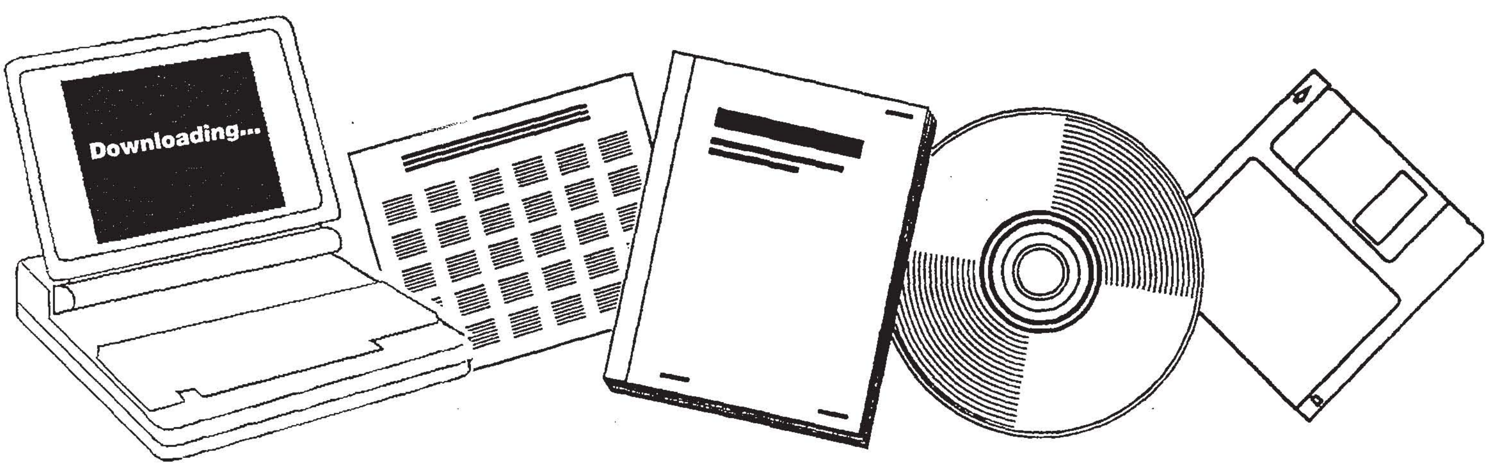
PB294635

PB294635

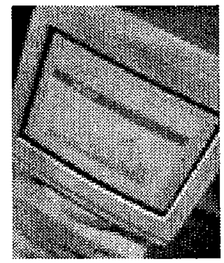
EFFECTS OF NUCLEAR POWER PLANTS ON COMMUNITY GROWTH AND RESIDENTIAL PROPERTY VALUES

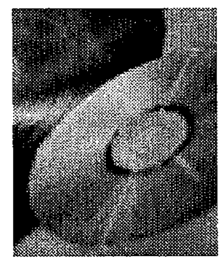
PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. INST. FOR RESEARCH ON LAND AND WATER RESOURCES

APR 1979



U.S. Department of Commerce
National Technical Information Service





PB 294635

NUREG/CR-0454

EFFECTS OF NUCLEAR POWER PLANTS ON COMMUNITY GROWTH AND RESIDENTIAL PROPERTY VALUES

Final Report
September 30, 1977 - November 15, 1978

H. B. Gamble
R. H. Downing O. H. Sauerlender

The Pennsylvania State University

Prepared for
U. S. Nuclear Regulatory Commission

NOTICE

NRC FORM 335 (7-77)

U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

1. REPORT NUMBER *(Assigned by DDC)*
NUREG/CR-0454

4. TITLE AND SUBTITLE *(Add Volume No., if appropriate)*
Effects of Nuclear Power Plants on Community Growth and Residential Property Values

2. *(Leave blank)*

3. RECIPIENT'S ACCESSION NO.

7. AUTHOR(S)
Gamble, Hays B., R. H. Downing, O. H. Sauerlender

5. DATE REPORT COMPLETED
MONTH: November
YEAR: 1978

9. PERFORMING ORGANIZATION NAME AND MAILING ADDRESS *(Include Zip Code)*
The Pennsylvania State University
Institute for Research on Land and Water Resources
104 Land and Water Building
University Park, PA 16802

DATE REPORT ISSUED
MONTH
YEAR

6. *(Leave blank)*

8. *(Leave blank)*

12. SPONSORING ORGANIZATION NAME AND MAILING ADDRESS *(Include Zip Code)*
Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
SAFER Division, Mail 113055
Washington, DC 20555

10. PROJECT/TASK/WORK UNIT NO.

11. CONTRACT NO.
NRC-04-77-166

13. TYPE OF REPORT
Final

PERIOD COVERED *(Inclusive dates)*
October 1977 - November 1978

15. SUPPLEMENTARY NOTES

14. *(Leave blank)*

16. ABSTRACT *(200 words or less)*

This study tested the hypothesis that nuclear power plants adversely affect community growth and residential property values in nearby municipalities. Total assessed real property values from 1960 to 1976 for 64 municipalities and market sales data from 1975 to 1977 on 540 single family dwellings formed the data base, which was within 20 miles of 4 nuclear power plants in the Northeast: Pilgrim, Millstone, Oyster Creek, and R. E. Ginna. Analysis of the time series data showed that the averaged annual growth rates of total assessed values, in real terms, were inversely related to distances from the plants, and that growth rates for the years following plant construction were higher than for the years before plant construction, with the largest growth rate increase observed in the host municipalities. Multiple regression analysis of the cross sectional data explained about 80 percent of the variation in housing prices. The plants exerted no influence on the price of housing. The original hypothesis is rejected. Most people in these areas apparently have little fear over plant related health and safety factors, and the plant itself does not influence residential location decisions. Lower tax rates in host municipalities may even encourage development.

17. KEY WORDS AND DOCUMENT ANALYSIS

17a. DESCRIPTORS

Nuclear Power Plants
Community growth
Property values
Property taxes
Property assessments
Residential location choice

17b. IDENTIFIERS/OPEN-ENDED TERMS

18. AVAILABILITY STATEMENT

19. SECURITY CLASS *(This report)*
unclassified

20. SECURITY CLASS *(This page)*

21.

22. PRICE
A05-A01

NRC FORM 335 (7-77)

NUREG/CR-0454

EFFECTS OF NUCLEAR POWER PLANTS ON COMMUNITY GROWTH AND RESIDENTIAL PROPERTY VALUES

Final Report
September 30, 1977 - November 15, 1978

H. B. Gamble
R. H. Downing O. H. Sauerlender

The Pennsylvania State University
Institute for Research on Land and Water Resources
University Park, PA 16802

Manuscript Completed: November 1978
Date Published: April 1979

Prepared for
Division of Safeguards, Fuel Cycle and Environmental Research
Office of Nuclear Regulatory Research
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555
NRC FIN No. B6173

ABSTRACT

This study tested the hypothesis that nuclear power plants adversely affect community growth and residential property values in nearby municipalities. Total assessed real property values from 1960 to 1976 for 64 municipalities and market sales data from 1975 to 1977 on 540 single family dwellings formed the data base, which was within 20 miles of 4 nuclear power plants in the Northeast: Pilgrim, Millstone, Oyster Creek, and R. E. Ginna. Analysis of the time series data showed that the averaged annual growth rates of total assessed values, in real terms, were inversely related to distances from the plants, and that growth rates for the years following plant construction were higher than for the years before plant construction, with the largest growth rate increase observed in the host municipalities. Multiple regression analysis of the cross sectional data explained about 80 percent of the variation in housing prices. The plants exerted no influence on the price of housing. The original hypothesis is rejected. Most people in these areas apparently have little fear over plant related health and safety factors, and the plant itself does not influence residential location decisions. Lower tax rates in host municipalities may even encourage development.

TABLE OF CONTENTS -- Continued

TABLE OF CONTENTS

Preceding page blank

TABLE OF CONTENTS -- Continued

LIST OF FIGURES

Preceding page blank

Figures

LIST OF TABLES

PREFACE

The authors wish to acknowledge the assistance provided by the many local tax assessors and other local and state officials who cooperated so generously with us in providing the data. We also wish to thank the Plymouth County, Mass., multiple listing service for making available their files.

Within the Institute for Research on Land and Water Resources, Howard Hester, Daniel Huegel, and Kathy Phillips spent many days collecting, processing, and coding the data. Beth Marquiss skillfully typed all the text and tables in the final report.

Finally, we wish to thank the U.S. Nuclear Regulatory Commission for supporting this study and for providing background information on the 4 study sites. Views expressed and conclusions reached are those of the authors and not necessarily those of the sponsor, the U.S. Government, or any of the above named individuals or groups.

Hays B. Gamble
Professor of Agricultural Economics

Roger H. Downing
Research Assistant

Owen H. Sauerlender
Professor Emeritus of Economics

Preceding page blank

EFFECTS OF NUCLEAR POWER PLANTS ON COMMUNITY GROWTH AND RESIDENTIAL PROPERTY VALUES

I. INTRODUCTION

1.1 Statement of the Problem

Over the past decade it has become increasingly more difficult for electric utilities to receive timely approval of new nuclear generating facilities. The proposed plant at Seabrook, New Hampshire is a case in point. Lengthy delays are not only very costly to the utility, but may become costly to the utility's consumers as well. Higher rates reflecting higher construction costs and more frequent interruptions of power as generating capacity fails to keep pace with power demand increase consumer costs.

In part, siting difficulties arise from the strong opposition to nuclear plants from some citizens who perceive such plants to pose real threats to health and safety. The extent to which such views are held by society at large are very difficult to ascertain, however. If many people hold such views, it seems logical, then, to expect that people would not choose to live in communities near to such plants and that as a consequence residential property values would decline and growth would be adversely affected.

It would seem that information about the extent to which society holds fears about health and safety would enable utilities and government agencies to make more timely and better informed siting decisions. This study is directed towards supplying some of this information.

1.2 Objectives of the Study

If a sizable proportion of the population hold genuine fears about the health and safety aspects of a nuclear power generating facility, then they certainly would not choose to reside (own residential property) near one. This would have the effect *ceteris paribus* of shifting the demand curve for housing to the left, as illustrated by D_2 in Figure 1.1, thus lowering the price from P_1 to P_2. D_1 reflects a demand curve for housing in an area before a nuclear plant was proposed, while D_2 reflects an hypothesized reduced demand curve for housing in the same area after the nuclear plant is constructed and operating.

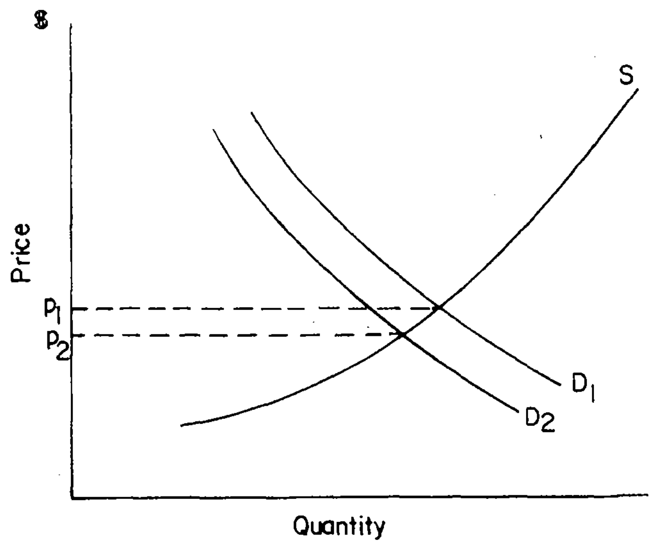


Figure 1.1. Effect of reduced demand on price.

We believe that residential property value differences in the vicinity of nuclear plants will provide the best empirical means by which the general public's reaction to such plants can be guaged. The public's perception of the likely health and safety effects from such plants get put to the real test when their own dollars are "on the line," and this occurs in the real estate market for residential property near such plants. We lack sufficient information or insight to postulate what proportion of the population must hold real fears of health hazards from nuclear power plants before property values near such plants are measureably reduced. Intuitively, we feel that if only a small proportion of the population hold such fears there will be no negative effects on real estate values, although the model theoretically states that even a small reduction in demand should affect prices, ceteris paribus. But in the real world there are many variables affecting housing prices, all working simultaneously; the real estate market at any one point in time is relatively thin, in that only a few houses in an area are up for sale at the same

time and we can't assume, as the model does, that all potential buyers are fully knowledgeable about all variables affecting the housing market (some prospective buyers may not be aware of the presence of the plant). What we feel we can state is that if no measureable drop in housing prices in the vicinity of a plant is found, then the extent of the public's concern about health effects is not sufficiently widespread to adversely influence land values. This in itself can be important in terms of siting policies and decisions.

The specific objectives of this research are as follows:

(1) To ascertain if, over time, nuclear generating plants have had an effect on the growth of the towns or communities in which they are located as compared to towns or communities more distantly located (control areas). Such growth would be evidenced by changes in equalized real property assessments.

(2) To determine the effects of nuclear generating plants on the market values of residential properties.

The specific hypotheses to be tested in the research are:

(1) That growth in communities near nuclear generating plants is less than growth in more distant communities.

(2) That nuclear generating plants have an adverse effect upon residential property values; i.e., property values are directly related to distance from the nuclear plant (the closer to the plant, the lower the value, <u>ceteris paribus</u>).

To achieve the above objectives, 4 nuclear power generating plants were chosen for study:

(1) Pilgrim, in Plymouth, Massachusetts
(2) Millstone, in Waterford, Connecticut
(3) Oyster Creek, near Tom's River, New Jersey
(4) R. E. Ginna, near Rochester, New York.

1.3 Relevancy of the Study

There is general agreement that additional power generating capacity is sorely needed in this country to meet the anticipated demand for electric energy, even with a reduction in the historical growth rate of such demand. Many authorities feel that a substantial portion of this additional generating capacity will have to be met with nuclear plants. The record in the last few years, however, has shown that because of

environmental considerations, fears for human health and safety, availability of capital funding, and water availability constraints, the approval of new sites for nuclear plants has been a slow, laborious, and frustrating process.

To the best of our knowledge, a study of the effects of nuclear power plants on land values has not been made. Knowledge about such effects would be helpful to government agencies responsible for developing and implementing regulations controlling the siting of such plants.

Electric utilities are experiencing increased resistance from the public in the siting of new generating capacity. Whether our hypotheses are supported or rejected by this study, such evidence could be useful to utilities in their evaluation of potential sites and to public agencies in their reviews of siting applications. It could be useful also to local governments faced with the prospect of a nuclear plant in their midst, for knowledge about the likely effects of such plants on the demand for land would assist local planners and other officials in theri attempts to plan for orderly development.

Finally, the information gained from this study will help in developing improved site selection criteria for the siting of future power generating facilities.

1.4 Previous Research

Economists and others have recognized for many years that land values reflect the beneficial impacts arising from public and private investment expenditures. Numerous studies have documented the dramatic increase in land values following the introduction in rural areas of interstate highways and large water impoundments for recreation (for example, see 1, 2, 3, 4, 5, 6).

In recent years economists have become quite interested in studying land values as they may reflect the negative influences of developmental activities. Adverse effects such as noise and air pollutants from highways and airports have received the most attention, and a number of studies have empirically verified the negative influence of these on nearby property values (for example, see 7, 8, 9, 10, 11, 12, 13). Another study examined the effect of a sanitary landfill solid waste disposal site on nearby land vaues (14).

Two studies have focused on the impact of fossil fueled electric generating plants on land use and land values in their vicinity. Blomquist (15) investigated property value changes around a small (26 MWe) plant in Winnetka, Illinois, a Chicago suburb. Using mean property value estimates by owners by census blocks in a regression model he found that within 11,500 feet of the power plant a typical

single family residential property loses 0.9 percent of its value for each 10 percent move closer to the plant. The total disamenity value of the power plant is somewhere between $202,804 and $17,708,000, the low estimate assuming no damage to non-residential property and the high estimate assuming all area property is evaluated and damaged as residential property. Jack Faucett Associates, Inc., (16) studied the 1260 Mw fossil fueled plant at Chalk Point, Maryland, a rural area southeast of Washington, D. C. They estimated that the average total effect on property values in the impact area amounted to $30.91 per $1000 of property valuation. The aesthetic components of odor, noise, and sight (visual impact) accounted for $17.19 of this total effect. The Faucett report points out that because of few property sales the derived estimate of total externality per $1000 valuation of impact area properties is not definable within strict confidence limits. They do feel, however, that the results represent an appropriate order of magnitude estimate of the impact on property values. This finding is very tentative because of the few observations (property sales) available.

To the best of our knowledge, there has been no economically sound research conducted to directly examine the effects of nuclear generating plants on surrounding property values.

1.5 Plan of the Study

The remainder of this report is divided into 3 chapters and 2 appendices. Chapter II discusses the selection of study sites and briefly describes them, presents the methodologies employed in the time series (longitudinal) and cross section analyses; and describes the collection of data. Chapter III describes the analyses of the time series and cross section data and provides an interpretation of the results. Chapter IV presents the conclusions and recommendations and also provides a summary of the study. The appendices contain a more detailed description of the regression models and how they were used as well as more detailed data on the time series analysis.

1.6 Literature Cited

1. Knetsch, J. L. "The Influence of Reservoir Projects on Land Values." Jrn. of Farm Econ., Vol. 46, pp. 231-243, 1964.

2. Miller, S. F., Jr. Effects of Proposed Highway Improvement on Property Values. NCHRP Report No. 114. Washington, D. C. Highway Research Board. 1971 42 pp.

3. Mohring, H. "Land Values and the Measurement of Highway Benefits." Jrn. Political Economy. pp. 236-249. June 1961.

4. Pendleton, W. C. "Relation of Highway Accessability to Urban Real Estate Values." Highway Research Record No. 16, pp. 14-23. Nov. 1962.

5. Schutjer, W. A. and M. C. Hallberg. "Impact of Water Recreational Development on Rural Land Values." Am. Jrn. Agric. Econ., Vol. 50, No. 3, pp. 572-583. 1968.

6. U.S. Department of Transportation, Federal Highway Administration. Social and Economic Effects of Highways. 1974. 180 pp.

7. Anderson, R. J. and T. D. Crocker. "Air Pollution and Residential Property Values." Urban Studies. Vol. 8. pp. 171-180. 1971.

8. Emerson, F. C. The Determinants of Residential Value with Special Reference to the Effects of Aircraft Nuisance and Other Environmental Features. Ph.D. Dissertation. University of Minnesota, 1969.

9. Gamble, H. B., O. H. Sauerlender, and C. J. Langley. "Adverse and Beneficial Effects of Highways on Residential Property Values," Transportation Research Record 598, Social, Economic, Behavioral, and Urban Growth Consideration in Planning. Transportation Research Board, National Research Council, National Academy of Sciences, Washington, D.C. 1974, pp. 37-48.

10. Ridker, R. G. and J. A. Henning. "The Determinants of Residential Property Values with Special Reference to Air Pollution." Review of Economics and Statistics, Vol. 69, No. 2, pp. 246-257. May 1967.

11. Vaughan, R. J. and L. Huckins. The Economics of Expressway Noise Pollution Abatement. Rand Paper Series, Rand Corporation, Santa Monica, Cal. 1975.

12. Walther, H. O. A Study of the Impact of Airports on the Market Value of Real Estate in the Adjacent Area. Chicago, Ill., 1960.

13. Nelson, J. P.: Aircraft Noise and the Market for Residential Housing: Empirical Results for Seven Selected Airports. Institute for Policy Research and Evaluation, The Penna. State Univ., Univ. Park, PA. 1978.

14. Havlicek, J., Jr., R. Richardson, and L. Davies. "Measuring the Impacts of Solid Waste Disposal Site Location on Property Values." Am. Jrn. Ag. Econ., Vol. 53, No. 5, Dec. 1971, pp. 869.

15. Blomquist, G. "The Effect of Electric Utility Power Plant Location on Area Property Value." Land Economics, Vol. 50, No. 1, Feb. 1974, pp. 97-100.

16. Jack Faucett Associates, Inc. "Evaluation of Power Plant Externalities: A Land Value Approach," Maryland Department of Natural Resources, Annapolis, Md. 1976.

II. METHODOLOGY

2.1 Selection of Study Areas

The selection of nuclear power generating sites was restricted to those in the Northeastern United States in order to keep travel costs and time to a minimum. The Nuclear Regulatory Commission supplied the researchers with a list of 11 Northeastern plants that had been in operation for 3 or more years, together with data on host county population growth 1965-1975, host county per capita income, and population within 5 miles of each plant. From this list, 7 plants were identified as possible candidates. For the 4 plants excluded from initial selection, the Indian Point plant in New York exhibited high population within 5 miles but very little growth (2.2 percent in 10 years), indicating the possibility of a rather stagnant real estate market. The other three plants (Vermont Yankee, Yankee Rowe, and Maine Yankee) were in areas of low population, again reflecting a thinness to the real estate market.

Criteria were established for selecting the 4 study sites out of the 7 potentially identified. There had to be a population of about 10,000 within 5 miles of the plant in order to provide sufficient data on residential property transactions; the local tax assessment offices had to have their data in a form that would readily provide information (descriptors) on individual properties; the county court houses had to be able to provide information on property sales; and the local planning commissions or township governments had to be able to provide maps and other information on land use.

All 7 potential sites were visited and contact made with local planning officials, tax assessors, and recorders of deeds in the court houses. On the basis of these site visits, the Peach Bottom plant in Pennsylvania, the Connecticut Yankee, and the Nine Mile Point plant in New York were eliminated, primarily because of sparsity of data on residential property sales during the past few years.

The 4 plants finally selected and approved by the Nuclear Regulatory Commission were: Pilgrim 1 in Plymouth, Massachusetts; Millstone 1 in Waterford, Connecticut; Oyster Creek in Lacey Township, New Jersey; and R. E. Ginna in the town of Ontario, New York. Figure 2.1 shows the general location of each plant in the Northeast.

Because these plants were not randomly selected, the findings of this study are applicable only to these plants or to plants that would be similar in all locational attributes, including the socio-economic variables associated with the surrounding communities. The results

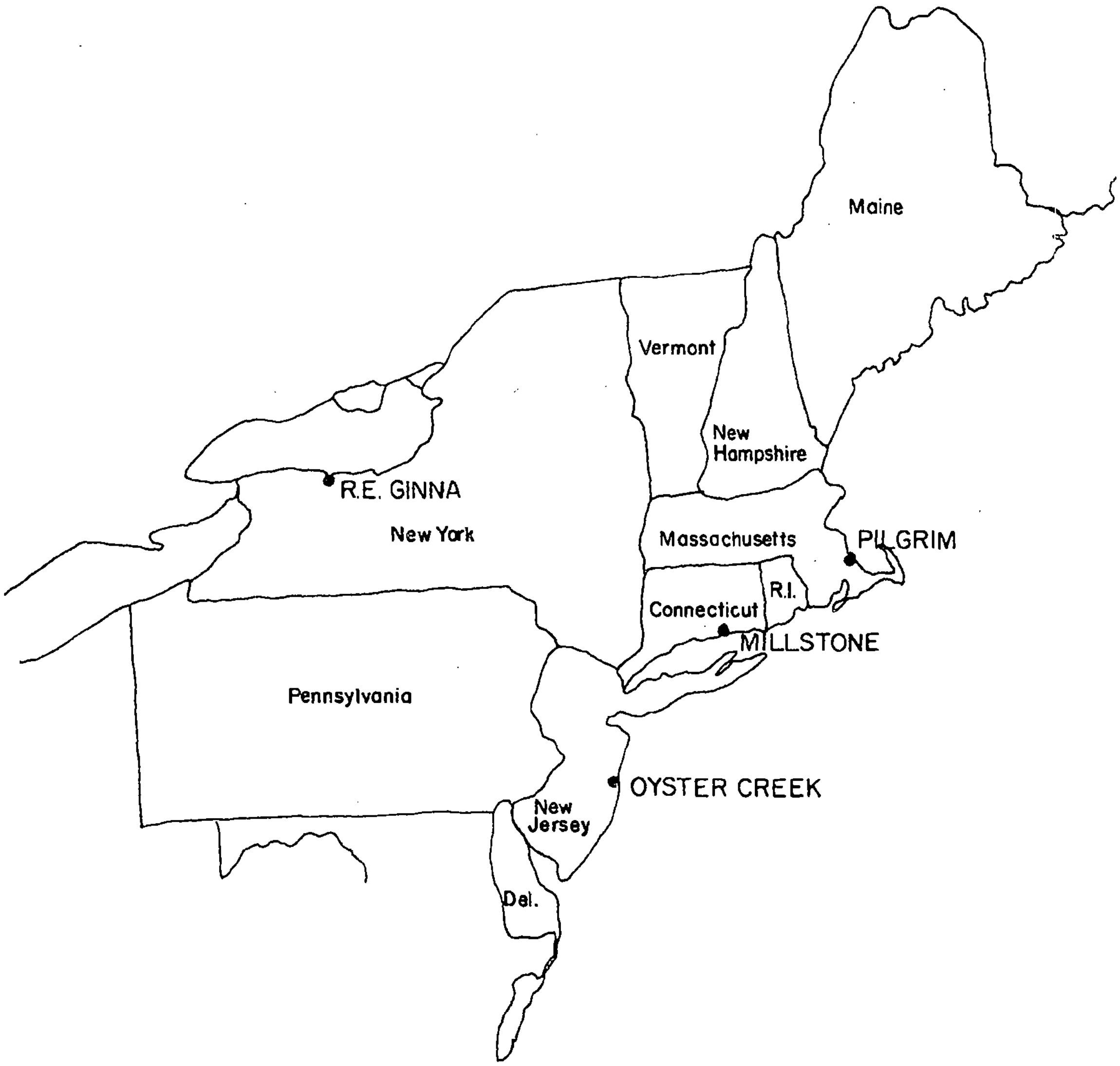


Figure 2.1. Location of 4 plant sites in Northeast United States.

should not be used in a predictive way for existing or potential sites elsewhare.

2.2 Description of Study Sites

Table 2.1 summarizes general information about each of the 4 study sites. Site visits were made to each of the 4 plants and those portions of the following discussion that deal with land use are based on field observations

2.2.1 Pilgrim 1. -- The Pilgrim plant, owned by the Boston Edison Company, is located in the Southeastern part of Massachusetts about 3.5 miles from the town of Plymouth (See Figure 2.2). It is located on Cape Cod Bay about 36 miles south of Boston and 44 miles east of Providence, Rhode Island.

Pilgrim 1 has a 670 MWe generating capacity and is a boiling water reactor. Cooling is accomplished by drawing water from Cape Cod Bay which is returned through a discharge channel. The plant was constructed between 1968 and 1972 and became operational in December of 1972.

The site occupies 517 acres on a bluff overlooking the Bay. The structure is about 180 feet tall but a forested portion of the tract forms an effective sight barrier to observers from the land side. Approximately 60 percent of the area within a 50 mile radius of the plant is open water. Within 2 miles of the plant development is sparse with the exception of seasonal home developments along the bay shore south of the plant.

2.2.2 Millstone 1. -- The Millstone plant, owned and operated by the Northeast Utilities, is located on the north shore of Long Island Sound in the town of Waterford, Connecticut. It is about 4 miles southwest of New London, 40 miles east of New Haven, and 60 miles southwest of Providence, Rhode Island (See Figure 2.3).

The Millstone 1 plant has a rated capacity of 652 MWe and is a boiling water reactor. Millstone 2 generates 830 MWe and is a pressurized water reactor. The once through cooling system draws water direct from Niantic Bay, and discharges it back to the bay via an old quarry. Construction began on unit 1 in May 1966 and on unit 2 in November 1969. Units 1 and 2 became operational in December 1970 and December 1975, respectively.

The plant site occupies about 500 acres of land on Millstone point jutting into Long Island Sound. The areas along the shore of the Sound

Table 2.1. General information on the four nuclear power plant study areas.

Plant Name	Year		1975 Population			Distance To Nearest City of 50,000	Host County Per Capita Income	
	Construction Began	Plant Operational	Within 5 Miles	Host County	Host County Change 1965–1975		1975	Change 1965–1975
					(%)	(miles)	($)	(%)
Pilgrim 1	1968	1972	14,401	379,800	+24.1	36	5,555	+117
Millstone 1	1966	1970	46,550	240,600	+11.2	40	6,079	+121
Oyster Creek	1964	1969	9,835	296,800	+81.3	60	6,259	+112
R. E. Ginna	1966	1970	10,800	708,400	+ 7.9	20	7,009	+ 98

Source: Nuclear Regulatory Commission

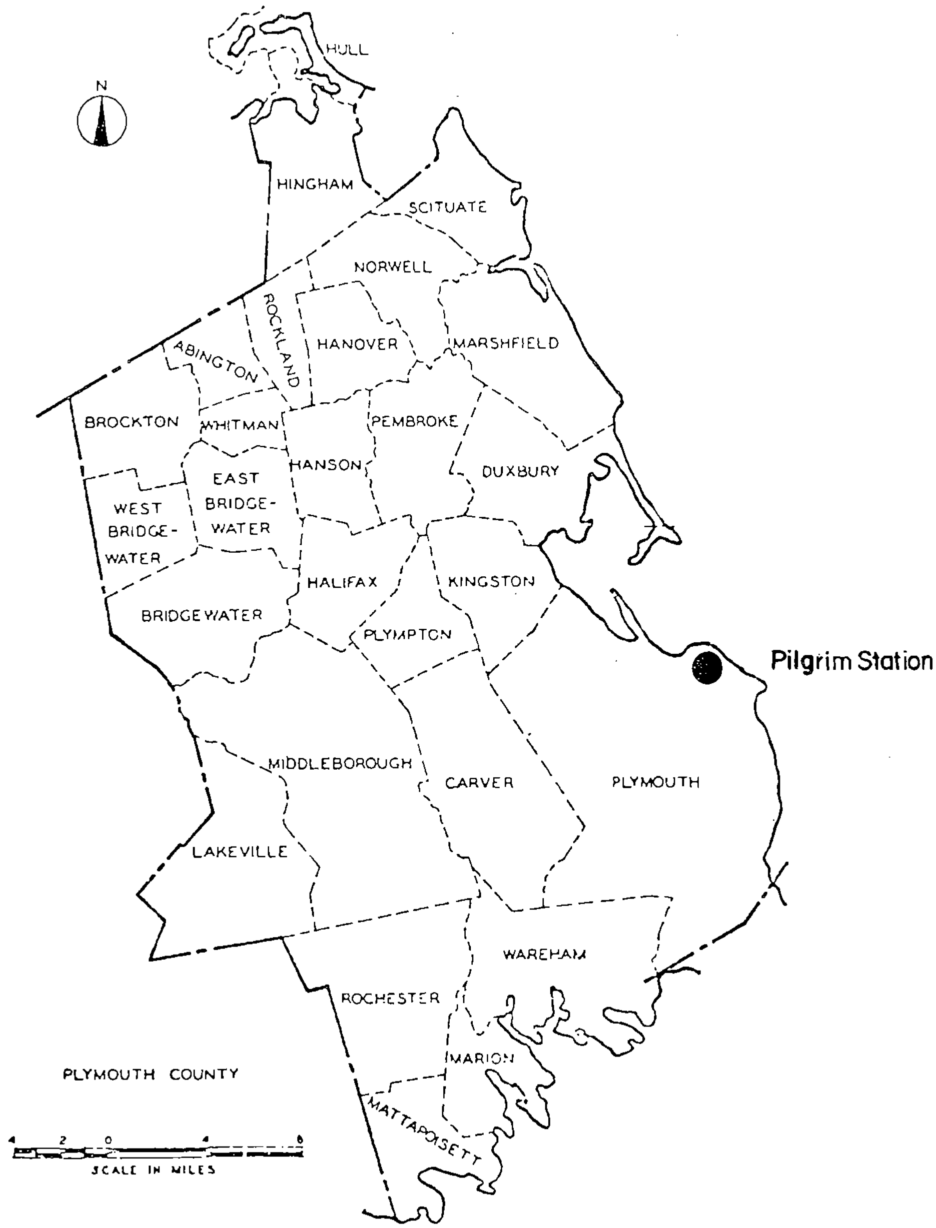


Figure 2.2. Location of Pilgrim Station, Plymouth, Massachusetts.

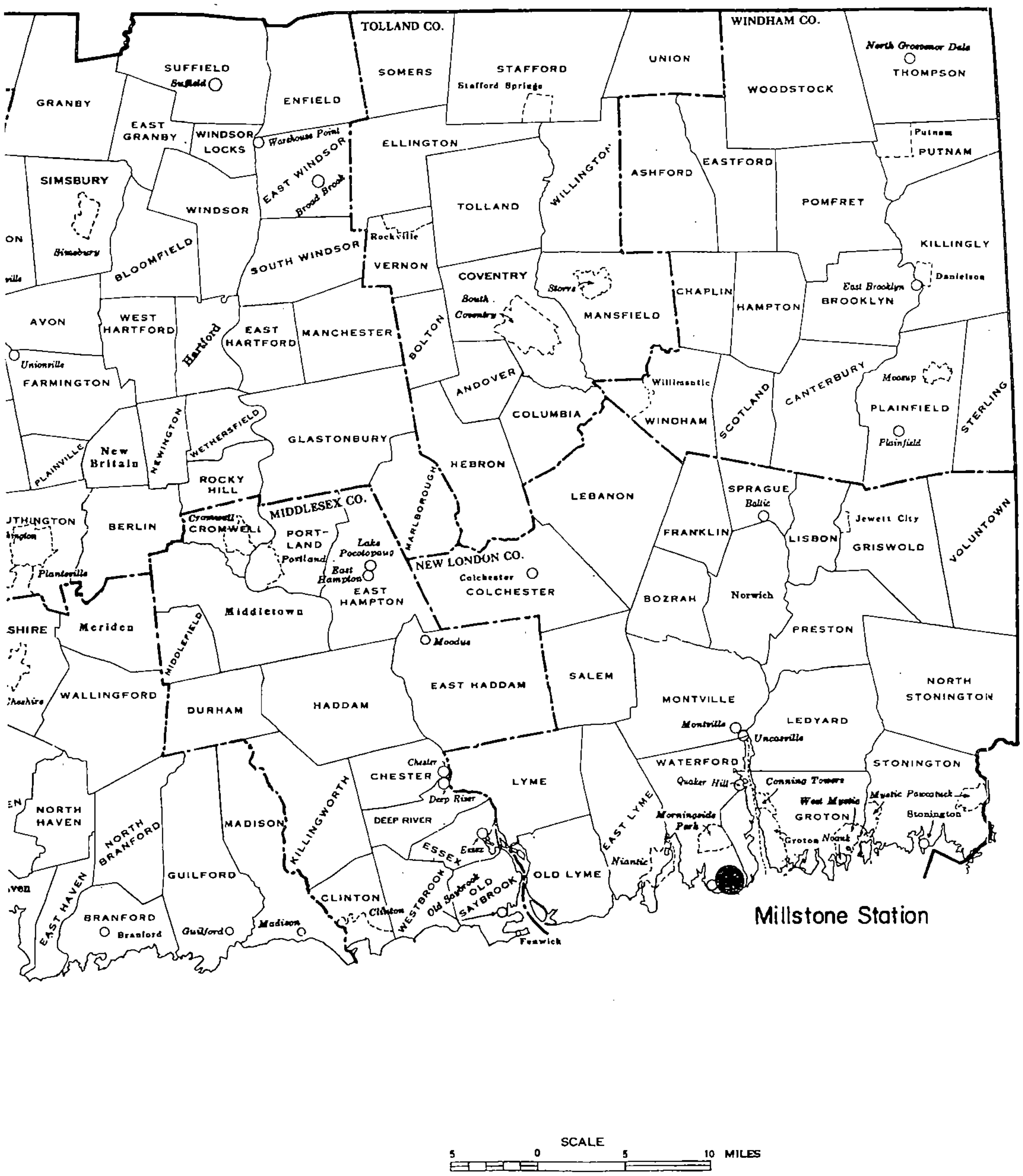


Figure 2.3. Location of Millstone Station, Waterford, Connecticut.

are quite heavily developed for residential use, including many seasonal homes. The plant, about 160 feet tall with a ventilating stack 375 feet high, is very visible to the heavily developed areas across Niantic Bay from Millstone point. The flat terrain and lack of forest cover make it difficult to blend the plant into the environs. Inland a few miles from the shore land use is mostly agriculture and open space.

2.2.3 Oyster Creek. -- The Oyster Creek plant is operated by the Jersey Central Power and Light Company. It is located in Ocean County, New Jersey, 2 miles inland from Barnegat Bay, and mostly in Lacey Township. A small portion of the site is in Ocean Township. The site is about 60 miles south of Newark and 35 miles north of Atlantic City (See Figure 2.4).

Oyster Creek plant has a rated capacity of 640 MWe and uses a boiling water reactor. Coolant water is taken from a series of canals from Barnegat Bay, South Branch Forked River, Oyster Creek, and from deep wells. Discharge water goes into a canal feeding into the bay. Construction of the plant began in 1964 and it became operational in December, 1969.

The site occupies 1416 acres. The reactor building is 140 feet tall with a 368 feet tall stack. The plant is very visible from nearby areas and particularly from the bay area. Vegetative cover render the plant much less visible from inland areas.

Between 1960 and 1970 New Jersey's population increased by 18.2 percent, while Ocean County increased by 92.6 percent and Lacey and Ocean Township increased by 138 and 141 percent respectively. The bay area is one of the state's most rapidly growing areas and is used heavily for water based recreation. Many of the developments in the area are seasonal homes.

2.2.4 R. E. Ginna. -- The Ginna plant is owned and operated by the Rochester Gas and Electric Company and is located in the town of Ontario, Wayne County, New York. It is on the shore of Lake Ontario about 20 miles east of Rochester (See Figure 2.5). Construction of the plant began in 1966 and it became operational in 1970.

The Ginna plant has a design power level of 490 MWe, and uses a pressurized-water reactor. Coolent water (400,000 gpm) is drawn from Lake Ontario and is returned to the lake by underground conduits. The Rochester Gas and Electric Company own 338 acres at the site, of which about 30 acres are occupied by the reactor and auxiliary buildings.

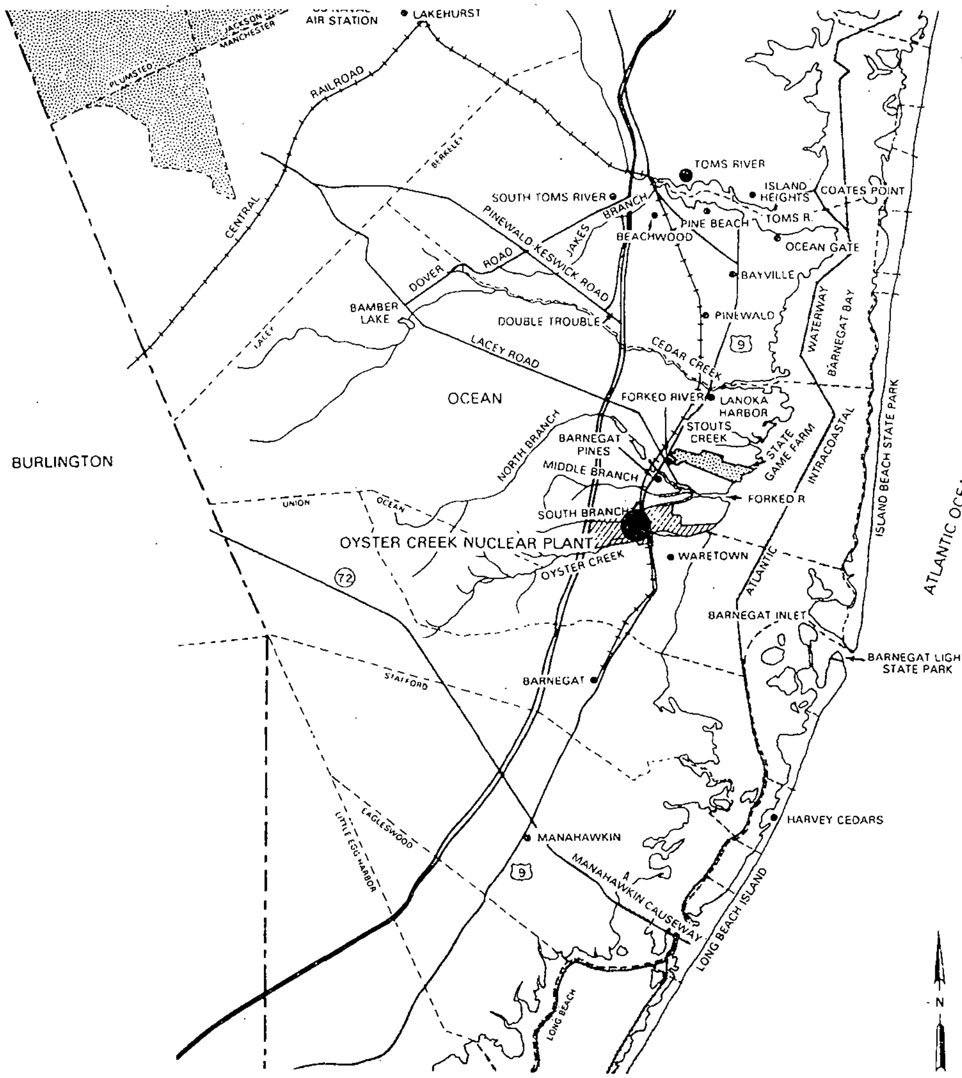


Figure 2.4. Location of Oyster Creek Plant, Ocean County, New Jersey.

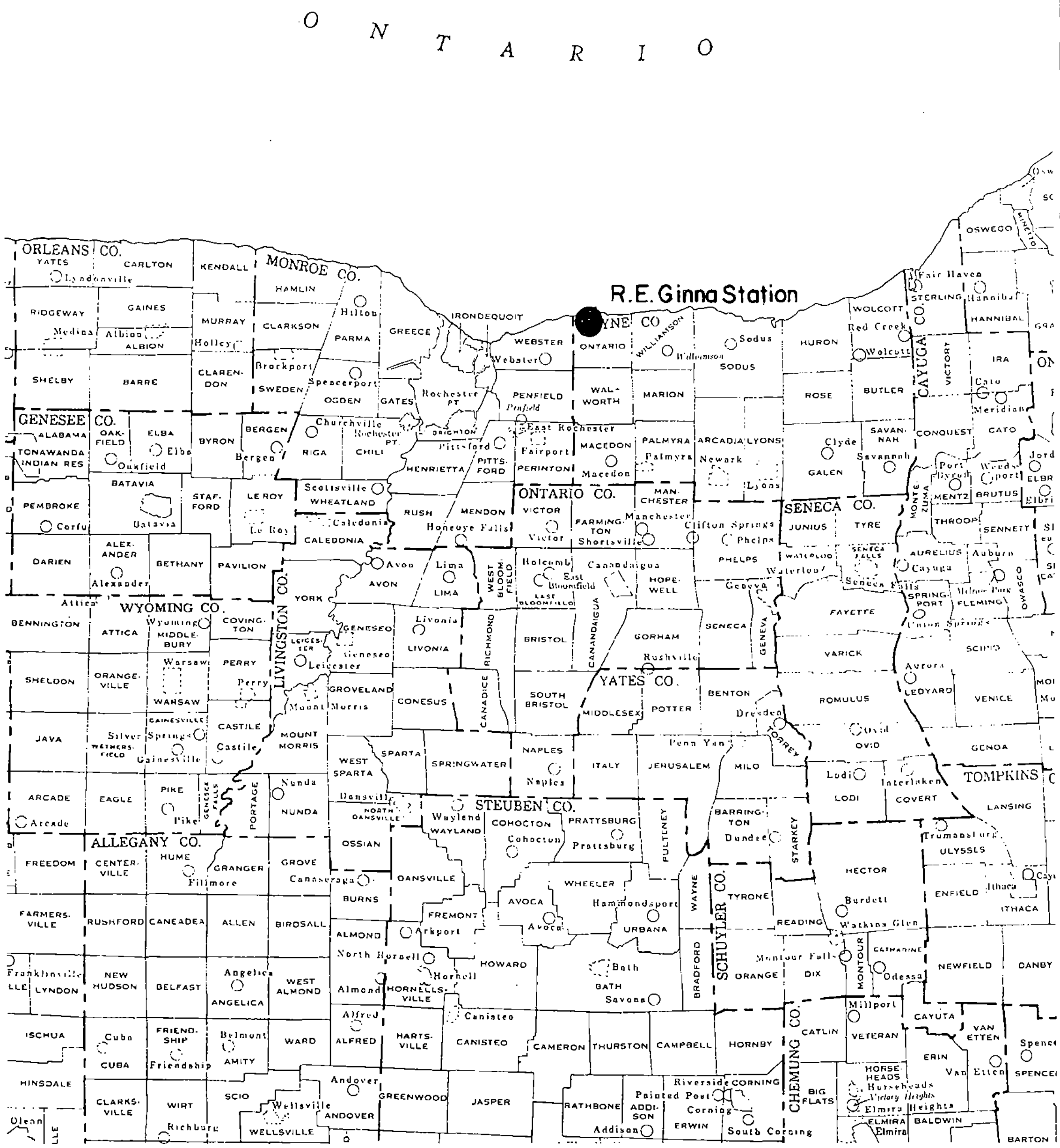


Figure 2.5. Location of R. E. Ginna Station, Wayne County, New York.

Agriculture is the dominant land use in a broad area surrounding the plant; consequently the plant is highly visible because of lack of forest cover and the relatively flat terrain.

Unlike the other three sites, this area has not experienced the heavy influx of recreationists and consequently relative to the other study sites, there are few seasonal homes nearby.

2.3 Methodology: Time Series Analysis

The purpose of the time series study is to analyze data on the changes in land use and land values beginning with a year or so prior to the first public announcement of the plant site and continuing to the present time. A very important question that needs answering is: what changes (developments) would have taken place in the vicinity of each plant had it not been constructed? (This is the "with" and "without" issue so important in a benefit-cost type of analysis). This, in turn, suggests that a good time series study must examine not only the area within the vicinity of the plant (an impact area), but also an area well beyond the zone of impact (a control area). Ideally, the control area should be as similar as possible to the impact area, except for the presence of the power plant. Realistically, it is very difficult to find communities with many very similar attributes or conditions. This is why we proposed doing a cross section analysis as well as a time series analysis.

We had no empirical evidence upon which to base a decision as to how distant from the power plant a control area should be (an area where the plant had no influence on land use or land values). *A priori*, we assumed that there would be no effects from the plant on communities or municipalities 15 to 20 miles away.

Originally, we envisioned getting time series data on the values for land in various uses (agricultural, residential, etc.); on changes in employment, population, and migration patterns; and on changes in the proportion of land area devoted to various specific uses. However, it was found that for the most part such data covering the time period required were not available from secondary sources. Since all plants became operational at about the time of the 1970 census or shortly thereafter, this source was not productive. The planning commissions and/or local governments in the study areas had few or no maps or other information showing land uses in the early or mid 1960s. Tax assessment records did not show for all sites a breakdown of assessed valuations by years and by different land use categories for the different municipalities.

Because of these data shortcomings, total property assessments by years for each municipality were the only data that could be used to reflect growth. Total assessed values combine the assessments for residential, commercial, industrial, agricultural, forest, and all other land use categories. These values are an excellent indicator of growth, because

they automatically eliminate the effects of inflation on property values unless a general reassessment is undertaken during the period studied. Where general reassessments were conducted, the true ratios of assessed valuation to actual market values for the pre and post reassessment data were used to keep the assessments in constant dollars for a base year.

An increase over time in the total assessed valuations for all property in a municipality does reflect growth, although it is not possible to determine from these values the amount of growth due to residential expansion or new commercial and industrial development. For most communities, and we have no reason to believe that the municipalities included in this study are any exception, growth in residential land use will lead to growth in commercial activities as the business sector moves in to fulfill consumer demand. By the same token, expansion of industrial activity will entice new residents into an area, and through the multiplier effect, lead to more commercial activity. Thus, the changes in total assessed property values in various municipalities for the period 1960 to 1976 (the time period used in this study) will provide very good estimates of differential growth rates.

If it had been available, the total assessment in the residential land use category alone would have been ideal, in that this would have provided a specific indicator of people's choices for residential location with respect to the nuclear power plant. By using total assessed valuations for all land use categories, however, we cannot claim that these precisely reflect people's choices for a residential location, since we cannot assume that the proportion of total assessments represented by residential assessments remains constant over time and between municipalities. For the host municipality we have deducted the assessed valuation of the nuclear plant by years from the total assessed valuation, because it represents such a large share of the latter and its inclusion would give biased growth estimates.

For most of the municipalities included in this time series study industrial activity is quite minor. The one exception is the area around New London, Connecticut (Groton Township). Because of significant industrial growth in the three townships abutting the city of Rochester, New York, these were omitted from our time series study of the R. E. Gina plant site. In most other township and municipalities, particularly in New Jersey, the significant expansion has been in seasonal home development because of the proximity to water for recreation. For these reasons we feel that the total assessed property valuation data used in this time-series study provide a reasonable proxy for growth in terms of the locational choice of people.

All municipalities and townships that exhibited reasonable similarities

to the host town and which were within about a 20 mile radius of the plant site were included in the time series study. The exceptions included three townships abutting the city of Rochester, N.Y., and inland townships (those not along Long Island Sound) in Connecticut. In the latter case, most new growth and development is occurring near the coastal cities and towns served by major transportation routes (rail and highway).

2.4 Methodology: Cross Section Analysis

The cross section analysis concentrates on the changes in residential property values occasioned by the presence of the nuclear plants. We hypothesize that nuclear plants have an adverse effect on such property values; i.e., these values are directly related to distance from the plants (as distance from a plant increases property values increase).

Land value theory holds that people's expectations as to the earning capacity of a parcel of land are what basically determine the value of land. Buyers who are rational and knowledgeable generally will not make a capital investment in land unless there is a reasonable chance (accounting for risk) that the returns will be at least equal to the returns in the best alternative investment opportunities. The returns from land can be monetary, as in the case of farmers or apartment house owners, or they can be in the form of a service, as in the case of a homeowner.

Inherent but not explicit in the theory that land values reflect people's expectations of the earning capacity of land, is the idea that all perceived factors influencing the expected returns, whether they be beneficial or adverse, are reflected and thus captured in the value of land. Beneficial effects such as nearness to the ocean or a good view, and adverse effects such as noise or nearness to unsightly structures tend to be reflected in land values. As was cited in the previous chapter, a number of studies have empirically verified these expectations. This study focuses on the effects that the presence or nearness of a nuclear power generating facility might have on residential property values. Buyers may perceive a lessening of the value of housing services because of real or imagined threats to health and safety, and thus for housing of equal quality in all respects but for the nearness of the plant, be willing to purchase such a property only at a reduced price.

Since the early 1970s, there have been major achievements in developing the theory underlying property values. The fundamental papers summarizing these achievements are those of Rosen (1) and Freeman (2). The conceptual economic framework and the development of the basic theoretical model of housing markets is well described by Nelson (3).

The cross section analysis in this study uses a hedonic price equation with which to test our main hypothesis that residential property values are reduced by proximity to a nuclear power plant. The variables or factors affecting the price of a particular house or lot are numerous and interrelated in a complex way, and each house represents almost a unique combination of these. Such things as the characteristics of the house and lot; the kind of neighborhood it is in; its nearness (access) to schools, highways, shopping, and recreation; and the kind and quality of community services and facilities all enter into the price of a residential property. Statistical analysis of appropriate data provide a way to determine the degree to which each variable contributes to the price of a house and lot. Thus, estimates can be obtained for the price of living space in dollars per square foot, the price of accessibility in dollars per mile, the implicit price of residing at a perceived safe distance from a nuclear plant in dollars per mile, and so on.

With a sample of actual market (sales) values of residential housing at varying distances from a nuclear plant, multivariate regression analyses can be used to obtain estimates of the implicit or hedonic prices of housing characteristics. A simplified linear economic relationship would take the form:

$$(1) \quad V_i = b_0 + b_1X_{1i} + b_2X_{2i} + \dots b_nX_{ni} + u_i = 1, \dots, N$$

where V is the selling price of the i th house in dollars; $X_1,\dots,X_n$ are the variable amounts of the housing characteristics, including distance from the nuclear plant; $b_1, \dots b_n$ are the implicit prices to be estimated; b_0 is a constant term; and u is a stochastic error term reflecting possible omitted variables and measurement errors.

In order to show the effect, if any, that proximity to a nuclear plant has on the value of housing it is important to include in the analysis as many variables as possible among those that a priori are known to explain variations in housing prices. Potentially, a large number of variables contribute to housing price differences within a given area. These variables may be logically grouped into several broad classes:

(1) House characteristics -- the number of square feet of living space by floors, the number of bathrooms, the presence of a finished basement, the type and quality of construction, existence of central air conditioning, materials used in construction, the size of the garage, etc.

(2) Lot characteristics -- the size and dimension of the lot, the presence of large trees, the landscaping, the view from the lot, the topography or slope, etc.

(3) Accessibility characteristics -- distance of the lot to the nearest schools, shopping centers, limited access highway, employment centers, recreational facilities, etc.

(4) Locational characteristics -- characters of the neighborhood, land use mix, waterfront location, distance from nuclear plant, etc.

(5) Public sector characteristics -- availability of water, gas, sewer; the type of road the lot fronts upon; the real property tax rate; the existence and kind of land use controls, etc.

(6) Transaction characteristics -- such factors as month of sale, mortgage terms, etc.

A description of the 76 variables identified for inclusion in the regression equations, together with their method of construction, data source, means, and ranges are given in Appendix A. The following discussion elaborates on those variables that proved most important in explaining housing price variations.†

2.4.1 Real Selling Price. -- The dependent variable, it is the actual selling price of a single-family house and lot as recorded in the court house. Prices over the time period examined were corrected for inflation. Sales were screened to eliminate those that indicated a less than "arms length" or bona fide transaction and those to which certain conditions or restrictions were attached. It was not possible to distinguish between seasonal homes and those occupied all year.

2.4.2 House Characteristics. -- Houses built before 1914 (1), because of their age, were expected to sell for less, all other characteristics such as living space remaining equal, as compared with houses built between 1946 and 1968, the standard which is reflected in the constant term of the equation. Consequently, we predict a negative sign for this variable's coefficient. On the other hand, houses constructed between 1969-1977 (4) presumably would command a higher price and thus show a positive sign. Both of these variables were entered as dummy variables.

The more living space in a house, the higher should be the value, all other factors being equal. Three variables reflect this characteristic, all measured in square feet: area of the first floor (47), area of the

†The number in parentheses refers to the variable number as used in the regression equation.

second floor (48), and area of the finished basement (49). Apart from size, houses with basements finished or improved for living areas would sell for more than houses without basements or with unfinished basements. All three variables are expected to have positive signs. Houses built on slabs (50), a dummy variable, would expect to sell for less than houses with full basements but unfinished (51), also a dummy variable. The former should show a negative coefficient while the latter a positive one.

Apart from the amount of living area, the greater the number of bathrooms (46), the number of bedrooms (65), and the number of fireplaces (55), the higher one would expect the price of the house, other things remaining constant. Therefore, the coefficients of these variables should all be positive. Similarly, houses with central heating (56) and stone facing on the front (59) should command higher prices than houses lacking these attributes. These latter two variables were entered as dummy variables.

Not only living space, per se, but space to accommodate other household needs are important to house buyers. One of these needs is garage space. The attached garage (53), detached garage (54), and internal garage (76) variables, entered as the number of car spaces provided, accounted for this attribute. All should affect the sale price in a positive manner.

The condition of a house in terms of its state of maintenance and appearance can be an important determinant of price. Two variables were created, both entered as dummies, to reflect this attribute. House condition poor (25) and house condition good (26) were expected to have negative and positive regression coefficients, respectively. In a parallel vein, the grade of a house, as reflected in the quality of the materials and workmanship that went into its construction, has an important effect on price. The condition and grade of the houses were judgementally determined in all four study areas by the same individual. Thus consistency in interpreting these variables among the sites was achieved, which is important in a comparative study of this kind. A dummy variable, good grade of house, was interacted with two other variables describing the amount of living space. Good grade of house times second floor area (23) and good grade of house times first floor area (24) would reflect the differential effect that house size and grade would have on selling price. Both variables should show positive coefficients.

One other variable, not directly a house descriptor, was included to account for secular trends in the local real estate markets. It was thought that the expanding sales of seasonal homes in some of the study areas would make the variable month of sale (42) very important in explaining variations in house prices.

2.4.3. Lot Characteristics. -- The size of the lot upon which it is built is directly related to the market value of a house; all other things being equal, the larger the lot the higher the price. Lot frontage (7) and lot depth (8), both expressed in feet, were interacted to form area of lot (66) in square feet. All three variables should show positive coefficients. Also, the position of a lot on the block or street may be important; therefore corner lot (11), a dummy variable, was used to designate such lots, with a positive coefficient expected.

The view the lot affords the owner can have an effect on price. Two dummy variables were created to account for this attribute: outstanding view (15) was used to denote those lots from which a broad panoramic view was possible, such as ocean front lots, while view from house (18) indicated that a view of more than just the neighboring houses was possible.

In some shore communities there are beach rights that are a part of (attached to) the deed to a parcel of land. Deeded beach rights (71) was a dummy variable which recognized such an attribute and was expected to have a positive coefficient.

2.4.4 Accessibility Characteristics. -- Over broad areas, accessibility is one of the most important determinants of land values. Holding all other characteristics constant, the closer a parcel of land is to an urban center, or to a major highway interchange, the more value it will command. Six variables were used to account for the positive effects of accessibility on housing prices: distance to nearest shopping center (33), distance to high school (34), distance to nearest swimming area (36), distance to nearest big employer (37), distance to limited access highway (38), and distance to nearest state park (39). All distances were expressed in miles; therefore, all coefficients were expected to have negative signs (the greater the distance, the poorer the accessibility and hence the lower the sales value, all other factors being equal.

2.4.5 Locational Characteristics. -- All 4 of the power plant sites studied were located on major bodies of water. At 3 of the sites (all but the R. E. Ginna plant) water oriented recreation was very important, as evidenced by the high proportion of seasonal homes in nearby communities. Therefore, water frontage (70) was expected to be an important variable in explaining house price variations. The very limited amount of land available on the water front coupled with an ever growing demand for such land has increased prices tremendously in recent years. This was entered as a dummy variable with an expected positive coefficient.

Two locational variables were used to relate the house site to the

plant site. Distance to plant (31), given in straight line miles, is the key variable in the regression equation. If the coefficient is significant and positive (the greater the distance from the plant the higher the value, all other conditions being equal), the study's hypotheses will be supported. If it is not significant, then it would appear that the presence of the nuclear power plants in this study have little or no effect on residential property values.

It was thought that if the plant was visible from the property this may have a more pronounced adverse effect on the feeling of well-being or security of potential buyers and thus have a negative influence on property prices. Nuclear plant visible (22), a dummy variable, would help determine the acceptance or rejection of the hypothesis, and should have a negative coefficient.

Two locational variables relate to environmental conditions in terms of the amount of traffic on the road or highway abutting the lot. Noise and air pollutants, including dirt and dust, from high volumes of traffic tend to lower housing prices. Abut heavy traffic (28) and abut light traffic (27) were two dummy variables chosen to express the extremes of highway conditions. They should show negative and positive regression coefficients, respectively.

2.4.6 Public Sector Characteristics. -- The provision of public services by local municipalities and the quality of those services are attributes to which many home buyers give consideration when choosing residential locations. With respect to local roads, lot on surfaced road (9), a dummy variable, should have a positive coefficient.

For many potential house buyers, local taxes are an important consideration. Over time, tax rates tend to become capitalized in the value of real property, therefore, all other conditions being the same, a house in a low tax rate municipality would sell for more than a similar house in a high tax rate municipality. The host municipalities of the 4 plants included in this study realize large property tax payments from the plants, making it possible to reduce taxes on other classes of property.

Such a situation would attract house buyers. Low tax rate town (19), entered as a dummy variable, was intended to account for this situation and should have a positive coefficient. A low tax rate town was one in which the real tax per $1000 of market value was $15.00 or less. Real tax rate per $1000 of property value (69) is an empirical measure to reflect tax effects on housing prices for all municipalities, and should show an inverse relationship or negative coefficient (the higher the real tax rate the lower the house price, all other characteristics being the same).

Because of the importance of water recreation in the communities included in the study, the availability of a restricted or controlled beach for sunbathing and surf swimming was felt to be important in determining housing prices. Many ocean communities have beach associations, either privately or publicly operated, to which residents of the municipality or of a certain housing development may belong. Membership may be included as part of the rights of property ownership within a certain municipality or housing development, in which case it would be capitalized into the housing price. Two dummy variables were constructed to reflect this condition: average quality beach association (72) and good quality beach association (73) with both expected to have positive coefficients. These two variables were only observed at the Millstone site, and they were classified by the town clerk in the respective towns.

2.5 Collection of Data

2.5.1 Time Series Data. -- Real property tax assessments for all classes of property for individual years 1960 through 1976 for each municipality were the data required for this phase of the study. It would have been much more meaningful to use residential assessments only, but these separate values were not available in all of the areas by years.

For the Oyster Creek and R. E. Ginna plants, municipalities within the host county were selected. In Ocean County, New Jersey, 33 townships and boroughs comprised the data base, all within a 20 mile radius of the plant. In all study areas, the geographical center of the municipality was used as the point of reference for measuring straight line distances from the nuclear plant, unless an obvious population concentration dictated otherwise.

For the R. E. Ginna area, 10 towns in Wayne County, New York, were within a 20 mile radius of the plant and comprised the data base. Three towns and the city of Rochester in neighboring Monroe County are within 20 miles of the plant, but because of the heavy growth over the past 18 years generated by the city these were not included in the final analysis. Data were obtained on the 3 towns abutting the city and were used in a preliminary analysis.

For the Millstone site, 7 towns were selected in addition to the host town of Waterford. These towns, located primarily along the shores of Long Island Sound, were selected so as to duplicate conditions in Waterford as nearly as possible.

For the Pilgrim site, 13 towns comprised the data base, including the host town of Plymouth. Towns on Cape Cod Bay, close to Boston, were avoided as well as towns on Cape Cod itself.

The assessed values for each nuclear plant were obtained for every year since they came onto the tax rolls. These values were deducted from the total assessed values for the host municipalities. For all 4 sites, the plant values were obtained from the host municipality assessor's office.

Assessed values by years for the 13 towns included in the Pilgrim site were obtained from the Department of Corporations and Taxation of the Commonwealth of Massachusetts in Boston. Also provided was a list of all towns in the state showing the years in which general reassessments were made. The assessment figures included only taxable real estate, and not personal property. A state study provided information on the true ratio of assessed values to market values for each town as of a given year.

The local tax assessor's office in each town included in the Millstone site provided copies of the Grand Lists for that town for the years studied. From these Grand Lists it was possible to calculate the real estate assessments only (omitting personal property assessments).

The Department of the Treasury, Division of Taxation, in Trenton, N.J. provided Tables of Equalized Valuations, for each year showing for every township in the Oyster Creek study area the aggregate assessed valuations of real property and the average ratio of assessed values to true values. A significant change in the ratio from one year to the next indicated when a general reassessment was made.

The county treasurer's office in Wayne and Monroe Counties, New York provided county equalization tables by year for each town in the county. These tables also gave the ratio of assessed value to true value. The State Board of Equilization and Assessment in Albany also provided information on equalized values and the true ratio for certain years for towns in the R. E. Ginna study area.

In addition to real estate assessment data, maps and aerial photographs were obtained with the intent to count new residential units that were constructed within a 2 mile radius of each plant over the study's time span. United States Geological Service quadrangle maps were obtained for the most recent year prior to plant construction for each plant site. For the years subsequent to plant construction, aerial photographs from the Agricultural Stabilization and Conservation Service were procured. In addition, recent aerial photographs of the Millstone site were obtained from the Department of Environmental Protection in Connecticut and of the Oyster Creek Plant from the Ocean County, N.J. Planning Commission.

2.5.2 Cross Section. -- One criterion in selecting sites for the study

was the availability of detailed data on property transactions. A very high priority was placed on obtaining as much detailed information as possible on each property sale, because it was recognized that if the influence of a nuclear plant on housing values was not large, a maximum amount of detailed data would be needed to isolate that influence.

In 3 of the study areas, data on individual property characteristics were obtained from the real property assessment offices in the various municipalities. For the Pilgrim area, the Plymouth County Multiple Listing Service was most helpful and cooperative in providing data.

From the beginning, it was our intent to visit every property that had been sold recently and make an on-site inspection so as to get data on those lot and house characteristics that are not included on property description cards. Thus, it was possible to combine data from several sources and with varying degress of precision into a study reflecting a variety of site conditions.

Following some familiarization with the general area surrounding each study site, certain housing developments within a 15 mile radius of each nuclear plant were selected. These developments, not necessarily new, were chosen so as to reflect as high a degree of homogeneity as possible with the developments in close proximity to each respective plant. The one variable in which variation was sought was distance from the plant. Developments were chosen such that varying distances were represented. A 15 mile limit was imposed because we felt that beyond this distance very few prospective home buyers, if any, would be influenced in their decision by the presence of the plant.

Within each of the housing developments, all property sales that occurred in 1975, 1976, and 1977 formed the data base. Sales and property characteristics data were then recorded from the respective assessor's offices or multiple listing service. Sales that were obviously not bona-fide (arm's length) were rejected. Each property recording a sale in those years was then located on a map and visited, with other property descriptors noted and distances for the various accessibility variables determined. These data were coded and punched on computer cards.

A second on-site inspection was made of each property to make additions or corrections to the computer print-out. A few properties were deleted from the sample after this inspection, mainly due to errors in the data collection process. A total of 540 observations (properties) comprised the final sample. After all corrections were made, the data were processed into a form suitable for the regression analyses.

The following is a more detailed accounting of the data sources for each study area:

Pilgrim Study Area. -- Property record cards and most of the information in the town assessment offices in Massachusetts are not matters of public record. Consequently, information was obtained from the Plymouth County Multiple Listing Service. Multiple listing is quite widely used, therefore a large percentage of all properties sold are listed in this manner. The Plymouth County Multiple Listing had a detailed description of each property including sales price, date of sale, location, etc. In order to make the Plymouth County data conform with data from the other study areas with respect to sale recording dates, 60 days were added to the actual sales date.

Millstone Study Area. -- Town assessment office records in Connecticut are a matter of public record. The state is now engaged in equalization studies to improve their educational subsidies, and as a result most towns have lists of sales which have occurred in recent years. From these lists it was a relatively easy matter to select property record cards in the developments chosen and copy the appropriate data.

Oyster Creek Study Area. -- Assessment data is a matter of public record in New Jersey where data is available at the municipal level. Local township assessors have tax maps upon which are shown all properties that sell along with the sales price and date of sale. From these tax maps it is then possible to select the property record card and hand copy or photocopy all the necessary information.

R. E. Ginna Study Area. -- Wayne County, N.Y., has availed itself of multiple regression techniques provided under the sponsorship of the New York State Board of Equalization and assessment. Consequently, an excellent data base existed for all the municipalities in Wayne County, showing on tax maps all property sales with values and dates of sales. The data on the corresponding property record cards was available to the public.

2.6 Literature Cited

1. Rosen, Sherwin: "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition," Journal of Political Economy, Jan./Feb. 1974, pp. 34-55.

2. Freeman, A. Mylick: "On Estimating Air Pollution Control Benefits from Land Value Studies," Journal of Environmental Economics and Management, May 1974, pp. 74-83.

3. Nelson, Jon P.: The Effects of Mobile-Source Air and Noise Pollution on Residential Property Values. Report No. DOT-TST-75-76, U.S. Department of Transporation, Office of the Secretary, April 1975.

III. DATA ANALYSIS AND INTERPRETATION

3.1 Time Series Studies

3.1.1 Data Analysis. -- Before the assessment data could be used to make comparisons of growth rates between the different municipalities in each of the study areas, they had to be equalized. Once equalized, the assessment figures for municipalities within specified distance zones were additive.

Actual assessment figures rarely reflect 100 percent market values. Even if they do in any one year, the following year's figures would not reflect actual market values unless a general reassessment were made, because inflation would not have been take into account. Thus, equalized assessed values over time reflect growth in real terms, i.e., remove inflationary effects in the real estate market.

Assessed values in one municipality may be only 20 percent of the actual market value, while in a neighboring municipality they may reflect 80 percent of the actual market value. The "true ratio" of assessed values to market values fluctuates from year to year, depending upon the extent to which inflationary forces are at work in the local real estate market. For communities experiencing growth (new development), the true ratio in any one year depends upon the time span since the last general reassessment, the published ratio at the time of general reassessment, and the amount of inflation that has occurred in the local real estate market since the last reassessment.

Some municipalities attempt to keep their assessment data reasonably up-to-date and reassess every few years. Other municipalities delay many years between reassessments because of the high costs. In most states municipalities are free to choose their published ratio at the time of reassessment.

To equalize assessed values between municipalities, they must have the same true ratio for that year. Within each of the 4 study areas, a municipality was selected and the assessed values for a certain year were designated as the base. Then for that same year, the proportions of the true ratio of every other municipality to the true ratio of the base municipality were used to adjust the assessed values for the other municipalities. To equalize for each municipality the assessed values for years before and after the base year, the actual percentage change in the published assessed values from one year to the next was applied to the equalized value for the previous year's calculation.

Preceding page blank

When a municipality completed a general reassessment in any one year, further adjustments had to be made to the data in order to maintain a sequence of equalized values over time. If the true ratios were known for both the year of reassessment and the preceding year (or subsequent year if one were calculating backward from a more recent base year), the equalized values were calculated by the following formula:

$$(1) \quad \frac{(TR_{t_1}/TR_{t_2})\ AV_{t_2}}{AV_{t_1}}\ EV_{t_1} = EV_{t_2}$$

where: TR = true assessment ratio
AV = actual assessed value
EV = equalized assessment value
t_1, t_2 = current year and subsequent year, respectively

If the true ratios were not known,† then an average of the growth rates in actual assessed values for the 3 preceding and 3 subsequent years were used to compute the equalized values.

For all 4 study areas, the assessed values for the nuclear plants were subtracted from the total assessed values for their respective host municipalities for each year since the plant came on the tax rolls. This was necessary because of the extremely high values for those plants relative to the total value of all other real property. Table 3.1 shows these values for 1976. It should be pointed out that the plant values shown are not comparable (not actual market values) because of a wide variation in true ratios between the study areas.

Table 3.1. Real property assessments of nuclear plants and host municipalities, 1976.

Plant	Assessed Values: Host Municipality	Plant	Plant Proportion
	$1000	$	%
Pilgrim	107,564	26,492	24.6
Millstone	598,402	389,493	65.1
Oyster Creek	237,802	10,486*	4.4
R. E. Ginna	64,738	40,170	62.0

*Most of the real value of this plant is classified as personal property and not included in the assessed value.

†True ratios must be determined by comparing actual market sales to the corresponding assessed values for a given year, a procedure clearly beyond the scope of work for this study. Some states and counties do their own true ratio studies; many do not.

Appendix B shows the equalized real property assessed values by years for each municipality in all 4 study areas. Because relatively minor changes in assessed values occurred on a yearly basis, the tables show every other year values eccept for the last 3 years.

In order to pool the assessment data, the equalized yearly values <u>within</u> each study area had to be equalized <u>among</u> the study areas. The new or adjusted equalized values were calculated to reflect 1976 full market values. This was accomplished by calculating an adjustment factor for each study area using the following formula:

$$(2) \quad \frac{AV/TR}{EV} = \text{Equalized Value across all study areas (all 1976 data).}$$

The formula was calculated for a single township in each study area in which the true ratio was known and then applied to the previously calculated 1976 equalized values for all other townships in that study area to get the 1976 full market values. For the Oyster Creek and R. E. Ginna study areas, true ratios published by the state were used for Lacey Township and the Town of Ontario, respectively. For the Pilgrim and Millstone study areas, there were enough residential property sales data gathered (for the cross section analysis) in Plymouth and East Lyme, respectively, to calculate our own true ratios.

Table B.5 shows, for all sites separately and combined, the total assessed real property values equalized to 1976 full market values. In Table B.6 in the appendix the increases in assessed values as shown in Table B.5 have been computed as average annual compound growth rates.

Table 3.2 summarizes the data in Tables B.5 and B.6, showing the growth in assessed values for three time periods: 1960-1976, 1960-1970, and 1970-1976. All the plants but Pilgrim became operational in late 1969 or 1970, with the Pilgrim plant starting up in mid 1972. Therefore, 1970 roughly separates the pre and post operational plant years.

Examining the compound growth rates for the individual study areas, the results are somewhat mixed. Average growth rates in the host municipalities after the plants became operational (1970-1976) exceeded the growth rates for the same time in their respective regions for all plants except Millstone. For all 4 study sites, the average 1970-1976 growth rates for those municipalities within 10 miles of the plant exceeded the growth rate for all municipalities that were 10-20 miles from the plant. In all study areas but Millstone, the average annual growth rate over the

Table 3.2. Assessed valuations and growth rates, 4 study areas, 1960-1976.

Study Area		Number of Municipalities	Full Assessed Market Values ($1000)			Average Annual Compound Growth Rates (%)		
			1960	1970	1976	1960-1976	1960-1970	1970-1976
Pilgrim:	Plymouth[1/]	1	192,498	294,209	453,083	5.5	4.3	7.2
	< 10 Miles	2	181,542	323,973	488,651	6.2	6.0	6.5
	10-20 Miles	10	995,617	1,688,107	2,178,779	5.0	5.4	4.3
	Region[2/]	12	1,177,159	2,012,080	2,667,430	5.1	5.5	4.6
Millstone:	Waterford[1/]	1	234,076	318,370	375,376	3.0	3.1	2.8
	< 10 Miles	3	653,205	963,603	1,253,236	4.2	4.0	4.5
	10-20 Miles	4	620,965	937,880	1,101,900	3.6	4.2	2.7
	Region[2/]	7	1,274,170	1,901,483	2,355,136	3.9	4.1	3.6
Oyster Creek:	Lacey[1/]	1	38,486	102,903	278,574	13.2	10.3	18.1
	< 10 Miles	12	184,576	341,662	715,254	8.8	6.4	13.1
	10-20 Miles	20	1,037,162	1,909,953	3,081,116	7.0	6.3	8.3
	Region[2/]	32	1,221,738	2,251,615	3,796,370	7.3	6.3	9.1
All Areas Combined:								
	Host Towns[1/]	4	496,485	761,794	1,173,432	5.5	4.4	7.5
	< 10 Miles	20	1,076,879	1,732,028	2,616,516	5.7	4.9	7.1
	10-20 Miles	40	2,903,945	4,850,492	6,778,458	5.4	5.3	5.7
	Region[2/]	60	3,980,824	6,582,520	9,394,974	5.5	5.2	6.1

[1/] Does not include nuclear plant assessed value.

[2/] Does not include plant site municipalities.

years 1970-1976 for the host municipalities exceeded their average annual growth rate over the years 1960-1970. For municipalities within 10 miles of the plant, all 4 study areas showed a higher growth rate following plant opening than before plant opening.

Examining the combined data for the 4 study areas, average annual growth rates in 1970-1976 declined as distance from the plant site increased. Host communities had a 7.5 percent average growth in assessed values, communities within 10 miles of the plant had 7.1 percent, while communities 10-20 miles away had a 5.7 percent growth rate. All 3 locational groups experienced an increase in growth rates from the 1960-1970 years to the 1970-1976 years, with the size of the increase greatest for the host municipality and least for the municipalities the farthest away.

Figures 3.1 to 3.5 plot graphically the average annual growth rates over the years as shown in Table B.6 in the Appendix. Several salient points should be highlighted. There was a decided expansion in growth in the late 1960's and very early 1970's that was experienced in all study areas except Millstone, but this boom drastically slowed after 1972. The same trend is reflected in national data on new housing units, which is plotted along with the other data in Figure 3.5. Thus, it might be logically assumed that the nuclear power plants had little to do with the surge in new growth in the early 1970's.

Ontario, the host community for the R. E. Ginna plant, was the only municipality to show an exception to the relatively low growth rates continuing on into 1975 and 1976. Ontario was the least developed of any of the host communities, with only $55.5 million total market

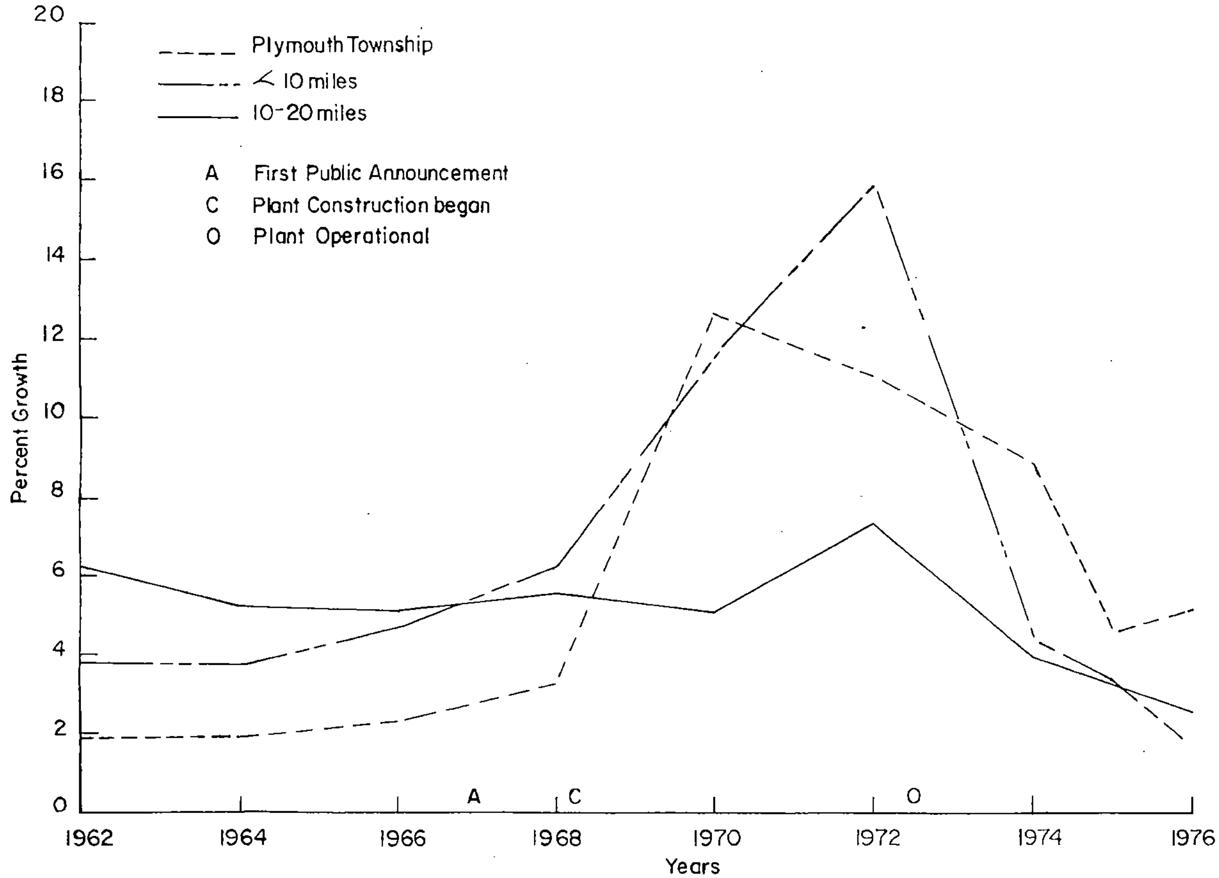


Figure 3.1. Growth reflected by total assessed valuations, Pilgrim Plant.

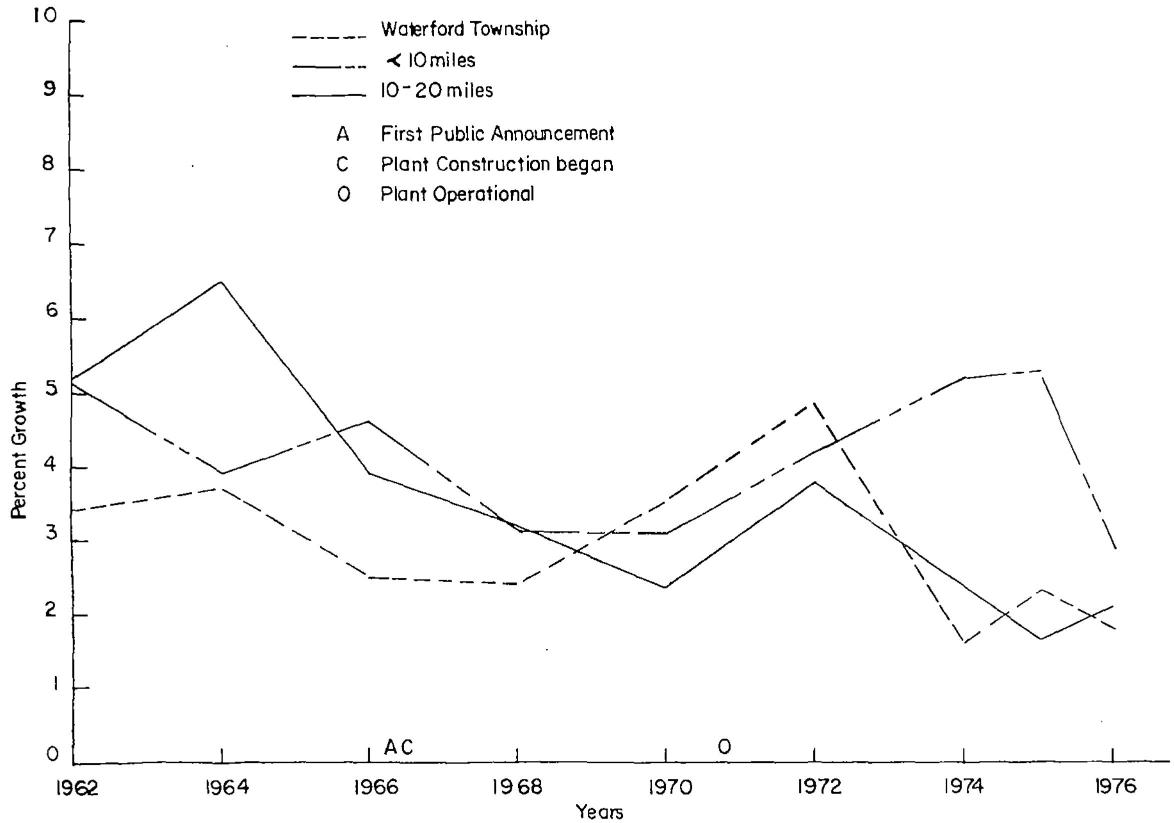


Figure 3.2. Growth reflected by total assessed valuations, Millstone Plant.

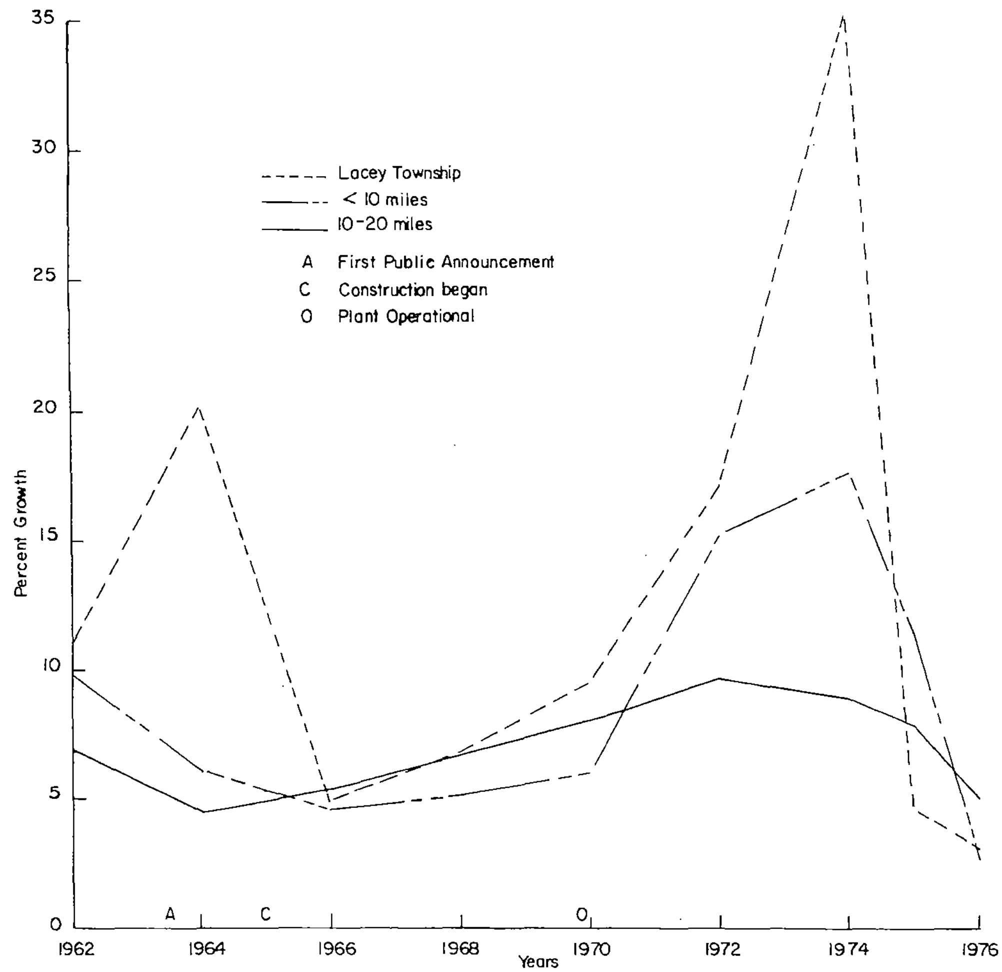


Figure 3.3. Growth reflected by total assessed valuations, Oyster Creek Plant.

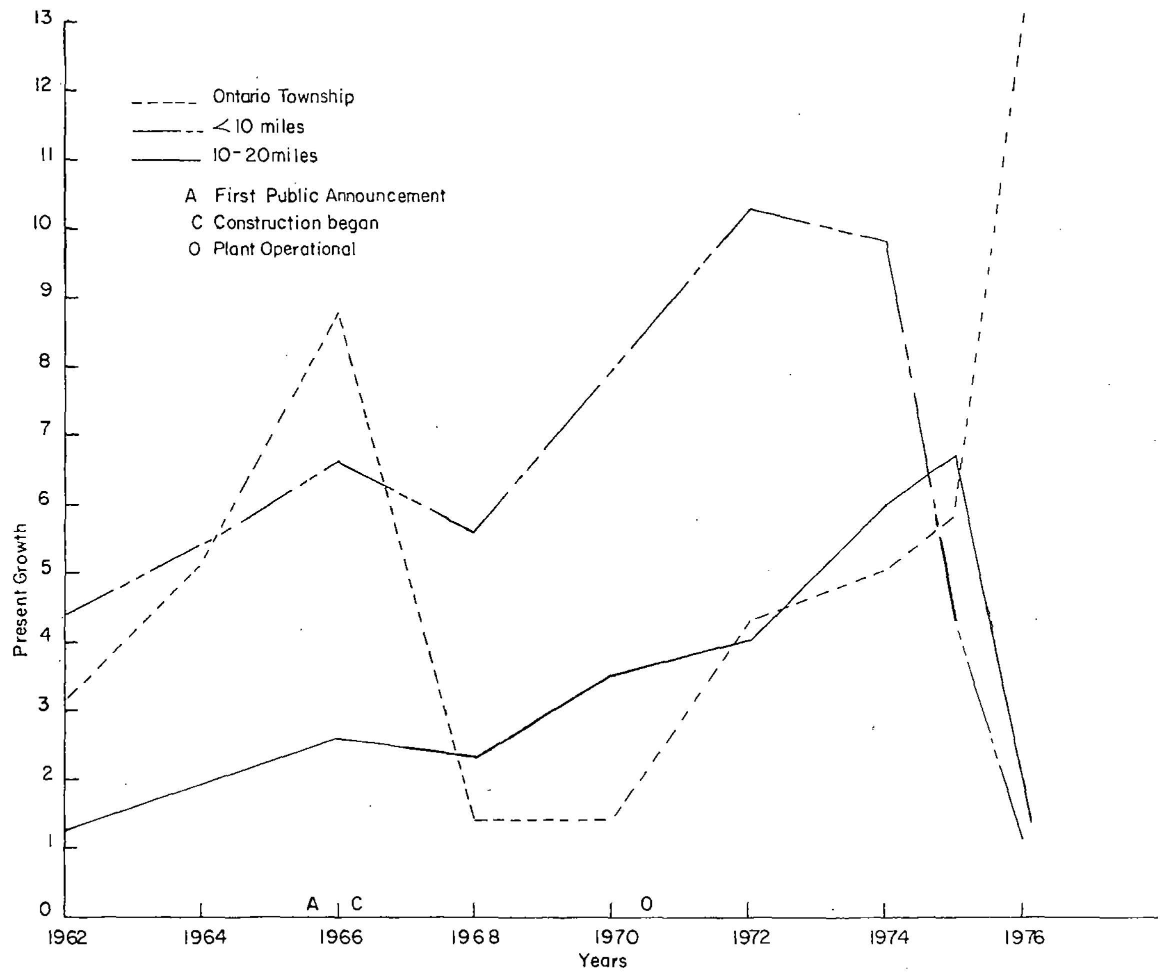


Figure 3.4. Growth reflected by total assessed valuations, R. E. Ginna Plant.

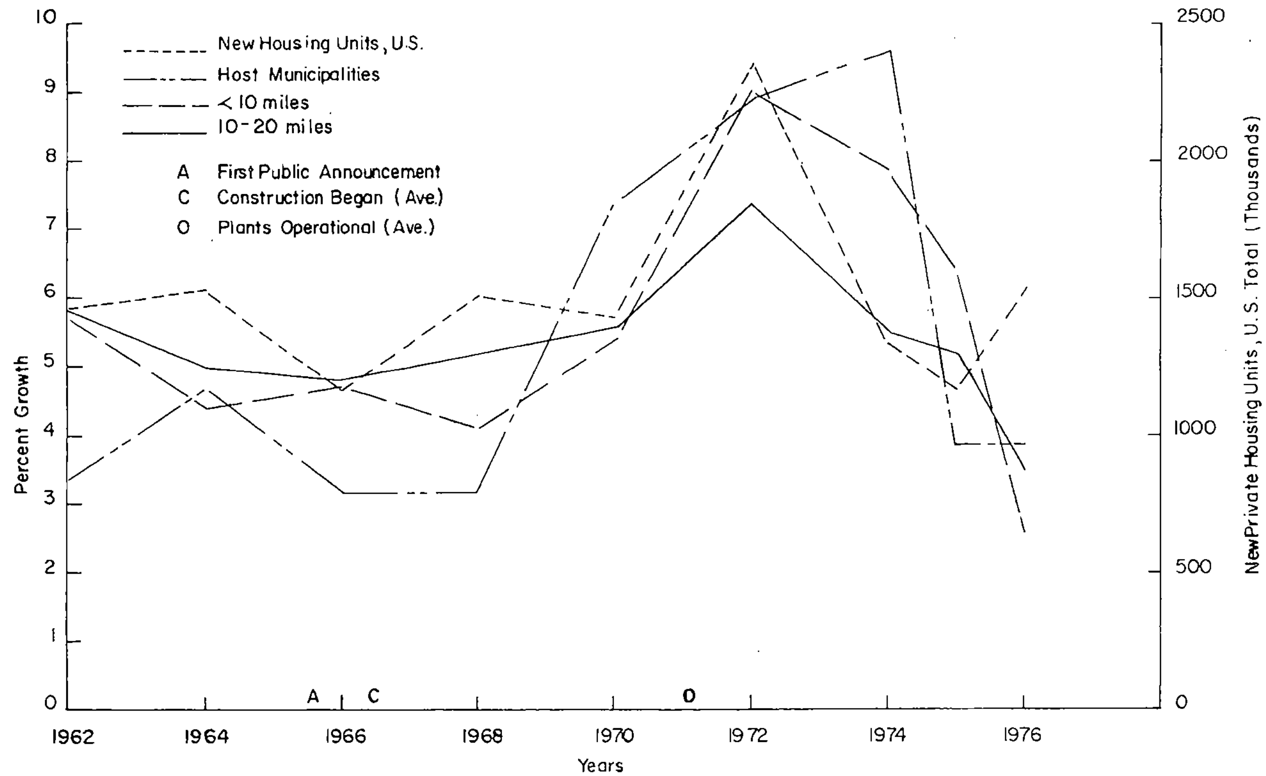


Figure 3.5. Growth reflected by total assessed valuations, all areas combined.

valuation in 1974. Located quite close to Rochester, N.Y., any urban growth pressure from this source could have a significant impact on the town.

A second striking feature revealed by these graphs is the phenomenal growth rate in Lacey Township, N.J. from 1970 to 1974, followed by a drastic reduction. Between 1972 and 1974, there was a 35 percent average annual increase in total assessed valuations. This was primarily a boom in residential construction, probably reflecting people moving to the township to take advantage of the highly favorable property tax rates occasioned by the plant. The same motivations may exist at the Pilgrim and Millstone sites, although to a lesser degree. The state subsidization of schools in New York mitigates to some extent tax advantages at the Ginna site. Lacey is within commuting range to the New York City area.

To support the hypothesis that people tend not to live in the vicinity of nuclear power plants, the curves depicting the growth rates for the host municipalities should be below the curves for the groups of communities more distantly located, beginning at about the time construction began at each site. The graphs for the individual sites reveal no consistent pattern in this regard. In Figure 3.5, all study areas combined, the growth rate after 1968 for the host communities is higher than the growth rates for municipalities farther from the plants (except for 1975), clearly not supportive of the hypothesis.

Figures 3.6 to 3.10 depict in another way the average annual compound growth rate for the two time periods (1960-1970 and 1970-1976) in each study area and all areas combined. They make quite obvious the fact that in all study areas the 1970-1976 growth rates exceeded the 1960-1970 growth rates in communities within 10 miles of the plant, except for Waterford, Conn., the Millstone plant host community. Figure 3.10 (all areas combined) is even more dramatic, in that in all 3 distance zones the growth rates after the plants opened exceeded the growth rates before the plants opened. Moreover, the order of magnitude of rates of growth in the 3 distance zones reversed themselves after 1970. In the 1960-1970 period, the host towns had the lowest average annual compound growth rate (4.4 percent) while the municipalities 10-20 miles away had the highest (5.3 percent). After 1970 and up to 1976 the host towns had the highest growth rate (7.5 percent) while the municipalities 10-20 miles away had the lowest (5.7 percent), clearly opposite to what one would expect to support the hypothesis. For all the regions viewed as a whole (no distinction made as to distance from plant), exclusive of the host municipalities, growth rates after 1970 exceeded growth rates before.

We thought it desirable to study one area in more depth, looking at growth data for municipalities more than 20 miles from the plant site

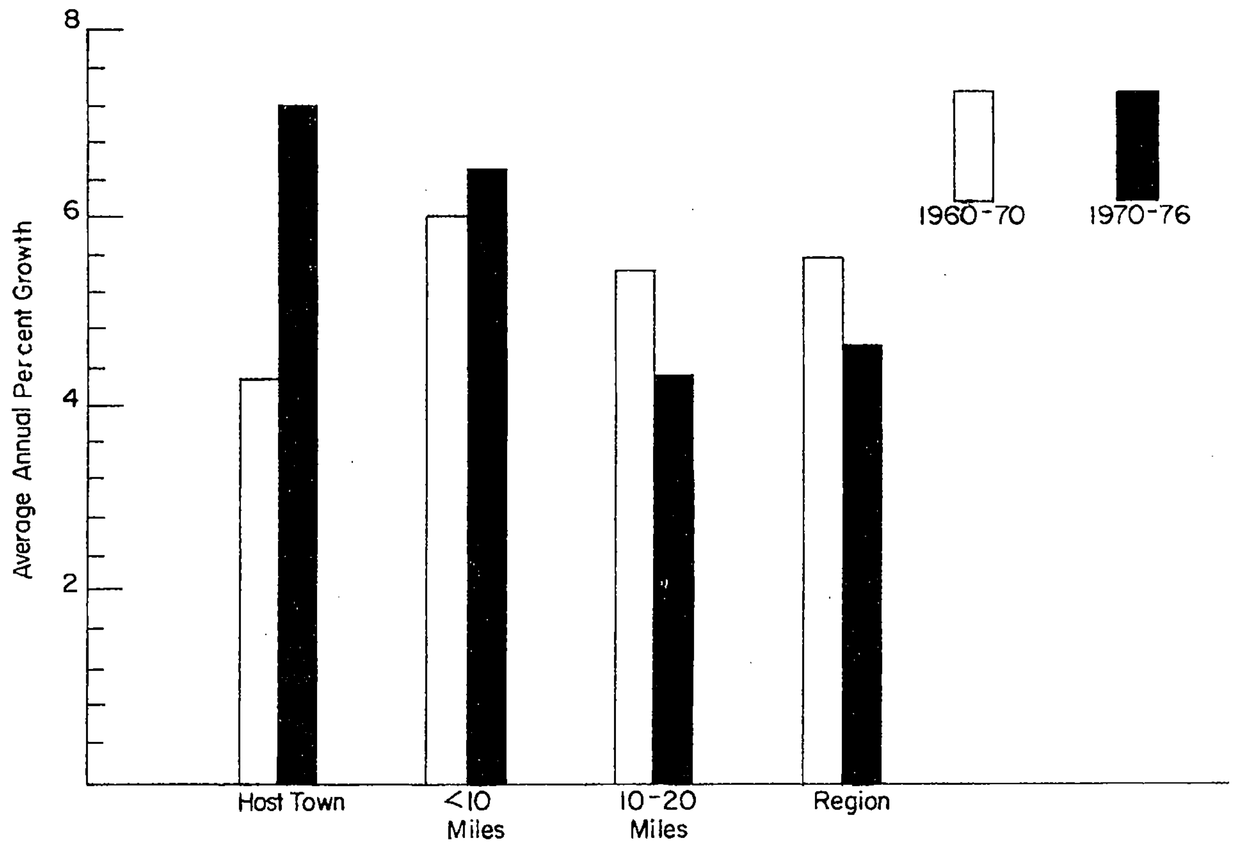


Figure 3.6. Average annual growth rates in total market assessed valuations, Pilgrim Site, 1960-1970 and 1970-1976.

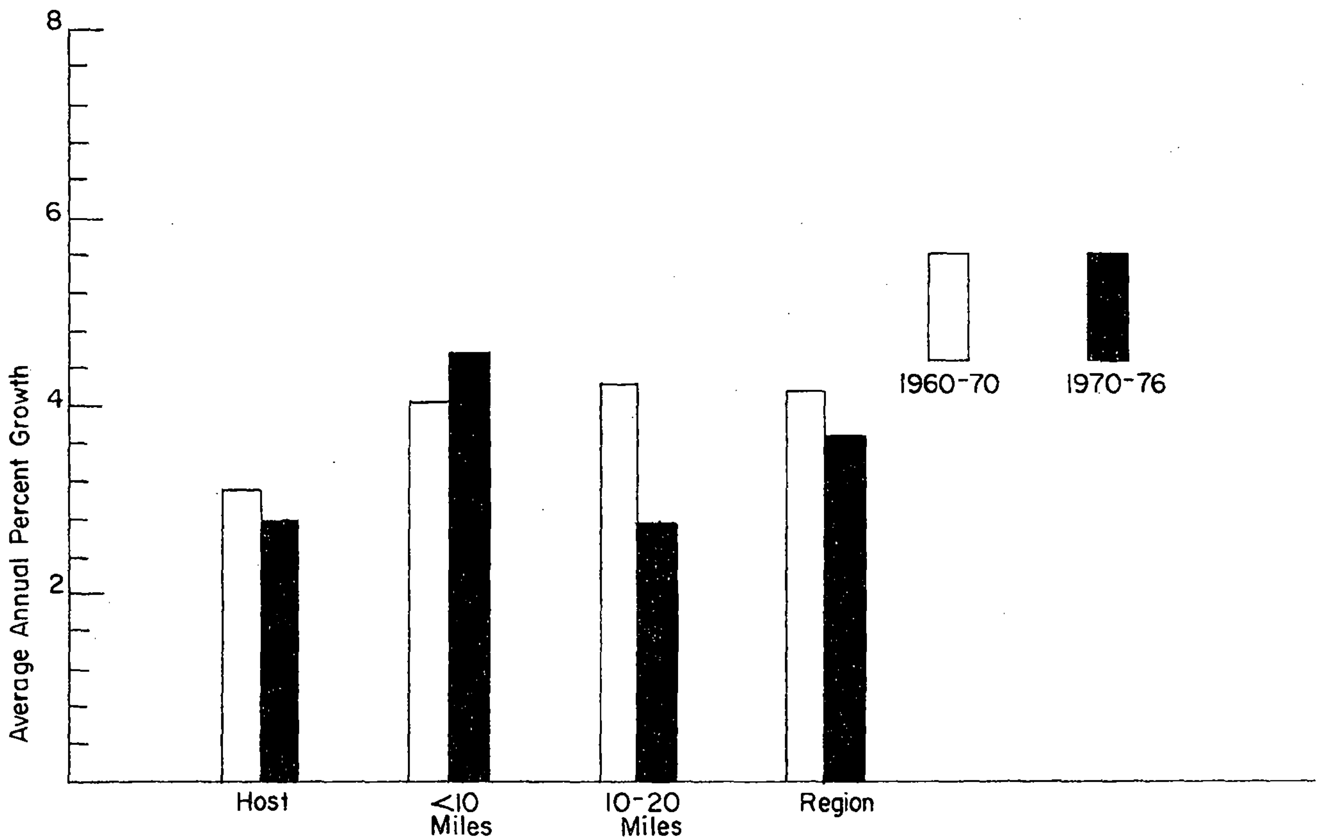


Figure 3.7. Average annual growth rates in total market assessed valuations, Millstone Site, 1960-1970 and 1970-1976.

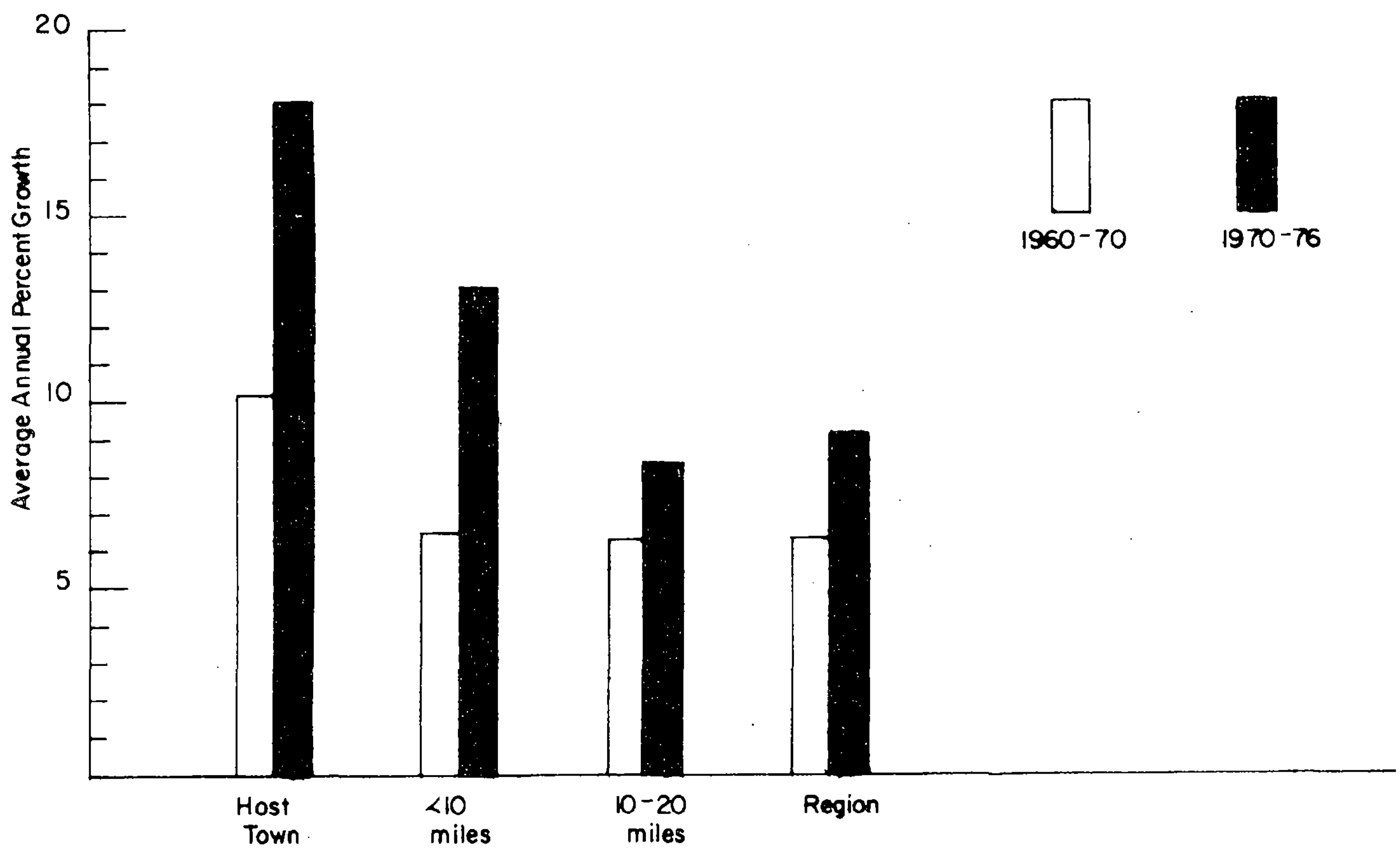


Figure 3.8. Average annual growth rates in total market assessed valuations, Oyster Creek Site, 1960-1970 and 1970-1976.

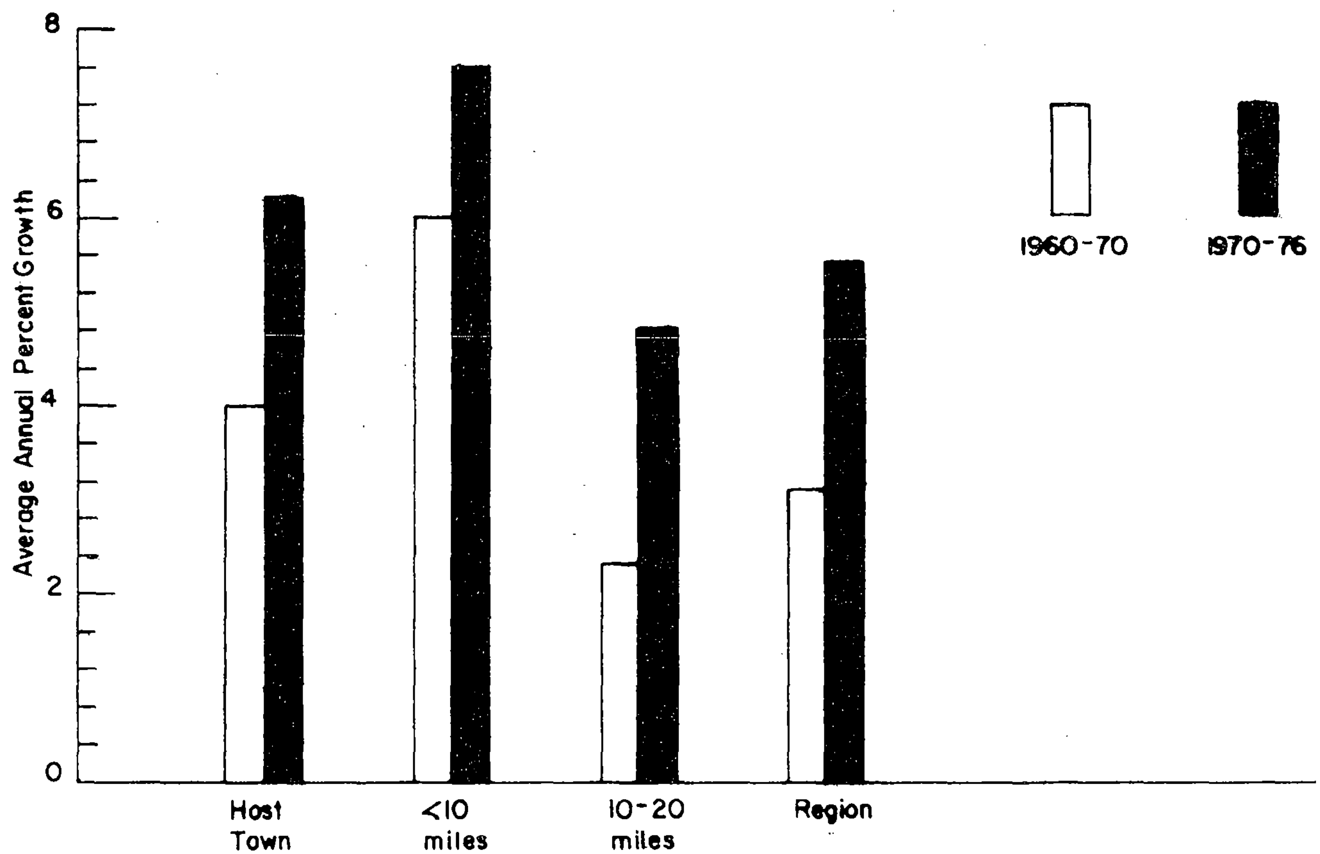


Figure 3.9. Average annual growth rates in total market assessed valuations, R. E. Ginna Site, 1960-1970 and 1970-1976.

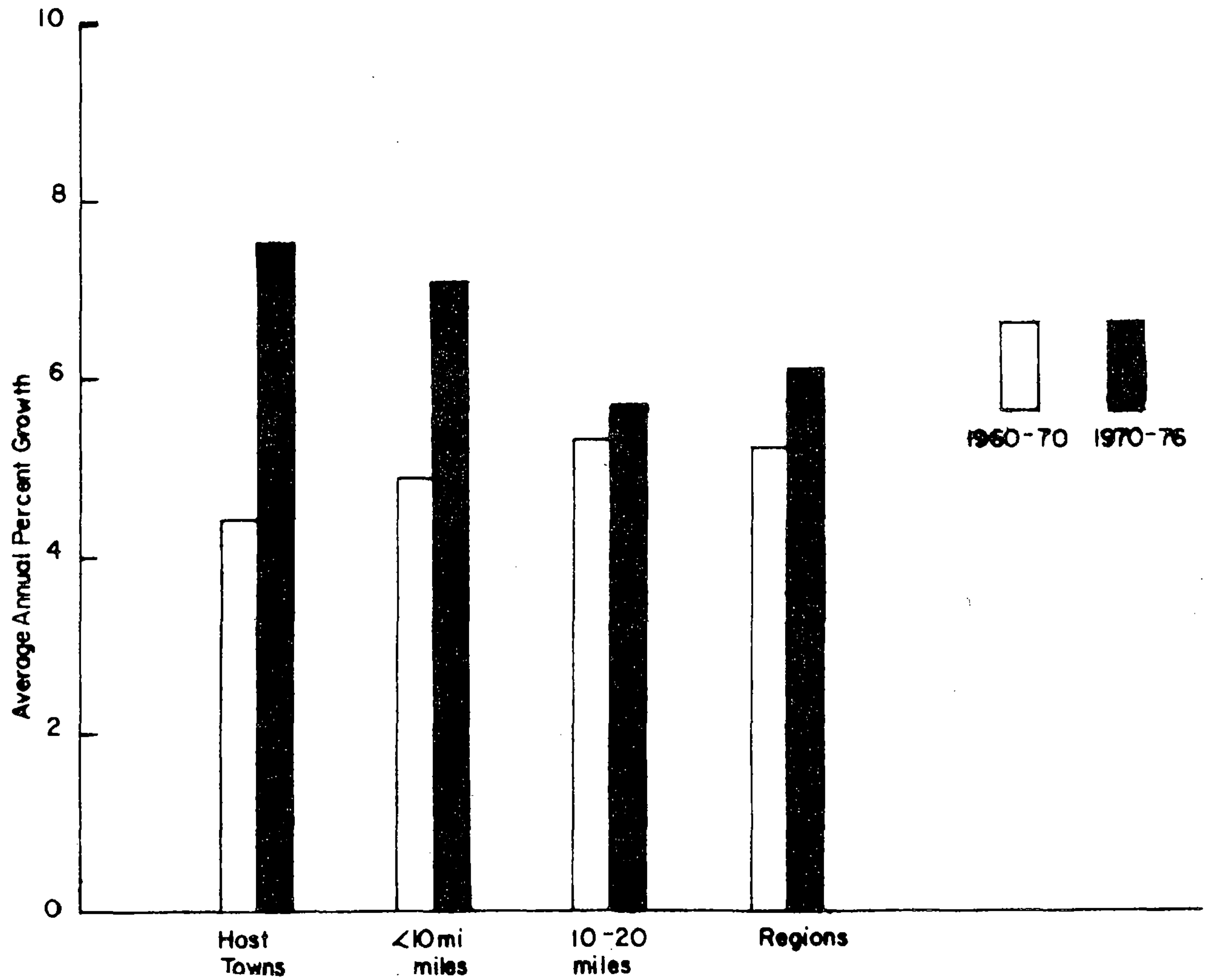


Figure 3.10. Average annual growth rates in total market assessed valuations, all areas combined, 1960-1970 and 1970-1976.

and relating other variables such as nearness to major population centers and water accessibility to growth rates. The R. E. Ginna study area was chosen for this, because (1) the data was very readily available; (2) Rochester was a dominant SMSA not far from the plant site; (3) topographically the region was very uniform; and (4) there wasn't the intensity of development of seasonal homes that existed at the other sites.

Data on 19 towns were assembled; 16 towns (including Ontario, the host town) in Wayne County, and 3 towns in eastern Monroe County abutting Wayne County to the West but next to the city of Rochester. Table 3.3 summarizes the total assessed equalized values for the years 1963, 1970, and 1976 and shows the average annual compound growth rates.

Examining the growth rates in Table 3.3 reveals that since 1970 growth has tended to increase with distance from Rochester, greater than 9.6 miles. This agrees with most other demographic studies. It is very apparent that the growth in the region has received most of its stimulus from the Rochester SMSA.

With respect to distance from the R. E. Ginna plant, the growth rates in the 1970-76 period declined from the 1963-70 period for the 2 closest distance zones, but increased for the zone farthest away, although the 5.3 percent growth rate for the 20-30 mile zone in 1970-76 was still below that of the less than 10 mile zone and that of the host municipality. In all likelihood, the plant had no relationship to this trend; it is a reflection of a national trend of population migration to rural areas in recent years.

Being close to the shores of Lake Ontario had no particular influence on growth. For both time periods, the growth rate of inland towns was somewhat higher than that for towns bordering the lake.

Counts were made of new residential structures within one and 2 mile distance zones of each of the nuclear power plants. These counts were taken from the maps and aerial photographs representing various years before and after plant construction. A high degree of reliability should not be placed on these counts because of lack of clarity on some of the photographs and lack of preciseness in being able to always identify residential structures. Table 3.4 summarizes these counts.

At the Pilgrim and Millstone sites there appears to be a sharp decline in new residential construction within 2 miles of the respective plants. On the other hand, at the Oyster Creek and R. E. Ginna sites there has been an increase in such construction since 1972 and 1969, respectively. Thus, the findings from this form of the analysis provided mixed results.

3.1.2 <u>Interpretation of Results</u>. -- The only logical interpretation that

Table 3.3. R. E. Ginna Study Area: total assessed real property values, equalized to Macedon Township, 1963, and average annual compound growth rates.

	Total Assessed Values			Growth Rates		
	1963	1970	1976	1963-1976	1963-1970	1970-1976
	$1000	$1000	$1000	%	%	%
Host Township (Ontario)[1]	$ 18,364	$ 24,303	$ 34,844	5.1	4.1	6.2
Distance from R. E. Ginna Plant:						
5 Townships < 10 Miles[2]	94,457	157,558	233,827	7.2	7.6	6.8
6 Townships 10-20 Miles[3]	280,893	468,679	637,553	6.5	7.6	5.3
7 Townships 20-30 Miles	57,261	68,379	93,329	3.8	2.6	5.3
Distance from Rochester, N.Y.:						
3 Townships, Ave. 9.6 Miles	208,982	403,027	565,034	8.0	9.8	5.8
3 Townships, Ave. 16.2 Miles[2]	40,617	59,587	94,485	6.7	5.6	8.0
3 Townships, Ave. 22.6 Miles	50,053	65,293	84,857	4.1	3.9	4.5
3 Townships, Ave. 29.8 Miles	92,808	117,550	155,848	4.1	3.4	4.8
3 Townships, Ave. 37.7 Miles	22,170	28,021	37,230	4.1	3.4	4.9
3 Townships, Ave. 43.9 Miles	17,981	21,138	27,255	3.3	2.3	4.3
Orientation to Lake Ontario:						
6 Townships abutting Lake[2]	122,233	189,182	259,520	6.0	6.4	5.4
12 Townships inland	310,378	505,434	705,189	6.5	7.2	5.7
Region Total:						
18 Townships[2]	432,611	694,616	964,709	6.4	7.0	5.6

[1] Excludes value of nuclear plant.

[2] Includes Ontario Township.

[3] Includes 3 townships next to Rochester.

Table 3.4. New residential structures within one and two miles of nuclear plants.

Site (Year Plant became Operational)	Time Periods	New Houses Within One Mile		New Houses Within 2 Miles		Total No. Houses, Year of Last Count[1]
		Number	Ave. Per Year	Number	Ave. Per Year	
Pilgrim (1972)	1962-1971	27	3.0	374	41.6	
	1971-1976	2	0.4	20	4.0	1,338
Millstone (1971)	1958-1970	40	3.3	238	19.8	
	1970-1975	9	1.80	29	5.8	1,704
Oyster Creek (1969)	1953-1972	77	4.1	1343	70.7	
	1972-1976	16	4.0	350	87.5	2,277
R. E. Ginna (1970)	1952-1969	8	0.5	47	2.8	
	1969-1976	4	0.6	38	5.4	240
All Areas Combined	1962-1969	77	11	944	135	
	1972-1975	20	7	309	103	5,559

[1] Within 2 miles radius.

one can give to the analysis of the time series data is that the presence of the nuclear power plants has not discouraged new growth in the host municipalities or in nearby communities (within 10 miles), if one is willing to accept the increase in total assessed real property values as a proxy measure for growth. Neither can it be said that new growth was directed to communities 10 to 20 miles distant from the power plants. There is strong evidence that at least in the case of the Oyster Creek plant new residential development was actually attracted to the host municipality, Lacey Township, because of property tax advantages arising after the plant was constructed. The same may be true but to a lesser extent in the other study areas. Examining the combined data for all sites, one finds that the average annual growth rates in assessed values for those years following plant construction were higher than for the years prior to construction, and that the growth rates were highest for host municipalities, next highest for municipalities within 10 miles of the plant, and lowest for municipalities 10-20 miles from the plant.

3.2 Cross Section Studies

3.2.1 Functional Forms of the Model. -- Several functional forms of the multiple regression model, equation (1) Chapter II, may be used to explain variation in the selling price of residential housing. In this study the linear and log-log forms were used, expressed as follows:

$$(3) \quad V_i = b_o + \sum_{j=1}^{n} b_j X_{ij} + \mu \qquad \text{(Linear)}$$

$$(4) \quad \ln V_i = \ln b_o + \sum_{j=1}^{n} b_j \ln X_{ij} + \mu \qquad \text{(Log-Log)}$$

where V_i = the deflated selling price of the i^{th} residential property,

b_o = constant term,

X_{ij} = independent variables from 1 to n associated with the i^{th} property,th

μ = an error term, assumed to be randomly distributed, reflecting all other unexplained variation.

In the linear multiple regression model the regression coefficient (b_j) represents the marginal effect that the j^{th} variable has on selling price. When the variables are not independent, an interrelationship (multicolinearity) exists between 2 or more independent variables and the interpretation of the meaning of the coefficients becomes more difficult.

The linear model anticipates that all the functions within the model are linear, whereas the log-log model anticipates a curvilinear relationship. Consequently, there is more flexibility in the log-log form in that the coefficients represent rates and not fixed amounts associated with unit changes in each variable. However, certain difficulties arise in interpretation of the log-log coefficients in that the regression curve is through the geometric mean of each variable rather than the arithmetic mean, the latter being the case of the linear form of the model. Therefore, a certain bias arises in the log-log forms. This will be discussed in somewhat greater depth in the error analysis section.

The functional forms of the models are quite rigid and the direction of change associated with each variable is fixed within the range of the functions. Some of the residential property characteristics (independent variables) fit better into logarithmic forms than into linear forms, and with some the converse is true. Thus neither form of the model can be expected to explain perfectly all of the variation in residential property prices.

3.2.2 Statistical Package. -- The California Statistical Procedures computer programming package was used for all of the regression analyses (1). This package was specifically developed for property value analysis and contains 7 Fortran programs. The first two programs are for editing variables and for displaying histograms (standard frequency, mean, standard deviation, and limits) of each variable. The last 5 programs perform stepwise regressions using the Breaux (2) modifications of the Effroymson (3) technique, one that is particularly suited to solve a regression problem in which there are a lot of independent variables, some of which may be significant and others may not.

The Efroymson procedure is a step-up procedure in which variables are entered stepwise singly and at each step a subset of equations is run to test this variable against all other variables. A variable is entered only if the variance of the residuals is significantly reduced and removed only if the variance of the residuals is significantly increased. The significance is determined by use of the F-test on the fractional variance of residuals or a t-test on the coefficient of partial correlation. The same variable can be entered and removed from the equation several times in the process of developing a final equation. Every variable in the final equation, then, is significant. For these models a significance level of .05 was selected for a variable to be entered or removed.

We hypothesized 4 variables to be particularly important for purposes of this study:

Variable #19: Low Tax Rate Town
Variable #22: Nuclear Plant Visible
Variable #31: Distance to the Nuclear Plant, and
Variable #69: Real Tax Rate Per $1000.

If these variables did not enter the final equation through the computer selection process, they were "forced in" one at a time to see if they could be significant. Once a variable is forced in, it is possible for the program to continue to add or reject other variables. This procedure was done for both the linear and log-log models.

3.2.3 Regression Results: Individual Study Areas (Linear Model). -- Table 3.5 presents the variables that were significant at the 5 percent level for each of the 4 study areas. The Oyster Creek equation is the strongest or best of the 4, in that 87 percent of the variation in housing prices (R^2) was accounted for by the 16 explanatory independent variables. Moreover, the Oyster Creek equation had the highest level of significance (F = 64) and the lowest standard error of estimate (SEE = 2999).

The weakest of the 4 equations was that for the R. E. Ginna study area, although it was still very significant at the 1 percent level and explained 70 percent of variations in price, despite the fact that only 6 variables proved significant at the 5 percent or better level.

It should be noted that only 3 variables had common significance in each of the 4 study areas: area of the first floor, area of the second floor, and number of fireplaces. There were no variables that were common to only 3 of the areas. The rather wide variation in the number (6-16) of significant variables for each study area and the total number (23) appearing in all 4 equations reflects the housing and community differences between the study areas.

The signs of all the coefficients were as expected _a priori_ except for variable #11, corner lot, in the Oyster Creek equation. Normally, corner lots are expected to be the more valuable lots. Examination of the original data revealed that corner lots were common in only two of the housing developments included in the Oyster Creek area. These two were older developments and contained generally low priced houses. This variable is reflecting the lower values associated with these specific developments rather than values associated with corner lots per se.

The magnitudes of most of the coefficients appear reasonable. For example, the equation indicates that newer houses in the Pilgrim and

Table 3.5. Regressions - separate study areas, linear form (dependent variable: real selling price).

Variables	Regression Coefficients - (F Values) Pilgrim 1	Millstone 2	Oyster Creek 3	R. E. Ginna 4
Constant	9,013.3794	14,903.9026	8,862.5415	31,162.0543
(4) Built 1969-1977 (dummy)	2,856.0243*** (11.5242)	--	2,434.7583*** (9.2602)	--
(8) Lot depth (feet)	--	--	55.8792*** (11.1628)	--
(11) Corner lot (dummy)	--	--	-1,602.1536** (6.0848)	--
(15) Outstanding view (dummy)	--	3,796.2865** (5.0827)	--	10,198.2599*** (19.9990)
(18) View from House (dummy)	--	--	2,176.3442*** (16.7123)	--
(23) Good Grade House x 2nd floor area (feet^2)	--	11.7013*** (10.0339)	--	--
(24) Good Grade House x 1st floor area (feet^2)	8.2295*** (32.3257)	4.8013** (5.2270)	--	--
(25) House condition Poor (dummy)	--	-4,589.0444** (6.5464)	-2,650.2209*** (7.8231)	--
(26) House condition Good (dummy)	--	--	3,446.3050*** (15.8563)	--
(37) Distance: nearest big employer (miles)	--	--	-244.4289*** (42.2390)	-956.4580*** (64.3676)
(42) Month of sale (month)	--	--	103.4298*** (17.3536)	--
(47) Area 1st floor (feet^2)	11.1279*** (20.8761)	15.2171*** (47.8407)	9.7135*** (95.1522)	8.7015*** (14.1429)
(48) Area 2nd floor (feet^2)	5.1255*** (15.4041)	13.5226*** (46.3163)	12.8721*** (26.9152)	6.2397*** (8.7629)
(49) Area finished basement (feet^2)	--	--	5.3464*** (8.0519)	--
(50) House on slab (dummy)	--	-2,557.9630** (6.0031)	--	-5,626.7081*** (6.0907)
(53) Attached garage (No. spaces)	3,959.7367*** (28.9168)	--	1,164.3843** (4.3202)	--
(54) Detached garage (No. spaces)	2,024.1264** (4.6128)	--	2,950.7664*** (9.0645)	--
(55) Fireplaces - (No.)	3,015.0936*** (17.5594)	4,110.8264*** (19.3192)	2,763.9151*** (18.0314)	7,128.1341*** (18.1410)
(59) Stone facing on house (dummy)	--	--	2,211.2127** (4.7119)	--
(65) Bedrooms - (No.)	1,543.2346*** (7.4012)	--	--	--
(66) Area of lot (feet^2)	--	0.1718*** (10.1842)	--	--
(70) Water frontage (dummy)	--	10,161.7264*** (20.5191)	7,927.3780*** (182.3555)	--
(76) Internal garage (dummy)	3,008.5063*** (7.1201)	--	--	--
R^2	.809	.7614	.8737	.7057
F	54.131***	55.8579***	64.0036***	22.7781***
SEE	4,310.6128	6,633.2539	2,999.3516	5,074.7552
Residual degrees freedom	115	175	148	57

**Significant at the 1-5% level of significance.
***Significant at the 1% or better level of significance.

Oyster Creek areas cost $2400-$2900 more than older houses; the cost of a square foot of first floor area is $9.71 to $15.22 depending upon the study area; and the presence of a fireplace adds several thousand dollars to the price of a house.

It is important to point out that distance to the nuclear plant was not a significant variable in any of the 4 study area regressions. Thus it appears that the hypothesis that a nuclear plant has a negative effect on housing prices is not supported by this analysis.

3.2.4 Regression Results: Pooled Data.

3.2.4.1 Linear Model. -- The results of pooling the data from all 4 study areas and using the linear form of the regression model are presented in Table 3.6. All variables which proved significant at the 5 percent or better level of significance are presented. Column one shows the final equation results of the Computer Analysis using the statistical package described earlier. Columns 2-5 show the results when certain variables not appearing as significant in the final equation are "forced" into the solution.

In the final equation (Column 1), 20 variables are highly significant at the 1 percent level and 5 variables are significant at the 5 percent level. The equation itself is highly significant and explains about 80 percent of the variation in housing prices (R^2 = .8055). If the equation explained much more variation than this it would be suspect, because there is normally about 20 percent random variation or fluctuation expected in housing prices in the actual workings of such a diverse real estate market. In other words, a highly skilled appraiser or assessor could not be expected to do much better than this in determining such housing prices.

The most important variables (those with the highest F ratios) in explaining housing prices are area of the first floor (48), area of the second floor (49), and water frontage (70). The latter is a dummy variable indicating whether or not the house was situated directly on the shore or water front. The accessibility variables were also important, particularly distances to swimming area, nearest big employer, and limited access highway.

The signs of all coefficients turned out to be as expected, and the magnitudes of most coefficients appear reasonable. The most significant aspect, however, of the final equation for purposes of this study is that variable 31, distance to the plant, did not enter the equation as having a significant effect on housing prices. This variable and variable 22,

Table 3.6. Regressions - all areas combined, linear form (dependent variable: real selling price).

	Variable	Regression Coefficients (F Values)				
		1	2 #69 Forced in	3 #22 Forced in	4 #31 Forced in	5 #19 Forced in
	Constant	19,508.6722	20,093.9435	19,363.0669	19,588.4397	18,171.1479
(1)	Built before 1914 (dummy)	-3,461.8008*** (7.9515)	-3,308.1484*** (7.3025)	-3,604.2171*** (8.6272)	-3,498.4632*** (8.0555)	-3,490.5084*** (8.1641)
(4)	Built 1969-1977 (dummy)	2,233.3499*** (14.7176)	2,212.1649*** (14.5896)	2,236.1475*** (14.8255)	2,228.8599*** (14.6277)	2,194.9105*** (14.3467)
(18)	View from House (dummy)	1,345.7207** (4.8632)	1,115.5324* (3.3104)	1,150.5855* (3.4697)	1,323.6311** (4.6530)	1,200.5011** (3.8780)
(19)	Low tax rate town (dummy)	--	--	--	--	1,007.6117* (3.4854)
(22)	Nuclear plant visible (dummy)		--	1,189.1570** (3.4776)	--	--
(23)	Good grade house x 2nd floor area - ($feet^2$)	7.7968*** (11.5839)	7.8235*** (11.7827)	7.7059*** (11.3647)	7.7562*** (11.4183)	7.8153*** (11.7432)
(24)	Good grade house x 1st floor area - ($feet^2$)	6.1389*** (22.5051)	5.9889*** (20.9448)	6.2563*** (23.4313)	6.2204*** (22.4268)	5.9650*** (20.7634)
(25)	House Condition - Poor (dummy)	-2,367.6967*** (6.8464)	-2,252.6799** (6.2108)	-2,215.7051** (5.9758)	-2,319.6461** (6.4297)	-2,342.5063*** (6.7501)
(27)	Abut light traffic (dummy)	-1,436.6735** (5.1759)	-1,443.8294** (5.2822)	-1,391.7042** (4.8732)	-1,426.6069** (5.0857)	-1,452.1828** (5.3350)
(28)	Abut heavy traffic (dummy)	-2,117.5599** (5.6796)	-2,098.5475** (5.6395)	-2,092.4405** (5.5711)	-2,111.3580** (5.6350)	-2,176.0847** (6.0425)
(31)	Distance to plant (dummy)	--	--	--	-20.2960 (0.1386)	--
(36)	Distance: swimming area - (miles)	-241.0020*** (20.1327)	-265.5982*** (23.8863)	-253.1494*** (21.9954)	-240.2885*** (19.9548)	-250.0444*** (21.0453)
(37)	Distance: nearest big employer - (miles)	-195.9621*** (38.4866)	-188.4731*** (34.9873)	-188.0193*** (34.9620)	-191.5359*** (32.1587)	-200.7114*** (40.6467)
(38)	Distance: limited access highway - (miles)	-532.4123*** (59.8109)	-537.8035*** (59.1270)	-534.5350*** (60.5627)	-527.4600*** (56.4993)	-536.5230*** (58.4867)
(39)	Distance: nearest state park - (miles)	-350.3679*** (18.0435)	-308.9049*** (13.4313)	-357.8957*** (18.8725)	-362.7444*** (18.6143)	-343.3460*** (17.4817)
(46)	No. bathrooms (rooms)	--	1,163.0493** (4.4210)	--	--	1,188.3657** (4.5776)
(47)	Area 1st floor ($feet^2$)	11.4355*** (151.7206)	11.0986*** (141.9771)	11.4093*** (151.7192)	11.3957*** (148.4480)	11.0366*** (138.5905)
(48)	Area 2nd floor ($feet^2$)	10.3332*** (110.5851)	9.8638*** (96.3694)	10.2355*** (108.7170)	10.3180*** (109.8871)	9.8263*** (95.4468)
(49)	Area finished basement - ($feet^2$)	3.5740*** (9.8608)	3.3542*** (8.6220)	3.6713*** (10.4332)	3.5891*** (9.9153)	3.4364*** (9.0024)
(50)	House on slab (dummy)	-1,465.9804** (5.1821)	-1,315.6121** (4.1889)	-1,508.2608** (5.5049)	-1,447.5862* (5.0149)	-1,271.2440** (3.8750)
(53)	Attached garage - (no. spaces)	2,256.7438*** (29.3698)	2,440.9291*** (32.9844)	2,278.9593*** (30.0705)	2,283.2300*** (29.1632)	2,418.6882*** (32.4937)
(54)	Detached garage - (no. spaces)	2,230.1819*** (17.9198)	2,269.5876*** (18.6146)	2,200.8626*** (17.5201)	2,223.6713*** (17.7659)	2,276.6028*** (18.6660)
(55)	Fireplaces - (no.)	2,508.6704*** (26.3139)	2,262.5940*** (20.8135)	2,495.2999*** (26.1599)	2,499.9617*** (26.0342)	2,288.1665*** (21.3197)
(56)	Central heating (dummy)	1,688.0826** (4.5835)	1,724.7138** (4.8053)	1,848.8542** (5.4590)	1,704.4480** (4.6505)	1,694.1003** (4.6396)
(66)	Area of lot ($feet^2$)	0.0571*** (7.5141)	0.0629*** (8.8298)	0.0551*** (7.0130)	0.05705*** (7.4940)	0.0586*** (7.8793)
(69)	Real tax rate per $1,000	--	-957.6135* (4.0677)	--	--	--
(70)	Water frontage (dummy)	8,103.6769*** (114.4282)	8,183.6664*** (116.5680)	7,950.1608*** (109.3670)	8,104.4578*** (114.2576)	8,188.4587*** (116.5717)
(72)	Ave. beach assoc. - (dummy)	2,577.4708*** (7.3143)	2,799.8533*** (8.6166)	1,916.8925* (3.5696)	2,517.1745*** (6.7693)	3,129.1756*** (9.9430)
(73)	Good beach assoc. - (dummy)	3,696.0241*** (8.3986)	3,539.6326*** (7.7736)	3,641.7788*** (8.1889)	3,681.7740*** (8.3125)	3,595.0335*** (8.0182)
(76)	Internal garage (dummy)	2,106.5358*** (10.3419)	2,203.8663*** (11.4105)	2,146.6487*** (10.7796)	2,112.9910*** (10.3807)	2,195.4190*** (11.3137)
	R^2	.8055	.8068	.8068	.8056	.8082
	F	85.1662***	82.3852***	82.4190***	81.7586***	79.9150***
	SEE	5,294.6395	5,282.7982	5,281.9249	5,299.0816	5,268.2444
	Residual Degrees Freedom	514	512	513	513	512

*Significant at 5-10 percent levle of significance.
**Significant at 1-5 percent level of significance.
***Significant at 1 percent or better level of significance.

plant visible, were forced in during subsequent runs. The data in column 3 show that variable 22 was significant at the 5 percent level, but its sign is positive, the reverse of that hypothesized. The coefficient indicates that when the plant is visible from a house, the house will sell for about $1200 more than other houses from which the plant is not visible, all other characteristics remaining the same. It appears that this variable is "picking up" some of the effect of nearness to the ocean or lake, since all 4 plants are directly on waterfront sites. This is confirmed by the large change in the coefficient of variable no. 72, average beach associations, which instead of being highly significant becomes significant at only the 10 percent level, and decreases in magnitude.

When variable 31, distance to plant, was forced in (column 4) there was virtually no change in any of the coefficients of the explanatory variables. Moreover, the variable itself was not at all significant and the coefficient has a negative sign, indicating that the closer the house to the plant the higher the price, clearly opposite to the condition hypothesized for this study.

When the two tax rate variables were forced in, (Columns 2 and 5), the explanatory ability of the equations improved very little, if at all, as these variables were significant at only the 10 percent level. The coefficients did have the expected signs, however. It is interesting to note that when these two variables were forced in, variable number 46 (number of bathrooms) then became significant (at the 5 percent level). There appears to be little explanation for this.

3.2.4.2 Log-Log Model. -- Table 3.7 shows the log-log form of the regression equation with the analysis following much the same format as in the linear form, the sole exception being that variable number 19 (low tax rate town) was not forced in because it entered as a significant variable during the final equation run (column 1).

The amount of variation in housing prices explained by both forms of the regression are about the same, as are the levels of significance as expressed by the F ratios. Seventeen independent variables are common to both forms in the final equation run. In the log-log form, fireplaces (55) and water frontage (70) are a little more significant than in the linear form, while the floor area variables are somewhat more important in the linear form.

Important variables appearing in the log-log form that are not in the linear form are: lot frontage in feet (7), lot on surfaced road (9); two accessibility variables, distance to shopping center (33) and

distance to high school (34), number of bedrooms (65), and deeded beach rights (71).

All coefficients in the final equation had the expected sign and the size of the coefficients are very reasonable. In this equation, Column 1 of Table 3.7, variable 31, distance to the plant was not significant.

When the variable "real tax rate per $1000" was forced in (column 2) it proved significant at the 5 percent level, replacing variable (19) "low tax rate town," in the final equation (Column 1). These two variables are obviously strongly interrelated as indicated by an r of .75.

When the variable "nuclear plant visible" (22) was forced in, it proved significant at the 1 percent level, but had a positive sign rather than the hypothesized negative sign. With this equation, lot frontage in feet (7) became insignificant instead of highly significant and was replaced by lot area (66). "Real tax rate per $1000" (69) became significant at the 1 percent level. These results indicate that the plant visible variable has high multicolinearity with other variables associated with the community and/or housing characteristics in locations near the plant, making interpretation difficult. In any case, the hypothesized negative effect of the plant on housing prices would be rejected by these results.

When "distance to nuclear plant" (31) was forced in, it proved to have no significance at all.

The conclusions dealing with the cross section analysis of the combined data are quite straightforward and clear: There is no evidence to support the hypothesis that nuclear power plants have an adverse effect on residential property values.

3.2.5 Error Analysis. -- In order to draw valid conclusions from the results of the regression analysis, the independent variables, as expressed through their coefficients, must be explaining the variation in housing prices as realistically and as accurately as possible. The purpose of this error analysis is to see if, by some independent standards, our regression equations are providing good explanations of property values.

The standards selected for this comparison are two measures that are widely used by the assessment profession for determining accuracy in real property assessments: the coefficient of dispersion and the index of regressivity. The coefficient of dispersion measures the average error in the explanation of property values. More precisely, it

Table 3.7. Regressions - all areas combined, log-log form (dependent variable: real selling price).

	Variable	Regression Coefficients (F Values)			
		1	2 #69 Forced in	3 #22 Forced in	4 #31 Forced in
	Constant	3.3857	3.3993	3.2787	3.3989
(1)	Built before 1914 (dummy)	-0.0477***	-0.0460***	-0.0486***	-0.0461***
		(7.9211)	(7.3196)	(8.4172)	(7.3275)
(4)	Built 1969-1977 (dummy)	0.0498***	0.0503***	0.0483***	0.0504***
		(35.7830)	(36.4887)	(33.9959)	(36.4806)
(7)	Lot frontage (feet)	0.0873***	0.0883***	0.0481	0.0884***
		(16.8010)	(17.1447)	(2.6926)	(17.1270)
(9)	Lot on surfaced road (dummy)	0.1199***	0.1194***	0.1065***	0.1208***
		(8.7450)	(8.6933)	(7.0330)	(8.7145)
(19)	Low tax rate town (dummy)	0.0167**	--	--	--
		(4.6710)			
(22)	Nuclear plant visible (dummy)	--	--	0.0257***	--
				(9.5758)	
(24)	Good grade house x 1st floor area ($feet^2$)	0.0229***	0.0233***	0.0223***	0.0234***
		(24.6709)	(25.3007)	(23.0943)	(25.3138)
(25)	House condition - poor (dummy)	-0.0469***	-0.0461***	-0.0439***	-0.0458***
		(14.2228)	(13.6977)	(12.6023)	(13.3601)
(28)	Abut heavy traffic (dummy)	-0.0429***	-0.0410***	-0.0406***	-0.0413***
		(12.7552)	(11.7361)	(11.7830)	(11.7715)
(31)	Distance to plant (dummy)	--	--	--	-0.0027
					(0.0593)
(33)	Distance: shopping center (miles)	-0.0409***	-0.0345**	-0.0497***	-0.0357**
		(7.7346)	(6.2657)	(12.1437)	(5.9500)
(34)	Distance: high school (miles)	-0.0374**	-0.0422**	-0.0329*	-0.0425**
		(4.6969)	(6.1664)	(3.6563)	(6.2116)
(36)	Distance: swimming area (miles)	-0.0953***	-0.0600***	-0.0598***	-0.0602***
		(30.5126)	(31.2803)	(31.8719)	(31.1895)
(37)	Distance: nearest big employer - (miles)	-0.1244***	-0.1165***	-0.0928***	-0.1151***
		(57.1548)	(47.1462)	(26.0990)	(41.8270)
(38)	Distance: limited access highway - (miles)	-0.0455***	-0.0458***	-0.0505***	-0.0453***
		(16.5258)	(16.7652)	(20.3050)	(15.9147)
(47)	Area 1st floor ($feet^2$)	0.3267***	0.3265***	0.3243***	0.3266***
		(116.0166)	(115.9029)	(116.8561)	(115.7385)
(48)	Area 2nd floor ($feet^2$)	0.0291***	0.0291***	0.0285***	0.0291***
		(75.1128)	(75.2483)	(73.6599)	(75.1073)
(49)	Area finished basement ($feet^2$)	0.0288***	0.0288***	0.0284***	0.0289***
		(54.3516)	(54.3571)	(50.9256)	(54.0457)
(51)	Full basement, floor, finished - (dummy)	0.0343***	0.0351***	0.0358***	0.0352***
		(15.9360)	(16.7449)	(16.7022)	(16.7736)
(53)	Attached garage (no. spaces)	0.1068***	0.1075***	0.1028***	0.1076***
		(21.7430)	(21.9052)	(20.4465)	(21.8875)
(54)	Detached garage (no. spaces)	0.1300***	0.1283***	0.1171***	0.1279***
		(20.6778)	(20.2244)	(17.0908)	(19.9633)
(55)	Fireplaces - (no.)	0.1638***	0.1623***	0.1529***	0.1617***
		(47.0990)	(46.3087)	(41.6343)	(45.4539)
(59)	Stone facing on house (dummy)	0.0423**	0.0436**	0.0444***	0.0438**
		(6.0867)	(6.4618)	(6.8571)	(6.4887)
(65)	Bedrooms - (no.)	0.0842***	0.0848***	0.0856***	0.0845***
		(9.2714)	(9.3949)	(9.7687)	(9.2854)
(66)	Lot Area ($feet^2$)	--	--	0.0457**	--
				(4.7566)	
(69)	Real tax rate per $1000	--	-0.0665**	-0.0809***	-0.0644**
			(4.7542)	(6.7965)	(4.1320)
(70)	Water frontage (dummy)	0.1141***	0.1141***	0.1110***	0.1144***
		(129.7577)	(129.7868)	(124.5334)	(129.0477)
(71)	Deeded beach rights (dummy)	0.0421***	0.0389***	0.0316***	0.0388***
		(17.6255)	(14.4308)	(8.8177)	(14.3670)
(73)	Good beach assoc. (dummy)	--	--	0.0362**	--
				(4.4039)	
	R^2	0.7985	0.7986	0.8045	0.7986
	F	85.0499***	85.0670***	78.0567***	81.5175***
	SEE	0.0731	0.0731	0.0723	0.0732
	Residual Degrees Freedom	515	515	512	514

*Significant at 5-10 percent level of significance.
**Significant at 1-5 percent level of significance.
***Significant at 1 percent or better level of significance.

measures the variation of individual assessment sales ratios around their median and is calculated by dividing the mean deviation by the median ratio. A coefficient of dispersion of 10 means that average assessment error of the properties involved is 10 percent. A coefficient of dispersion between 10 and 15 percent is considered good, and one below 20 percent is considered acceptable.

The index of regressivity measures the uniformity of assessment errors throughout the range of property values, from the highest to the lowest. The index is computed by regressing the logs of the assessment sales ratios on the selling prices. An index of regressivity between +0.2 and -0.2 is good, while one between +0.5 and -0.5 is considered acceptable. A negative index means that the assessed values tend to be regressive; that low value properties are overestimated and high value properties underestimated. A positive index means the opposite. An index of zero is neutral.

The California program, as part of its computational routine, calculates from the equation the values for each of the observations (properties sampled). From these computed values, coefficients of dispersion and indexes of regressivity were calculated. Table 3.8 shows these two measures of error as calculated for the linear and logarithmic forms of the regression models and compares them to the same measures as calculated from the actual assessment data used in the host municipalities. The coefficients of dispersion from the regression equations are better than the corresponding coefficients from the actual assessment data. The two indexes of regressivity from the regression equations are within the good range, and have lower values than two of the same indexes from two of the towns. From these two measures we can conclude that the regression equations are doing a good job of explaining property value differences. They are certainly in line with the best assessing jurisdictions in the country. The linear model may be slightly better than the log form of the model in explaining property value differences.

"Overfitting" the regression equations is a possibility with models this large in terms of number of variables. Overfitting arises when a certain combination (out of many tried) of the many independent variables best explains a given data set, but does not explain other comparable data sets nearly as well. Because not all potential house buyers are fully aware of all real property market conditions, there is considerable error or variance in market sales data. It is felt that the regression models developed here are about as accurate as they can be; if they were better, overfitting would be suspected.

Table 3.8. Coefficients of dispersion and indexes of regressivity (1975-1976 data).

	Number of Sales	Coefficient of Dispersion	Index of Regressivity
PSU Log Model	540	13.2	-0.182
PSU Linear Model	540	12.7	-0.170
Assessment Data			
Plymouth, Mass.	79	24.4	+0.041
Waterford, Conn.	46	15.1	-0.330
Lacey, N.J.	63	17.5	+0.063
Ontario, N.Y.	21	14.5	-0.606

3.3 Literature Cited

1. California State Board of Equilization. California Statistical Procedures, 1020 North N Street, P. O. Box 1799, Sacremento, CA, 95808.

2. Breaux, Harold J. "A modification of Efroymsons technique for stepwise regression analysis," Communications of the ACM, Vol. 11: 8, Aug. 1968, pp. 556-557.

3. Ralston, A. and Wilf, H. S. (Eds.) "Mathematical models for Digital Computers," John Wiley & Sons, N.Y. 1960.

4. Efroymson, M. A. "Multiple Regression Analysis" in Mathematical models for digital computers, John Wiley & Sons, New York, 1960, pp. 191-203.

IV. CONCLUSIONS AND SUMMARY

4.1 Conclusions

This study was undertaken to test the hypotheses that nuclear power plants have an adverse effect upon (1) community growth and (2) residential property values. Implicit in the second hypothesis is that prices paid for residential properties reflect people's perceptions of house and lot quality, community services and attributes, and environmental characteristics, and that if people in general perceive nuclear plants as a possible threat to health and safety they will tend to avoid living close to them. Such actions should be revealed in the real estate market for residential properties, and everything else being equal the closer to the plant the lower the price for housing.

The following conclusions are apparent from analysis of time series data on total assessed real property values from 1960 to 1976 and from regression analysis of 540 single family house sales in 1975, 1976, and 1977 in the vicinity of 4 nuclear power generating plants in the Northeast:

1) Assuming that the real (deflated) increase in total assessed property values is a good indicator of growth, the presence of the nuclear plants have had no adverse effects on the growth rates of communities in close proximity to the plant.

2) In light of the fact that (a) growth rates were inversely related to distance from the plant, and (b) annual growth rates for the years following plant construction were higher than for the years before plant construction, with the increase in the growth rate for the host communities higher than the increase for the region as a whole, the presence of the nuclear plant may actually serve as a stimulus to growth. The likely explanation for this is the lower tax rates in the host municipalities which are made possible by the large tax assessments levied on the plants.

3) The presence of the nuclear power plants, at least in 1975, 1976, and 1977 exerted no influence on the price of single family housing within 20 miles of these plants. Therefore, our hypothesis that residential property values are directly related to distance from the nuclear power plants must be rejected and the null hypothesis accepted.

4) For most people in these study areas, the proximity of a

nuclear power plant does not appear as a factor in residential location choice. The fears for health and safety expressed by some individuals and groups in society are not reflected in the housing decisions of residents in communities near the nuclear plants studied.

The conclusions stated above are strictly applicable only to the 4 study areas. Since the plants were preselected, and do not represent a random sample of all nuclear plants, the findings cannot be used to predict influences on growth and property values at other plant sites. Moreover, society's perceptions and values change over time, and what may have been true in the mid 1970's may not hold over a long time period.

This study was unable to uncover any negative effect on residential property values in the vicinity of the four nuclear plants examined, whereas both of the studies reported in section 1.4 of this report found that property values are discounted in the vicinity of the two plants studied therein. Such a divergency in findings warrants discussion.

One must look for differences in the sites and plants studied as well as for differences in methodological approaches to find possible explanations for the divergency in the findings. The most striking difference is that in both the Blomquist and Faucett studies a fossil fueled plant was studied, whereas the four plants included in this study were nuclear generating plants. People may react more negatively to the air pollutants and odor that generally emanate from fossil-fueled plants, whereas nuclear plants are clean with respect to these kinds of pollutants.

The plant that Blomquist studied was in a Chicago suburb, surrounded by development that was minimally buffered from the plant by open space. The nuclear plants in this study occupied relatively small areas on large tracts of land; thus there was a considerable buffer of open space between the plant itself and nearby development.

All four of the nuclear plants were rather attractively designed in external appearance. Aesthetically they would not be too displeasing as industrial structures. Although the researchers have not seen the plants in the Blomquist and Faucett studies, if they are typical fossil-fueled generating plants it is our opinion that they would be less acceptable than the nuclear plants in visual appearance within a residential setting.

Methodologically, Blomquist used owner-estimates of property values as obtained by the census in his regression model. Such estimates are less accurate as indicators of real property values than actual valid real estate transactions. When having to declare property

values to census enumerators, owners may feel such figures may be used for tax purposes and consequently tend to underestimate such values (or overestimate the possible negative effect of a nearby disamenity).

The Faucett report readily admitted to a weakness in that study; too few property sales had occurred to obtain sufficient data to define within strict confidence limits the negative impact on property values.

The reasons discussed above may explain the divergency in findings between these studies.

4.2 Summary

Electric utilities are experiencing increased resistance from the public in the siting of new nuclear generating facilities, much of this supposedly a reflection of fears for health and safety. The extent to which such fears are held by the general public is unknown. If people's perception of possible health and safety effects are real and strong, they should be reflected in their locational choices for housing. In turn, growth rates in communities near nuclear plants should be lessened, and the local real estate market, all else being equal, should show a lower price for housing. The hypotheses to be tested in this study are: (1) that growth in communities near to nuclear generating plants is less than growth in more distant communities; and (2) that nuclear generating plants have an adverse effect upon residential property values, that is property values are directly related to distance from such plants.

Four nuclear plants in the Northeastern United States were selected for study: Pilgrim (Mass.), Millstone (Conn.), Oyster Creek (N.J.), and R. E. Ginna (N.Y.). Total assessed real property values, equalized from 1960 to 1976 for 64 municipalities within 20 miles of the 4 plants, were assumed to adequately reflect community growth trends, and were used as the data base for the time series analysis. The cross section analyses employed multiple regression using linear and log-log forms to statistically analyze data on 540 single family houses that sold between 1975 and 1977 within about 20 miles of the plants. Market sales price corrected for inflation formed the dependent variable while the independent variables included approximately 70 descriptors of house, lot, community, environment, and accessibility characteristics. Distance from house to nuclear plant" and "nuclear plant visible from the house" were the two key independent variables that were used to reflect the effects of the plant on selling price. Regression runs were made for each study area separately and then the data from the 4 study areas were combined and regressions run on the pooled data.

The assessed values for all property classes were equalized for the years of the study to full 1976 market values for all municipalities in all study areas. Average annual compound growth rates were determined from the increases in assessed values. The results for the pooled data show that following plant construction the rates of growth were inversely related to distance from the plant. Between 1970 and 1976, host communities had the highest annual growth rate (7.5 percent), other communities within 10 miles of the plant had a growth rate of 7.1 percent, while communities 10 to 20 miles from the plant had a 5.7 percent growth rate. This order was reversed for the years 1960 to 1970, basically the years preceeding the time when the plants became operational, when the host towns had the lowest growth rate (4.4 percent) while the communities 10 to 20 miles away had the highest (5.3 percent). In all 4 regions, growth rates after the plant became operational exceeded the growth rates in the 1960 decade.

Both forms of the regression equations (linear and log-log) for the pooled data in the cross section analysis were significant at the 1 percent level, as were the equations for each study area examined separately. The pooled data equations explained about 80 percent of the variation in housing prices, and contained about 25 variables significant at the 5 percent level or better, of which 20 were significant at the 1 percent level. The predicted signs of the regression coefficients turned out as expected, and the magnitude of most of the coefficients were very reasonable.

Of most significance, however, is the fact that neither of the two independent variables intended to reflect the possible effects of the nuclear plant on housing prices (distance to plant and plant visible) were significant. When the "plant visible" variable was forced into the equation it was significant at the 5 percent level, but had the opposite sign of that hypothesized.

In the log-log form of the model, a dummy variable for low tax rate town was significant at the 5 percent level. This coupled with the results of the time series analysis, lends strong credence to the supposition that the low tax rates in the host municipalities, resulting from the large local tax payments by the utilities, initially attract residential and subsequently other development. The issue of local tax impacts from nuclear plants is a fruitful area for future research.

The conclusions that can be drawn from this research are quite clear. The presence of the nuclear power plants had no adverse effects on the growth rates of the host or nearby communities, nor did they have any significant effects on the price of single family housing within 15 miles of the plants between the years 1975 and 1977. Therefore, the hypotheses stated earlier must be rejected. The fears for health and safety associated with nuclear power plants, as expressed by some individuals and groups in society, apparently are not shared by the majority of people.

APPENDIX A

Cross Section Analysis: Sources and Processing of Data, Selection of Variables, and Construction of the Regression Model.

The data sources by study area for the cross-section analysis are listed below:

CROSS-SECTIONAL DATA SOURCES BY STATE

Massachusetts

1. Commonwealth of Massachusetts, Department of Education.
2. Commonwealth of Massachusetts, Department of Corporation and Taxation.
3. Massachusetts Tax Payers Foundation.
4. Annual reports, tax duplicates and other public records for the towns of Plymouth, Kingston, Duxbury and Marshfield.
5. Multi-list data from the Plymouth County Multi-List Service.

Connecticut

1. State of Connecticut, Department of Education.
2. Annual Report, property record cards, tax duplicates, tax maps and other public records for the towns of Waterford, East Lyme and Old Saybrook.

New Jersey

1. State of New Jersey, Department of the Treasury, Division of Taxation.
2. State of New Jersey, Department of Education, Division of Administration and Finance.
3. Annual reports, property record cards, tax duplicates, tax maps and other public records of townships of Lacey, Berkeley, Ocean, Barnegat and Little Egg Harbor.

New York

1. The State Education Department, Division of Educational Finance.
2. State of New York, State Board of Equalization and Assessment.

3. Annual reports, property record cards, tax duplicates and other public records for the towns of Ontario, Macedon, Sodis, Walworth and Williamson.

4. Wayne County Real Property Tax Service, tax maps.

In addition, on-site inspection was made of every property included in the analysis.

The characteristics selected to describe the house and lot were based on appraisal techniques, a number of property value studies related to accessibility and environmental factors (noise and air pollutants), and land economic principles. Prior to data collection, it is impossible to identify all of the characteristics that will ultimately be useable as variables in the regression equation. For example, in warm climates houses with central air conditioning sell for more than similar house without it. In this study, only 13 houses, most in New Jersey, had central air conditioning, precluding its use as a variable because of too few observations. Certain other variables or variable sets and their use must be restricted. Information on some variables was simply not available. For example, not all towns included on their tax assessment record cards information concerning a modern kitchen. Since it was impossible to ascertain a modern kitchen from outside on-site inspection, the variable had to be dropped. The computer program used eluminates variables having constant or near constant values and ones with too few observations.

Six different types of houses were identified in the study areas as follows:

1. Split level
2. Ranch
3. Raised ranch
4. Cape Cod
5. Slab
6. Multi-story.

Three different typse of garages were identified as follows:

1. Internal garage -- enclosed within the main walls and roof of the house.
2. Attached garage -- a common wall between the house and the garage.
3. Detached garage -- a separate structure.

Number of garage spaces refers to the number of cars the garage was built to accommodate.

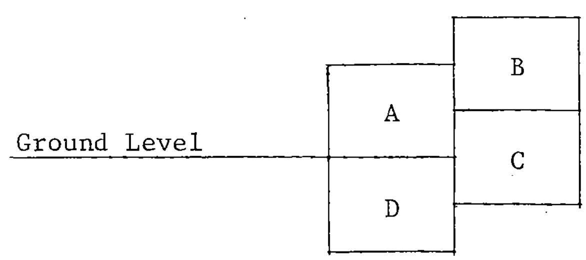
House basements were handled by four configurations:

1. Houses on a slab, including houses built on piers, were listed as "house on slab," a dummy variable.
2. Houses with an unfinished basement, with dirt floor, were included in the constant term.
3. Houses with a full basement with cement floor, is "full basement floor finished," a dummy variable.
4. Houses with a finished basement were shown as "area finished basement," and the area in square feet entered.

The first floor of a house was considered to be the floor which one entered from the main or front entrance, and the floor which usually included the living room and kitchen. A dummy variable covered houses with attics. Since only a few houses contained four floors, the fourth floor was not counted.

Split level houses are more difficult to evaluate in terms of floors and living area. In Figure A.1, Area A is considered to be the first floor; Area B the second floor; Area C the finished basement, which often contains an internal garage; and if Area D is finished as a basement it is included along with Area C. If Area D does not exist, the house is considered to be on a slab, so that the variables are additive.

Figure A.1. Split level house diagram, front view.



Financial, tax, and assessment data used for the variables in the cross-section analysis are applicable to the townships in which the house sales occurred. These data are shown in Table A-1. Table A-2 lists the regional variables applicable to each of the 4 study areas.

The variable numbers, from 1 to 76, are the same as those used in the regression equations. Initially, there were more than 76 variables listed, but subsequent processing of the data eliminated some. When an original variable was subsequently replaced by a new variable, the original number is identified with the letter A following the number.

Table A-3 describes, for each of the 76 variables, a number of characteristics that should enable the reader to get a better understanding of the variables and see how they were used in the regression equations. The following guide refers to Table A-3:

Column 1: The name and number of the variable, how it is measured (dummy, months, miles, feet^2, spaces, etc.).

Column 2: Study areas: (1) Plymouth; (2) Millstone; (3) Oyster Creek; (4) R. E. Ginna; (5) Total - Pooled areas.

Column 3: The number of observations in each site having the characteristic.

Column 4: The value for the characteristic shows: minimum; mean (for a dummy variable the mean is the proportion of observations having the characteristics); the standard deviation; and maximum (where the values are not available or are meaningless, they are not shown).

Column 5: Source:
- PRC - Property record card data or multilist data slips for Massachusetts.
- OSI - On-site inspection.
- TM - Assessment office tax maps.
- RM - Oil company road map + Table A-2.
- DNA - Data not available.
- TD - Town data (see Table A-1).
- CODE - Codes used.

Column 6: Construction: Examples

6 x 70 - means variable 6 times variable 70.

44 (Dummy) - means the variable is a dummy variable, 0 or 1 derived from the code variable 44.

None - means actual value of the variable is used.

Column 7: Limitation: Observations excluded from the sample because the value was greater or less than the value given in this column.

None - means no limitations.

Column 8: Effect: Hypothesized effect on the dependent variable.
(+) means an increase in the value.
(-) means a decrease in value.
(?) effect is undetermined bedause the variable could have different effects on the dependent variable.

Tried - means the variable was tried in trial equations and had no effect on the dependent variable and thus another variable was put in its place.

None - means the variable is hypothesized to have no effect on the dependent variable and was collected for data housekeeping reasons only.

Used - means the variable was used to construct other variables.

Column 9: Pooled: Yes - means the variable was included in the pooled analysis and was available to the computer program to enter or leave the equation automatically, depending on its effect on the explained variation of the dependent variable.

No - means the variable was not included in this set of data and was excluded for various reasons. An explanation of these reasons will follow:

Out M: The variable is multicollinear with other variables which are listed. This variable was eliminated and another variable picked.

Picked: The variable is multicollinear with other variables. This variable was selected and the others in the list were deleted.

Out D: Variable dropped because it does not represent the characteristic but a combination of factors that could be more representative of other characteristics.

Out A: Variable dropped and a new variable placed in that position.

Test: Variable to be tested for significance by forcing it into equation at the proper time.

Used: Variable used only to construct another variable.

Too Few: There were too few observations with this characteristic to include it in the equation.

Column 10: Class: (1) - House characteristics

(2) - Lot characteristics

(3) - Accessibility characteristics

(4) - Locational characteristics

(5) - Public sector characteristics

(6) - Transfer characteristics

Within the constant term in the regression equations are many variables which are dummy variables, that is, they are designated as a one or a zero. The one indicates that the characteristic is present and the zero inticates its absence. Table A-4 gives a description of these variables that are reflected in the constant term. The table shows the name and number of the variable and number of the non-constant variable from which it was constructed. The table also shows for each variable the number of observations having the variable characteristic, the mean value, how the variable was constructed, and the hypothesized effect on the dependent variable.

Regression mathematics dictate that when dummy variables are used, all observations cannot be in the equation simultaneously; one or a group must be omitted, otherwise the sum of all variables is one. For example, the years the houses were built were divided into 5 time periods (5 dummy variables), but only 4 of these were entered in the equation. The 5th dummy, built between 1947 and 1967, was omitted; therefore, it was reflected in the constant term. A number of the dummy variables used in this analysis were constructed from numeric variables.

When the non-constant variable does not appear as one of the independent variables, then the constant term does not contain observations on this variable. For example, when the dummy "houses with fireplace" is not in the equation, then the constant term does not reflect houses without fireplaces.

Table A-1. Local financial tax and assessment data.

Towns or Township	State Aid Per Student	Cost of Education Per Student	State Equiliza- tion Rate	Number of Sales	Coefficient of Dispersion	In-House Equiliza- tion Rate	Actual Tax Rate	Real Tax Rate Per $1000
<u>Massachusetts</u>								
Plymouth	154	1284	36.0	83	24.4	18.8	78.8†	14.8
Kingston	482	1173	34.0	9	38.1	35.8	101.4	36.3
Duxbury	208	1741	87.0	21	19.5	59.3	53.0	31.4
Marshfield	474	1293	59.0	12	19.8	39.4	82.5	32.5
<u>Connecticut</u>								
Waterford	394	1311	*	41	15.1	65.5	18.5	12.3
East Lyme	378	1265	*	88	14.5	39.3	46.0	17.9
Old Saybrook	370	1702	*	57	12.5	35.7	36.0	12.8
<u>New Jersey</u>								
Lacey Twp.	163	977	85.5	62	17.5	76.5	17.54*****	13.4
Berkeley	193	1524	77.3	16	15.8	54.4	30.01	16.3
Ocean Twp.	247	1381	67.8	48	23.2	67.3	29.90	20.1
Barnegat	193	1524	98.5	14	9.8	95.9	27.39	26.3
Little Egg Harbor	219	1382	82.5	25	10.0	81.4	28.96	23.5
<u>New York</u>††								
Ontario	765**	1993***	39.0	22	14.5	25.6	79.74****	31.1
Macedon	1200	1284***	49.0	20	6.3	37.5	63.24****	31.0
Sodis	1251	1881***	26.0	10	27.2	19.1	124.94****	32.3
Walworth	765**	1993***	52.0	9	9.7	32.7	70.45****	36.6
Williamson	1257	1793***	28.0	3	5.1	16.8	120.78****	33.8

*No state equilization study in Connecticut.
**In the same school district.
***Adjusted to reflect accounting differences.
****Includes county tax, township tax, and school tax. No other special district taxes.
*****In addition to property taxes the township of Lacey collects a gross receits tax of 2 million+ from the nuclear plant annually.
†There is a personal property tax on the nuclear plant in Massashusetts with a yield of $500,000 annually.
††In New York State, the strong equalization through reduced state aid to the school system in areas with high market value per student reduces the tax effect from the nuclear plant.

Table A-2. Regional variables.

Site	31 Other Plant	37 Big Employer	38 Limited Access Highway	39 State Park	40 Small SMSA	41 Large SMSA
Pilgrim	Millstone, Conn.	Town of Braintree, Mass.	Mass. Route 3	Myles Standish	Brockton, Mass.	Boston, Mass.
Millstone	Groton, Conn.	Electric Boat of General Dynamics, Groton, Conn.	1-95	Rocky Neck	New London, Conn.	New Haven, Conn.
Oyster Creek	Salem, N.J.	Tom's River Industrial Park	Garden State Parkway	Bass River Double Trouble	Atlantic City, N.J.	Newark, N.J.
R. E. Ginna	Nine Mile Point, N.J.	Xerox Plant, East of Rochester	I-490 N.Y., 104	Sodis Point, Macedon Centre	Rochester, N.Y.	Buffalo, N.Y.

Table A-3. Description of variables used in the cross-section regression equations.

Variable Number and Name	Study Area	No. Obser-vations	Values: Minimum	Mean	Standard Deviation	Maximum	Source	Construc-tion	Limitation	Effect	Pooled	Class
(1) Built before 1914 (Dummy)	1	7	0	.056		1	PRC	44 (Dummy)	None	?	Yes	1
	2	11	0	.088		1						
	3	1	0	.005		1						
	4	6	0	.094		1						
	Total	25	0	.046		1						
(1a) Study site code number	1	125	1			1	T.M.	Code	None	None	No Out A	6
	2	186	2			2						
	3	165	3			3						
	4	64	4			4						
	Total	540	1			4						
(2) Built 1915-1933 (Dummy)	1	8	0	.064		1	PRC	44 (Dummy)	None	?	Yes	1
	2	29	0	.156		1						
	3	4	0	.024		1						
	4	3	0	.047		1						
	Total	44	0	.081		1						
(2a) Development code number	1	125	1			8	T.M.	Code	None	None	No Out A	6
	2	186	11			14						
	3	165	21			27						
	4	64	31			35						
	Total	540	1			35						
(3) Built 1934-1946 (Dummy)	1	0	0	.000		0	PRC	44 (Dummy)	None	?	Yes	1
	2	14	0	.075		1						
	3	2	0	.012		1						
	4	4	0	.063		1						
	Total	20	0	.037		1						
(3a) Observation number in development	1	125	1			57	T.M.	Code	None	None	No Out A	6
	2	186	1			99						
	3	165	1			52						
	4	64	1			25						
	Total	540	1			99						
(4) Built 1968-1977 (Dummy)	1	53	0	.424		1	PRC	44 (Dummy)	None	+	Yes	1
	2	25	0	.134		1						
	3	58	0	.352		1						
	4	39	0	.609		1						
	Total	175	0	.324		1						
(4a) Sale price (Dollars)	1	125	12,000	33,961	10,885	69,900	PRC	None	< 10,000 >100,000	Used (43)	No Used	6
	2	186	20,000	40,991	14,757	95,000						
	3	165	10,450	26,449	8,601	53,000						
	4	64	12,000	35,368	9,637	60,500						
	Total	540	10,450	34,608	13,274	95,000						
(5) Date of sale (Month)	1	125	1	8.08		12	PRC	None	None	Used (42)	No Used	6
	2	186	1	7.10		12						
	3	165	1	7.39		12						
	4	64	1	6.81		12						
	Total	540	1	7.38		12						
(6) Year of Sale (Year)	1	125	75	76.3		77	PRC	None	> 74 < 78	+ Used (42)	Yes	6
	2	186	75	76.1		77						
	3	165	75	76.1		77						
	4	64	75	76.0		77						
	Total	540	75	76.2		77						
(7) Lot frontage (Feet)	1	125	46	112.6	57.4	292	PRC T.M. OSI	None	> 30 < 300	+ Used (66)	Yes	2
	2	186	40	88.7	39.6	281						
	3	165	40	70.6	24.1	166						
	4	64	30	119.3	40.0	260						
	Total	540	30	92.3	44.8	292						
(8) Lot depth (Feet)	1	125	43	166.9	104.1	579	PRC T.M. OSI	None	> 40 < 400	+ Used (66)	Yes	2
	2	186	55	137.2	74.6	563						
	3	165	66	104.5	16.5	157						
	4	64	90	242.3	87.7	580						
	Total	540	43	146.5	84.8	580						

Table A-3. Continued

Variable Number and Name	Study Area	No. Observations	Values: Minimum	Mean	Standard Deviation	Maximum	Source	Construction	Limitation	Effect	Pooled	Class
(9) Lot on a surfaced road (Dummy)	1	98	0	.784		1	OSI	None	None	+	Yes	5
	2	184	0	.989		1						
	3	151	0	.915		1						
	4	61	0	.953		1						
	Total	495	0	.916		1						
(10) Traffic volume (Code)	1	125	1			3	OSI	None	None	Used	No	4
	2	186	1			3	R.M.			(23)	Used	
	3	165	1			3						
	4	64	1			3						
	Total	540	1			3						
(11) Corner lot (Dummy)	1	18	0	.144		1	T.M.	None	None	+	Yes	2
	2	21	0	.113		1	OSI					
	3	30	0	.182		1						
	4	8	0	.125		1						
	Total	77	0	.143		1						
(12) Lot with curbs and storm sewers (Dummy)	1	26	0	.208		1	OSI	None	None	+	No	2
	2	30	0	.161		1					Out	
	3	30	0	.182		1					D	
	4	0	0	.000		0						
	Total	86	0	.159		1						
(13) Town of Plymouth (Dummy)	1	83	0	.664		1	PRC	64	None	Used	No	6
	2	0	0	.000		0		(Dummy)		(19)	Used	
	3	0	0	.000		0						
	4	0	0	.000		0						
	Total	83	0	.154		1						
(13) Lot with public sewer (Dummy)	1	2	0	.016		1	PRC	None	None	+	No	2
	2	0	0	.000		0	OSI				Out	
	3	37	0	.224		1					D	
	4	25	0	.390		1						
	Total	77	0	.120		1						
(14) Town of Waterford (Dummy)	1	0	0	.000		0	PRC	64	None	Used	No	6
	2	41	0	.220		1		(Dummy)		(19)	Used	
	3	0	0	.000		0						
	4	0	0	.000		0						
	Total	41	0	.076		1						
(14a) Lot with public water (Dummy)	1	118	0	.944		1	PRC	None	None	+	No	2
	2	136	0	.731		1	OSI				Out	
	3	39	0	.236		1					D	
	4	59	0	.922		1						
	Total	372	0	.652		1						
(15) Outstanding view (Dummy)	1	11	0	.088		1	OSI	None	None	+	Yes	2
	2	18	0	.097		1					Picked	
	3	10	0	.061		1					70,71,	
	4	13	0	.203		1					22	
	Total	52	0	.096		1						
(16) Township of Lacey (Dummy)	1	0	0	.000		0	PRC	64	None	Used	No	6
	2	0	0	.000		0		(Dummy)		(19)	Used	
	3	62	0	.375		1						
	4	0	0	.000		0						
	Total	62	0	.115		1						
(16a) Water front, water heated (Dummy)	1	0	0	.000		0	OSI	None	None	-	No	4
	2	0	0	.000		0					Out	
	3	10	0	.061		1					D	
	4	0	0	.000		0						
	Total	10	0	.018		1						
(17) Town of Old Saybrook (Dummy)	1	0	0	.000		0	PRC	64	None	Used	No	6
	2	57	0	.306		1		(Dummy)		(19)	Used	
	3	0	0	.000		0						
	4	0	0	.000		0						
	Total	57	0	.106		1						

Table A-3. Continued

Variable Number and Name	Study Area	No. Observations	Values: Minimum	Mean	Standard Deviation	Maximum	Source	Construction	Limitation	Effect	Pooled	Class
(18) View from house (Dummy)	1	86	0	.688		1	OSI	None	None	+	Yes	2
	2	176	0	.946		1						
	3	102	0	.618		1						
	4	58	0	.906		1						
	Total	422	0	.781		1						
(19) Low tax rate town (Dummy)	1	83	0	.664		1	T.D.	13+14+16 +17	None	+	Yes Test Out M 19,69	5
	2	98	0	.527		1						
	3	62	0	.376		1						
	4	0	0	.000		0						
	Total	243	0	.450		1						
(19a) Nusiance near lot (Dummy)	1	2	0	.016		1	OSI	None	None	-	No too few	4
	2	3	0	.016		1						
	3	1	0	.006		1						
	4	0	0	.000		0						
	Total	6	0	.041		1						
(20) Favorable slope for development (Dummy)	1	105	0	.636		1	OSI	None	None	+	Yes	2
	2	181	0	.973		1						
	3	165	0	1.000		1						
	4	58	0	.906		1						
	Total	509	0	.943		1						
(21) Trees on lot (Dummy)	1	119	0	.080		1	OSI	None	None	+	Yes	2
	2	136	0	.336		1						
	3	70	0	.236		1						
	4	39	0	.312		1						
	Total	364	0	.248		1						
(22) Nuclear plant visible (dummy)	1	10	0	.080		1	OSI	None	None	?	No Out M 70,71, 15	4
	2	62	0	.236		1						
	3	39	0	.236		1						
	4	20	0	.312		1						
	Total	131	0	.248		1						
(23) Good grade x 2nd floor area (feet^2)	1						PRC	24ax 47	None	+	Yes	1
	2											
	3											
	4											
	Total											
(23a) Mixed use near lot (Dummy)	1	4		.032			OSI	None	None	-	No too few	4
	2	1		.005								
	3	1		.006								
	4	1		.016								
	Total	7		.013								
(23b) Poor grade x 1st floor area (feet^2)	1						PRC	23cx 46	None	- Tried	No Tried Out A	1
	2											
	3											
	4											
	Total											
(23c) Poor grade x house (Dummy)	1	3		.024			PRC	60 Dummy	None	- Tried	No Used	1
	2	2		.011								
	3	16		.097								
	4	7		.109								
	Total	28		.052								
(24) Good grade x 1st floor area (feet^2)	1						PRC	24ax 46	None	+	Yes	1
	2											
	3											
	4											
	Total											
(24a) Good grade house (Dummy)	1	15		.120			PRC	60 Dummy	None	+ Tried	No Tried Used	1
	2	20		.108								
	3	3		.018								
	4	0		.000								
	Total	38		.070								

Table A-3. Continued

Variable Number and Name	Study Area	No. Observations	Values: Minimum	Mean	Standard Deviation	Maximum	Source	Construction	Limitation	Effect	Pooled	Class
(25) House condition	1	10		.080			PRC	61	None	-	Yes	1
Poor	2	16		.086			OSI	Dummy				
(Dummy)	3	13		.079								
	4	8		.125								
	Total	47		.087								
(25a) High value in low	1	1		.004			OSI	None	None	-	No	4
value neighbor-	2	1		.005							too	
hood	3	1		.006							few	
(Dummy)	4	5		.078								
	Total	8		.015								
(26) House condition	1	5		.040			PRC	61	None	+	Yes	1
Good	2	10		.054			OSI	Dummy				
(Dummy)	3	44		.267								
	4	33		.515								
	Total	92		.170								
(26a) Low value house	1	0		.000			OSI	None	None	+	No	4
in a high value	2	4		.023							too	
neighborhoor	3	3		.018							few	
(Dummy)	4	1		.015								
	Total	8		.015								
(27) Abut light traffic	1	26		.208			OSI	10	None	?	Yes	4
(Dummy)	2	30		.161				Dummy				
	3	58		.352								
	4	2		.031								
	Total	116		.215								
(27a) Underground	1	2		.016			OSI	None	None	+	No	1
electric	2	1		.005							Out	
(Dummy)	3	40		.242							D	
	4	14		.219								
	Total	57		.106								
(28) Abut heavy traffic	1	12	0	.096		1	OSI	10	None	-	Yes	4
(Dummy)	2	13	0	.070		1		(Dummy)				
	3	17	0	.103		1						
	4	2	0	.031		1						
	Total	44	0	.081		1						
(28a) Gas mains	1	0	0	.000		0	OSI	None	None	+	No	1
(Dummy)	2	0	0	.000		0					Out	
	3	99	0	.600		1					D	
	4	51	0	.796		1						
	Total	150	0	.278		1						
(29) Zoning ordinance	1	125	1	1.000		1	T.D.	None	None	+	No	5
at time of sale	2	181	0	.970		1					too	
(Dummy)	3	165	1	1.000		1					few	
	4	55	0	.859		1						
	Total	526	0	.974		1						
(30) Town building code	1	115	0	.920		1	T.D.	None	None	+	Yes	5
at time of con-	2	66	0	.355		1						
struction	3	65	0	.394		1						
(Dummy)	4	31	0	.484		1						
	Total	277	0	.513		1						
(31) Distance to plant	1		0	4.58	4.16	14	RM	None	None	?	Yes	4
(Miles)	2		0	4.46	3.78	11					Test	
	3		0	5.35	6.77	21					Picked	
	4		0	7.00	5.89	16					31,32	
	Total		0	5.06	5.24	21						
(32) Distance to other	1		87	91.30	2.25	94	RM	None	None	?	No	4
plant	2		15	18.54	1.98	22					Out	
(Miles)	3		63	73.60	5.18	79					M	
	4		34	50.97	8.29	59					31,32	
	Total		15	56.05	29.87	94						

Table A-3. Continued.

Variable Number and Name	Study Area	No. Observations	Values: Minimum	Mean	Standard Deviation	Maximum	Source	Construction	Limitation	Effect	Pooled	Class
(33) Distance to	1	125	2	6.58	2.69	13	RM	None	None	-	Yes	3
shopping center	2	186	1	2.27	1.67	7	OSI					
(Miles)	3	165	1	2.92	1.31	5						
	4	64	3	3.63	1.44	9						
	Total	540	1	3.63	2.48	13						
(34) Distance to	1	125	2	5.06	2.20	11	RM	None	None	-	Yes	3
high school	2	166	1	3.48	1.36	5	OSI					
(Miles)	3	165	2	6.82	2.85	12						
	4	64	3	4.97	2.26	9						
	Total	540	1	5.04	2.57	12						
(35) Distance to	1	125	0	2.10	2.47	10	RM	None	None	-	No	3
marina	2	186	0	2.54	1.56	7	OSI				Out	
(Miles)	3	165	1	2.50	.93	5					M	
	4	64	1	5.63	5.81	15					35, 36	
	Total	540	0	2.79	2.74	15						
(36) Distance to	1	125	0	1.41	.82	15	RM	None	None	-	Yes	3
swimming area	2	186	0	.96	1.93	7	OSI				Picked	
(Miles)	3	165	9	15.70	2.62	19					35, 36	
	4	64	1	8.09	4.50	15						
	Total	540	0	6.41	6.97	19						
(37) Distance to	1	125	15	29.14	6.15	36	RM	None	None	+	Yes	3
nearest big	2	186	5	12.38	4.87	19	OSI				Picked	
employer	3	165	9	16.29	7.58	34					37, 40,	
(Miles)	4	64	7	12.97	6.91	28					41	
	Total	540	5	17.71	9.10	36						
(38) Distance to	1	125	0	2.95	1.82	6	RM	None	None	+	Yes	3
limited access	2	186	0	2.18	.80	4						
highway	3	165	1	3.33	2.32	7						
(Miles)	4	64	10	12.52	5.58	20						
	Total	540	0	3.94	4.02	26						
(39) Distance to	1	125	2	7.16	2.59	14	RM	None	None	+	Yes	3
nearest state	2	186	0	1.40	2.19	8	OSI					
park	3	165	2	6.91	2.63	10						
(Miles)	4	64	1	1.96	1.44	6						
	Total	540	0	4.48	3.30	14						
(40) Distance to	1	125	14	23.12	4.93	32	RM	None	None	+	No	3
small SMSA	2	186	5	12.38	4.84	19	OSI				Out	
(Miles)	3	165	26	41.05	6.92	50					M	
	4	64	5	17.03	5.73	31					37, 40	
	Total	540	15	24.18	13.18	50					41	
(41) Distance to	1	125	20	33.57	6.12	40	RM	None	None	+	No	3
large SMSA	2	186	36	39.61	2.11	43	OSI				Out	
(Miles)	3	165	37	51.62	10.03	73					M	
	4	64	68	70.90	8.60	93					37, 40,	
	Total	540	20	48.75	16.14	93					41	
(42) Month of sale	1	125		-22.34			PRC	5 and 6	See	?	Yes	6
Base 12/77	2	186		-20.04					6-7	Used		
(Month)	3	165		-20.06						(43)		
	4	64		-18.37								
	Total	540		-20.38								
(43) Deflated selling	1	125		30,222.6	9499.3		PRC	42 and 4	See		Yes	Depen-
price	2	186		36,969.6	13208.8			.005 per	4			dent
(Dollars)	3	165		23,907.1	8018.3			month				vari-
	4	64		32,279.4	8897.6			Base 1/75				able
	Total	540		30,860.4	11724.7							
(44) Year built	1	125					PRC	None	< 1860	Used	No	1
	2	186					OSI		> 1977	1-2-3-4	Used	
	3	165								+ Con-		
	4	64								stant		
	Total	540										

Table A-3. Continued.

Variable Number and Name	Study Area	No. Obser-vations	Values: Minimum	Mean	Standard Deviation	Maximum	Source	Construc-tion	Limitation	Effect	Pooled	Class
(45) Number of floors	1	125	1	1.43	.53	3	PRC	None	None	+	No	1
(Floors)	2	186	1	1.40	.52	3	OSI				Out	
	3	165	1	1.09	.29	2					M	
	4	64	1	1.51	.53	3					45-48	
	Total	540	1	1.34	.49	3						
(46) Number of bath-	1	125	1	1.22	.43	3	PRC	None	None	+	Yes	1
rooms	2	186	1	1.15	.38	3						
(Rooms)	3	165	1	1.13	.36	4						
	4	64	1	1.58	.91	4						
	Total	540	1	1.21	.50	4						
(47) Area 1st floor	1	125	480	860.8	199.2	1404	PRC	None	< 2000	+	Yes	1
($feet^2$)	2	186	288	902.6	272.4	1994	OSI		(Used)			
	3	165	360	861.2	332.7	1804			23+24			
	4	64	408	1013.2	370.4							
	Total	540	288	893.4	294.3	1994						
(48) Area 2nd floor	1	55		615.4		1600	PRC	None	None	+	Yes	1
($feet^2$)	2	71		555.4		1518	OSI		(Used)		Picked	
	3	11		465.0		605			23		45-48	
	4	30		651.7		359						
	Total	107		587.2		1600						
(49) Area finished	1	22		544.3		1248	PRC	None	None	+	Yes	1
basement	2	29		510.5		1456	OSI					
($feet^2$)	3	12		511.5		960						
	4	19		657.2		1248						
	Total	82		553.8		1248						
(50) House on slab	1	15	0	.120		1	PRC	None	None	-	Yes	1
(Dummy)	2	88	0	.473		1	OSI					
	3	149	0	.903		1						
	4	12	0	.188		1						
	Total	264	0	.489		1						
(51) Full basement	1	89	0	.712		1	PRC	None	None	+	Yes	1
floor, finished	2	66	0	.355		1	OSI					
(Dummy)	3	0	0	.000		0						
	4	31	0	.484		1						
	Total	187	0	.346		1						
(52) House has an	1	3	0	.024		1	PRC	None	None	+	Yes	1
attic	2	27	0	.145		1	OSI					
(Dummy)	3	2	0	.012		1						
	4	4	0	.062		1						
	Total	36	0	.067		1						
(53) Attached garage	1	19	0	1.50		2	PRC	None	None	+	Yes	1
(No. spaces)	2	37	0	1.40		2	OSI					
	3	52	0	1.10		2						
	4	40	0	1.65		2						
	Total	148	0	1.40		2						
(54) Detached garage	1	10	0	1.50		2	PRC	None	None	+	Yes	1
(No. spaces)	2	36	0	1.33		2	OSI					
	3	8	0	1.10		2						
	4	6	0	1.50		2						
	Total		0	1.40		2						
(55) Fireplace	1	73	0	1.15		3	PRC	None	None	+	Yes	1
(No.)	2	109	0	1.06		2	OSI					
	3	31	0	1.00		1						
	4	15	0	1.07		2						
	Total	229	0	1.07		3						
(56) Central Heating	1	118	0	.944		1	PRC	None	None	+	Yes	1
(Dummy)	2	165	0	.887		1	OSI					
	3	135	0	.818		1						
	4	61	0	.953		1						
	Total	479	0	.887		1						

Table A-3. Continued.

Variable Number and Name	Study Area	No. Obser-vations	Values: Minimum	Values: Mean	Values: Standard Deviation	Values: Maximum	Source	Construc-tion	Limitation	Effect	Pooled	Class
(57) Central air conditioning (Dummy)	1	0	0	.000		0	PRC OSI	None	None	+	No	1
	2	3	0	.016		1						
	3	10	0	.061		1						
	4	0	0	.000		0						
	Total	13	0	.024		1						
(58) Modern kitchen (Dummy)	1						DNA	None	None	+	No	1
	2											
	3											
	4											
	Total											
(59) Stone facing on house (Dummy)	1	3	0	.024		1	PRC OSI	None	None	+	Yes	1
	2	5	0	.027		1						
	3	15	0	.091		1						
	4	2	0	.031		1						
	Total	23	0	.043								
(60) House grade (Grade)	1	125	1			3	PRC OSI	None	> 1 < 3	+ Used 23c 24a Constant	No Used	1
	2	186	1			3						
	3	165	1			3						
	4	64	1			3						
	Total	540	1			3						
(61) House condition (Code)	1	125	1			3	PRC OSI	None	> 1 < 3	+ Used 25 26 Constant	No Used	1
	2	186	1			3						
	3	165	1			3						
	4	64	1			3						
	Total	540	1			3						
(62) Assessed value of house (Dollars)	1	120	0	1066.10	1021.73	4806	PRC	None	None	+	No Out M All	1
	2	186	713	1798.59	864.60	5432						
	3	152	0	1764.14	959.50	4547						
	4	56	0	872.52	474.50	1590						
	Total	514	0	1508.75	983.44	5432						
(63) Town tax rate (1976)	1	125	53.00	76.48	12.02	101.40	T.D.	None	None	Used 69 19	No Used	5
	2	186	18.50	36.84	10.68	46.00						
	3	165	17.54	24.91	5.76	30.01						
	4	64	63.24	82.13	22.13	124.94						
	Total	540	17.54	47.74	25.92	124.94						
(64) Town or township code (Code)	1	125	12			15	Code	None	None	Used 13-14 16-17 19	No Used	6
	2	186	9			11						
	3	165	4			8						
	4	64	1			17						
	Total	540	1			17						
(65) Bedrooms (Number)	1	125	1	2.94	.83	6	PRC	None	> 1 < 6	+	Yes	1
	2	186	1	2.82	.90	6						
	3	165	1	2.40	.76	6						
	4	64	1	3.05	.60	5						
	Total	540	1	2.75	.85	6						
(66) Area of lot (feet^2)	1	125		19,689.5	18,483.6		PRC T.M.	7 x 6	See 7 See 6	+	Yes	2
	2	186		12,576.8	9,585.8							
	3	165		7,386.2	2,827.3							
	4	64		29,557.6	15,747.4							
	Total	540		14,649.3	13,836.4							
(67) In-house equalization rate (Rate)	1	125	18.80			59.30	T.D.	None	None	? Used 69 19	No Used	5
	2	186	35.70			65.50						
	3	165	54.40			95.90						
	4	64	16.80			37.50						
	Total	540	16.80			95.90						
(68) State equalization rate (Rate)	1	125	34.00			87.00	T.D.	None	None	Tried	No Used	5
	2	0	0			0						
	3	165	77.30			98.50						
	4	64	26.00			52.00						
	Total	540	34.00			98.50						

Table A-3. Continued.

Variable Number and Name	Study Area	No. Obser-vations	Values: Minimum	Mean	Standard Deviation	Maximum	Source	Construc-tion	Limitation	Effect	Pooled	Class
(69) Real tax rate per $1000 (Dollars)	1	125	14.80			36.3	TD	67 x 63 ÷ 100	None	-	No Test Out M 19,69	5
	2	186	12.3			17.9						
	3	165	13.4			26.3						
	4	64	31.0			36.6						
	Total	540	12.3			36.6						
(70) Water Frontage (Dummy)	1	9		.072			OSI	None	None	+	Yes Picked 70,71, 22	4
	2	14		.075								
	3	53		.321								
	4	10		.156								
	Total	86		.159								
(71) Deed beach rights (Dummy)	1	15		.120			PRC OSI	None	None	+	Yes Picked 70,71, 22	5
	2	131		.704								
	3	0		0								
	4	0		0								
	Total	146		.271								
(72) Average beach assessment (Dummy)	1	0		0			OSI	None	None	+	Yes	5
	2	59		.317								
	3	0		0								
	4	0		0								
	Total	59		.109								
(73) Best beach assessment (Dummy)	1	0		0			OSI	None	None	+	Yes	5
	2	23		.124								
	3	0		0								
	4	0		0								
	Total	23		.043								
(74) Cost per student (Dollars)	1	125	1173	1353.68	176.44	1741	T.D.	None	None	+	Yes Picked 74-75	5
	2	186	1265	1436.64	236.89	1792						
	3	165	977	1255.35	221.94	1524						
	4	64	1285	1745.41	314.90	1994						
	Total	540	977	1398.63	273.55	1994						
(75) State aid per student (Dollars)	1	125	154	217.41	118.51	482	T.D.	None	None	+ Tried	No Out M 74-75	5
	2	186	370	379.08	8.65	394						
	3	165	163	201.38	34.91	246						
	4	64	544	806.53	254.51	1058						
	Total	540	154	338.02	216.78	1058						
(76) Internal garage (No. space)	1	9	0	1.1		2	PRC	None	None	+	Yes	1
	2	38	0	1.33		2						
	3	8	0	1.05		2						
	4	10	0	1.24		2						
	Total	65	0	1.1								
	1											
	2											
	3											
	4											
	Total											
	1											
	2											
	3											
	4											
	Total											
	1											
	2											
	3											
	4											
	Total											
	1											
	2											
	3											
	4											
	Total											

Table A-4. Description of variables reflected in the constant term of the regression equations.

Variable Number and Name	Study Area	Number Observations	Mean	Construction	Effect
(1-2) (3-4) Built 1947-1967 (dummy)	1	87	.696	44 (Dummy)	?
	2	143	.768		
	3	90	.545		
	4	60	.937		
	Total	380	.704		
(9) Lot on non-surfaced road (dummy)	1	27	.216	None	-
	2	1	.005		
	3	14	.085		
	4	3	.047		
	Total	45	.083		
(11) Non-corner lot (dummy)	1	107	.856	None	-
	2	165	.887		
	3	135	.818		
	4	56	.875		
	Total	463	.857		
(15) Lot with no outstanding view (dummy)	1	114	.912	None	-
	2	168	.903		
	3	155	.939		
	4	51	.797		
	Total	488	.904		
(18) House with no view (dummy)	1	39	.312	None	-
	2	10	.054		
	3	63	.382		
	4	6	.094		
	Total	118	.219		
(19) High tax rate town (dummy)	1	42	.336	13+14+16+17	-
	2	88	.473		
	3	103	.624		
	4	64	.000		
	Total	297	.550		
(20) Unfavorable slope for development (dummy)	1	20	.364	None	-
	2	5	.027		
	3	0	.000		
	4	6	.094		
	Total	31	.057		
(21) No trees on the lot (dummy)	1	6	.048	None	-
	2	50	.268		
	3	95	.576		
	4	25	.390		
	Total	176	.326		
(22) Nuclear plant not visible (dummy)	1	115	.920	None	?
	2	124	.667		
	3	126	.764		
	4	44	.688		
	Total	409	.757		
(23c-24a) Average grade house (constructed)	1	107	.856	66 (Dummy)	?
	2	164	.881		
	3	146	.885		
	4	57	.891		
	Total	474	.878		
(25-26) House in average condition (dummy)	1	110	.880	61 (Dummy)	?
	2	160	.860		
	3	108	.654		
	4	23	.360		
	Total	401	.743		
(27-28) About medium volume traffic (dummy)	1	87	.696	10 (Dummy)	?
	2	143	.769		
	3	90	.545		
	4	60	.938		
	Total	380	.704		

Table A-4. Continued

Variable Number and Name	Study Area	Number Observations	Mean	Construction	Effect
(30)	1	10	.080	None	-
No building codes	2	120	.645		
(dummy)	3	100	.606		
	4	33	.516		
	Total	263	.487		
(50-51)	1	21	.168	Yes	-
House with a dirt basement	2	32	.172		
(dummy)	3	16	.096		
	4	21	.328		
	Total	89	.165		
(52)	1	122	.976	None	-
House with no attic	2	159	.855		
(dummy)	3	163	.988		
	4	60	.938		
	Total	504	.933		
(53) (54) (76)	1	87		Yes	-
House with no garage spaces	2	75			
(spaces)	3	97			
	4	6			
	Total	265			
(55)	1	52		None	-
House with no fireplace	2	77			
(no.)	3	133			
	4	49			
	Total	311			
(56)	1	7	.056	None	-
No central heating	2	21	.113		
(dummy)	3	30	.182		
	4	3	.047		
	Total	61	.115		
(59)	1	122	.976	None	-
No stone front on house	2	181	.973		
(dummy)	3	150	.909		
	4	62	.969		
	Total	517	.957		
(70)	1	116	.928	None	-
No water frontage	2	172	.925		
(dummy)	3	112	.679		
	4	54	.844		
	Total	454	.841		
(71)	1	110	.880	None	-
No deeded beach rights	2	55	.296		
(dummy)	3	165	1.000		
	4	64	1.000		
	Total	394	.891		
(72)	1	125	1.000	None	-
Not in an average beach association	2	127	.683		
(dummy)	3	165	1.000		
	4	64	1.000		
	Total	481	.891		
(73)	1	125	0	None	-
Not in a good beach association	2	163	.876		
(dummy)	3	165	0		
	4	64	0		
	Total	517	.957		

APPENDIX B

The tables in Appendix B show the total assessed real property values, equalized, for selected years 1960 to 1976 for each of the study areas separately and for all areas combined. Within each study area, the values are shown for each municipality, with the municipalities grouped according to distance zones from the nuclear plant. The final table (B-6) converts the increases in assessed values to average annual compound growth rate.

Table B-1. Pilgrim Site: total assessed real property values, equalized on Halifax (1975 = 100%) in $1000 units.

Township	1960	1962	1964	1966	1968	1970	1971	1972	1973-74	1975	1976	1977
0-10 Miles												
Plymouth	100,537	104,368	108,467	113,582	121,231	153,658	167,613	189,600	215,279	225,200	236,634	250,649
Growth (%)		1.9	1.9	2.3	3.3	12.6	9.1	13.1	8.8	4.6	5.1	5.9
Kingston	31,907	33,608	36,235	39,889	45,026	54,218	60,818	67,984	73,942	76,659	78,456	82,560
Duxbury	62,908	68,630	73,652	80,279	90,569	114,985	137,929	159,262	168,843	174,308	176,754	180,858
Total	94,815	102,238	109,887	120,168	135,595	169,203	198,747	227,246	242,785	250,967	255,210	263,418
Annual Growth (%)		3.8	3.7	4.6	6.2	11.7	17.5	14.3	4.5	3.4	1.7	3.2
10-15 Miles												
Carver	20,588	22,718	25,383	27,219	28,460	31,430	34,654	39,860	42,348	45,871	48,465	51,412
Marshfield	124,629	141,171	156,684	171,218	189,182	203,556	216,726	233,277	248,956	256,617	260,276	265,193
Pembroke	46,753	57,979	69,972	79,353	86,637	95,185	100,964	106,245	110,276	113,490	116,341	131,966
Plympton	3,132	10,520	11,920	14,620	17,565	22,100	23,629	28,465	30,245	33,286	33,456	34,805
Wareham	105,940	111,669	124,045	137,072	151,394	166,556	181,132	193,556	200,590	206,793	209,651	214,577
Total	301,042	344,057	388,004	429,482	473,238	518,827	557,105	601,403	632,415	656,057	668,189	697,953
Annual Growth (%)		6.9	6.2	5.2	5.0	4.7	7.4	8.0	3.4	3.7	1.9	4.5
15-20 Miles												
Halifax	15,844	17,939	20,020	22,339	23,805	25,601	26,359	27,185	28,560	29,039	29,745	30,689
Middleboro	74,734	81,446	83,855	88,285	97,667	109,952	114,005	119,579	125,507	128,840	137,425	140,480
Hanson	32,657	37,813	42,030	49,678	59,784	68,794	72,727	76,726	79,045	80,999	82,454	84,774
Bridgewater	54,592	58,992	63,695	70,342	75,565	82,434	91,734	102,268	118,217	122,237	125,267	128,949
E. Bridgewater	41,117	46,595	52,911	58,382	69,113	76,048	80,114	87,732	91,439	93,242	94,842	96,628
Total	218,944	242,785	262,511	289,026	325,934	362,829	384,939	413,490	442,768	454,357	469,733	481,520
Annual Growth (%)		5.3	4.0	4.9	6.2	5.5	6.1	7.4	4.7	2.6	3.4	2.5
Total less Plymouth	614,801	689,080	760,402	838,676	934,767	1050,859	1140,791	1242,139	1317,968	1361,381	1393,132	1442,891
Annual Growth (%)		5.9	5.0	5.0	5.6	6.0	8.6	8.9	4.0	3.3	2.3	3.6

Plant became operational in Dec. 1972

Table B-2. Millstone Site: total assessed real property values, equalized on Waterford (1960 = 60%) in $1000 units.

Township	1960	1962	1964	1966	1968	1970	1972	1973	1974	1975	1976
0-5 Miles											
Waterford	40,376	43,179	46,474	48,856	51,238	54,916	60,299	60,514	62,193	63,623	64,749
East Lyme	22,784	25,338	27,404	30,689	33,210	36,603	42,873	45,069	46,449	47,761	48,952
Total	63,160	68,517	73,878	79,545	84,448		103,172	105,583	108,642	111,384	113,701
Annual Growth (%)		4.2	3.8	3.8	3.0		7.5	2.3	2.9	2.5	2.1
5-10 Miles											
Groton	68,925[1]	77,033[1]	82,922	90,163	93,998	99,344	103,917	107,638	117,465	125,525	129,784
Old Lyme	20,963	22,176	24,052	26,219	29,102	30,266	33,520	34,670	35,440	36,602	37,436
Total	89,888	99,209	106,974	116,382	123,100	129,610	137,917	142,308	152,905	162,127	167,220
Annual Growth (%)		5.1	3.8	4.3	2.8	2.6	3.0	3.5	7.4	6.0	3.1
10-15 Miles											
Stonington	40,598	43,117	46,660	50,039	53,637	56,293	62,068	64,675	65,900	66,751	68,444
Old Saybrook	34,459	38,171	43,150	45,682	47,903	49,479	52,667	54,198	54,827	56,004	56,807
Total	75,057	81,288	89,810	95,721	101,540	105,772	114,735	118,873	120,727	122,755	125,251
Annual Growth (%)		4.1	5.1	3.2	3.0	2.1	4.1	3.6	1.6	1.7	2.0
> 15 Miles											
Westbrook	10,219	10,766	11,537	12,475	13,303	14,451	15,573	16,259	16,714	16,931	17,075
Clinton	21,835	26,383	32,881	36,789	39,440	41,553	44,066	44,754	45,494	46,415	47,742
Total	32,054	37,149	44,418	49,264	52,743	56,004	59,639	61,013	62,208	63,346	64,817
Annual Growth (%)		7.7	9.3	5.3	3.5	3.0	3.2	2.3	2.0	1.8	2.3
Regional Total less Waterford	219,784	242,984	268,606	292,056	310,593	327,989	354,684	367,263	382,289	395,989	406,240
Annual Growth (%)		5.1	5.1	4.3	3.1	2.8	4.0	3.5	4.1	3.6	2.6
Waterford Only		3.4	3.7	2.5	2.4	3.5	4.8	0.4	2.8	2.3	1.8

Plant became operational Oct. 1970

[1] Interpolated

Table B-3. Oyster Creek Site: total assessed real property values, equalized in Lacey Township (1960 = 10%) in $1000 units.

	1960	1962	1964	1966	1968	1970	1972	1974	1975	1976
Lacey Twp.	2,636	3,242	4,685	5,157	5,879	7,048	9,663	17,700	18,512	19,080
Annual Growth (%)		10.9	20.2	4.9	6.8	9.5	17.1	35.3	4.6	3.1
< 5 Miles										
Ocean Twp.	975	1,170	1,453	1,747	1,964	2,191	2,931	3,388	3,447	3,476
Union Twp.	603	684	694	712	755	786	1,266	2,876	4,859	4,854
Total	1,578	1,854	2,147	2,459	2,719	2,977	4,197	6,264	8,306	8,330
Annual Growth (%)		8.4	7.6	7.0	5.1	4.6	18.7	9.2	32.6	0.3
5-10 Miles										
Barnegat Light Boro.	604	789	880	1,036	1,170	1,456	1,901	1,955	1,946	1,946
Harvey Cedars Boro.	775	840	757	914	1,068	1,518	1,764	2,304	2,315	2,325
Stafford Twp.	874	1,190	1,660	2,168	2,669	3,252	5,538	7,280	8,422	8,662
Berkeley Twp.	2,617	3,456	4,066	4,176	4,754	5,460	7,719	12,881	13,989	14,830
Ocean Gate Boro.	689	719	755	777	808	828	844	1,076	1,107	1,110
Pine Beach Boro.	726	767	883	941	974	1,023	1,175	1,246	1,353	1,353
Beachwood Boro.	1,410	1,560	1,708	1,806	1,928	2,113	2,481	3,572	3,667	3,793
S. Tom's River Boro.	657	1,274	1,397	1,449	1,463	1,472	1,788	1,795	2,105	2,097
Inland Hts. Boro.	539	627	657	665	678	695	856	901	893	921
Seaside Park Boro.	2,173	2,200	2,310	2,436	2,579	2,607	2,733	3,568	3,600	3,622
Total	11,064	13,422	15,073	16,368	18,091	20,424	26,799	36,578	39,397	40,659
Annual Growth (%)		10.1	6.0	4.2	5.1	6.3	14.5	16.8	7.7	3.2
10-15 Miles										
Surf City Boro.	1,447	1,718	1,792	2,020	2,201	2,457	3,144	3,321	3,373	3,397
Ship Bottom Boro.	1,378	1,474	1,574	1,679	1,941	2,366	2,859	2,962	3,615	3,650
Long Beach Twp.	5,973	6,514	6,728	7,151	8,882	10,761	13,452	14,346	14,509	14,604
Eagleswood Twp.	385	391	484	467	471	480	508	725	919	899
Seaside Hts. Boro.	2,021	2,040	2,024	2,123	2,166	2,355	2,420	3,012	3,458	3,333
Dover Twp.	17,010	19,251	21,539	24,627	28,274	31,502	39,762	44,170	46,219	50,286
Lavallete Boro.	2,344	2,453	2,382	2,446	2,636	3,384	4,198	4,357	4,393	5,009
Manchester Twp.	580	791	926	927	1,373	1,897	2,917	4,891	5,875	8,201
Total	31,138	34,632	37,449	41,440	47,944	55,202	69,260	77,784	82,361	89,379
Annual Growth (%)		5.5	4.0	5.2	7.6	7.3	12.0	6.0	5.9	8.5
15 Miles										
Beach Haven Boro.	2,011	2,404	2,253	2,562	2,760	2,927	3,750	3,924	3,964	4,293
Little Egg Harbor Twp.	715	985	1,551	2,157	2,665	3,239	3,873	5,374	5,770	5,980
Lakehurst Boro	624	652	631	535	532	541	590	692	714	804
Lakewood Twp.	6,883	7,251	7,468	8,459	10,394	12,779	16,217	20,660	23,724	23,919
Jackson Twp.	2,140	3,899	6,134	7,479	8,296	10,527	11,978	13,616	16,433	16,669
Plumsted Twp.	789	894	1,019	1,072	1,109	1,147	1,207	1,632	1,666	1,811
Brick Twp.	11,801	14,181	15,361	16,989	19,513	24,150	27,623	36,313	39,311	40,442
Mantoloking Boro.	1,705	1,857	1,929	2,128	2,183	2,254	2,265	2,294	2,513	2,539
Bay Head Boro.	1,750	1,993	1,800	1,857	1,956	2,005	2,312	2,352	2,368	2,391
Pt. Pleasant Beach Boro.	4,584	4,725	4,988	5,024	5,175	5,682	6,751	7,391	7,505	8,059
Pt. Pleasant Boro.	6,074	6,811	7,178	7,968	8,622	9,432	10,237	12,900	13,021	13,213
Tuckerton Boro.	823	886	869	870	887	931	1,253	1,376	1,572	1,532
Total	39,899	46,538	51,181	57,100	64,092	75,614	88,056	108,524	118,561	121,652
Annual Growth (%)		8.0	4.9	5.6	5.9	8.6	7.9	11.0	9.2	2.6
Total County less Lacey	83,679	96,446	105,850	117,367	132,846	154,217	188,312	229,150	248,625	260,020
Annual Growth (%)		7.4	4.8	5.3	6.4	7.7	10.5	10.3	8.5	4.6

Table B-4. R. E. Ginna Site: total assessed real property values, equalized on Macedon (1963 = 85%) in $1000 units.

Township	1960	1962	1964	1966	1968	1970	1972	1974	1975	1976
Ontario	16,491	17,540	19,381	22,962	23,633	24,303	26,420	29,141	30,820	34,844
Annual Growth (%)		3.1	5.1	8.8	1.4	1.4	4.3	5.0	5.8	13.1
< 10 Miles										
Williamson	16,432	17,957	19,964	22,157	23,268	25,573	33,191	34,104	34,558	35,038
Walworth	6,772	7,340	8,474	9,856	11,246	14,485	16,413	26,553	28,292	28,380
Marion	7,000	7,644	8,172	9,560	11,827	13,883	15,988	18,490	19,810	20,217
Total	30,204	32,941	36,610	41,573	46,341	53,941	65,592	79,147	82,660	83,635
Annual Growth (%)		4.4	5.4	6.6	5.6	7.9	10.3	9.8	4.4	1.2
10-20 Miles										
Sodus	24,485	25,358	27,314	28,065	29,752	31,558	32,847	35,083	38,557	38,929
Macedon	12,248	13,757	15,306	18,001	19,405	20,799	23,338	29,570	30,207	31,261
Palmyra	22,596	23,261	23,715	24,439	25,155	25,837	27,297	28,883	29,123	29,602
Arcadia	48,575	49,087	50,083	52,248	54,111	59,329	64,277	73,398	76,686	78,896
Lyons	17,714	17,168	17,083	17,527	18,165	19,220	21,690	22,972	28,575	28,844
Auron	5,680	6,025	6,437	7,125	7,537	8,324	8,987	10,771	10,959	11,120
Total	131,298	134,656	139,938	147,405	154,125	165,067	178,436	200,677	214,107	218,652
Annual Growth (%)		1.3	1.9	2.6	2.3	3.5	4.0	6.0	6.7	2.1
Regional Σ (less Ontario)	161,502	167,597	176,548	188,978	200,466	219,008	244,028	279,824	296,767	302,287
Annual Growth (%)		1.9	2.6	3.5	3.0	4.5	5.6	7.1	6.1	1.9

Table B-5. All sites combined. Total assessed real property values, equalized to 1976 full market value ($1000 units).

		1960	1962	1964	1966	1968	1970	1972	1974	1975	1976	Number Municipalities
Pilgrim:	Plymouth	192,498	199,833	207,682	217,475	232,121	294,209	363,027	412,195	431,190	453,083	
	< 10 Miles	181,542	195,755	210,401	230,086	259,624	323,973	435,108	464,860	480,527	488,651	2
	> 10 Miles	995,617	1,123,626	1,245,541	1,375,727	1,530,175	1,688,107	1,943,216	2,058,653	2,126,110	2,178,779	10
	Region[1/]	1,177,159	1,319,381	1,455,942	1,605,813	1,789,799	2,012,080	2,378,324	2,523,513	2,606,637	2,667,430	12
Millstone:	Waterford	234,076	250,326	269,428	283,238	297,047	318,370	349,577	360,558	368,848	375,376	
	< 10 Miles	653,205	722,049	779,043	852,629	906,192	963,603	1,045,329	1,155,735	1,216,805	1,253,236	3
	> 10 Miles	620,965	686,627	778,173	840,536	894,440	937,880	1,010,916	1,060,547	1,078,902	1,101,900	4
	Region[1/]	1,274,170	1,408,676	1,557,216	1,693,165	1,800,632	1,901,483	2,056,245	2,216,282	2,295,707	2,355,136	7
Oyster Creek:	Lacey	38,486	47,334	68,402	75,294	85,835	102,903	141,083	258,425	270,281	278,574	
	< 10 Miles	184,576	223,034	251,417	274,880	303,832	341,662	452,551	625,506	696,478	715,254	12
	> 10 Miles	1,037,162	1,185,106	1,294,025	1,438,714	1,635,759	1,909,953	2,296,861	2,720,153	2,933,521	3,081,116	20
	Region[1/]	1,221,738	1,408,140	1,545,442	1,713,594	1,939,591	2,251,615	2,749,412	3,345,659	3,629,999	3,796,370	32
R. E. Ginna:	Ontario	31,425	33,424	36,932	43,756	45,035	46,312	50,346	55,531	58,731	66,399	
	< 10 Miles	57,556	62,772	69,764	79,222	88,307	102,790	124,992	150,823	157,517	159,375	3
	> 10 Miles	250,201	256,600	266,666	280,895	293,701	314,552	340,028	382,410	408,002	416,663	6
	Region[1/]	307,757	319,372	336,430	360,117	382,008	417,342	465,020	533,233	565,519	576,038	9
Combined Sites:												
	4 Towns	496,485	530,917	582,444	619,763	660,038	761,794	904,033	1,086,709	1,129,050	1,173,432	4
	< 10 Miles	1,076,879	1,203,610	1,310,625	1,436,817	1,557,955	1,732,028	2,057,980	2,396,924	2,551,327	2,616,516	40
	> 10 Miles	2,903,945	3,251,959	3,584,405	3,935,872	4,354,075	4,850,492	5,591,021	6,221,763	6,546,535	6,778,458	50
	4 Regions[1/]	3,980,824	4,455,569	4,895,030	5,372,689	5,912,030	6,582,520	7,649,001	8,618,687	9,097,862	9,394,974	90

[1/] Includes all municipalities less host municipality.

Table B-6. Annual compound growth rate in assessed valuations (percent).

		1962	1964	1966	1968	1970	1972	1974	1975	1976
Pilgrim:	Plymouth	1.9	1.9	2.3	3.3	12.6	11.1	8.8	4.6	5.1
	< 10 Miles	3.8	3.7	4.6	6.2	11.7	15.9	4.5	3.4	1.7
	> 10 Miles	6.2	5.3	5.1	5.5	5.0	7.3	3.9	3.3	2.5
	Region	5.9	5.0	5.0	5.6	6.0	8.7	4.0	3.3	2.3
Millstone:	Waterford	3.4	3.7	2.5	2.4	3.5	4.8	1.6	2.3	1.8
	< 10 Miles	5.1	3.9	4.6	3.1	3.1	5.2	5.3	3.0	4.0
	> 10 Miles	5.2	6.5	3.9	3.2	2.4	3.8	2.4	1.7	2.1
	Region	5.1	5.1	4.3	3.1	2.8	4.0	3.8	3.6	2.6
Oyster Creek:	Lacey	10.9	20.2	4.9	6.8	9.5	17.1	35.3	4.6	3.1
	< 10 Miles	9.9	6.2	4.6	5.1	6.0	15.1	17.6	11.4	2.7
	> 10 Miles	6.9	4.5	5.4	6.6	8.1	9.7	8.8	7.8	5.0
	Region	7.4	4.8	5.3	6.4	7.7	10.5	10.3	8.5	4.6
R. E. Ginna:	Ontario	3.1	5.1	8.8	1.4	1.4	4.3	5.0	5.8	13.1
	< 10 Miles	4.4	5.4	6.6	5.6	7.9	10.3	9.8	4.4	1.2
	> 10 Miles	1.3	1.9	2.6	2.3	3.5	4.0	6.0	6.7	2.1
	Region	1.9	2.6	3.5	3.0	4.5	5.6	7.1	6.1	1.9
All Areas:	4 Townships	3.4	4.7	3.2	3.2	7.4	8.9	9.6	3.9	3.9
	< 10 Miles	5.7	4.4	4.7	4.1	5.4	9.0	7.9	6.4	2.6
	> 10 Miles	5.8	5.0	4.8	5.2	5.6	7.4	5.5	5.2	3.5
	Region	5.8	4.8	4.8	4.9	5.5	7.8	6.2	5.6	3.3