the direction of improving the management situation with respect to fly ash transportation and disposal. But it is impossible at this stage to assess what impact they will have and how soon. They help to clarify the status of fly ash as a regulated product. Toxic fly ash is to be treated as a special waste and non-toxic fly ash as a solid waste, but USEPA's Proposed Regulations and Ohio legislation do not identify toxic fly ash and non-toxic fly ash in terms that make it possible to distinguish between the two for practical regulatory purposes. USPEA's Proposed Regulations would exclude non-toxic fly ash which is used from regulation as a solid waste, but Ohio legislation is silent on this point. Neither USEPA's Proposed Regulations nor Ohio legislation provide an effective mechanism for regulating fly ash transport.

In addition to these bureaucratic and legislative questions and gaps, the impact which these recent developments will have on fly ash management remains uncertain because there are major obstacles standing in the way of effective implementation of USEPA's and OEPA's regulatory program with respect to fly ash. Even if the bureaucratic and legislation questions are answered and the gaps filled, the fly ash regulatory program will not get off the ground unless money and manpower sufficient to do the job are made available. At present money and manpower are conspicuous by their absence, and there are signs on the horizon that quick action is going to be taken to provide them. Current governmental concerns are focused upon economic issues to a greater extent than upon environmental issues, and these priorities will not change as long as economic problems remain as serious as they are today. One should not be surprised, therefore, if the appropriation of funds to implement a fly ash regulatory program lags behind its authorization.

V. Technical Potential - Short Term

Up to this point, the analysis of fly ash use and disposal in Northeast Ohio's coastal region has focused upon problems. There is another side to the story -- the potential for improving the present state of affairs. That potential exists on both the technical and management fronts. In bringing it to realization, however, the time factor is very important. Part of that potential can be realized within the next few years. The remainder will require a considerable period of time before it can be brought to actuality.

Accordingly, the potential side of the fly ash story has to be told in two installments, the first dealing with the short-term and the second dealing with the long-term. In order to tell it in an orderly manner, these time divisions must be divided into technical and management components. Thus, the story will begin with the following discussion of short-term technical potential.

Currently, fly ash is being used in the United States in a number of different ways: The list includes: cement additive, making concrete and concrete products, construction fill, road base and soil stabilization, light weight aggregate, mineral filler for asphaltic pavements, grouting, foundary cores, filler in plastics and chemicals, blasting grit, soil conditioning, land reclamation, coal mine and coal pile fire control, coal mine subsidence control, coal washing, cementing oil wells, and mine acid neutralization. Here are some of the details illustrating fly ash's present use potential:

The application of fly ash together with lime and aggregates to manufacture statilized pavement has been known and practiced in this county for several years. This field has received added impetus by the program carried out at the New York Port Authority's Newark Airport Redevelopment Project.[5] Laboratory research by the Port Authority finally developed a mixture of hydrated lime, portland cement, fly ash and the <u>in situ</u> sand as materials for the base of the new runways. This composition, as used in Newark, has the following composition: hydrated lime 2.8 to 3.6%, portland cement 0.7 to 0.9%, fly ash 12 to 14%. The remainder is hydraulic fill sand, Where exceptionally high base strength is required, 30 percent crushed stone is added to the above mixture. The Port Authority calls the material LCF (lime, cement, fly ash), and is projecting five-year strength for this material to be between 2,000 to 2,400 psi in compression. The Port Authority also reports that a 30" thick LCF base has a load performance equivalent to 16" of portland cement concrete or 60" or more of aggregate base asphaltic concrete. Cost estimates for placing the material have resulting in savings of up to 60 percent compared to competitive materials capable of sustaining equivalent loads.

In September 1975, a demonstration project was conducted at the Harrison Power Station in Haywood, West Virginia, to determine the feasibility and cost of utilizing cement-stabilized fly ash as a parking lot base course.[6] Approximately 10,000 square yards of pavement were constructed using 3,800 tons of fly ash. The construction mix of the base course was as follows:

Fly ash	83 pcf of mix
Cement	10 pcf of mix
Water	18 pcf of mix

Approximately two weeks after completion of the base course, a three-inch bituminous wear surface was constructed over the base course. Base course cores were drilled when the base course was seven days old.

Unconfined compressive strengths of the cores averaged 566 psi. Cores were again drilled in December 1975 when the base course was 90 days old and the pavement had been subjected to several periods of below-freezing temperatures. The average unconfined compressive strength was 869 psi, quite satisfactory in view of the late construction period. The adjusted net cost of constructing the base course and wearing surface was $7.23/square yard, which is competitive with conventional pavements.

In 1971, a fly ash-lime-aggregate base was placed in North Dakota near the site of the Basin Electric Power Plant, a few miles south of Stanton.[7] Approximately 13 percent fly ash and two percent hydrated lime were mixed with 85 percent aggregate and sufficient water to obtain maximum density. Since 1971, two other North Dakota projects involving lignite fly ash have been completed, and in 1973, eight 500 x 12' test sections were placed in a test road near Lakota, North Dalota. The tests have shown satisfactory results. A combination of three percent fly ash and three percent lime proved to be superior to a six percent addition of lime on a sub-grate A-7 soil stabilization project on I-29 in eastern North Dakota. A 15-mile portion utilized 7,000 tons of fly ash at a savings of approximately $80,000 compared with the use of lime.

Recent research has shown that fly ash and lime can be combined with a variety of sulfate sludges to produce compositions which are useful as paving and stabilization aggregates. These materials form a composition which is easily laid and compacted to form a tough, low cost base and surfacing material. The composition has properties resembling concrete in regard to strenght.

Lightweight aggregate is the fastest growing use to which fly ash is being put. Fly ash aggregate is produced when dry ash is mixed with water and agglomerated by extrusion or balling. The pellets are spread on a traveling grade, ignited by gas or oil, and kept burning by air drawn through the grate and the bed of burning pellets. A recent study by the Portland Cement Association on 3,000 and 5,000 psi structural concrete shows that fly ash lightweight aggregate concrete compares equally with other quality lightweight concretes. Gas concrete or aerated concrete is finding acceptance in multi-family, commercial and industrial structures. The material has very excellent thermal and acoustic properties, is dimensionally stable, fire resistent, termite, and decay free. It can be drilled, nailed, screwed and sawed with ordinary tools. Its lightweight features enable it to be shipped and handled in large economical sizes. The product is made by introducing gas into a paste or slurry composed of cement and/or lime and a siliceous filler such as fly ash. Fly ash, in amounts up to 80 percent by weight, can be used as the siliceous filler in this lightweight building material.

The benefits of using fly ash in concrete are widely known. Listed below are some of those benefits:[8]

1. Reduction of water demand for the same workability, which reduces -

   a. the bleading of fresh concrete, making it not only more pumpable, but finishable as well.

   b. the permeability of the hardened concrete, as well as its shrinkage and creep.

2. Increase in the solids fraction of the paste volume of the cement present -

   a. by using a greater mass of fly ash of a lower density, the absolute volume replaced in greater, thus enabling greater strengths to be obtainable.

   b. the quantity of effective Portland Cement actually hydrated is greater by the combination of the by-product lime, liberated by the hydration of both di- (C_2S) and tri-(C_34) calcium silicate.

3. Increased serviceability of the resultant concrete -

   a. as one of lower heat generation, reducing thermal contraction and problems associated with cracking.

   b. for use in sulphate bearing soils and marine environments.

4. Greater economic advantage -

   a. It is cheaper than most of its competitors.

   b. has better workability, reducing placement costs.

   c. produces higher quality surface finishes.

The Dundee Cement Company now markets a Portland-Pozzalan cement (Type I-P) for general use in the construction industry.[9] This cement contains fly ash and its advantages are reported to be: improved workability, reduced segregation and bleeding, better and faster finishing, improved pumpability and handling in hot weather, increased ultimate strength reduced shrinkage and cracking, improved water tightness, sulfate resistance and appearance, and low susceptibility to alkali-aggregate reaction.

Research on fly ash usage in the production of cements has shown that the addition of fly ash to cement mixtures initially reduces its strength.[10] However, later on, lime liberated during the hydration of the cement reacts with the soluble active components, such as SiO_2 and Al_2O_3, forming strength-carrying secondary hydrate compounds of water insoluble calcium silicate and calcium aluminate hydrates. These fill the pores of the cement stone, yielding a more compact structure, with the result that the strength of the cement stone reaches and finally exceeds that of the cement which does not contain fly ash. Research has also shown that the heat development and shrinking/expansion properties of cement containing fly ash are lower than those of cements with no fly ash addition.[11] Moreover, the corrosion resistance of fly ash cements exceeds, and the frost resistance is identical with those of fly ash free cements. Given these characteristics, cement containing fly ash cannot be used for winter concreting and in structures where high initial strength is essential. On the other hand, it can be used in structures where compactness, corrosion resistance and low heat development are required and in mass concreting, hydraulic engineering, and some prefabricating technologies.

Chicago, Illinois, is the location in the United States where the largest amount of fly ash has been used in the construction industry.[12] Fly ash was used in the foundation of the Prudential Building. The two reasons for using fly ash were that it would reduce the heat of hydration and produce water-tight concrete. The later consideration was particularly important because of the Building's proximity to Lake Michigan.

A substantial amount of fly ash was also utilized during the construction of the Central District filtration plant on the shore of Lake Michigan. Again, the reason was that water-tight concrete in the filter beds was essential. The caissons and floor of the Blair Building also contain fly ash, as does the concrete used to construct the Marina Towers.

Every ounce of concrete in the new Sears Tower, the world's tallest building, contains fly ash. Fly ash concrete was used in the foundations, the walls, the floors, and in the concrete fire-proofing throughout the entire structure.

Water Tower Place is the world's tallest reinforced concrete building. Fly ash was used in the foundations and walls, in the floors and in the pre-stressed girders. One-hundred forty-eight thousand cubic yards of concrete went into the building. Based on 100 pounds of fly ash per cubic yard, that amounts to 7,500 tons of fly ash.

The Chicago area , although the largest user of fly ash for construction purposes, is not the only location in the nation where large amounts of fly ash have been put to work in this way. Of greatest significant for the coastal region of Northeast Ohio is the fact that the Cleveland-Akron metropolitan area has used substantial amounts of fly ash in a number of construction projects.[13] Here are some of them:

Cuyahoga County

State Office Building
National City Bank
Westerly Sewage Plant
Diamond Shamrock Building
Lakeview Dam
Beachwood Mall
CEI, Lakeshore & Eastlake Plants

Summit County

Akron Childrens Hospital
Akron University, Chemistry Building
Re-cycle Center, Akron
Gold Circle Stores
Water Treatment Plant, Akron
Martha Avenue Bridge
Cuyahoga Falls High School

Lake County

Perry Nuclear Power Plant

J.P. Horne, Mentor Mall

Portage County

Robinson Memorial Hospital, Ravenna
Kent Free Library
Kent State Physical Education Building
Lamb Electric Company, Kent

Another use of fly ash is in the making of bricks. Fly ash bricks were first manufactured on a trial basis in this country in 1949, but not until recently, with the commercialization of the WVU-OCR process at International Brick and Tile, Ltd., in Western Canada, has sufficient justification existed for commercial-scale exploitation of fly ash as a brick raw material.[14] In the Canadian operation, fly ash is supplied from Calgary Power's

Wabarium Station. Bricks made from this ash are light, strong, amendable to coloring, and meet or exceed ASTM's criteria for severe weathering application. Composition of fly ash bricks is three parts fly ash/one part slag/and a small amount of sodium silicate which acts as a binder.

John F. Slomaker, Project Supervisor, Coal Research Bureau, College of Mineral and Energy Resources, West Virginia University, Morgantown, West Virginia, has carried out a research project on the production of 40 percent core area fly ash bricks using fly ashes from different types of coal: lignite ash, ash from nothern West Virginia bitumious coal, ash from southern West Virginia bituminous coal, and ash from western Kentucky bituminous coal.[15] The ingredients were mixed in a mix-muller at a typical seven percent moisture level. The bricks were formed by pressing and were fired in a shuttle kiln. All bricks were tested in accordance with the American Society for Testing and Material Designations C-62 and C-216 for severe weathering grade brick and found to exceed these Designations.

The first batch of lignite ash, containing 3.0 percent grade 47 sodium silicate, stuck to the mix-muller. A similar batch, in which the sodium silicate was left out, did not stick to the mix-muller. When fired to Orton Core 7, neither of the aforementioned batches met ASTM Designations for severe weathering grade brick. When these bricks were fired to Orton Core 8, they produced a brick meeting ASTM Designation. Additional bricks were fired to Orton Core 9, at which temperature they suddenly vetrified and completely melted. The bricks produced with this lignite fly ash have an extremely narrow firing range and required that firing conditions be carefully controlled. It has been determined that the most satisfactory lignite fly ash brick can be produced using 75 percent lignite fly ash and 25 percent bottom slag at seven percent moisture and firing the brick to Orton Core 8.

Bricks made from the Northern West Virginia fly ash were satisfactory if the sodium silicate (grade 47) content was at least three percent and the firing range Orton Core 6. The high sodium silicate content was necessary to give the bricks adequate unfired strength to allow them to be removed by hand from the press. Because the Northern West Virginia fly ash had approximately 25 percent iron, these bricks also had a very narrow firing range.

Bricks produced from the Southern West Virginia fly ash had excellent unfired compressive strenght and could be moved from the press and stacked upon the kiln car without undue care to prevent breakage of the brick. A sodium silicate percent of 1.1 percent produced satisfactory results. (Sodium silicate is a strengthening agent in the unfired state, and it has a minor effect on the fired properties of the brick.)

The first bricks made from Western Kentucky fly ash showed white, fluffy deposits on the surface of the unfired bricks. This was caused by water soluble salts which migrate with the water to the surface of the brick during the drying process. The effect of this scumming is that it decreases the unfired compressive strength. It was found that 1.2 percent sodium hydroxide eliminated the scumming. Tests showed that the best results produced were when the mixture contained 70.4 percent fly ash, 26.8 percent bottom slag, 28 percent grade, 45 percent sodium silicate, 10.0 percent moisture level, and was fired to Orton Core 1.

In addition to meeting ASTM Designations for severe weathering grade bricks, fly ash bricks have only a fraction of the air leakage of conventional bricks and are less porous. For these reasons, they are particularly suited to situations where air tight or water tight bricks are needed.

Fly ash particles will combine with cement to form a dense and durable slurry which can be used for grouting mixes. These mixes can be used in filling underground voids, such as bridge foundations, where mortar has been washed away by water or where underlying strata need stabilizing and strengthening. They can also be used to stablize and strengthen underlying strata in the construction of tunnels and of dams.

When mixed with normal Portland cement, Bentonite Clay and water, as follows:

Normal Portland Cement	424 lbs/c.y.
Fly ash	214 lbs/c.y.
Bentonite	54 lbs/c.y.
Water	1,415 lbs/c.y.

fly ash produces a high quality impervious grout which is used for the construction of "cut-off walls." ("Cut-off walls" are barriers to sub- surface flow of water.)[16)

Fly ash has also been used for mud jacking bridges.[17) The batch mix contains two bags of fly ash, one bag of cement, and one bag of Bentonite clay, with enough water added to form a slurry. The mix is pumped under pressure of 290 psi through pre-drilled 2-1/2" diameter holes to solid ground to stabilize the fill and raise the slab to its original position.

Fly ash can be utilized as construction material for water retaining structures.[18] However, laboratory field tests show that certain critical factors must be controlled. Fly ash is susceptible to erosion when subjected to excessive seepage flows and must be protected by properly designed filter layers to prevent migration of fines. Care must also be exercised to ensure that possible cracking due to brittleness of compacted ash is adequately protected by filters. The fine grading and uniform particles of fly ash render it susceptible to liquefaction. This is a failure phenomenon brought about by the almost complete loss of shearing resistance of a saturate soil due to the development of high pore pressure. For liquefaction to occur, the material must be both loose and saturated; therefore, all zones of fly ash incorporated in any water retaining structure must be well compacted to provide a medium dense enough to eliminate any risk of liquefaction failures.

Preliminary studies to determine the effect of mixing fly ash with natural soil material indicate that this mixture is superior in certain engineering properties to either material used alone.[19] A mixture of sandy soil with fly ash (1:1 ratio) compacted much better than fly ash alone. Likewise, the addition of very silty fly ash to two very clayey soils and one loaming soil reduced the plasticity and swelling characteristics of all the soil material. While the shear strength of very clayey soil mixed with very silty fly ash mixture decreased as the amount of fly ash increased, this decrease did not become critical until the soil to fly ash ratio reached 1:3. From these results, the possibilities of using soil/fly ash mixtures in structural fills seem excellent. In addition, the use of soil material to stabilize fly ash and the use of fly ash to reduce critically high plasticity and swelling in soils are definite possibilities.

In 1964, the Chicago Fly Ash Company, representing the Commonwealth Edison Company, proposed the construction of a short section of embankment utilizing fly ash in order to prove the feasibility of using fly ash as a structural embankment.[20] The Illinois Division of Highways agreed to plan and supervise the construction and material testing on the test section. In 1965, a trial embankment 200' long, 40' wide and 6' high was constructed. The trial embankment construction was utilized to develop construction methodology for future utilization of fly ash in Illinois highway projects. The results were as follows: compacted embankment showed an unconfined compressive strength of 4-4 1/2 tons/feet. The fly ash had a tendency to "age harden"; that is, gain strength with time. On the negative side, fly ash alone would not support vegetation, and dusting of fly ash at a moisture content below 13 percent became a problem.

In October 1971, approximately 390,000 cubic yards of fly ash were used for highway embankment in the construction of a 1.45 mile section of four-lane divided concrete pavement in Chicago, Illinois.

Field observation produced the following conclusions:

1. Electrically precipated fly ash is an acceptable material to use as an alternative to naturally occurring soils as an embankment material above the water table and, in some cases, would be a superior structural material.

2. The method of construction are essentially the same as those used for natural soils.

3. Fly ash is more responsive to vibration than kneading or loading or tamping.

4. The use of large quantities of water is necessary as a means of controlling dust.

5. Fly ash causes excessive wear to contractor's equipment.

6. Environmental hazards must be analyzed and the effect on ground water quality must be studied.

Continued progress in the use of fly ash for reclaiming acidic coal mine strip spoil has been reported.[21] Plots in two sites in Northwestern West Virginia were treated with varying tonnage of fly ash and subsequently planted with grasses, legumes, trees and shrubs. Rye and red top grasses, Kentucky 31 fesgue and birdsfoot trefoil demonstrated greatest promise for growth under harsh soil conditions. Fly ash increased the pH to a range tolerable to these types of plants, improved soil texture and increased water availability. Forage yields from fly ash-reclaimed spoil areas compared favorably with yields from undisturbed pastures and field.

In a research study at the Virginia Polytechnic Institute, investigators have studied the plant availability of boron, molybdenum, potassium, and zinc in fly ash samples by laboratory and greenhouse procedures.[22] Certain of the ashes studied increased the boron, potassium, molybdenum and zinc supplying power of soils.

Fly ash has been used to control active coal mine fires.[23] The loss of thousands of dollars in property damage has been averted through the use of fly ash in the filling of mines for the control of active mine fires in Western Pennsylvania within the past several years. Injecting fly ash, with liquid nitrogen as the float agent, to control coal mine fires has proved to be so successful that the U.S. Bureau of Mines is preparing a manual on its use. Fly ash has also been used to counteract coal mine subsidence.[24] The ash is introduced both in dry and water slurry forms through boreholds drilled into the mined-out areas.

Fly ash has been used to extinguish coal refuse pile fires by injecting a fly ash/water slurry through pipes driven into the burning zone to smother the fire and cool the hot material.[25] This is perhaps the safest means of extinguishing such fires, for a number of reasons: The burning material is treated in place, with minimum exposure to men and equipment. Since pipes are driven with air-powered hammers, it is not necessary for spark producing equipment to be present in the fire zone. The fly ash in the slurry also helps minimize the potential for stream explosions. A good example of the efficacy of this method was provided at the Ohio Edison project in Akron, Ohio. Here, approximately 8,000 cubic yards of coal burning in a refuse pipe was treated with approximately 1,500 tons of fly ash, and the fire was extinguished.

So much for some of the details of the technical potential which fly ash has for being used. These details do not tell the complete story, but they will suffice to make clear that the potential is far from limited. Moreover, although the story has been told in national terms, much of it is applicable to fly ash produced in the coastal regions of Northeast Ohio.

One additional important point needs to be made in assessing the technical potential which Northeast Ohio fly ash has for being used, and that is that there are no impending changes in the quality of that fly ash which would lessen its use potential. For some time it looked as though air quality regulations might force all of Northeast Ohio's coal-fired power plants to shift to low sulphur coal. Recently, however, USEPA and OEPA decided to allow these plants to continue to burn high sulphur coal. Even if a future change in the regulatory picture were to lead to a switch to low sulphur coal, this would not substantially diminish the use potential of the fly ash produced, since sulphur content is not a determinent of that potential.[26]

Nor would mixing municipal solid waste with coal produce a fly ash with lower use potential.[27] Cuyahoga County already has a project on the drawing boards to burn municipal solid waste to make steam, and there is a possibility that a similar project might be implemented in Lorain County. One type of fuel which could be used in such resource recovery plants is municipal solid waste mixed with coal. The fly ash which resulted from this burning fuel could still be put to use, however, because it would not combine with the solid waste residues to produce a new by-product.

Thus far, the discussion of short-term technical potential has focused on fly ash use. Attention must now be shifted to fly ash disposal. Here the crucial point is that fly ash has the technical potential for being disposed of in an environmentally acceptable manner, provided that disposal sites are carefully designed and constructed. Excerpts from a recent article entitled "Design and Construction of Bituminous Fly Ash Disposal Sites" will describe how this can be accomplished.[28]

"With the current State-of-the-Art, the following aspects should be incorporated into the design and construction of dry ash disposal sites. First, and probably most important, the site should be looked upon as potentially valuable real estate and managed as such. Its projected ultimate use should be determined and could include: wildlife habitat; agricultural land; and recreational, residential, commercial, or industrial sites. The initial planning and design should reflect potential future leachate treatment requirements. The ultimate goal is to design a disposal area that is in harmony with nature, having safe slopes and effective surface and subsurface drainage collection systems.

A basic consideration is the volume requirements for storage. It appears land surface area occupied by these sites will continue to increase. This can be offset somewhat by compacting the materials and placing them in greater depths. An increase of approximately 20 to 30 percent in tonnage of stored ash can be realized by compaction versus loosely placed or tailgated ash."

"In selecting a disposal site visual impact and noise control are important considerations. It is becoming common to require undisturbed peripheral buffer zones and fill height restrictions to control visual impact. Careful planning of revegetation and conforming fill shapes are effective means of dealing with this point. Noise control is associated with hauling vehicles and construction equipment. While noise from such equipment cannot be eliminated, it can be mitigated by planning the schedules of operation relative to the areas travelled through and adjacent to the disposal site.

Good engineering and site operational procedures for a disposal area can mitigate or eliminate potentially destructive environmental effects. Careful geological and geotechnical investigations can, for instance, identify potentially unstable soils which are incapable of sustaining increased loadings or can decrease the probability of groundwater contamination by identifying certain site characteristics which should either be avoided or recognized during the design phase. The site should not only have stable slopes but should be protected against the erosive actions of wind and water. Additionally, the site should be designed so that the impact on surface water and groundwater quality due to chemical leaching of the fly ash is minimized. Groundwater quality monitoring stations should be installed well in advance of the beginning of construction to establish a data base and monitored continuously to evaluate the impact on groundwater quality.

The disposal site normally involves the construction of on-site haul roads, a compacted earth toe embankment (if in a valley), and surface and subsurface drainage systems. A geologic study should be performed and a subsurface investigation conducted to ascertain the nature, strength, and condition of the foundation materials in the region of the toe embankment, in the contact zone between the fly ash embankments and the original ground, and along the proposed centerlines of any drainage conduits.

Figure 4 shows a typical cross-section through a disposal site constructed in a valley and indicates the staging procedures often used in development.

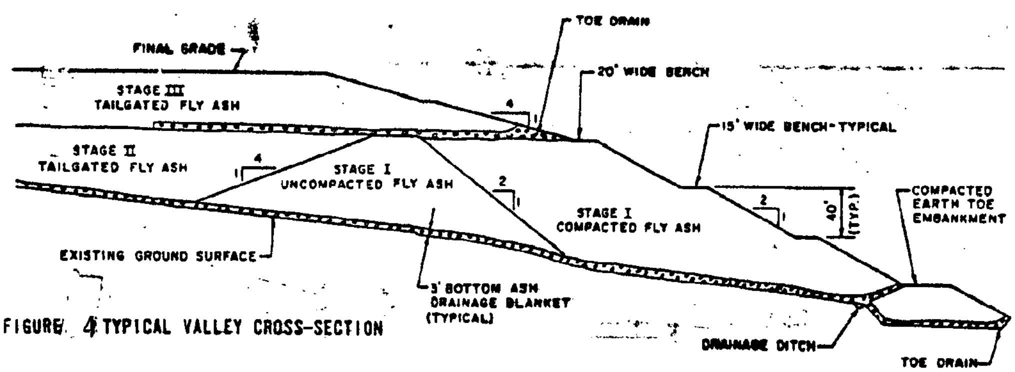


FIGURE 4 TYPICAL VALLEY CROSS-SECTION

The principal design features of the disposal site are as follows: A compacted earth toe embankment constructed at the base of the disposal site with a compacted fly ash embankment face assures a stable and durable storage site. The size of the earth toe embankment varies and is dependent upon the magnitude of stabilizing force required to provide an adequate safety factor for the completed earth-fly ash embankment. The Stage I fly ash embankment consists of a compacted fly ash face portion and an up-valley uncompacted portion. The fly ash within the face portion of Stage I is placed in thin lifts and compacted to a dry density equal to 90 to 95 percent of the maximum density. The slope of the Stage I fly ash embankments depends on the strength of the ash being stored. The remainder of the stored ash can be loosely placed or compacted for maximum capacity. This decision is based on economics and the planned future use. The face of all embankments are benched at a vertical interval of between 30 and 50 feet and covered with soil and seeded to resist erosion.

Any streams which flow in the valley are diverted into culverts which follow the valley beneath the entire storage site. Since fly ash is a highly erodible material, proper consideration should be given to the design of anti-seep collars for any drainage pipes passing under the stored ash. The upstream and downstream ends of all drainage pipes should be properly protected from erosion effects. Manholes for cleanout purposes should also be provided on all pipes. A blanket of bottom ash is placed beneath all of the Stage I embankment as indicated in Figure 4. This blanket will collect any surface water which enters the site and percolates through the fly ash. The collected water will be drained toward the valley bottom where it can be collected at predetermined intervals and conducted into the culvert. As indicated in Figure 4, a bottom ash drainage blanket is also placed under subsequent embankment slopes.

Surface drainage is provided by a system of peripheral cutoff ditches constructed outside of the fill area to divert overland flow away from the fill area. These cutoff ditches minimize erosion effects and reduce the volume of water that must be handled by the erosion and sedimentation ponds.

The fly ash embankment is shaped to control runoff. Runoff from the fly ash embankment is collected in ditches and diverted to sedimentation ponds to provide siltation control. Comprehensive erosion and sedimentation control plans are a must for all disposal sites.

All completed surfaces of the disposal site are covered with one to two feet of soil and then seeded with a mixture of grass and legumes.

A detailed, comprehensive operational plan for disposal sites must be developed as part of the construction package. Since the filling operation of a disposal site extends for many years, engineering and environmental controls are extremely difficult to maintain unless a very specific plan exists. In addition, with a detailed operation plan available, the disposal site can be more easily modified to conform to changes in disposal regulations while still maintaining the original concepts of storage life or to adopting the site to some other use."

No doubt, the fly ash disposal site described above could cost more to design and construct than a least-cost disposal site. But this is an economic, not a technical consideration. Technically speaking, it is possible to provide fly ash disposal sites which will not pass on costs to residents of the surrounding area in the form of environmental costs and which will, at the same time, convert the site from a disposal area into land which can be used for more productive purposes.

VI. <u>Management Potential - Short-term</u>

The potential for managing the fly ash presently produced by Northeast Ohio's coastal power plants in such a way that it is used in increasing qualities and disposed of in an environmental acceptable way is being enhanced by changes which are taking place in both the private and public sector. In the private sector, inflation coupled with growing scarcity of natural resources is altering substantially the economic situation with respect to fly ash use and disposal. Land for landfills is becoming more expensive, and, as landfills close to power plants reach their capacity, they have to be located farther from fly ash collection points. This means that the fly ash has to be hauled farther and at a greater cost per mile, because hauling costs -- fuel, vehicles, maintenance -- are rapidly increasing. All of this adds up to substantially rising disposal costs.

At the same time, inflation coupled with growing resource scarcity is boosting the value of fly ash as a commodity which can be used instead of dumped as a waste product. Power plants can obtain a larger amount of revenue by selling the fly ash they produce, thereby offsetting to some degree rising coal costs, rather than increasing their costs by disposing of the fly ash in landfills. The cost of cement and aggregates used in construction is going up, with the result that using cheap fly ash as a substitute becomes, economically speaking, more attractive. Construction is not the only industry, however, where the potential of using large quantities of fly ash is on the increase. The coal industry also puts fly ash to use, and the coal industry, formerly on the decline, is now on the upswing.

Developments taking place in the public sector are also producing significant changes in the fly ash management situation. Fly ash, formerly an unregulated commodity, is now coming under USEPA regulation as a solid/hazardous waste. This development in itself is an indication that the days of least-cost fly ash disposal are numbered. In addition, fly ash disposal in Northeast Ohio will be impacted by several State regulatory programs. OEPA does not allow fly ash disposal in sites where it would cause air quality or water quality standards to be violated and generally identifies wetlands and flood plains among such sites. ODNR's Coastal Zone Management Program would prevent coastal wetlands, lake and riverine flood plains, and lake erosion hazard areas from being filled with fly ash, and the designation of portions of the Chagrin River as a "Scenic River" will introduce a certain measure of control into fly ash disposal along its banks.

Generally speaking, local governments within Northeast Ohio's coastal region are still free to issue land use permits for fly ash disposal sites, but this freedom is not unlimited for those which participate in the National Flood Insurance Program (NFIP). NFIP Regulations prohibit locating a fly ash disposal site in a floodway and restrict the placing of fill in a flood fringe area if the result would be an increase of more than one foot in the flood stage for the 100-year storm. This limit has a special significance for fly ash disposal sites since, in the past, they were frequently sited in flood plains.

All in all, then, current developments in both the private and public sector are increasing fly ash's use potential and decreasing its least-cost disposal potential. In order to have a significant and timely impact, however, these developments need to be complemented by changes in regulatory standards, construction specifications, and building codes which will remove official barriers to fly ash use. Fortunately, these changes are beginning to be made.

So far as regulatory standards are concerned, the State of Maryland has taken the lead by excluding fly ash which is used from the category of waste materials which are subject to solid/hazardous waste regulations. According to Maryland law, fly ash is a natural resource which should be stockpiled and later recovered and put to use. Several States have adopted specifications for using fly ash as a cement additive and as an aggregate in highway construction projects, among them Ohio, Pennsylvania, and West Virginia, the States closest to Northeast Ohio's coastal power plants.

The Federal Government has also taken steps to encourage fly ash use in construction projects. The Federal Aviation Administration has approved specifications for a mineral aggregate/lime/fly ash/water mixture as a base course for runways. The Federal Highway Administration has issued a memorandum to field personnel commending the use of fly ash in Portland cement and in base course construction. The Corps of Engineers has used fly ash in its construction work for a number of years and is today probably the world's largest producer of fly ash concrete.

One of the primary reasons for fly ash's increasing official acceptability as a useable resource is that an organized interest group has come into existence which has as its aim the promotion of coal ash utilization. At the center of this interest group is the National Ash Association, located in Washington, but its activities are not limited to lobbying the Federal government. Rather, its membership is national in scope, consisting of power companies, coal companies, ash marketing companies, and academic institutions, and its activities cover fly ash's every aspect -- production, disposal, marketing, research. Thus, fly ash utilization is being promoted, not only by the general interest of a society which is being subjected to inflation and resource scarcity, at a time when it is also trying to protect its environment, but also by the special interest of companies and academic institutions which have a direct stake in fly ash management.

In summary, the United States has entered an era in which by-products are regarded less as wastes, to be disposed of an cheaply as possible, and more as resources, to be used as beneficially as possible. Since fly ash is one of these by-products, the potential for fly ash use has improved accordingly. To be sure, this improvement is only in its initial stage, and it will have to continue for sometime before it has a significant impact upon the fly ash disposal situation in Northeast Ohio. But progress is already being made, and, since the developments which have brought them about constitute lasting changes in the American scene, this progress is likely to continue.

VII. Technical Potential - Long-term

Fly ash's technical potential for certain uses is now under investigation by means of laboratory research and pilot projects. Results to date look promising enough to justify the prognosis that fly ash will prove to have the technical characteristics required for some if not all of these uses. However, a considerable amount of time and effort will have to be invested before it can be determined how this program will work out; therefore, what follows must be considered long-term technical potential.

The use of fly ash to condition the sludge from wastewater treatment plants for subsequent de-watering has been investigated by a number of researchers. Eye and Basu made an extensive study of the effect of fly ash in improving filterability of digested sludge.[29] A summary of their results is as follows: (1) it was found that a 1:1 mixture of fly ash to sludge filtered better than digested sludge alone; (2) addition of chemical conditioning to this mixture increased filterability significantly; and (3) optimum filtering conditions (minimum filtering time) were obtained when sludge/fly ash ratios ranged from 3:1 to 4:1.

Fly ash has proved its worth in water pollution control by eliminating up to 90 percent of the typical pollutants found in small freshwater lakes. Financed by a grant from the Federal Water Pollution Control Administration, two professors of civil engineering from the University of Notre Dame concentrated their effort on the small (150 acres) scum covered Stone Lake at Cossopolis, Michigan.[30] For more than 30 years, the city poured raw and treated sewage into the lake, speeding its eutrophication. As a result, the once healthy lake turned into a weed-clogged, algae-covered, smelly body of water on its way to becoming a swamp. When Cossopolis stopped discharging pollutants into Stone Lake, Professors Echelberger and Tenny sensed the possibilities the lake had as a natural laboratory designed to see if "sick" lakes could be "cured." The lake was ideal because it was not flushed by a river or stream and received only surface runoff.

Fly ash was used because of its ability to release lime, which purifies the water as it settles on the lake bottom, where it retards the release of bottom mud pollutants into overlying waters. The result was that fly ash, when coupled with other resources such as seed cutting, helped reverse the lake's decaying process. However, some limitations exist. First, fly ash is not suitable for large lakes, and second, unanswered questions remain on the effects of fly ash on fish.

On the positive side, the purfying effect which fly ash had on the "sick" lake at Cossopolis point to the possibility of using fly ash to treat municipal and industrial wastewater. If this possibility proves out, a major new market for fly ash would open up because fly ash is much cheaper than chemicals presently used in wastewater treatment plants.

Pilot projects have been conducted in Morgantown, West Virginia, and Columbus, Ohio which show that fly ash can be used in operating sanitary landfills.[31] Not only did it prove to be a satisfactory intermediate cover, but the fly ash accelerated the decomposition of household refuse and aided in its compaction, thus prolonging the life of the landfill. In addition, injection grouting with fly ash stabilized a portion of the Morgantown landfill, with the result that its load bearing capability increased.

Another long-term utilization possibility is the production of castable ceramics.[32] Although a high quality product can be produced, the large quantity of heat energy required to make castable ceramics from fly ash makes this process uneconomic at the present price level for ceramics. As the ceramic price level and the cost of producing ceramics by other means goes up, however, the economic potential may move in line with the technical potential.

Fly ash has been used to produce natural gas from non-coking bituminous coal.[33] Fly ash (60%), coal (20%) and lime (20%), with the latter acting as a fluxing agent, were pre-mixed before being introduced into an electric furnace using argon gas. The result was a high grade gas produced from low grade coal.

Fly ash also contains constituents which could be used in themselves or retrieved as resources. One of these constituents is the cenospheres (microscopic, hallow glass-like balls) which exist within fly ash.[34] These particles have been tested at the University of Minnesota and have withstood a hydrostatic pressure of over 100,000 psi. In addition, cenospheres have been found to be non-grindable. A joint venture between Northern States Power Company and Ceno-Science Research, Inc. has developed a process to separate cenospheres from the rest of the fly ash. At the present time, both Northern States Power Company and Ceno-Science Research are investigating suitable markets for this material. The following are current use possibilities under investigation and testing:

a. plastic extenders
b. aluminum
c. paints
d. tapes
e. sands
f. insulation
g. foams
h. coatings
i. sprays
j. rubber compounds
k. fire proofing

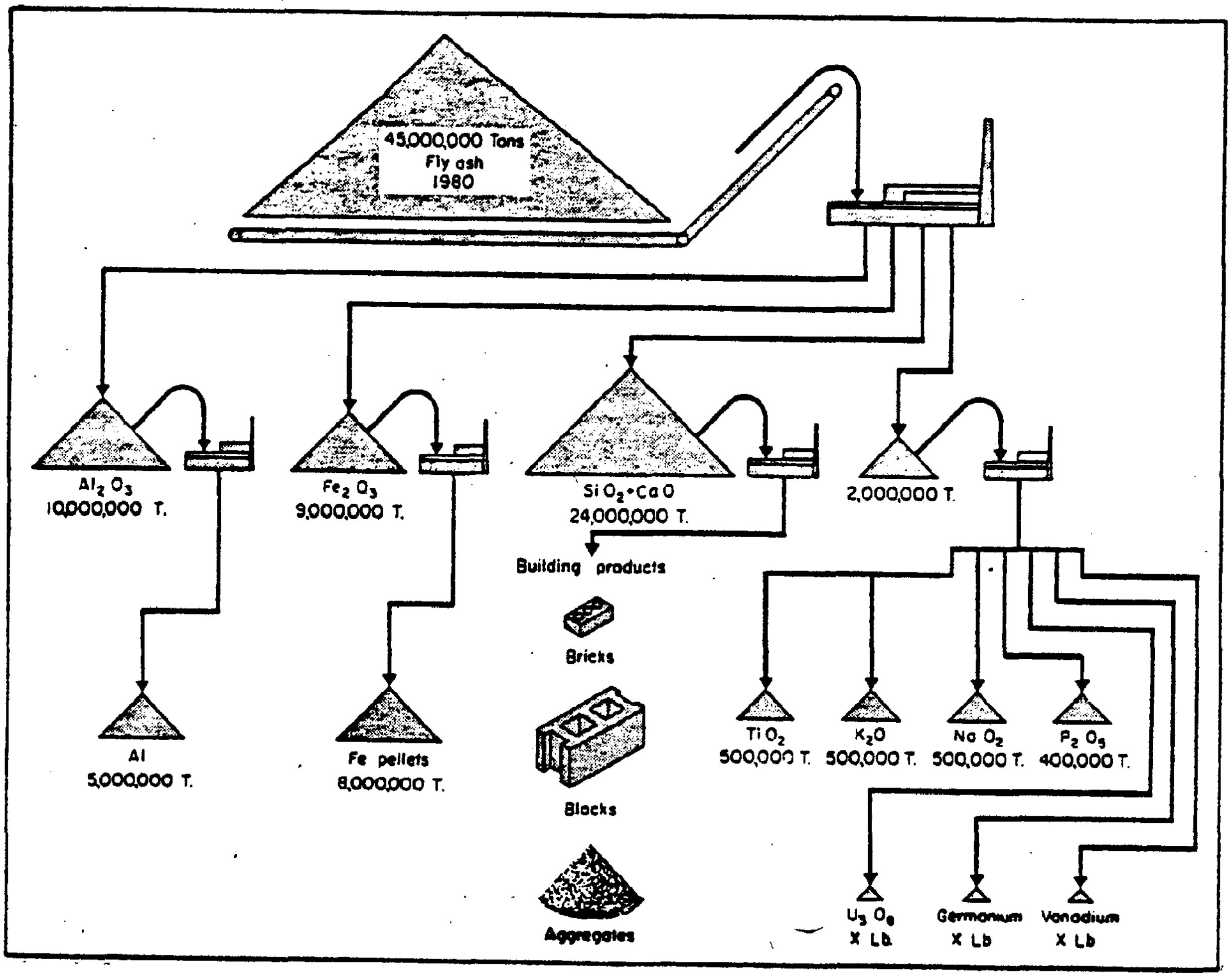
Researchers at Washington State University have produced a lightweight, fire-proof material from cenospheres held together by a bonding agent.[35] The cost of producing this material is low enough that it could be used as a substitute for plastic in the manufacture of ceiling and wall tile, door cores, insulation, trims and moldings, and other building materials. Its fire-proof characteristic would make it superior to many of the building materials presently in use.

Calcium oxide (lime) from fly ash could be used to remove sulfur dioxide from boiler flue gas. The so-called Fly Ash Alkali Process (FAA) is a wet scrubbing of SO_2 from flue gas, utilizing the alkali (CaO, MgO, K_2O, Na_2O) in fly ash. An implementation study conducted by Sanderson and Porter, Inc., Consulting Engineers for Square Butte Electric Cooperative, resulted in the recommendation of the FAA process for the Minnesota Power Plant in North Dakota.[36]

A Georgia State University chemist has envisaged a $45 billion per year industry based upon the recovery of metals from coal ash.[37] According to his calculations, the following metals could be extracted from coal ash in quantities which, even at 1974 prices, would be worth billions of dollars annually; copper, aluminum, iron, chromium, vanadium, manganese, lead, zinc, nickel, titanium, magnesium, strontium, barium, lithium, and calcium. Much of this annual production of recycled metals would come from the fly ash component of coal ash. Figure 5 shows the quantities of aluminum, iron and other materials which could be extracted from 45 million tons of fly ash.

Most of the metals in ash can be recovered through the use of the extended arc furnace. Low grade iron pellets can be produced from fly ash utilizing both air and magnetic separation. Seventy to 80 percent of the iron in fly ash is found in an iron-rich fraction which represents 20 percent by weight and 10 percent by volume. This iron-rich fraction has a market potential as material for preparation of high density media used in coal washing and other mineral dressing operations. Dense media material, which presently costs $100 per metric ton, is being used in increasing quantities as the demand for washed coal grows. The iron-rich fraction also has potential as a source of iron. If further processing can reduce the silica level found in the iron-rich fraction as it is separated from the fly ash, pellets similar to taconite can be prepared as blast furnace feed. Separation and use of this fraction could be profitable for power companies

Figure 5



Source: William E. Morton, "Direct Reduction of Fly Ash Into Ferro-Silican." Highway Materials, Bridgeport, West Virginia.

and could lead to the utilization of large quantities of fly ash in the process of making steel.

At the present rate of production of fly ash, a 50 percent recovery level of aluminum would provide 35 percent of the aluminum needs of the United States.[38] With an increase in the recovery rate to 90 percent, which could be obtained with improved processing conditions (the standard line sinter process recovers approximately 50 percent), fly ash could supply 63 percent of the country's aluminum needs.

No doubt, the foregoing uses for fly ash are only long-range possibilities, some of which will be difficult to realize. But the technical potential for realizing them exists, and technological advances and changing market conditions could result in several of them paying off over the long-term. However one evaluates their chances of becoming a reality, the economic benefit which could result from putting fly ash to use in these ways is substantial enough to justify an intensified research and development effort.

VIII. Management Potential - Long-term

Despite the significant technical potential which fly ash has for being used, the fact remains that fly ash management in the short-term must rely heavily on disposal. Economic and institutional barriers, as well as traditional attitudes and established ways of doing things, stand in the way of a quick switch from disposal to use. In the long-term however, the potential for making use the key to ash management is high. Thus, while the short-term will continue to display the familiar pattern of a large quantity of fly ash being disposed of in landfills and a small quantity being used, the long-term can be turned into the opposite story,

Attention has already been focused on the ways in which economic and institutional barriers to fly ash use have begun to come down, and this process will continue. Traditional attitudes and ways of doing things, which see fly ash as a useless waste and deal with it by getting rid of it in the easiest and cheapest way possible, are beginning to change, but only just beginning. We have a long way to go before the dominant view of fly ash is that it is a valuable resource which should be put to use rather than disposed of even if in environmentally damaging ways. Nevertheless, this revised view is now shared by a significant number of groups as dissimilar as environmentalists, power company officials, coal company operators, ash processors and marketeers, academic researchers, bureaucrats and legislators, and they can carry the message to the wider world. There it will find an attentive ear because that wider world is becoming convinced that increasing prices and growing scarcity make it necessary to use whatever is useful, even products which we used to call wastes and throw away.

Another barrier which stands in the way of fly ash use during the short-term can also be overcome in the long-term, and that is variation in fly ash quality. Fly ash quality varies according to the coal and engineering processes which produce it. The result is that fly ash quality differs from plant to plant and even from boiler to boiler. This means that it is difficult to use fly ash as a raw material because the quality of that raw material does not match with the use to which it could be put and the area within which it could be used. As long as the quality of fly ash produced by a power plant is such that it cannot be used as a raw material for products for which there is a market in an area close enough to the plant to make transporting the fly ash economically feasible, that fly ash is likely to be disposed of rather than used. At present, this is generally the case. Of course, it is possible to reprocess fly ash to make it suitable for marketing, but the costs of reprocessing added to transportation costs push the price which has to be charged for the product to the point where it loses a substantial part of its competitive advantage. The result is that its marketability is lessened.

One of the main reasons for this state of affairs is that fly ash quality control has not been taken into consideration in making decisions regarding the coal and engineering processess which produce it. Those decisions have been made with the view to producing power at minimum cost, regardless of the quality of the fly ash which results. This being the case, the road to changing the present state of affairs lies in the direction of introducing fly ash quality control into the decision-making process. In other words, the type of coal burned and the engineering design used in a power plant should be selected, not only on the basis of efficient power production, but also on the basis of the quality of the fly ash produced. So far as fly ash quality is concerned, the aim should be to produce a by-product for which there is a market in the area served by the power plant.

Obviously, a change in the decision-making process would not have a major impact on the power plants now in operation. The coal which they use and their engineering processes have already been decided, and it would not make sense, technically and economically speaking, to change them in order to produce a marketable fly ash. But such a change could be introduced in the planning and design of new coal-fired power plants. No doubt, its introduction could well add to the cost of electric power, but this is not a justifiable reason for leaving it out of the decision-making process. Producing fly ash which can be put to use is a legitimate cost of generating electricity with coal, and there is no reason why it should not be included in the rates paid by users of that electricity.

So far as the new coal-fired power plants which will be built in Ohio are concerned, there is a regulatory mechanism already in existence which could be used to introduce fly ash quality control into future power plant design. Under ORC 4906, the Ohio Power Siting Commission must issue a certificate for the building of coal-fired power plants with a capacity exceeding 50 megawatts and for substantial additions to existing power plants. In reviewing applications for such permits the Commission must take into account, among other things, the environmental impact, the reasons why the proposed site is best suited for the facility, and any other information the Commission may require. ORC 4906.09 further provides that a certificate shall not be issued unless the Commission finds and determines the nature of the probable environmental impact and concludes that the facility represents the minimum adverse environmental impact, considering the state of available technology, the nature and economics of the various alternatives, and other pertinent considerations.

The language of the Ohio Power Siting Commission's legislative language is broad enough to give the Commission authority to require that applicants for certificates include a fly ash management plan for the proposed facility. A review of that plan would enable the Commission to ascertain the extent to which the applicant had taken fly ash quality control into account and had designed the facility so as to maximize fly ash use potential. Inadequate attention to either of these considerations could be made a ground for refusing to grant a certification.

Adding fly ash quality control to the scope of Ohio Power Siting Commission review would do nothing more than to provide another means by which the Commmssion could determine the nature of the facility's environmental impact and satisfy itself that the facility represented the minimum adverse environmental impact. So taking such a step could not be questioned on legal grounds. Nor would it be objectionable on technical or economic grounds. The Commission is required by its legislative mandate to take the state of available technology and the nature and economics of various alternatives into account in reaching its decisions. Accordingly, it could not demand a level of fly ash management and fly ash quality control which is not technologically and economically feasible.

Nor would the power companies have to absorb any additional costs that might result from providing for the level of fly ash management and fly ash quality control which the Commission required. Such costs would be part of the construction and operating costs taken into account in calculating the rate structure for the electricity which would be supplied. In seeking approval of this rate structure from the Public Utilities Commission of Ohio, the power company could justify including these costs on the basis that they resulted from meeting the standards which the Ohio Power Siting Commission had set for approving its certificate application.

In the final analysis, any additional costs that might result from fly ash management and quality control would be met by the rate payers in the form of higher prices for electricity. Placing the ultimate burden of meeting these additional costs on electricity rate payers is justifiable, however, both on economic and equity grounds. From the economic point of view, producing a by-product which can be used rather than disposing of in ways which cause environmental damage is part of the fuel cycle of a coal-fired power plant, and all of the costs involved in completing that cycle should be covered by the price of the electricity produced. From the equity point of view, the costs of the final, fly ash stage of that fuel cycle should be met by all who use the electricity produced, rather than concentrated upon residents of communities located near power plants in the form of damage to their environment so that others can benefit from cheaper electricity.

IX. Fly Ash Management Planning Needs

The purpose of this report is to substantiate the existence of a fly ash management problem within the coastal region of Northeast Ohio and to assess the technical and management potential for dealing with it. The most that it can accomplish, therefore, is to present a convincing case that a fly ash management plan needs to be formulated and that such an effort can be justified on the basis that it will produce useful results. It is by no means a fly ash management plan or even the first step in preparing such a plan, but it is the necessary prerequisite for undertaking a fly ash management planning effort. That prerequisite having been completed, the next step would be to begin the work of formulating a fly ash management plan for the coastal region of Northeast Ohio. This fly management planning effort should not take the form of a planning exercise which produces nothing more than a paper plan which gathers dust on the shelf but, rather, the form of a process of deliberation and negotiation which results in a plan of action for improving the existing fly ash management situation. If it is to take this form, the planning process must involve, not only planners, but power company officials, fly ash marketers, fly ash haulers, OEPA, ODNR, ODOT, ODOE, environmental groups and citizens -- in short, a cross-section of groups who play a part in or are impacted by fly ash management. Such a cross-section would include a number of interested parties, some of whose interests would be in conflict, but all parties represented would share the common ground of having a stake in the formulation of a reasonable and implementable fly ash management plan for Northeast Ohio's coastal region. This goal can be achieved only if the conflicting interests of the various parties involved are faced squarely and resolved. If the bottom line of fly ash management planning for Northeast Ohio's coastal region is to be implementation, then the management plan which is formualted must be acceptable to those who are going to do the implementing.

Such an implementation-oriented fly ash management plan will take time and money to produce. But the fly ash problem in Northeast Ohio's coastal region is not going to go away. On the contrary, it will become more difficult to deal with the longer those involved postpone coming to grips with it. The prudent course, therefore, would be to set the fly ash management planning process in motion "with all deliberate speed."

Task D: Assistance to Local CEIP Projects

Letters were sent to the Lake County Planning Commission and the City of Lorain Community Development Department offering NOACA's assistance in implementing the Coastal Energy Impact Program planning projects for which they are responsible.

Since the City of Lorain's CEIP project was not implemented, the only CEIP grantee which could be assisted was the Lake County Planning Commission. NOACA assistance took two forms:

1. The Lake County Planning Commission CEIP project deals with the environmental impacts of the Perry Nuclear Power Plant. Since the Planning Commission's plan of study does not include an examination of on-site storage and off-site shipment of the Perry Plant's radioactive solid waste, NOACA prepared a proposal for such an examination. The Lake County Disaster Services Agency was contacted and agreed to participate in the study as a subcontractor to NOACA. The proposal was placed before the Steering Committee of the NOACA Board of Directors, which ratified its submission to ODOE. This was done, in the form of an EDATA application for an amendment to the work activities included in its contract with ODOE which would add the Perry Plant radioactive solid waste study. On July 6, NOACA was notified, by means of a copy of a letter sent to EDATA, that ODOE would not be able to fund the Perry Plant radioactive solid waste study from FY '79 CEIP funds but would consider it for FY '80 funding.

2. In response to expressions of interest on the part of the major utility companies operating in Northeast Ohio, NOACA organized a May 1 meeting of utility company representatives to discuss the setting up of a utility coordination committee. The concensus at that meeting was that forming such a committee would facilitate energy development activities in Northeast Ohio and that the best place to start was Lake County. During June, Lake County officials were convassed to obtain their reaction to this proposal, and it was found to be

uniformally positive. Accordingly, NOACA sponsored a July 24 meeting of Lake County officials and utility company representatives, at which it was decided to form a Lake County Utility Coordination Committee and to appoint an ad hoc committee, under the chairmanship of the Lake County Planning Commission Director, to frame bylaws for its organization and operation. The bylaws committee met during August and finalized the proposed bylaws for submission to an October 23 meeting of Lake County officials and utility company representatives.

At this meeting, the Lake County Utility Coordination Committee was organized with the following bylaws:

Contact was made with the County of Ashtabula and the City of Conneaut in regards to thier CEIP Projects.

3. The City of Conneaut Coastal Zone 1979 CEIP Project deals with the Pittsburgh and Conneaut Dock Company Extension Plan. This study has shown what social and economic impacts in the overall development of Conneaut, pursuent to the Dock Extension Plan.

4. The County of Ashtabula CEIP Project was a plan to mitigate land use conflicts caused by siting of a probable energy facility in Ashtabula Township.

LAKE COUNTY UTILITY COORDINATION COMMITTEE

BY-LAWS

PURPOSE: The purpose of the Lake County Utility Coordination Committee (Committee) shall be to foster a free exchange of information among private and public utilities, governmental agencies and construction organizations, and to promote cooperation among said groups in the planning, design, and implementation of projects affecting one another to the overall good of the members, their customers or constituents, and the general public.

FUNCTIONS: The Committee shall strive to fulfill its purpose by providing a forum for:

1. Exchanging maintenance, construction planning and program information on an ongoing basis for all major facilities (including water, gas, telephone and electric lines, sewers, streets, and highways) covering current and future projects to facilitate resolution of potential conflicts in the planning rather than implementation stage.

2. Providing advance notification on proposed sub-division plans or governmental agency plans which may have an impact on existing or future facilities.

3. Investigating possible common and multiple use of rights-of-way to promote more efficient use of land.

4. Encouraging and facilitating the coordination of specific projects in the planning, design and implementation stages.

5. Supporting programs which prevent damage to transportation and public and private utility facilities, and reduce hazards to work crews and the public resulting from damage to these facilities.

6. Encouraging the formation of utility coordination groups whose aims and purposes are consistent with those of the Committee.

7. Developing policies and procedures to facilitate the above functions.

It is intended that the members should conscientiously seek to carry out these functions through frank and impartial discussion and consideration of all matters pertinent to the objectives of the Committee, with full recognition and regard for the respective rights, obligations and interests of individual members.

It is expressly understood that this Committee is advisory only. It seeks to achieve its purpose through cooperation, education and service to transportation, utility and governmental organizations. Its members participate voluntarily. The Committee desires cooperation with other organizations. It shall not attempt to exercise any authority over any of its members or the industrial, professional or governmental agencies which they represent.

The interest of the Committee shall extend throughout Lake County and contiguous areas and shall include all interested parties who subscribe to its objectives, including the communication industry; electric power industry; water supply industry; pipe line industry; gas transmission and distribution companies; transportation industry (including the Ohio Department of Transportation); consulting engineers; contractors, the construction industry; governmental agencies which operate utility and transportation facilities; and entities which seek to promote utility coordination.

MEMBERSHIP: Membership in the Committee shall be open to any authorized representatives of those groups mentioned above whose activities are related in any manner to the objectives of the Committee.

OFFICERS: The Committee shall elect from its membership a Chairperson, Vice Chairperson and Secretary.

Chairperson: shall preside at meetings of the Committee and see that a meeting time and place are selected for the next scheduled meeting. The Chairperson shall serve a one year term and may be re-elected.

Vice Chairperson: shall assist the Chairperson and shall preside at meetings in the absence of the Chair. The Vice Chairperson will be elected each year.

Secretary: shall record and distribute the minutes of each meeting and maintain a current master list of addresses and telephone numbers of members. The Secretary will be elected each year.

The Offices of Chairperson and Vice Chairperson shall be distributed so that no more than one shall be from the same industry or governmental group as follows:

1. Communications Utilities
2. Non-Utility Communications Companies
3. Contractors and Construction Industry
4. Electric Power Utilities
5. Gas Distribution Utilities
6. Regional Agencies
7. Countywide Agencies
8. Townships
9. Municipal Agencies
10. Transportation Industry (including Ohio Department of Transportation)
11. Consulting Engineering Firms
12. Water Supply Industry

STEERING COMMITTEE: The officers shall be members of the Steering Committee which shall be composed of one designated representative of each of the aforementioned groups or entities elected by the members belonging to that group. The Steering Committee shall be composed of twelve members.

Officers and Steering Committee Members shall be elected at the regular October meeting of the Committee for a term of one year beginning on the first day of January.

Vacancies created during the terms of office will be filled by the Chair, except for the office of Chairperson, which will be for the unexpired term by election from the general membership.

COMMITTEES: Standing and/or Ad Hoc Committees may be established by the officers as may be deemed appropriate to carry out any particular assignment. Such assignments shall be clearly defined. Committees shall automatically terminate upon completion of such assignment to the satisfaction of the officers. Committees may include any number of members, and may include any person who possesses the skills needed to perform the assigned task.

MEETINGS: The Steering Committee shall meet as often as they deem necessary. The officers of the full Committee shall be the officers of the Steering Committee. The full Committee with all members and guests shall meet on Tuesday following the first Monday of February, June and

October or otherwise as determined by the Steering Committee. All members involved shall be given at least seven days notice of the location of all regularly scheduled meetings.

Meetings of the Steering Committee should include reports of Standing Sub-Committees and Ad Hoc Committees and any other business of the Steering Committee which is appropriate.

Meetings of the full Committee should include reports of the officers and the Steering Committee and any other reports which are appropriate. These meetings of the full Committee may also include pertinent, timely, educational topics of general interest to the membership.

RULES OF ORDER: In the election of officers, the voting members shall be limited to one designated representative of each agency or utility company in attendance. In no case shall any agency or utility company have more than one vote.

The deliberations of the Committee shall be governed by Robert's Rules of Order, Revised, except that a quorum shall be composed of the members present.

BYLAWS ADOPTION
AND AMENDMENT: Adoption of the bylaws shall be by the same voting formula as the election of officers. The full Committee shall be notified of any proposed amendment to the bylaws at the regular meeting prior to the meeting at which the vote of amendment is to be taken.

In addition, the October 23 meeting elected officers and designated Standing Committee members. January 18, 1980 was set as the date for the first meeting of the Standing Committee and February 5, 1980 as the date for the first meeting of the full Committee. Finally, the Committee began its work by appointing an ad hoc committee which would meet on November 13, 1979 to coordinate the utility activities which will be involved in the S.R. 306 By-pass project.

Task E - Assistance to Local Governments

Copies of an EDATA memorandum offering energy planning assistance were sent to the following county and local government agencies located in Lorain, Cuyahoga, Lake and Ashtabula County portions of the CEIP planning area:

Director
Cleveland Metropark District
55 Public Square - Room 1700
Cleveland, Ohio 44113

Director
Cleveland-Cuyahoga County Port Authority
101 Erieside Avenue
Cleveland, Ohio 44114

Cuyahoga County Engineer
1926 Standard Building
Cleveland, Ohio 44113

Director
Cuyahoga County Regional Planning Commission
415 The Arcade
Cleveland, Ohio 44114

Mayor
City of Bay Village
250 Dover Center Road
Bay Village, Ohio 44140

Mayor
City of Westlake
Dover Center Rd. & Hilliard Blvd.
Westlake, Ohio 44145

Mayor
City of Rocky River
21012 Hilliard Boulevard
Rocky River, Ohio 44116

Mayor
City of Lakewood
12650 Detroit Avenue
Lakewood, Ohio 44107

Mayor
City of Village
City Hall
601 Lakeside Avenue
Cleveland, Ohio 44114

Mayor
Village of Bratenahl
Bratenahl, Ohio 44108

Mayor
City of East Cleveland
14340 Euclid Avenue
East Cleveland, Ohio 44112

Mayor
City of Euclid
585 East 222 Street
Euclid, Ohio 44123

President
Bd. of County Commissioners
Lake County
Lake Co. Administration Bldg.
105 Main Street
Painesville, Ohio 44077

Director
Fairport Harbor Port Authority
Fairport Harbor, Ohio 44077

Lake County Engineer
550 Blackbrook Road
Painesville, Ohio 44077

Executive Director
Lake County Council of Governments
2551 Bishop Road
Wickliffe, Ohio 44092

Director
Lake County Metropolitan Park District
1385 West Jackson Street
Painesville, Ohio 44077

Mayor
City of Wickliffe
28730 Ridge Road
Wickliffe, Ohio 44092

Mayor
Timberlake Village
11 East Shore Boulevard
Timberlake, Ohio 44094

Mayor
City of Willoughby
4169 River Street
Willoughby, Ohio 44094

Mayor
Grand River Village
205 Singer Avenue
Grand River, Ohio 44045

Mayor
Fairport Harbor Village
220 Third Street
Fairport Harbor, Ohio 44077

Mayor
North Perry Village
4778 Lockwood Road
North Perry, Ohio 44081

Mayor
Madison Village
P.O. Box 7
126 West Main Street
Madison, Ohio 44057

Director
Lorain Metropolitan Park Board
126 Second Street
Elyria, Ohio 44035

Lorain County Engineer
247 Hadaway Street
Elyria, Ohio 44035

Mayor
City of Willowick
30435 Lakeshore Boulevard
Willowick, Ohio 44094

Mayor
Lakeline Village
33601 Lakeshore Boulevard
Lakeline, Ohio 44094

Mayor
City of Eastlake
35150 Lakeshore Boulevard
Eastlake, Ohio 44094

Mayor
City of Mentor-on-the-Lake
5860 Andrews Road
Mentor-on-the-Lake, Ohio 44060

City Manager
City of Mentor
P.O. Box 260
8500 Civic Center Boulevard
Mentor, Ohio 44060

Mayor
City of Painesville
7 Richmond Street
Painesville, Ohio 44077

Mayor
Perry Village
4203 Harper Street
Perry, Ohio 44081

Director
Lorain County Regional Planning Commission
Turner Black
Elyria, Ohio 44035

President
Board of County Commissioners
Lorain County
Lorain County Administration Building
226 Middle Avenue
Elyria, Ohio 44035

Mayor
City of Vermillion
736 Main Street
Vermillion, Ohio 44089

Mayor
City of Lorain
200 West Erie Avenue
Lorain, Ohio 44052

Mayor
City of Amherst
206 South Main Street
Amherst, Ohio 44001

Mayor
City of Sheffield Lake
609 Harris Road
Sheffield, Ohio 44054

Mayor
Sheffield Village
4820 Detroit Avenue
Elyria, Ohio 44035

Mayor
City of Avon Lake
150 Avon Belden Road
Avon Lake, Ohio 44012

Mayor
City of Avon
36774 Detroit Road
Avon, Ohio 44011

Chairman
Board of Township Trustees
Brownhelm Township
8372 Claus Road
Amherst, Ohio 44001

Chairman
Board of Township Trustees
Sheffield Township
4006 Elyria Avenue
Lorain, Ohio 44055

Chairman
Board of Township Trustees
Concord Township
7229 Painesville - Ravenna Road
Painesville, Ohio 44077

Chairman
Board of Township Trustees
Painesville Township
55 Nye Road
Painesville, Ohio 44077

Chairman
Board of Townships Trustees
Perry Township
3200 Narrows Road
Perry, Ohio 44081

Chairman
Board of Township Trustees
Madison Township
49 Park Street
Madison, Ohio 44057

Director
Lorain Port Authority
City Hall
200 West Erie Avenue
Ashtabula, Ohio 44004

City Manager
1925 E. 45th Street
Municipal Building
Ashtabula, Ohio 44004

Mayor
City Hall Building
294 Main Street
Conneaut, Ohio 44030

City Manager
81 E. Main Street
City Hall
Geneva, Ohio 44041

Chairman
Ashtabula County Commissioner
Ashtabula County Office Building
Jefferson, Ohio 44047

Executive Director
Ashtabula County Planning Commission
Ashtabula County Office Building
Jefferson, Ohio 44047

Mayor
4824 Kathryn Drive
Geneva-on-the-Lake, Ohio 44043

Mayor
Municipal Building, Box 253
North Kingsville, Ohio 44068

Chairman
Ashtabula Township Trustees
3611 Dickinson Road
Ashtabula, Ohio 44004

Chairman
Austinburg Township Trustees
3452 Route 307 W
Austinburg Township, Ohio 44010

Chairman
Geneva Township Trustees
6541 N. Ridge W
Geneva, Ohio 44041

Chairman
Harpersfield Township Trustees
Rd. #3
Geneva, Ohio 44041

Chairman
Kingsville Township Trustees
5284 Rt. 193
Kingsville Township, Ohio 44048

Chairman
Plymouth Township Trustees
Rt. 2
Ashtabula, Ohio 44004

Chairman
Saybrook Township Trustees
6710
Saybrook Township, Ohio 44004

Chairman
Sheffield Township Trustees
2753 Griggs Rd.
Jefferson, Ohio 44047

The only local government which requested assistance from NOACA was the City of Eastlake. Eastlake requested assistance in connection with its efforts to make good environmental losses at the mouth of the Chagrin River. These losses take the form of recurring spring flooding and restricted use of Eastlake's small boat harbor. Both result from sand bar build-up at the mouth of the river, which prevents river ice and small boats from moving freely into Lake Erie. One of the primary causes of the sand bar build-up is the presence of a 1200' water intake pipe for CEI's Eastlake Plant which runs along the bottom of Lake Erie on the western side of the River's mouth.

The City of Eastlake and Army Corps of Engineers have proposed to ameliorate both the flooding and boating problems by building a wing wall on the east side of the river mouth, which will prevent this sand bar build-up.

The estimated cost of the wing wall is $450,000, $300,000 of which will be met by the Ohio Department of Natural Resources. Eastlake sought NOACA's assistance in raising the remaining $150,000. Since the environmental problem in question was caused in part by an energy facility, NOACA staff directed the attention of Eastlake officials to Coastal Energy Impact Program financial assistance provided by Section 308(d)(4) of the Coastal Zone Management Act and assisted them in preparing an application for forwarding to the Ohio Department of Energy (ODOE). When it became apparent that ODOE would not be able to fund the project under CEIP, NOACA staff continued to work with Eastlake officials in securing funds from the State's watercraft program, HUD, and local sources. As a result of these efforts, the Eastlake City Council was able to make a commitment to meet the local share and thus clear the way for implementing the project.

APPENDIX

Public Participation Program in Ashtabula, Lorain, Cuyahogo, and Lake Counties

The Public Participation Program began with the sending of a press release announcing the beginning of the EDATA/NOACA CEIP project to the following newspapers and radio stations:

Newspapers

- Cleveland Plain Dealer
- Cleveland Press
- Willoughby News Herald
- Lorain Journal
- Painesville Telegraph
- Elyria Chronicle-Telegram
- Associated Press
- United Press
- Northern Ohio Business Journal (Cleveland)
- Business Review (Cleveland)
- Star-Beacon
- Tele Media Co.
- Conneaut News Herald
- Jefferson Gazette
- Farm and Dairy
- Youngstown Vindicator

Radio Stations

- WERE - Cleveland
- WPVL - Painesville
- WBEA - Elyria
- WREO - Ashtabula
- WWOW - Conneaut
- WAQI - Ashtabula

MEMBERS OF NOACA

COMMUNITY IMPROVEMENT COMMITTEE

Hon. Dennis J. Kucinich
Mayor, City of Cleveland
601 Lakeside Ave.
Cleveland, Ohio 44114

Hon. Alexander R. Roman
Mayor, City of Westlake
27216 Hilliard Blvd.
Westlake, Ohio 44145

Hon. Mae E. Stewart
Mayor & Comm. President
City of East Cleveland
1252 Melbourne
East Cleveland, Ohio 44112

Hon. Anthony J. Sinagra
Mayor, City of Lakewood
12650 Detroit
Lakewood, Ohio 44107

Hon. James H. Cowles
Mayor, City of Bay Village
350 Dover Center Road
Bay Village, Ohio 44140

Hon. Earl Martin
Mayor, City of Rocky River
21012 Hilliard Blvd.
Rocky River, Ohio 44116

Hon. Anthony J. Sustarsic
Mayor, City of Euclid
585 East 222nd Street
Euclid, Ohio 44123

State Senator Charles Butts
4915 Storer Ave.
Cleveland, Ohio 44102

Hon. Richard C. McKeon
Mayor, Bratenahl Village
12015 Lake Shore Blvd.
Cleveland, Ohio 44108

Jack Hively
Executive Director
Cleveland/Cuyahoga
County Port Authority
101 Erieside
Cleveland, Ohio 44114

Ronald Stackhouse
County Engineer
Cuyahoga County
1926 Standard Bldg.
Cleveland, Ohio 44113

Hon. Donald L. Smith
Mayor, City of Sheffield Lake
825 Lakewood Beach Drive
Sheffield Lake, Ohio 44054

Harold Schick, Dir.
Cleve. Metro. Park Dis.
1700 Illuminating Bldg.
55 Public Square
Cleveland, Ohio 44113

Hon. Anthony DePaola
Mayor, City of Amherst
513 N. Woodhill Dr.
Amherst, Ohio 44001

Larry Stark, Manager
Comm. Improve. Projects
Greater Cleve. Growth Assoc.
Union Commerce Bldg., Rm. 690
Cleveland, Ohio 44115

Hon. John M. Romoser
Mayor, Sheffield Village
5236 French Creek Rd.
Lorain, Ohio 44054

Hon. Joseph J. Zahorec
Mayor, City of Lorain
500 W. Erie Ave.
Lorain, Ohio 44052

Hon. Jim Odom
Mayor, City of Vermilion
P.O. Box 317
Vermilion, Ohio 44089

Hon. Donald L. Hubbard
Mayor, City of Avon
3348 Stoney Ridge Rd.
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A presentation on the CEIP project was made to the February 20 meeting of the NOACA Community Involvement Committee (CIC). As a part of this presentation, the CIC was informed that a CEIP Advisory Task Force would be organized and that a CEIP Workshop would be held as the first step in activating the Task Force.

The following officials and citizens were invited to attend a CEIP Workshop, which was held on March 20, 1979 and to participate in the activities of the Advisory Task Force.

The March 20 Workshop agenda consisted of a presentation on the CEIP project and a discussion of the Advisory Task Force's organization and role. In addition, an opportunity was provided for the local officials and citizens who attended to express their views on the local issues which should be addressed during the course of the CEIP planning process. Information sheets were provided so that these views could be put in a written form for the use of NOACA staff.

The first meeting of the CEIP Advisory Task Group was held on April 7, 1979. At this meeting, the Task Group reviewed the summary of the proceedings of the March 20 Task Group Orientation Workshop and the March 30 Progress Report. In addition, there was a discussion of the proposal to study on-site storage and off-site shipment of radioactive solid waste from the Perry Nuclear Power Plant.

On July 31 and August 2, public meetings were held in Lorain County and Lake County, reppectively, to discuss CEIP project components which are of special interest to each of those counties. The Lorain County meeting focused attention on the fly ash and resource recovery components. The Lake County meeting, in addition to discussing its fly ash problem, concentrated attention on the proposal to study on-site storage and off-site shipment of radioactive solid waste from the Perry Nuclear Power Plant.

On September 18, the second meeting of the Advisory Task Group was held. The September 30 Progress Report and the draft fly ash management report were reviewed. Proposed agendas for the Task Group's October 16 and November 20 meetings were discussed and adopted.

On October 16, the Advisory Task Group met for the third time. Proposals for the FY '80 CEIP project were discussed, and the draft reports on energy transmission lines/rights of way were reviewed. The Advisory Task Group's final meeting during the FY'79 project period was held on November 20, 1979. The agenda consisted of a review of the draft FY CEIP project report, and a discussion of the FY '80 proposed CEIP project, with particular reference to the 1980 Task Group activities that would be involved.

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On February 1st, public meeting of the Ashtabula County Citizens' Advisory Committee (ACCAC), the CEIP projects were discussed. A break down of each task of the project was reviewed and how the citizens could take an active part in the program.

The May 17th, 1979 meeting consisted of the Pipeline Study and right-of-way. A list of prospective pipeline companies, electric utility corporations and gas line utility companies. A staff person ask for any information that would be of some help in our work program.

The June 21st meeting of the (ACCAC) was an update on the progress of the (CEIP) project. At the meeting 10 year forcasts of the Asthabula County utility lines were shown. It was noted the drastic change of utility lines during the past 10 years, and if the U.S. Steel were built, how this would cause another change. A copy of the March 1st progress report was reviewed by each of the members. A rough draft of the Fly Ash Report was also given out for their review and comments for the next meeting.

On September 20th, a special interest was focused on the Fly Ash Report. It was noted that even if the fly ash that had been generated in Ashtabula County was being used in some commercial way, and that it really did not cause that much of a problem it still should be addressed. One point that was brought out in the report was that fly ash used as a cover with solid waste causes a chemical reaction that makes the solid waste decompose faster. This technique would give longer life to land fills now in operation, and should be used in the planning of new land fill rites. A great deal of discussion was made in regards to the many uses of fly ash. There was an agreed opinion that fly ash should be used and not just a fill.

The following major points were discussed:

1. Coal ash (Both Fly Ash and Bottom Ash) is the 7th most abundant solid mineral in the country.
2. There was an estimated 118,225 tons of Bottem Ash produced by CEI in Ashtabula in 1978 and only 7% was used, 93% was disposed of in landfills.

3. There is no in-depth Fly Ash management planning project for Ashtabula County.

4. Local governments land use controls are not an effective regulatory device.

5. Local Boards of health and health departments could, but do not regulate Fly Ash hauling, no money or staff.

Recommendations:

a. OEPA adopt performance standards for Fly Ash disposal sites.
b. OEPA adequately funded to provide staff to enforce standards and regulations.
c. Ashtabula County Comm. immediately implement a program of treating and injecting Fly Ash at the LAND-FILL site to prolong its life. (See page 73)
d. Conneaut investigate usage of Fly Ash to treat industrial and municipal wastewater. (See page 72)
e. Conneaut investigate and procure Bottom Ash (cindes) for snow/ice control to reduce usage of salt.

On The October 18th meeting the (ACCAC) citizens' Advisory Committee reviewed the solid waste report and the September 30th progress report. It was noted that the need of a resource recovery plant was even more evident now with the possible U.S. Steel plant being considered in Conneaut. It was pointed out that the Ashtabula County Planning Commission are very much in favor of a Resource Recovery Plant in their county.

The November 15th meeting consisted of review of the draft report of Pipeline and Right-of-Way Study/ Resource Recovery and Fly Ash Management. The 1980 CEIP work program that was sent to the Ohio Dept. of Energy was discussed, and what input the Citizens' Advisory Committee would have in future plans.