
Socioeconomic Impacts of Nuclear Generating Stations

Three Mile Island Case Study

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with
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Prepared for
U.S. Nuclear Regulatory
Commission

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ABSTRACT

This report documents a case study of the socioeconomic impacts of the construction and operation of the Three Mile Island nuclear power station. It is part of a major post-licensing study of the socioeconomic impacts at twelve nuclear power stations. The case study covers the period beginning with the announcement of plans to construct the reactor and ending in the period, 1980-81. The case study deals with changes in the economy, population, settlement patterns and housing, local government and public services, social structure, and public response in the study area during the construction/operation of the reactor.

A regional modeling approach is used to trace the impact of construction/operation on the local economy, labor market, and housing market. Emphasis in the study is on the attribution of socioeconomic impacts to the reactor or other causal factors. As part of the study of local public response to the construction/operation of the reactor, the effects of the Three Mile Island accident are examined.

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PART I — CASE STUDY INTRODUCTION AND PRE-ACCIDENT EFFECTS

This case study is in two parts. Part I is comprised of the first ten chapters, which cover the case study introduction and the pre-accident effects. These chapters are presented in the same format as was used for the other 11 sites in the Post-Licensing Studies. However, a chronology of events for the Three Mile Island Case Study, including the accident, is shown in Table 1-1 at the close of Chapter 1. The accident at TMI marked a significant change in the socioeconomic effects of operation of the TMI units. These, as well as other aspects of the accident, are presented in Part II.

CHAPTER I. INTRODUCTION

1.1 The NRC Post-Licensing Studies

This report—the case study of the Three Mile Island Nuclear Generating Station located in Dauphin County, Pennsylvania—is one of a series of reports that are being prepared as part of the NRC Post-Licensing Studies. The purpose of this chapter is to describe the objectives of the NRC Post-Licensing Studies, the major components of the studies, the relationship of research concerning Three Mile Island to the overall study plan, and the organization of this case study report.

1.1.1 Objectives of the Post-Licensing Studies

The Post-Licensing Studies have four main objectives: to determine the socioeconomic effects of nuclear power stations; to ascertain the significance of these effects to individuals and groups affected; to identify the determinants of the effects and their significance; and to determine whether currently available assessment methodology could have been used to anticipate the most significant of these effects.

Each of the latter three objectives depends upon clear identification of the effects as required in objective one—the difference in the socioeconomic conditions as they occurred with the station and those that would have prevailed had the station not been built. Once the effects have been identified and their incidence among groups established, they must be placed in the context of the values of the individuals affected by them to determine their significance. The explication of the effects, the evaluation of those effects, and their significance to local residents permit an analytic consideration of the overall evaluation and the response of local residents to the presence of the nuclear facility in or near their communities.

After determining the patterns of effects caused by the facilities and the meaning of the effects to local residents across sites, the Post-Licensing Studies will turn to an examination of the causes of the documented effects. It is necessary to know what combination of site, project, or other circumstantial determinants appears to be responsible for the effects that ensued and for the levels of significance attached to them by local residents. In short, some plausible explanation for the consequences of constructing and operating the stations must be developed.

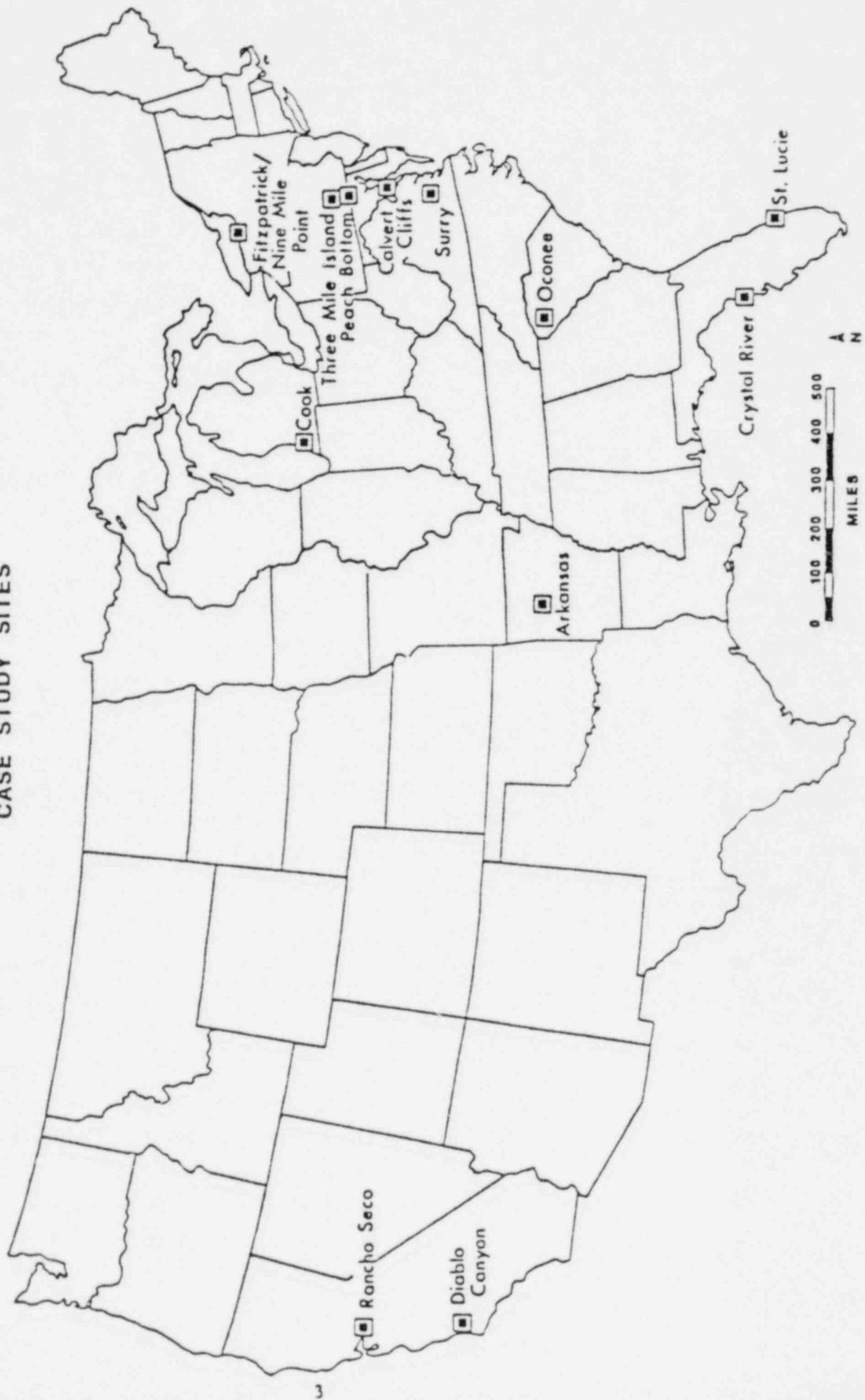
In addition, objective four of the Post-Licensing Studies is somewhat different from the preceding three in that it is directly concerned with the methodology of the socioeconomic-assessment process. The central question is whether there are assessment methods currently available that could have been used to foresee the most significant of the socioeconomic effects associated with the nuclear plant. Based on the answer to this question, recommendations will be developed with respect to the assessment methods that can most appropriately be applied to anticipate the effects of the construction and operation of nuclear generating stations.

1.1.2 Components of the Post-Licensing Studies

The Post-Licensing Studies have three distinct components: the individual case studies, the cross-site analysis, and the methodological recommendations. The individual case studies are being conducted at twelve sites, as listed in Figure 1-1. The twelve case study reports will meet the first two objectives of the study. They will establish the social and economic effects of the nuclear station, and they will determine the significance of the effects for those persons affected by them.

Once the twelve case studies have been completed, work will begin on the part of the study referred to as the cross-site analysis. The results from all twelve case studies will be utilized to identify more specifically the causal mechanisms responsible for the effects that occurred. Of particular importance will be the establishment of the relative roles of site characteristics, project characteristics, and external forces in determining the consequences of constructing and operating a nuclear plant. The objective is to understand why effects occurred as they did and what was responsible for the significance they assumed. It must be remembered that twelve case studies is a very small sample and will not support rigorous statistical analysis of postulated causal relationships. At the same time, twelve comparable observations are more than have heretofore been available, and it is anticipated that the cross-site analysis will contribute substantially toward an understanding of why the socioeconomic effects

FIGURE 1-1. UNITED STATES NUCLEAR REGULATORY COMMISSION
POST-LICENSING STUDY
CASE STUDY SITES



occurred as they did and what determined the significance of the effects for the individuals affected by them.

The final component of the study will develop recommendations for methods to be applied in assessing the social and economic effects of proposed projects. The recommendations will be based on an evaluation of the relative success that various assessment methods would have had in anticipating the most significant effects of the twelve nuclear stations. Based on these results, methodological recommendations will be made, with an attempt to indicate the relative strengths and weaknesses of the alternatives.

1.1.3 Three Mile Island Accident, Spring 1979

Since Three Mile Island was one of the case-study sites, the scope of the Post-Licensing Studies was expanded to include an analysis of the social and economic effects of the accident on the residents of south-central Pennsylvania. Because a reliable data base was necessary to support this effort, the NRC Telephone Survey of 1,500 households was conducted in late July (Flynn, 1979). Since that time, an additional report was prepared. This report described the social and economic consequences of the accident during the six-month period from the end of March through September, 1979 (Flynn and Chalmers, 1980).

Because of the unique circumstances surrounding the accident, the research at Three Mile Island culminated in an individual report with two major parts. Part I describes the pre-construction, construction, and operating experience of the station from late 1966 through 27 March 1979. This part is based on the same methodology used at the other eleven nuclear station sites and is directly comparable to those case study reports. Part II describes the emergency and the post-emergency periods covering the period from 28 March through the summer of 1981.

In addition to the expanded effort at the Three Mile Island site itself, the accident affected the Post-Licensing Studies in one other way. Each of the case study sites were examined for consequences of the Three Mile Island accident. There were two possibilities: the accident may have directly affected social or economic conditions at other sites, or the accident may have caused recognized effects to be evaluated in a different way and, therefore, to assume increased significance in the eyes of local residents. Both possibilities were investigated.

1.2 Overview of the Case Study Organization

As was explained previously, the purposes of the individual case study reports are to describe the socioeconomic effects of the construction and operation of the nuclear station that were experienced by residents of the area being studied and to indicate the significance of those effects to the individuals and groups affected. With the exception of the TMI study, which contains 13 chapters, each report contains ten chapters, the contents of which are summarized in Figure 1-2.

Following Chapter 1, the introductory chapter, Chapter 2 describes the project with emphasis on those project characteristics that are important determinants of socioeconomic effects. Chapter 3 then provides a general description of the region in which the project is located, both as an orientation and as a prelude to selecting the smaller study area that will be intensively analyzed in the remainder of the case study. Actual selection of the study area was determined by the spatial distribution of project consequences and on the geographic extent of the major social, economic, and political systems that function in the vicinity of the plant. The consequences of the project that are examined in this context include: the spatial distribution of the persons directly employed in constructing or operating the nuclear station; the distribution of direct purchases of goods or services made by the utility in order to build or operate the facility; and the spatial distribution, by jurisdiction, of the tax payments from the utility due to the nuclear station. The study area is then defined with reference both to the spatial distributions of these major consequences of the project and to the spatial distribution of the functional, social, economic, and political systems that operate in the vicinity of the station.

Chapters 4, 5, 6, and 7 trace the effects of the plant on the study area economy, on the size and composition of the area's population, on housing and settlement patterns in the study area, and on governmental activities and the provision of public services in the study area. There are several organizing principles used to present this information. First, an attempt is made to describe conditions as they existed in the study area prior to the start of construction and as they changed from that time to the time of the study. An explicit attempt is then made to identify that part of the change, or lack of change, due to construction and operation of the nuclear station. The temporal focus of the attribution of changes to the nuclear facility is on two points in time: the peak year of construction and a recent year of plant operation.

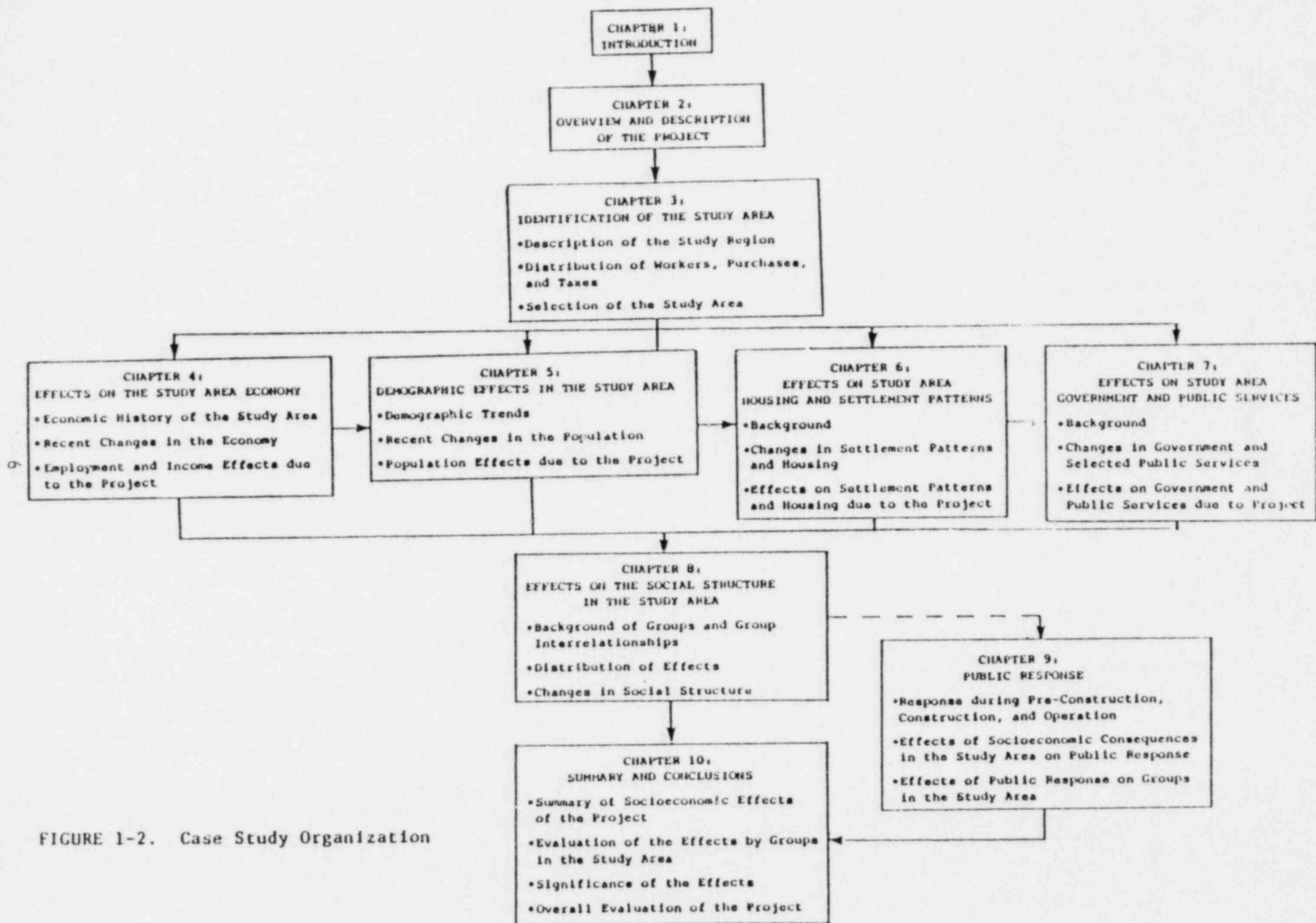


FIGURE 1-2. Case Study Organization

The second major organizing principle concerns the way in which effects are attributed to the nuclear station. There are two basic approaches to this problem. The first is to identify and control the effects of all other exogenous forces acting on the study area and, after their effects have been isolated, to attribute remaining effects to the nuclear station. The second approach is to make explicit causal arguments that directly tie postulated effects back to some known aspect of the construction or operation of the station. Both approaches require use and acceptance of the same kinds of behavioral hypotheses. Using the first approach, it is necessary to define the direct and indirect effects of other exogenous forces acting on the study area so that the effects due to the station can be determined as a residual. Using the second approach, the same kinds of hypotheses and behavioral relationships are used to directly argue the nature and extent of socioeconomic effects stemming from the construction and operation of the station. The most convincing case for attributing effects to the nuclear station results from use of both approaches—control of other exogenous influences and identification of direct causal links to the plant. Where possible, both approaches are pursued in the case studies. In general, however, the social and economic changes that took place in the area examined in this study over the ten- to fifteen-year period of investigation are so complex that the second general approach is relied upon more heavily than the first.

Chapter 4 begins with a description of the jobs and income directly associated with the station and then establishes other employment, income, and labor force effects experienced in the study area. Chapter 5 works directly from these estimates of employment change to examine effects on the size and composition of the study area's population, both from the in-migration of workers and their families and from reduced out-migration of local persons induced to remain in the area due to opportunities offered by the construction or operation of the station. Once Chapter 5 establishes population changes due to the station, Chapter 6 examines the effects of the combined economic and demographic changes on housing and settlement patterns in the study area. The emphasis is principally on changes in the number, type, and spatial distribution of residences although, where relevant, effects on patterns of commercial and industrial activity are also described.

Chapter 7 summarizes the major consequences of the station and its economic, demographic, and housing effects on the local government in the study area. It begins by examining the major local jurisdictions in the study area for evidence of change in organization or structure due to the station. The effects on the revenues of local jurisdictions

are then described. Finally, there is a discussion of the combined influence of changed revenues and changed levels of demand for public services on the provision of services in the study area. It was decided that these effects could be shown most clearly by focusing on a smaller number of important services rather than by trying to examine the provision of all public services in the study area. The services chosen were education, transportation, public safety, and social services.

Chapters 4, 5, 6, and 7 proceed in sequence, therefore, to trace the economic, demographic, housing, and governmental implications of constructing and operating a nuclear station. The geographic focus is the study area defined in Chapter 3. The temporal focus is on the change from preconstruction to the construction peak and on the change from preconstruction to a recent year of full operation. Finally, the attribution of the effects to the nuclear station is achieved primarily through the establishment of direct causal relationships that are linked to effects directly associated with the station.

Chapter 8 examines the social structure of the study area and the ways in which it was affected by the construction and operation of the nuclear station. The social structure is defined by the groups that exist in the area, their principal characteristics, and their social, political, and economic interrelationships. The chapter begins by identifying a set of functional groups into which the study area population is divided. A profile of each group is then developed. Each group is characterized in terms of livelihood, size, outstanding demographic characteristics, location, property ownership, values and attitudes, and patterns of intragroup interaction. The economic, political, and social interrelationships of the groups are then identified and described. An appreciation of these group characteristics and interrelationships helps to understand the way in which the effects of the project were evaluated and to explain group responses to these effects. In addition, the characterization of groups and their interrelationships prior to the project serves as the basis for assessing the degree to which groups and social structure were altered as a consequence of the project.

The final step in the analysis of social structure is to determine the distribution of the economic, demographic, housing, and governmental effects of the station. The distribution of effects across groups provides explanatory information concerning the changes in group structure and characteristics and provides data for interpreting and understanding the group evaluations of the project.

Chapter 8 is designed, therefore, to accomplish two very important objectives. First, it makes operational the concept of social structure so that its constituent parts can be described and so that the effects of the construction and operation of the plant on social structure can be assessed. Second, the approach permits the examination of the effects of the plant on each group. The information on group characteristics and on the project effects accruing to each group provides the basis for determining the project's impact on the groups as discussed in Chapter 10.

Chapter 9 provides another perspective on the socioeconomic effects of constructing and operating the nuclear station by examining the public response to the project. The emergence and expression of public concerns and the issues that arose over the plant during the three study periods--pre-construction, construction, and operations (including post-Three Mile Island)--are described and assessed. The issues are described in terms of topic, time of occurrence, actors, positions, and resolution. Unlike Chapters 4, 5, 6, 7, and 8 of the case study, which focused on the effects of the nuclear station within the study area defined in Chapter 3, the analysis of public response presented in Chapter 9 is regional in scope. The principal sources of information concerning public response are the local and regional press, transcripts of hearings, and key informants.

The analysis of public response focuses on three questions: the extent to which the socioeconomic effects of the station on individuals and groups in the study area played a causal role in the public response to the project; the level of the direct participation of study area residents in publicly responding to the project; and the effects of the public response itself on the residents of the study area. The latter question involves the degree to which issues and confrontations that arose in the course of constructing and operating the nuclear station were responsible for changes in social or economic conditions within the study area. The strategy of Chapter 9, therefore, is to identify public response to the nuclear project, and then sort out the reciprocal causal links from local socioeconomic effects to public response, and from public response to local socioeconomic effects.

The overall objectives of the individual case studies are to establish the socioeconomic consequences of constructing and operating a nuclear power station on the residents of the local area in which a station is located and to provide a perspective on the significance of these effects to the people who experienced them. Consequently,

Chapter 10 focuses on the evaluation of the major socioeconomic consequences of the project by each group in the study area. It also combines the information on group characteristics, effects, and group-specific evaluations to reach conclusions about the impacts and significance of the effects of the project. Absolutely large effects combined with strong positive or negative evaluations would imply strong significance. Similarly, absolutely small effects would tend to offset strong positive or negative evaluations, or indifferent evaluations could offset large effects and produce low levels of significance. This process will conclude with a summary of the significance of the effects of the project from the perspective of each of the groups in the study area.

Part II of the Three Mile Island Case Study begins with Chapter 11, which deals with the effects of the accident during the two-week emergency period immediately following the accident. Possible effects on individuals include evacuation effects, economic effects, health effects, stress factors, and psychological effects. Evidence is examined to ascertain the prevalence and significance of such effects. This chapter also examines short-run effects on the local economy, including effects on the economic base, employment and unemployment, income, and sectoral effects. Finally, the response of institutions in the area is examined.

Chapter 12 deals with the long-run effects of the accident, and covers the period through the summer of 1981. Here, too, the focus is on the project's effects on local residents, the local economy, and local institutions.

Chapter 13 discusses the issues which will shape the extent of the future effects of the accident. It includes discussions of the implications of potential cost of power changes, locational preferences, changes in institutional arrangements, and potential changes experienced by individuals.

Table 1-1 outlines the chronology of major events concerning the Three Mile Island Nuclear Generating Station.

TABLE 1-1
CHRONOLOGY OF MAJOR EVENTS

Date	Event
PRE-ACCIDENT	
November 1966	Public Announcement of Unit 1 (ERDA, 1976).
3 February 1967	Unit 2 announced (NUS, 1978).
12 February 1967	Three Mile Island site chosen. Unit 1 announced by Metropolitan Edison Company. (<u>Harrisburg Sunday Patriot News</u> , February 12, 1967.)
1 May 1967	Application for construction permit for Unit 1 submitted to NRC (NUS, 1978).
29 April 1968	Application for construction permit for Unit 2 (at Oyster Creek) submitted to NRC (NUS, 1978).
18 May 1968	Construction permit for Unit 1 issued (NUS, 1978).
8 January 1969	Announcement that Unit 2 will be built at Three Mile Island.
4 November 1969	Construction permit for Unit 2 issued (NUS, 1978).
August 1972	Peak on-site construction work force of 3,120.
19 April 1974	Operating License for Unit 1 issued (NUS, 1978).
2 September 1974	Unit 1 begins commercial operation (Met-Ed, 1980).
February 1978	Operating License for Unit 2 issued (NRC, 1978, p. 12).
31 December 1978	Unit 2 begins commercial operation (Gross, personal communication, January 24, 1979).
17 February 1979	Unit 1 shut down for refueling
28 March 1979	Accident at Unit 2 occurs.

TABLE 1-1 (Continued)

EMERGENCY PERIOD

Wednesday, 28 March 1979, 4:00 a.m.	Feedwater pumps supplying Unit 2 shut down.
Wednesday, 28 March 1979, 9:06 a.m.	Associated Press files first wire-service story on the accident.
Thursday, 29 March 1979	News accounts indicate situation increasingly under control.
Friday, 30 March 1979, 8:00 a.m.	Unannounced radiation release.
Friday, 30 March 1979, 10:30 a.m.	Governor recommends that persons near TMI remain indoors and close their windows.
Friday, 30 March 1979, 12:30 p.m.	Governor issues advisory that pregnant women and preschool children leave the region within a 5-mile radius of the plant and that all schools in the area be closed.
Friday, 30 March 1979, 2:00 p.m.	Harold Denton arrives at the plant site.
Saturday, 31 March 1979, 8:23 p.m.	AP reports story from NRC that hydrogen bubble could explode.
Sunday, 1 April 1979, 1:00 p.m.	President Carter arrives at the plant site.
Monday, 2 April 1979, morning	Harold Denton announces decrease in size of bubble and implies danger of explosion is less than originally thought.
Wednesday, 4 April 1979, morning	Schools outside 5-mile radius reopen, but those within a 5-mile radius remain closed and the governor's advisory remains in effect.
Saturday, 7 April 1979	Evacuation shelter at the Hershey Park Arena closed.
Monday, 9 April 1979	Governor's advisory withdrawn.
Wednesday, 11 April 1979	Middletown area schools reopen.

TABLE 1-1 (Continued)

POST-EMERGENCY PERIOD

April 1979	EPICOR-I used to begin decontaminating water containing low levels of radioactivity stored in auxiliary building.
June 1979	Pennsylvania Public Utility Commission (PUC) refuses to allow TMI-Unit 2 to be included in Met-Ed rate base.
August 1979	Petitions filed to intervene in federal hearings on start-up of TMI Unit 1 (hearings scheduled for February 1980).
September 1979	Release of Kemeny Commission Report.
October 1979	EPICOR-II begins processing low-level waste water.
January 1980	Release of the Rogovin Report.
January 1980	Pennsylvania PUC hearings on rate increases begin.
February 1980	Two TMI pumps leak radioactive krypton into the environment.
March 1980	Radioactive krypton gas released from Unit 2 air chamber.
March 1980	TMI accident anniversary
10 May 1980	PUC grants interim rate increase; Unit 1 removed from rate base.
28 June 1980	Radioactive krypton gas released from Unit 2 containment building.
July 1980	First successful entry into Unit 2 reactor building.
29 October 1980	Unit 1 restart hearings begin.
9 December 1980	GPU files \$4 billion suit against the NRC.
June 1981	Unit 1 restart hearings end; submerged demineralizer system begins processing high-level waste water.

CHAPTER 2: OVERVIEW AND DESCRIPTION OF THE PROJECT

2.1 Introduction

The purpose of Chapter 2 is to provide an overview of the characteristics of the Three Mile Island (TMI) project, so that the socioeconomic effects can be studied. The emphasis in this chapter is on a description of the major characteristics and elements of the project which are needed to provide an orientation for the more detailed analysis of the remaining chapters and to facilitate the cross-site comparisons with the other case studies of this research effort.

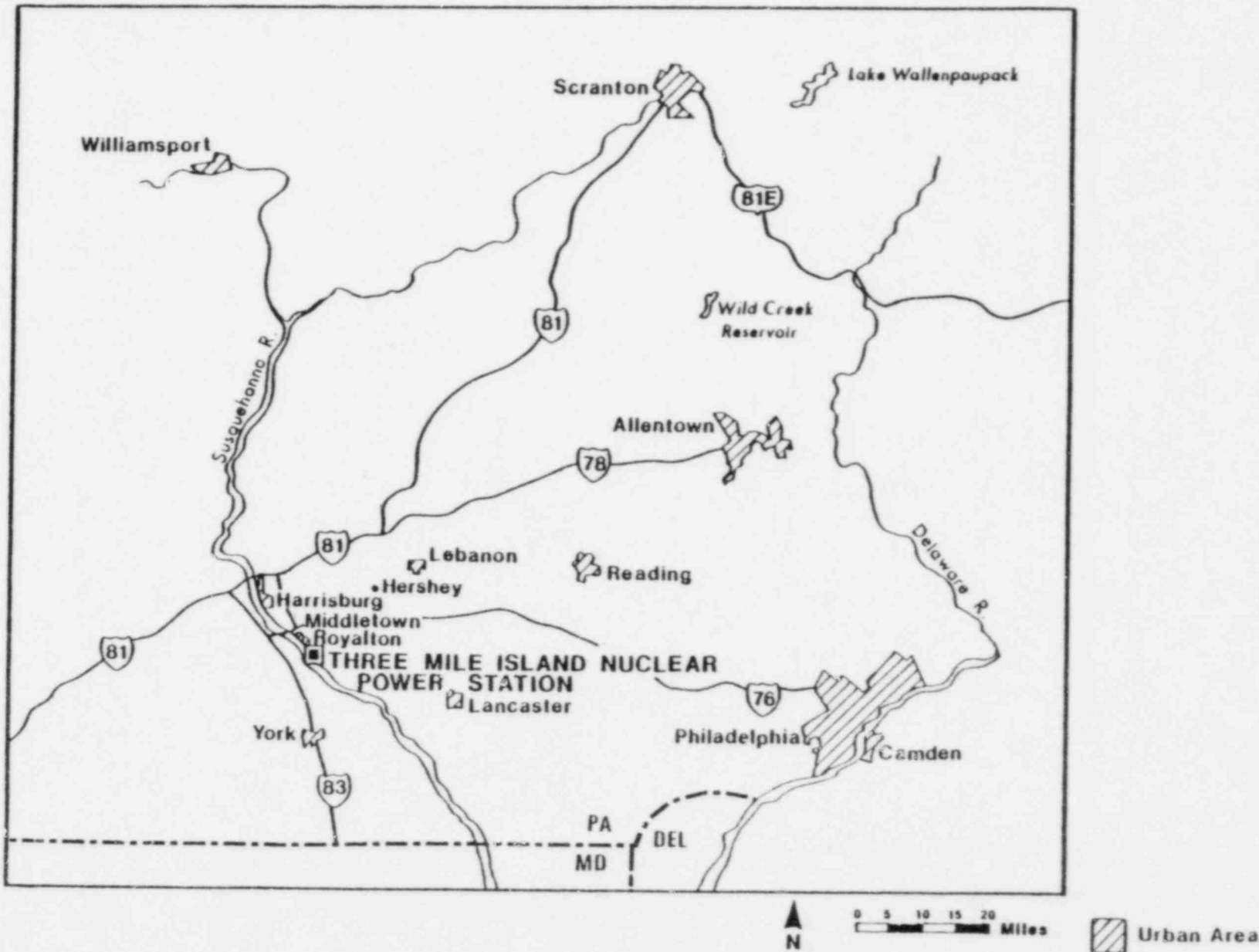
Information is provided concerning: the project's location, size, type, and site characteristics; the utility and other major factors involved with the project; the magnitude and duration of the construction effort; and the project's operating characteristics. This chapter is principally descriptive and is based on information provided by the utility, contractors, newspaper files, NRC docket materials, other reports, and interviews with a variety of informed people.

2.2 Location

The Three Mile Island Nuclear Generating Station, owned by General Public Utilities, is located in south-central Pennsylvania, in southern Dauphin County. It is situated in Londonderry Township on a long narrow island in the Susquehanna River, about 10 miles southeast of Harrisburg, the capital of Pennsylvania. Other cities in the vicinity include York, about 15 miles distant, and the Amish center, Lancaster, about 25 miles away. The adjacent area was formerly rural/small town, but is becoming part of the suburban commuting ring for Harrisburg.

As shown in Figure 2-1, the major transportation routes in the vicinity are Interstate 83 (I-83) on the western shore of the river; Interstate 76 (I-76) which is the Pennsylvania Turnpike; Interstate 81 (I-81); and Interstate 283 (I-283). Prior to the completion of I-283 and its extension to State Highway 230 (PA-230), access to the site from Harrisburg was via PA-230, a two-lane highway that runs parallel to the river and is not a limited access road. Because there are no bridges across the river between Harrisburg and York, all traffic from the western shore traveled to the site via Harrisburg.

FIGURE 2-1. LOCATION OF THREE MILE ISLAND NUCLEAR POWER STATION



2.3 The Utility

2.3.1 Corporate Background

Metropolitan Edison Company (Met-Ed) is one of the three companies that form the General Public Utilities Corporation (GPU) system. Met-Ed owns 50 percent of the Three Mile Island (TMI) station and is the GPU unit responsible for its construction and operation. The other two GPU companies, Pennsylvania Electric Company (Penelec) and New Jersey Central Power and Light Company (NJCP&L), each own 25 percent of TMI.

New Jersey Central Power and Light Company also owns the Oyster Creek Nuclear Power Station. Oyster Creek was the first commercial nuclear station built by the system, and it began commercial operation in 1969. Constructed as an experimental station by the three companies at Saxton, Pennsylvania in 1962, it was one of the first nuclear power stations in the United States. At the time of this study, construction had begun on an additional nuclear station at Forked River, New Jersey, near the Oyster Creek site.

GPU's history dates back to the late nineteenth century, with the introduction of electric service.¹ The present GPU operating companies were the result of a series of consolidations of many early electric utility companies. Metropolitan Edison Company, which was a product of some of these earlier consolidations, was incorporated in 1922 as part of the General Gas and Electric Corporation, which itself was acquired by the Associated Gas and Electric Company in 1929.

2.3.2 Service Area

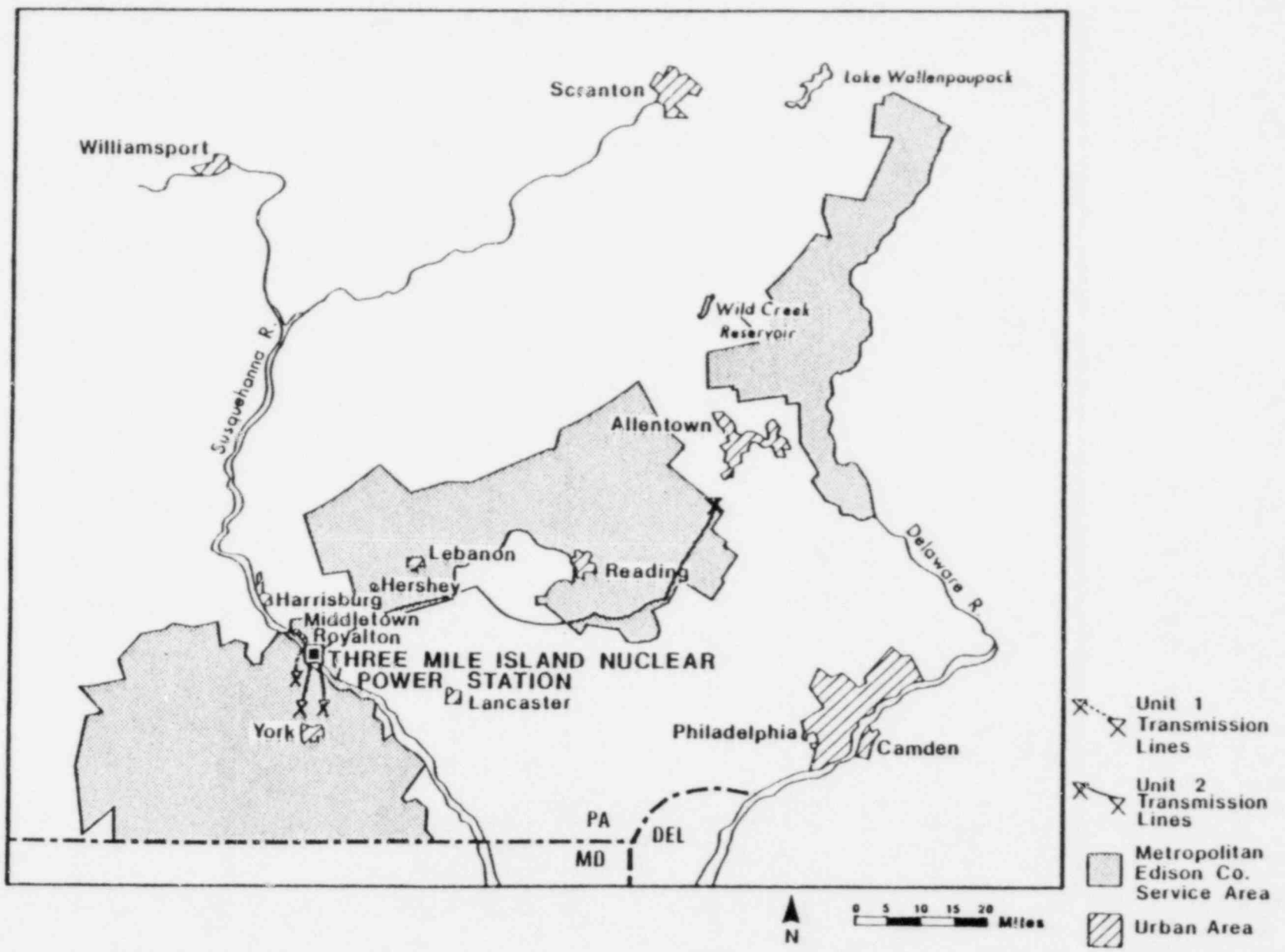
The service area for Met-Ed in 1977, shown in Figure 2-2, comprised approximately 3,300 square miles in southern, central, and eastern Pennsylvania. The population served was 812,000. Although most of the service area covered rural areas and smaller towns, but it also included Gettysburg, Hanover, Reading, York, and Bethlehem, Pennsylvania. Harrisburg was not in the service area.

2.3.3 Generating Capacity and Production

In 1977, GPU had a total generating capacity of 7,190 megawatts (Mw), of which 33 percent was supplied by nuclear stations. With the completion of TMI Unit 2, GPU

¹The source of much of this data is orientation information available from the TMI Visitors' Center.

FIGURE 2-2. METROPOLITAN EDISON COMPANY SERVICE AREA



expected to have a fuel mix that was approximately 50 percent coal and 50 percent nuclear. TMI Unit 1 was designed with a net electrical capacity of 871 Mw, and Unit 2 with a capacity of 959 Mw.

2.4 The Project

2.4.1 The Project Site

Three Mile Island is near the northern extent of a 60-mile portion of the Susquehanna River which produces a total of 5,000 Mw of electrical generating capacity from hydroelectric, pumped storage, coal, steam, and nuclear generating plants (Pennsylvania Forest Magazine, February 1972, p. 59). Three Mile Island has been owned by Metropolitan Edison since 1906. As its name indicates, TMI is located on a long, narrow island in the Susquehanna River. Until construction of Unit 1 began, portions of the island were used for farming and for leased summer cottages (Harrisburg Evening News, 27 April 1969; Schneider, personal communication, January 1979). Subsequent to the siting, seventy summer cottages were relocated to nearby Behore Island. The river area surrounding the island continues to be used for sport fishing.

The island consists of 427 acres, 200 of which are occupied by the plant itself. The island, which is located about 900 feet from the east bank of the river and 6,500 feet from the west bank, is now connected to the east bank by two bridges—a temporary bridge that was installed for construction of the plant, and a permanent bridge that provides access to the plant site. (Atomic Energy Commission, 1972, p. II-1.)

The site is near the coal-fired Crawford Station which Met-Ed began operating in 1904. By the mid-1960s, Crawford Station was having difficulty meeting environmental protection standards, and did not produce sufficient power to meet increasing demands. For these reasons, there was local support for closing the Crawford Station and retaining some of its personnel to operate TMI.

Archeological studies were conducted prior to construction of TMI because the area was believed to have been inhabited by Susquehannock Indians. Archeologists were unable to find evidence of a village on the island, although artifacts were found.

2.4.2 The Plant

The Three Mile Island plant consists of two pressurized water reactors and utilizes a closed-loop cooling system with a combination of natural draft and mechanical draft

cooling towers. There are some thermal effects on the river, however, because the water in the closed-loop cooling system is passed through a heat exchange mechanism that is cooled by river water. The plant uses a Babcock and Wilcox reactor. The turbine generator on Unit 1 was supplied by General Electric, while that on Unit 2 was supplied by Westinghouse Corporation. Both units were constructed by United Engineers and Constructors (NUS Corporation, 1978, p. 31).

Although Unit 1 of Three Mile Island necessitated the construction of only seven miles of transmission line to interconnect with existing transmission grids, the construction of Unit 2 necessitated an extensive new 500 kV line 74.7 miles east of the station site (AEC, 1972, p. III-5; NRC, 1976, pp. 3-11). Two short (7.1 and 11.1 mile) 500 kV lines to the south connected the site to the existing Peach Bottom-Juniata line. (See Figure 2-2 for the transmission grid.)

2.5 Construction

2.5.1 Announcement

The first public announcement of the plan to construct Unit 1 was made in November 1966. In February 1967, Three Mile Island was designated as the site. In 1967, the total cost was estimated at \$110 million and the peak labor force at 900. Completion of Unit 1 was expected by May 1971 (Harrisburg Sunday Patriot News, 12 February 1967; Middletown Journal, 22 November 1967).

Unit 2 was announced in February 1967, although at that time the intention was to build it at Oyster Creek, New Jersey, rather than at Three Mile Island. In April 1968, the application for a construction permit for the Oyster Creek station was made to the federal Atomic Energy Commission (AEC). In January 1969, however, it was publicly announced that the nuclear generating station originally intended for location at Oyster Creek would be built as Unit 2 at the Three Mile Island site due to delays in obtaining permits for the Oyster Creek site (Middletown Press and Journal, 8 January 1969). The cost of Unit 2 was estimated at \$130 million and the scheduled completion was late 1973.

2.5.2 Schedule and Cost

Construction on Unit 1 began in May 1968, and its operating license was issued in April 1974. Unit 2 construction began in November 1979, and the operating permit was issued in February 1978. By December of 1978, just three months before the accident, both units were producing commercial electricity. The total cost of constructing the

project was estimated as of December 1979, at \$1.1 billion. The cost of Unit 1 was \$408,600 thousand; Unit 2 was \$708,500 thousand. (Met-Ed, 1979.) Thus, the total cost was more than four and a half times the original estimate.

2.5.3 Construction Phase Work Force

The peak daily construction work force of 3,120 was reached in August 1972, as shown in Figure 2-3. This peak was reached by a gradual increase from an average annual work force of about 30 in 1967 to 375 in 1968; 1,108 by the end of 1969 (Unit 2 construction began that year); 1,991 by the end of 1970; and 2,591 by the end of 1971. The peak average annual work force was reached in 1972 with 2,746 workers. Thereafter, the total work force declined, although there were annual fluctuations, as shown in Table 2-1.

Construction was done by union labor, and was handled for the most part by Harrisburg locals. There were no unusual hiring practices for the job. Early in the project, some overtime was available, but not guaranteed.

2.5.4 Construction Experience

Considering the size and duration of the construction project, work was not seriously delayed by labor problems (Doherty, personal communication, 1980). Delays in completion were attributed to: (1) a three-month boilermakers strike in late 1969; (2) a six-week operating engineers strike in mid-1971, (3) Hurricane Agnes in the summer of 1972; and (4) fiscal limitations, which reduced the work force on Unit 2 four times. Among the labor grievances were issues regarding working conditions, 40-hour guarantees, and jurisdictional disputes.

2.6 Operations

2.6.1 Schedule and Costs

Annual operating costs are available for Unit 1 beginning in 1974. Operating costs were about \$2 million in that (partial) year, but remained at about \$9 million after that time. Maintenance expenses fluctuated between about \$5 and \$8 million due to the refueling cycle. Fuel costs were only \$5.3 million in 1974, but averaged \$11.7 million annually thereafter. Since Unit 2 had been operating commercially for less than four months prior to the accident, no annual operating costs were available for that unit.

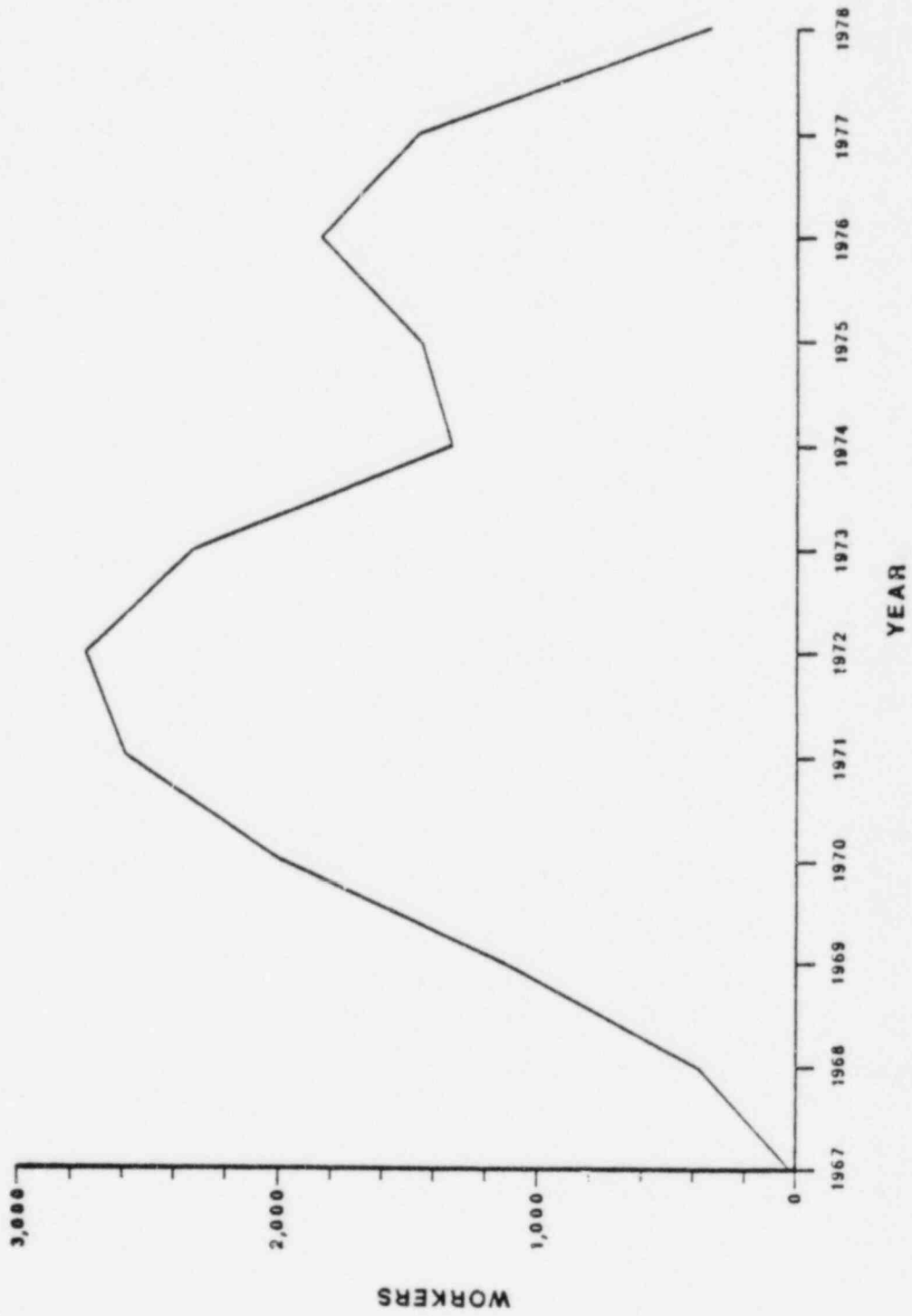


FIGURE 2-3. Average Daily Construction Work Force, Three Mile Island Nuclear Power Plant.

TABLE 2-1

AVERAGE ANNUAL CONSTRUCTION/REFUELING WORK FORCE
THREE MILE ISLAND NUCLEAR GENERATING STATION
1967-1978

Year	Average Annual Employment
1967	30
1968	375
1969	1,108
1970	1,991
1971	2,591
1972	2,746
1973	2,387
1974	1,331
1975	1,453
1976	1,804
1977	1,487
1978	330

Source: Metropolitan Edison Company, 1980; Social Impact Research, 1980.

2.6.2 Operations Phase Work Force

As shown in Table 2-2, during the five years that Unit 1 was in commercial operation, the work force increased from 308 to 563 workers. The utility assumed direct control over security in 1977, and the figures for that year include security personnel, whose services were previously provided by contractors.

TABLE 2-2
AVERAGE ANNUAL OPERATIONS WORK FORCE
THREE MILE ISLAND NUCLEAR GENERATING STATION
1967-1979

Year	Average Annual Employment ^a
1967	1
1968	14
1969	64
1970	86
1971	125
1972	126
1973	207
1974	308
1975	342
1976	412
1977	484
1978	528
1979	563

^aIncludes Metropolitan-Edison permanent employees hired to operate and maintain both units. Includes security personnel beginning in 1977.

Source: Metropolitan Edison Company, personal communication, 1980.

2.6.3 Operations Phase Experience

Three Mile Island Unit 1 compiled an excellent operating record during its five years of commercial operation. In 1976, the plant was ranked first in the United States and eighth in the world, in terms of the overall load factor that it had achieved (York Daily Record, 2 August 1976). In 1977, the plant continued to have a very favorable operating performance, achieving a capacity factor of almost 79 percent during that year, more than 10 percent above the national average for all nuclear plants (Metropolitan Edison Company, 1979). Its capacity factor of 82.1 percent in 1978 was

more than 20 percent above the national average. Other than refueling outages, there have been only six outages lasting a week or more, and none was a major incident; all other outages lasted less than a week. In October 1974, leaking relief valves on the reactor coolant pressurizer were repaired; in April 1975, a rod was dropped due to a faulty cable connector; and in November 1975, the CRD stator and control valves of the turbine were repaired. Then, in October 1976, a leaking valve was repaired and the main condenser tube leaks were worked on; in September 1977, there was high conductivity on the secondary side and generator grounding problems; in June 1978, the reactor coolant pump seal failed. The most lengthy of these six outages was 25 days, but the remainder were less than two weeks. (Metropolitan-Edison Company, Three Mile Island Nuclear Station - Unit #1 Histogram, 1980.)

The refueling, maintenance, and repair operations require additional personnel for specific periods during the year and units are scheduled for an "outage" period so this work can be done. Because of the special maintenance and repair requirements for each outage, there is a wide range of time and manpower needed for this work. Unit 1 was refueled three times: February-May 1976 (more than 13 weeks outage); March-May 1977 (8 weeks outage); and March-May 1978 (6 weeks outage). Refueling normally requires about 400 workers, 100 workers more than the normal maintenance work force. Since August 1977, these workers have been Catalytic employees; previously they were Crouse employees. (Doherty, personal communication, 1980; LeMay, personal communication, 1980.) Metropolitan-Edison statistics include these workers with other construction workers. Prior to the accident, Unit 2 had undergone no major repairs.

2.7 Taxes

In contrast to states where local jurisdictions receive substantial revenue from taxes on the assessed value of utility facilities, the Pennsylvania tax structure is such that local areas do not benefit directly from property taxes on generating facilities. The Public Utility Realty Tax Assessment of 1970 (PURTA) imposed an annual tax on the depreciated cost of utility real estate (including structures under construction) at a rate of 30 mills per \$1,000 of assessed valuation. After the tax is collected, the state distributes to each locality throughout the state an amount proportional to its share of all property taxes collected in the state. Thus, since metropolitan areas such as Philadelphia collect a larger proportion of the state's total property taxes, they also collect a larger proportion of the taxes paid on TMI. Small, rural areas that have a smaller tax base, such as Londonderry Township where the plant is located, receive a much smaller share of the taxes paid by the utility.

Taxes do not go directly to municipalities. The 1970-1978 payments to Dauphin County and the State of Pennsylvania, along with the PURTA taxes paid to the state for redistribution, are shown in Table 2-3. Ordinary real estate taxes paid on the Observation Center for 1971-1978 are as shown in Table 2-4.

TABLE 2-3
TAXES PAID BY GPU FOR THREE MILE ISLAND
 (Current Dollars)

Pennsylvania Utility Realty Tax Assessment (PURTA) (30 MILLS)	
Year	Taxes Paid
1970	\$1,000,000
1971	1,600,000
1972	2,000,000
1973	2,800,000
1974	3,600,000
1975	5,800,000
1976	5,800,000
1977	5,600,000
1978	5,800,000

Source: Metropolitan Edison Company, 1980.

TABLE 2-4
TAXES ON TMI OBSERVATION CENTER^a
 (Current Dollars)

Year	County	State
1971	\$330	\$1,812
1972	506	1,476
1973	454	1,476
1974	454	1,506
1975	454	1,520
1976	454	1,840
1977	534	1,998
1978	688	2,338

^aAssessed Valuation: \$23,700

Source: Metropolitan Edison Company, 1980.

Local municipalities in Pennsylvania can benefit by two additional taxes, the Earned Income Tax (1 percent of total annual income earned by resident of the municipality) and the Occupational Privilege Tax (\$10 per year per earner) which is assessed on workers employed in the municipality for even one day. Receipts due to the construction of TMI cannot be disaggregated from other receipts, but total receipts do vary with the size of the construction work force (see Chapter 3, Section 3.3.3).

2.8 Corporate/Community Programs

2.8.1 Emergency Planning

Prior to the accident and in compliance with NRC regulations, Metropolitan Edison had worked out emergency procedures with several local agencies. Although NRC guidelines specified that an emergency plan was required for the low population zone (LPZ), which for TMI was two miles, the State of Pennsylvania required a plan for a five-mile radius. The Hershey Medical Center agreed to provide emergency radiation treatment to any personnel involved in a radiological accident. The Pennsylvania State Police and the Middletown Police Department agreed to aid in any evacuation which might be necessary as the result of an accident at the station. Unit 1 of the Dauphin County Civil Defense and the State Department of Environmental Resources, Bureau of Radiological Health, agreed to assist Metropolitan Edison in the event of an emergency at the plant. (Harding, personal communication, 1979.)

Some problems have occurred in the implementation of these relationships. In December 1975, the Londonderry Township Fire Chief, Dennis Murray, was quoted in a feature article in the Harrisburg Evening News as saying he was not concerned about the potential for accidents or about the ability of local officials to handle any accident (Harrisburg Evening News, 26 December 1975). However, a little less than one year later, in November 1976, a newspaper article reported, "An eleven-vehicle caravan of fire trucks, ambulances, and rescue units responded to a fire alarm at the Three Mile Island Nuclear Power Plant and was denied entrance by a security guard." The article quoted Mr. Murray as saying this made him "very disgusted." The article further reported that, although the vehicles were admitted through the second gate, the firefighters could not open the fire hydrant because it had rusted shut (York Dispatch, 13 November 1976). Nevertheless, the county's civil defense director, Kevin Malloy, continued to be supportive of the emergency capabilities associated with Three Mile Island (York Daily Record, 11 April 1977). Moreover, the utility took steps to alleviate any problems with the local civil defense agencies.

In July 1976, the State Department of Community Affairs prepared a report on "Nuclear Facility Emergency Planning in Pennsylvania," in which it pointed out that Pennsylvania did not have an emergency plan that conformed with NRC guidelines. Additionally, few of the affected counties had emergency plans; local officials and support teams (fire, police, ambulance) lacked training; and the local population lacked education regarding emergency notification and evacuation procedures. The report recommended that these deficiencies be remedied and that the system be tested and evaluated.

In the fall of 1978, the utility conducted six emergency drills in coordination with local emergency agencies to ensure that coordinative mechanisms would function properly (Gross, personal communication, 1979).

2.8.2 Visitors' Center

The Three Mile Island Observation Center (Visitors' Center) is located on the eastern shore of the Susquehanna, directly east of the station. Groundbreaking for the center was in June 1969. The center contains displays describing nuclear power production in general and TMI in particular. The site can be viewed more closely from an observation deck equipped with telescopes. Attendance at the center averaged about 16,000 per year prior to the accident.

2.8.3 Public Relations

Met-Ed has engaged in an active public relations effort which began in July 1965, prior to plant construction. The effort included visits to other nuclear stations in order to benefit from the experiences of others involved in nuclear programs. Specific groups targeted for public relations efforts were Met-Ed employees, opposition groups, the communications media, governmental officials, educators, and youths, as well as the general public.

CHAPTER 3: DISTRIBUTION OF DIRECT PROJECT EFFECTS AND IDENTIFICATION OF THE STUDY AREA

3.1 Introduction

This chapter serves as a transition between the focus on the Three Mile Island (TMI) Nuclear Generating Station, presented in Chapter 2, and the focus on the socioeconomic effects caused by the project, presented in the remaining chapters. As such, this chapter has two principal purposes. The first is to describe the region near the Three Mile Island nuclear plant and the distribution of direct project effects—workers, purchases, and tax payments—within that region. The second is to identify a study area in which the combination of direct project effects and area characteristics results in socioeconomic effects that can be identified and analyzed, and to present the rationale employed in the selection of this study area.

A preliminary examination of the TMI project suggested a five-county region as the area within which discernible effects may have occurred. This region is identified in Section 3.2. Data from the counties, in conjunction with information from utility officials, union officials, and key informants, were used to estimate the distribution of the project work force, utility purchases, and tax payments. Data were collected for the peak construction year (1972) and for an operation year (1978). County data were disaggregated into the areas described in Section 3.2.2.

A systematic consideration of the distribution of the project work force, purchases, and tax payments throughout the region for each of the two years (1972 and 1978) is presented in Sections 3.3, 3.4, and 3.5, and reveals the scope, magnitude, and pattern of their individual and combined occurrence. As discussed in Section 3.6, this analysis provides a basis for identification and selection of a study area.

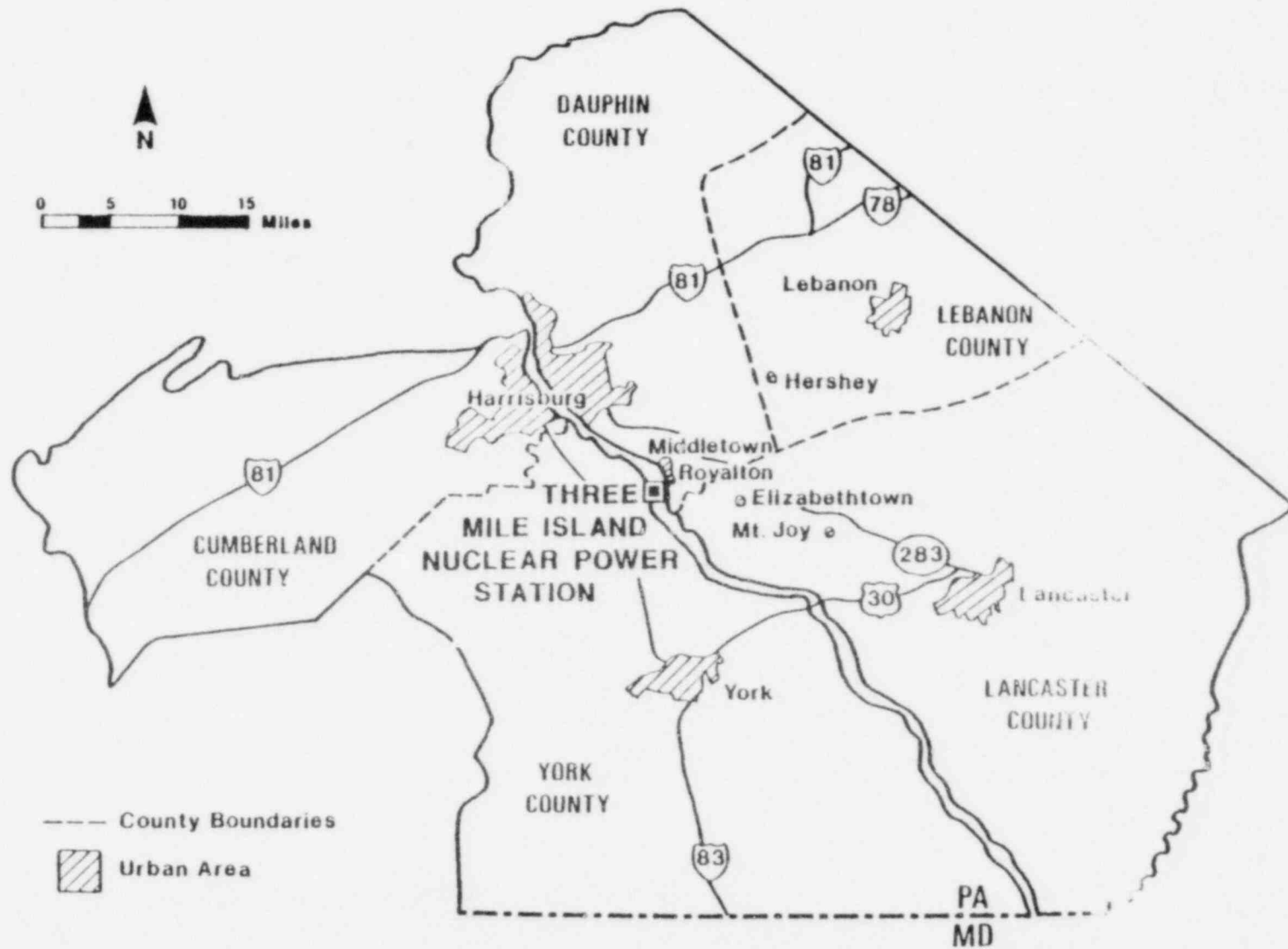
3.2 The Region

3.2.1 Description of the Region

The five counties of Dauphin, Lebanon, Cumberland, Lancaster, and York constitute the region examined in this chapter and are shown in Figure 3-1.

A conspicuous characteristic of the region is its dispersed settlement pattern. In 1975, Harrisburg was the most heavily populated city in the region (58,274), followed by Lancaster (56,669), York (48,587), and Lebanon (28,470). Between 1960-1980, all four cities steadily lost population to the suburban and rural areas that surround them.

FIGURE 3-1. STUDY REGION: FIVE COUNTIES IN SOUTHERN PENNSYLVANIA



Harrisburg's greatest expansion was to the west, from the river toward Carlisle, but the areas in Dauphin County to the east and south of Harrisburg also grew rapidly. Construction of Interstate Highways 81, 83, 283, and the "Airport Extension" drastically cut the commuting time from Harrisburg to its immediate suburbs. Prior to these improvements, there was some commuting to Harrisburg from the municipalities nearest TMI but, for the most part, these areas were either rural in character, with agriculture forming an important sector of the economy, or were local trade and manufacturing centers.

The economic base of the region is notable for its diversity. Agriculture, manufacturing, recreation/tourism, and the state/federal governments have all made important contributions to the strong economic performance of the region. Quantitatively, the manufacturing sector continues to be the dominant part of the region's economic base. Although it faces many of the problems encountered by manufacturing throughout the Northeast, it has recovered from the 1974-75 recession and seems to be stronger than the manufacturing sector in the state as a whole. For example, regional manufacturing employment rose from 13.3 percent of the Pennsylvania total in 1973, to 14.1 percent in 1976.

3.2.2 Identification of Places within the Region

Although a number of places within the region were originally examined for possible effects, information concerning the location of workers, purchases, and taxes is summarized only for those areas where the effects were discernible. Each of these areas is briefly described.

Harrisburg is the state capital and the metropolitan area nearest the site. Its urbanized area population in 1970 was 240,751. The boroughs (towns) nearest the site are Middletown and Royaltown, which are adjacent and share some services. They had a combined population of just over 10,000 in 1970. The plant is located in Londonderry Township, which is primarily rural, but which has grown in population (3,453 in 1970) during the late 1960s and 1970s due to suburban expansion of Harrisburg. A fourth Dauphin County area which was examined was the Steelton/Highspire area, just northeast of Middletown. It is dominated by the large Bethlehem Steel plant and has a preponderance of working class households. The Steelton and Highspire boroughs had a combined population of more than 11,000 in 1970. Hershey, with a 1970 population of 7,407, serves as an agricultural center, but is dominated by the Hershey Chocolate Factory with its ancillary recreation facilities, and the Hershey Medical Center, which is

a research and teaching hospital. The remainder of Dauphin County was also treated as a unit for analysis purposes. Much of the county is still agricultural, but there is increasing exurban growth from Harrisburg with shopping malls and retail strips in many areas.

In Lancaster County, the Elizabethtown/Mt. Joy area (1970 population 13,113) has been separated for analysis, as these boroughs are the nearest major towns to the south of the site. The remainder of the county, which is dominated by Lancaster (1970 population 56,667), is treated as a unit. Lebanon, York, and Cumberland counties were not subdivided.

3.3 Distribution of Direct Project Effects within the Region

In this section, direct project effects—direct basic employment, direct basic workers, utility purchases, and tax payments for the TMI project—are distributed within the study region for the peak construction year (1972), and an operation year (1978). Direct basic employment is the employment on the project itself, and in this discussion the focus is on the location of the employment by place of work. Direct basic workers are the workers directly employed on the project. The aggregate incidence of direct project effects was the principal component in the determination of the intensity of direct project effects and the identification of the study area.

3.3.1 Distribution of Direct Basic Employment by Place of Work

Because the project site and all direct project work were located in Londonderry Township, all direct basic employment by place of work occurred within the jurisdictional boundaries of the township in both 1972 and 1978. In 1972, the annual average daily employment at the project in Londonderry Township was 2,872 (including both construction and operations workers); in 1978 it was 858.

3.3.2 Distribution of Direct Basic Workers by Place of Residence

The 1972 construction work force was spatially allocated on the basis of information from key informants, including union managers and individuals from communities located in the five-county area. Detailed information on the origin and residential distribution of the 1978 operations work force was provided by the Metropolitan Edison Company.

Initial key informants agreed that about 50 percent of the 1972 construction work force moved into the region from other areas. Given the size of the Harrisburg labor pool, and the lack of any indication that there were labor availability problems during the

construction period, it seems unlikely that the proportion of in-migrants was that high. Therefore, estimates made by fourteen union managers were averaged to produce the estimates. Spatial estimates were originally made as a percent of the total work force, by craft. The number of workers was then reconstructed by Social Impact Research, Inc.

Table 3-1 shows the 1972 and 1978 work forces as they were spatially allocated within the five-county region. The work force was divided into two categories: (1) nonmovers--workers who were residents of the study area before construction began and did not relocate and, (2) movers--workers who relocated into the area to work at the site. Long-distance commuters--workers who commuted daily from outside the study area to the site--are indicated as residing outside the five-county region.

The distribution of the work force can be explained by several factors. In-migrants attempted to find inexpensive housing close to the site, but very little was available in Londonderry Township. Middletown had housing available because Olmsted Air Force Base had recently closed and most base personnel were reassigned to other bases. In addition, Middletown had rental rooms available as did both Steelton/Highspire and Elizabethtown/Mt. Joy.

In 1978, a total of 528 operations personnel and 330 construction personnel worked at the site. The residential location of the operations work force was tabulated from a Metropolitan-Edison computer printout of all employees which included addresses, dates of employment, and dates of termination. The residential location of the construction personnel was assumed to be similar to the distribution of construction workers in 1972. The additional personnel used during refueling are included in the annual average number of construction workers, and their residential distribution was assumed to be similar to that of the construction workers. Nearly 50 percent of the 1978 work force resided in Dauphin County, and more than 17 percent resided in the Middletown area.

3.3.3 Distribution of Utility Purchases

The majority of purchases associated with the construction and operation of TMI were made outside the region. There were, however, some major purchases in the Harrisburg metropolitan area. For instance, an analysis of all \$1 million plus contracts for Units 1 and 2 showed that three of the forty-one contracts went to firms with offices in the Harrisburg metropolitan area. These contracts were worth \$7.3 million out of the total \$366.6 million spent on all contracts of \$1 million or more. Since part of the \$7.3 million represents goods manufactured outside the local area and only distributed by a

TABLE 3-1

THREE MILE ISLAND DIRECT BASIC WORKERS
BY PLACE OF RESIDENCE
1972 AND 1978

Place	1972 ^a			Total Work Force	1978 ^b			Total Work Force	1970 Area Popula- tion	% of Total 5-County Popula- tion
	Nonmovers	Movers	% of Total Work Force		Nonmovers	Movers	% of Total Work Force			
	No.	No.	% of Total Work Force		No.	No.	% of Total Work Force			
Dauphin County	1,331	347	46.4	1,678	333	91	49.4	223,713	20.8	
Greater Harrisburg	620	6	21.6	626	105	9	13.3	68,061	6.3	
Middletown/Royalton	78	145	2.7	223	103	44	17.1	10,120	0.9	
Londonderry Township	12	23	0.4	35	22	9	3.6	3,453	0.3	
Steelton/Highspire	91	127	3.2	218	17	18	4.1	11,503	1.1	
Hershey	19	28	0.7	47	15	7	2.6	7,407	0.7	
Balance of County	511	18	17.8	529	71	4	8.7	123,169	11.5	
Lancaster County	297	118	10.3	415	117	44	18.8	320,079	29.8	
Elizabethtown/Mt. Joy	156	115	5.4	271	68	33	11.8	13,113	1.2	
Balance of County	141	3	4.9	144	49	11	7.0	306,966	28.6	
Lebanon County	138	16	4.8	154	92	30	14.2	99,665	9.3	
York County	192	1	6.7	193	39	6	5.2	272,603	25.4	
Cumberland County	264	1	9.2	265	45	5	5.8	158,177	14.7	
Outside Five-County Region	158	9	5.5	167	19	37	6.5	--	--	
TOTAL ^c	2,380	492	82.8	2,872	645	213	100.0	1,074,237	100.0	

^aIncludes 2,746 construction/maintenance/refuelling workers and 126 operations personnel.

^bIncludes 330 construction/maintenance/refuelling workers and 528 operations personnel.

^cTotals may not add exactly due to rounding.

Source: Social Impact Research, Inc., 1980 (based on information from union managers and Metropolitan Edison).

local firm, the portion of these contracts that represents local income is smaller than the total; however, even the total is not large compared to the total Harrisburg economy. To provide perspective, total personal income in Dauphin County in 1978 was \$1.8 billion. (BEA, 1980.) The remainder of the large contracts were with firms outside the study region. A sample of purchases made for Unit 2 indicated that only a very small percentage of all purchases were made in the study region outside of Harrisburg (Social Impact Research, Inc., 1980).

3.3.4 Distribution of Taxes

Since Pennsylvania Utility Realty Tax Assessment (PURTA) taxes paid by the utility go to the state for redistribution throughout the state, and property taxes on the Observation Center are small relative to total taxes collected by Dauphin County, only municipal taxes are likely to have been significant to the local residents. Table 3-2 shows the distribution of tax payments.

Local informants suggest that, with the exception of about \$5,000, all Occupational Privilege Taxes collected in Londonderry Township in 1978 were paid by TMI workers. They further suggest that, in earlier years, the amounts paid by workers other than those at TMI were even smaller. It is estimated that \$53,500 was collected by the township in 1972 and \$12,100 in 1978.

TABLE 3-2
METROPOLITAN EDISON COMPANY
DISTRIBUTION OF TAX PAYMENTS
1972 and 1978

Place	1972	1978
Londonderry Township (Act 511 taxes)	\$126,575 ^a	\$16,756 ^a
Dauphin County (property taxes on observation center)	253	344
State of Pennsylvania (property Taxes on site)	2,000,000	5,800,000

^aSee text for calculations.

Sources: Metropolitan Edison Company; Local Government Financial Statistics, 1972 and 1978; Social Impact Research, Inc., 1980.

The township also collected taxes amounting to 1 percent of the earnings of residents of the township who worked at TMI. Assuming an average 1972 annual wage of \$18,000 for the 29 resident construction workers and \$14,254 for the 6 operations workers, the township would have received about \$6,075 in additional taxes. In 1978, the 27 operations workers and 4 construction workers contributed about \$4,656 in township taxes. For residents of other municipalities, the tax went to the workers' legal residences unless the workers were from outside Pennsylvania. In the latter case, Londonderry Township received the tax, which was estimated at a maximum of \$67,000 in 1972; similar estimates are not available for 1978.

In addition, the township collected miscellaneous small fees as a result of the construction and operation of the plant. For instance, by 1978 the township charged \$2 per \$1,000 valuation for building permits; \$470 in building permit fees was paid to the township by Metropolitan Edison that year. However, since most of the construction occurred at a time when flat rates were charged for permits, the township did not benefit substantially.

3.4 Selection of Study Area

3.4.1 Area Selected

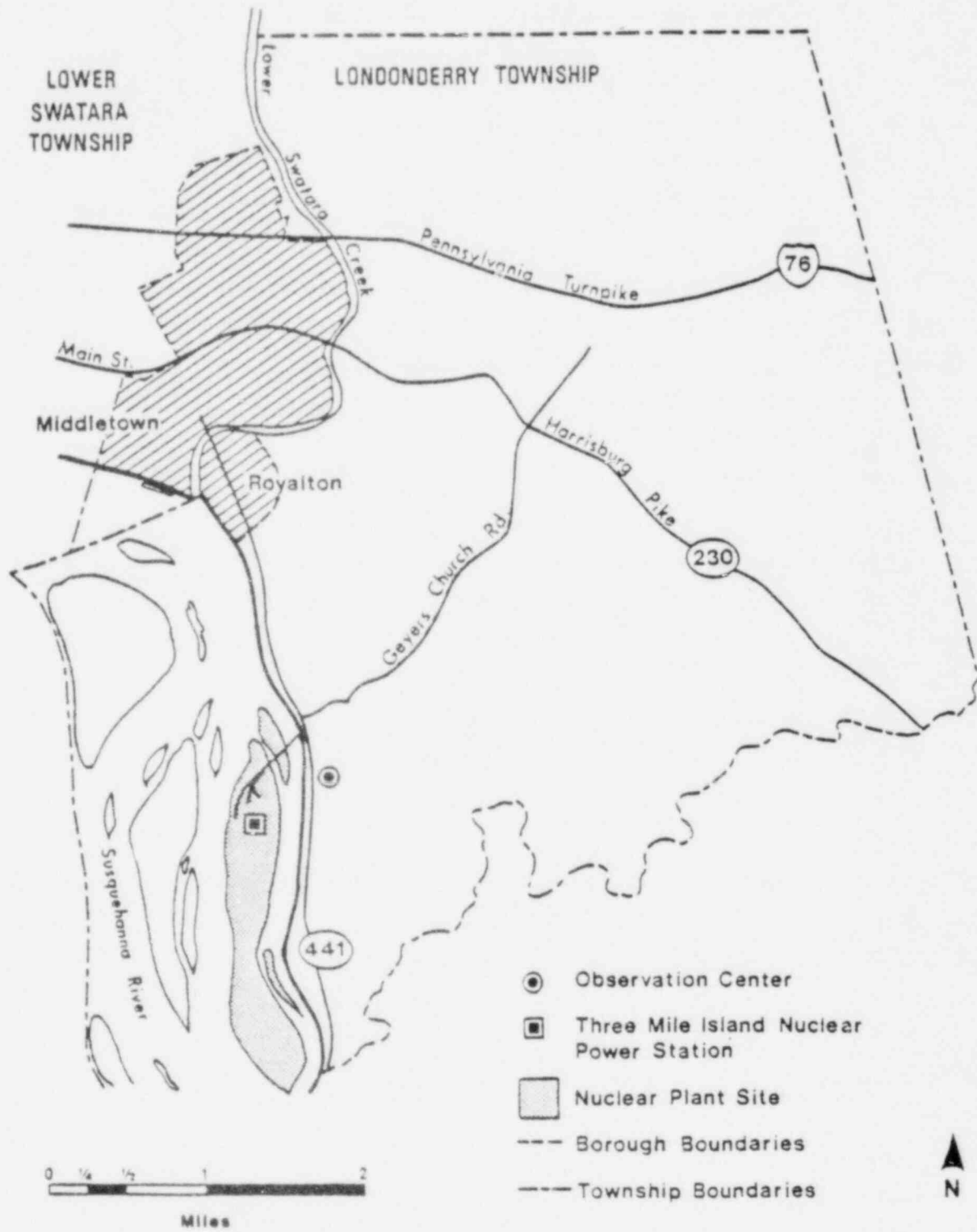
The Study Area selected for the Three Mile Island Case Study, as shown in Figure 3-2, was Londonderry Township, Middletown, and Royalton. There were three principal spatial distribution criteria on which the delineation of this Study Area was based—workers, taxes, and purchases.

3.4.2 Rationale

In 1972, 258 workers (222 in construction and 36 in operations), or 8 percent of the work force, resided in the Study Area. This was 1.7 percent of the Study Area population. Similar construction period impacts were experienced by Steelton/Highspire and Elizabethtown/Mt. Joy. In 1978, 178 workers (150 in operations and 28 in construction), or 21 percent of the work force, resided in the Study Area. Other towns with significant proportions of operations workers were Elizabethtown and Lebanon.

Most of the taxes paid by the utility to the state were distributed to local jurisdictions, and the revenues were therefore diffused. The county property tax paid on the Observation Center was insignificant to the county budget. Occupational Privilege Tax and Earned Income Tax were significant in Londonderry Township (estimated at a

FIGURE 3-2: THREE MILE ISLAND NUCLEAR POWER STATION STUDY AREA



Source: "Lower Dauphin School District", 1980

maximum of 35 percent of the total budget in 1972, and 4 percent of the total budget in 1978). Middletown/Royalton also benefited from the Earned Income Tax paid by residents who worked at Three Mile Island. In 1972, this amounted to about 2 percent of their combined budgets. The budgets of other municipalities were affected even less.

Because the station is not located in an isolated area, it is difficult to define the boundaries of the Study Area. A process of elimination was used to narrow the choice. Although Goldsboro and much of Newberry Township are located less than two air miles west of TMI, they are excluded from the Study Area. Given the shortage of bridges crossing the Susquehanna, persons from this area had to commute via Harrisburg or the turnpike bridge, a minimum 45-minute drive. In the early stages of construction, there was some "boat pooling" from the western shore to the site but, once fuel was loaded for Unit 1, boat access to the island was no longer permitted. Further, the western shore jurisdictions received no tax dollars during construction or operation.

Although Harrisburg had a large number of workers and a large amount of purchases, it was not included in the Study Area because the plant-related effects were small in proportion to the total population and economic base of Harrisburg. Other candidates for inclusion in the Study Area were Steelton/Highspire and Elizabethtown/Mt. Joy. Both had significant demographic impacts during the construction period, but smaller relative impacts in the operations period. Steelton/Highspire has virtually no social interaction with Londonderry Township, and is focused more towards Harrisburg than Middletown. Although Elizabethtown/Mt. Joy have some interaction with Londonderry Township, the interaction with Middletown is more limited.

By contrast, Londonderry Township residents have higher interaction with the contiguous Middletown/Royalton Boroughs. Virtually all of Londonderry Township has a Middletown telephone exchange, and many of the old families in the township refer to themselves as "Old Middletowners." Many residents of the three municipalities attend the same churches, have similar shopping patterns, and so forth, and have therefore developed strong social and economic bonds.

Thus, the Study Area includes three municipalities that were similar in three spheres: (1) they experienced large project-related fiscal effects; (2) they felt discernible project-related demographic effects during both the construction and operations periods; and (3) they have historical as well as current social and economic ties to one another.

CHAPTER 4: ECONOMY OF THE STUDY AREA

4.1 Introduction

The purpose of this chapter is to define the effects of the construction and operation of the Three Mile Island station on the economy of Middletown and Royalton Boroughs, and Londonderry Township. Emphasis is placed on changes in the employment, income, and labor force of the population. Attempts are also made to assess the impacts of the station on the standard-of-living of the Study Area's residents.

The analysis begins by providing an overview of the economic history of the Study Area. The historical discussion is oriented to the components of the economic base of Middletown, Royalton, and Londonderry Township—agriculture, trade and services, and manufacturing. A more detailed examination of changes that occurred in the economy of the Study Area over the 1967-1978 period is then made. The study period begins in 1967, the year construction began on Unit 1 at TMI, and continues through 1978. The discussion is organized around three topics: employment and income changes, labor force changes, and standard-of-living changes. Throughout this discussion, changes in the relevant data are described without attempting to attribute them to the construction and operation of the nuclear station.

The next sections of the chapter trace the employment and income effects associated with both the construction and operation of the station. The analysis of the construction effects centers on 1972 (the peak construction year), and the analysis of the operation focuses on 1978. The approach followed in the case study identifies three different categories of basic employment and income, which together determine nonbasic employment and income. A summary of the employment and income effects due to the station, followed by a summary of labor force effects and standard-of-living effects ends the chapter.

4.2 Economic History of the Study Area

Historically, the economy of the area was heavily influenced by its location on transportation routes. The road now known as the Harrisburg Turnpike (PA-230) was originally laid in 1730 and was built of logs. It was the main route between Philadelphia and Ohio for Conestoga or Pitt wagons. Wagons departing Philadelphia for the west contained dry-goods, groceries, and manufactured products; they returned to Philadelphia with flour, bacon, feathers, and whiskey.

Before the American Revolution, Middletown was the primary town in the area. It was the southern terminus of navigation for the famous keel boats. After 1738, it was linked to York and the western shore by a ferry to Goldsboro. In 1776, the Conewago Canal was built, which, along with newer boat designs, permitted river navigation further south. In addition, after the American Revolution, Dauphin County was formed and Harrisburg was named as the county seat. Both these factors led to a temporary lag in Middletown's fortunes (Stoctay, 1971).

Near the Swatara Creek, there were several mills in the 1800s, including two large flour mills and three saw mills. There was also a large boat landing and the terminal for the Goldsboro ferry. At least three other ferries terminated in what is now Royalton. In addition to the ferries and the Harrisburg Pike, the Union Canal, the Pennsylvania Canal, and the Harrisburg-Lancaster Railroad all intersected at the mouth of the Swatara, which separates Middletown and Royalton. This confluence of trade had the effect of restoring Middletown to prominence in the early 1800s (Stoctay, 1971).

During the late 1800s and early 1900s, Middletown lagged economically behind Harrisburg and Steelton. But the coming of Olmsted Air Force Base during WW I served to revive the Middletown economy. The base was originally used as a repair depot for planes and as a warehouse for surplus property from the war. It expanded substantially during the 1920s and 1930s. By the beginning of WW II, it employed 1,500 civilians and 240 military personnel, capable of overhauling plane engines at the rate of one per day. The base was a substantial force in mitigating the effects of the Depression in this area.

However, the most substantial expansion of the base occurred during WW II. At its peak, Olmsted employed 17,000 civilians, mostly women. Of course, it declined in size after the war, but still employed 10,000 civilians when its closing was announced in 1964. The closing was initially perceived as a disaster for the local economy since the remainder of the area's economic base was relatively small. The Windcroft Stove Works (wood-fired stoves) had shipped stoves all over the East Coast and provided crucial jobs during the Depression, but had closed by the beginning of the study period. The brick manufacturing company in Royalton had closed and a shoe manufacturer had relocated. Contracts for the steel fabrication plant were down (Bitner, personal communication, 1980; Thompson; personal communication, 1980).

4.3 Economic Changes during the Study Period

Three perspectives are taken in this section on changes in the economy of the Study Area over the 1967 to 1978 period. The first perspective focuses on the level of economic activity occurring within the boundaries of the Study Area. The measures of this activity are the number of jobs generated at places of work within the Study Area. The second perspective focuses not on economic activity occurring within the area but on the people residing there. The principal questions deal with the labor force status of area residents and their earned income. Thus, employment is a key indicator in both cases, but the distinction in the employment concepts must be kept clearly in mind. The first perspective deals with employment in terms of number of jobs measured at the place of work, while the second perspective measures number of employed persons at their place of residence. The third perspective taken in this section describes the standard-of-living of area residents.

4.3.1 Employment in the Local Economy

The study period begins in 1967, with the announcement of the selection of Three Mile Island as the site for Unit 1, and ends in 1978. The Study Area is composed of a rural agricultural area, Londonderry Township, and a local trading and industrial center, Middletown/Royalton.

At the beginning of the study period, Londonderry Township had very little indigenous employment other than agriculture. There was a large discount store, a sawmill, and a few restaurants, bars, and garages, but most of the rest of those employed within the township were self-employed in very small businesses. The township itself was also a major employer. Over the study period, agriculture continued to be a major source of employment in the Study Area.

The only employer of any size in Royalton was the Borough, which employed six persons in 1967. There were two small groceries, a vehicle inspection station, a bar, and about a half dozen other part-time self-employed persons. Everyone else who lived in the Borough commuted out of the Borough to work.

Middletown had a more diversified economic base. Although it was urban and, therefore, had little agricultural employment, all other sectors were represented. The major manufacturing plants were a clothing manufacturer, a factory shoe outlet, and a steel fabrication plant. The construction sector was small, consisting mainly of private contractors.

Over the course of the study period, the economy of the Study Area grew and diversified. Estimates of the levels and sectoral composition of employment at places of work in the Study Area are shown in Table 4-1 for 1966, before construction began; for 1972, the peak construction year; and for 1978, an operations year.

Since the boroughs of Middletown and Royalton run the public utilities for their residents, employment in this sector is combined with government employment. Besides the boroughs, government employment is limited to the U.S. post office in Middletown, and positions at the elementary and junior high schools. The trade and services sector includes a weekly newspaper, three supermarkets, numerous restaurants and bars, several car dealerships, repair shops, and parts dealers, professionals (doctors, veterinarians, optometrists, lawyers, dentists, morticians), barbershops, beauty salons, motels, pharmacies, television dealers, and a large number of other small businesses. For a town of this size, the trade and services sector is quite diverse.

It is estimated that employment exclusive of TMI increased from about 1,500 jobs to about 2,000 over the study period. The major shift was from manufacturing to trade and services. Some of the shift can be accounted for by the closure of a steel fabrication plant and the opening of a supermarket. These changes are indicative of the continued expansion of the commercial sector in Middletown and the decline of the historical manufacturing base. If TMI is included, employment in the Study Area doubled between 1966 and 1978.

TABLE 4-1
EMPLOYMENT IN THE STUDY AREA BY PLACE OF WORK
1966, 1972, and 1978

Sector	1966	1972	1978
Agriculture	100	100	100
Construction	30	2,830	380
Manufacturing	360	320	180
Trade and Services	721	921	1,366
Government/Utilities	<u>281</u>	<u>437</u>	<u>875</u>
TOTAL	1,492	4,608	2,901

Source: Social Impact Research, Inc., 1980.

4.3.2 Employment of Local Residents

Major employers for persons residing within the Study Area have been located outside the Study Area, at least since WW II. There has always been commutation to the state offices and manufacturing plants in Harrisburg and the Bethlehem Steel plant in Steelton. During the study period, more commuters moved into the Study Area, both into new suburban-type, owner-occupied housing in Londonderry Township and into rental units in Middletown and Royaltown. Currently, some are commuting to the Lancaster Industrial Park, located on the Study Area side of Lancaster and easily accessible by I-283.

However, there is also a group of major employers who local people perceive as being "in" Middletown, although in fact they are located just outside the Borough in Lower Swatara Township. The largest of these, historically, was Olmsted Air Force Base. When the base closed, its facilities were taken over by a variety of employers. The main administration building became the core of the Capital Campus of Pennsylvania State University, which currently employs about 330 people. Fruehauf Corporation, which manufactures truck trailers, obtained the space north of the campus, and currently employs about 1,100 people. The airport facilities are now operated as Harrisburg International Airport. Several light manufacturing firms (bookbinders, a packaging service, brakes manufacturer, dye works) and service companies now occupy the ancillary warehouse buildings. Other smaller employers that are located less than a half mile from the Middletown Borough limits include a nursing home, the Middletown Area High School, and a small shopping center with seven stores.

Thus, the labor force status of the residents of the Study Area is affected by the general economic forces acting on the greater Harrisburg area. The focus here is not on economic activity per se, however, but on the employment/unemployment status of area residents.

Intercensal employment and unemployment estimates are not available for the Study Area. All Middletown/Londonderry residents who are unemployed report to Harrisburg, and the data cannot be disaggregated. However, both the 1960 Census and the 1970 Census reflect changes associated with the closing of Olmsted Air Force Base and the early stages of construction at TMI. The data in Table 4-2 show a pattern of commutation out of the Study Area for non-TMI workers; it is obvious that there were far more people in the Study Area than there were jobs.

TABLE 4-2

LABOR FORCE CHARACTERISTICS OF THE STUDY AREA
1960 and 1970

Characteristics	1960		1970	
	Middletown	Royalton/ Londonderry	Middletown	Royalton/ Londonderry
Total Labor Force (Civilian and Military)	3,460	1,571	4,079	1,904
Males	2,313	1,136	2,455	1,238
Females	1,147	435	1,624	666
Civilian Labor Force	3,282	1,564	4,062	1,883
Civilian Labor Force as a percent of Total Labor Force	94.9%	99.7%	99.6%	98.9%
Civilian Employment	3,188	1,505	3,975	1,835
Males	2,075	1,099	2,376	1,195
Females	1,113	406	1,599	640
Civilian Unemployment	94	59	87	48
Males	60	33	62	22
Females	34	26	25	26
Unemployment as Percentage of Civilian Labor Force	2.9%	3.8%	2.1%	2.5%
Population (age 14 and over in 1960 and 16 and over in 1970)	5,861	2,774	6,548	3,101
Males	2,792	1,389	3,103	1,563
Females	3,069	1,385	3,445	1,538
Participation Rate	59%	57%	62%	61%
Males	83%	82%	79%	79%
Females	37%	31%	47%	43%

Source: U.S. Department of Commerce, U.S. Census of Population and Housing: 1960 and 1970, Census Tracts, Harrisburg, Pennsylvania SMSA.

Most of the labor force in the Study Area were civilians; most of the military were housed in Lower Swatara Township. Unemployment rates for the Study Area were very low for both decades. Most labor force participation rates increased, especially for females. However, they fell slightly for males. By 1970, labor force participation rates for both sexes exceeded national rates (39.6 percent for females and 72.9 percent for males).

Over the remainder of the study period, in-migration to the Study Area continued. Most of those in-migrating were employed commuters. However, no good estimates of the size of the addition to the labor force are available.

Residents of the Study Area enjoyed an increasing standard-of-living between 1960 and 1970 (U.S. Census, 1960; U.S. Census, 1970). Median family income increased about 21 percent in constant 1973 dollars (\$8,400 to \$10,200). The percentage of housing lacking some or all plumbing facilities decreased from 7.2 percent to 4.7 percent. The incidence of overcrowding (more than 1.01 persons per room) decreased from 10.1 percent to 4.5 percent. By 1970, the incidence of poverty in the Study Area was only 5.9 percent, considerably below the national average of 13.7 percent.

Although quantitative data are not available after 1970, there are indications that the standard-of-living continued to rise. After Hurricane Agnes, some of the poorest housing stock was razed, and many in-migrants to the area were able to afford new suburban-type housing.

4.4 Economic Changes in the Study Area due to the Project

The purpose of this section is to describe the effects of the TMI nuclear station construction and operation on the economic conditions in the Study Area. As was the case in the previous section, three perspectives will be taken: the effect of the project on economic activity in the area studied (i.e., on jobs and income on a place of work basis); the effect of the project on the labor force status of the residents of the area; and, finally, the effect of the project on the standard-of-living of area residents.

To accomplish these objectives, an economic base analysis (supplemented with an input-output analysis) is utilized. The premise of this analysis is that the economic activities of the project—the employment at the project, the purchases of materials for the project, and other market effects of the project (for example, the consequences of the taxes paid by the project)—caused additional economic activity in the Study Area.

Determination of the total project effects on employment and income in the Study Area requires quantification of both the direct project activity and the additional nonproject activity it induced. Once these income and employment consequences of the project have been estimated, their impacts on the area's economy, on the area's labor force, and on the area residents' standard-of-living will be summarized.

4.4.1 Estimation of Project-Related Employment and Income Effects

This analysis begins by describing the work force and the purchases of goods and services required to construct and operate the generating station. Persons directly employed in the construction or operation of the plant are called "direct" basic employees, and the income they earn is counted as "direct" basic income.

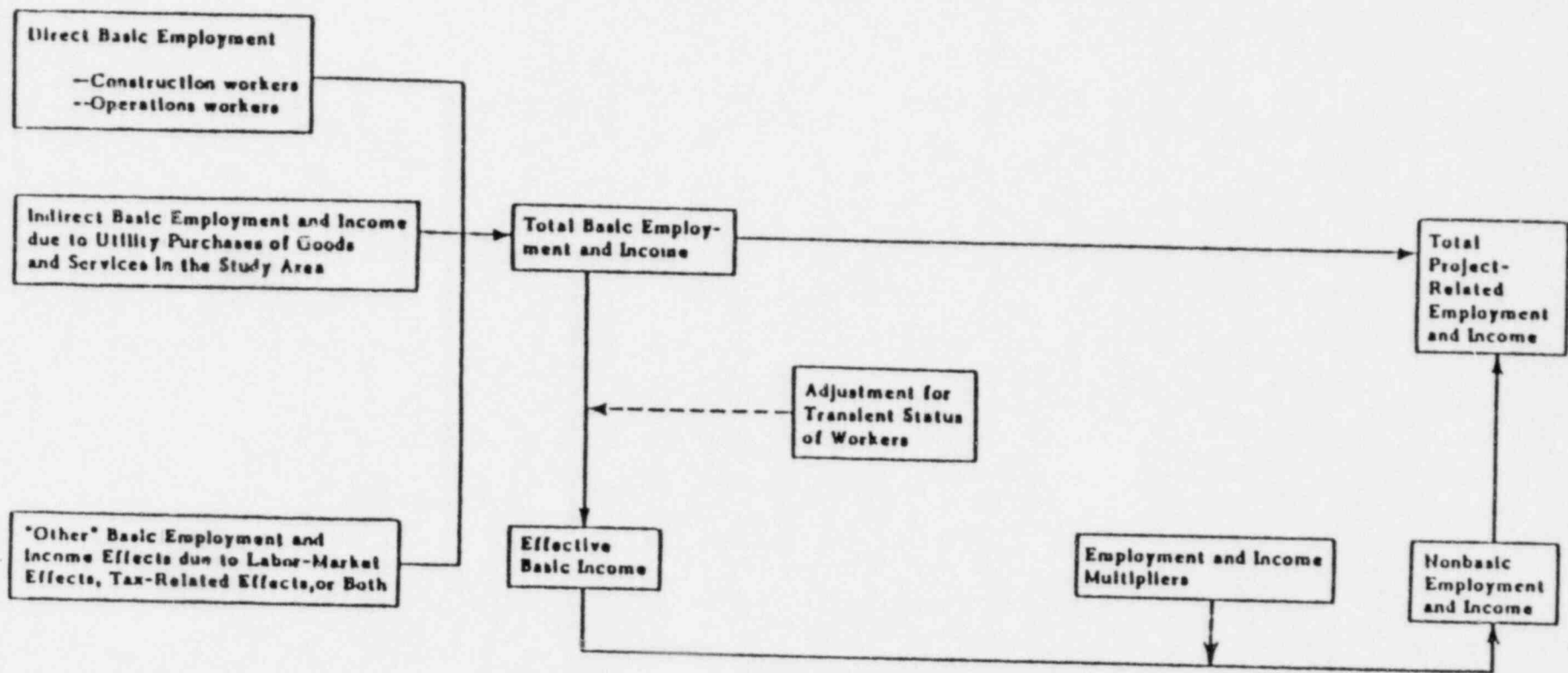
In addition to direct employment and income, local income and employment may have resulted from the purchase of goods and services for the construction and operation of the plant. If, for example, \$1,000 of materials was purchased locally, some fraction of the purchase would accrue as income to local labor. For materials produced locally, the ratio of locally-generated-income-to-total-purchases could be quite high. Materials produced elsewhere and only distributed locally would result in a lower ratio of income-to-purchases, which would reflect only the distributor's margin. Income and employment generated in response to the purchases of goods and services by the utility are referred to as "indirect" basic income and employment.

A third group of income and employment effects is referred to as "other" basic income and employment. This category includes labor-market effects due to labor shortages, higher wages, or changes in activity that are a response to the fiscal impacts of the station. To the extent that such responses changed the income or employment of local residents, the change would be categorized as "other" basic income and employment. Figure 4-1 summarizes the three major sources of change in basic income and employment: direct basic, indirect basic, and "other" basic.

A significant portion of the project-related basic income in the Study Area was earned by workers who lived outside the Study Area or who resided in the Study Area only during the work week. As a result, less of this income was spent in the Study Area than would have been if the income had been earned by area residents. To account for this, the total project-related basic income was adjusted to make each dollar equivalent in terms of its effect on the local economy. The resulting adjusted income total is referred to as "effective" basic income. For example, if one group of workers spent only

FIGURE 4-1

ESTIMATION OF PROJECT-RELATED EMPLOYMENT AND INCOME EFFECTS



25 percent as much money in the Study Area as did local residents earning comparable incomes, only 25 percent of the total income of the group would be included in effective basic income.

"Nonbasic" income and employment is that which results when effective basic income is spent and respent in the local economy. In general, the larger the economy, the smaller the income leakages due to imports and the larger the multiplier. Once a multiplier appropriate to the size of the local economy has been estimated, the change that basic income produces in nonbasic employment and income can be calculated. Nonbasic employment and income can then be added to the three categories of basic employment and income to arrive at an estimate of the total employment and income effects of construction and operation of the nuclear station.

The method for estimating the nonbasic employment and income response to an increase in effective basic income is based on the Regional Interindustry Multiplier System (RIMS)¹ developed by Ronald Drake (for the Regional Economic Analysis Division of the U.S. Department of Commerce, Bureau of Economic Analysis). The RIMS approach is well documented elsewhere (U.S. Water Resources Council, 1977; Anderson, 1980) and, therefore, is not described in detail here.

4.4.1.1 Employment and Income Effects of the Project in 1972

Direct basic employment and income effects of the project in 1972

The first of the three components of total project-related basic income and employment is direct basic income and employment. The direct basic employment in the Study Area due to the project is represented by those jobs and workers involved directly in the construction of the plant. The wages earned by direct basic employees constitute the direct basic income due to the project. Direct basic income and employment can be

¹In general, the RIMS technique develops industry-specific input-output types of multipliers based on national interindustry relationships at the 496-sector level of disaggregation, adjusted to reflect the availability of required inputs from suppliers in the county. In the simplest case, if an industry does not exist in the county economy, any requirements from that industry are assumed to be supplied by imports from outside the county economy. If an industry does exist in the county at the same, or greater, proportion to the county economy as the industry is to the national economy, the county demands from that industry are assumed to be met within the county economy. If an industry represents a smaller proportion of the county economy than it did of the national economy, some of the county demand is assumed to be supplied from in the county and some is assumed to be imported.

counted either at the place of work or the place of residence. Place of work data are used to show the number of jobs and amount of income generated by the project and their effect on the economy of the area. Data using place of residence of workers are used to show the number of residents of the area employed at the project and their effect on the labor force of the area.

In this study, the determination of direct basic income and direct basic employment at place of work is straightforward and is derived from project employment and wage data. TMI is located in Londonderry Township, Dauphin County. Consequently, in terms of employment and income by place of work, all direct basic employment and income from the project (2,872 jobs in 1972) accrued to the Study Area economy, as did the estimated \$51.2 million¹ of direct basic income generated by the project.

Not all of the direct basic employees resided in the Study Area. In 1972, it is estimated that only 258 direct basic employees², earning \$4.5 million in income from the project, were residents of the Study Area. The rest commuted to the site from outside the Study Area.

Indirect basic employment and income effects of the project in 1972

The second component of total project-related basic income and employment is the indirect basic, here designated as the profits, earnings, and employment that result from the purchase of goods and additional services by the utility for plant construction and operation. The amount of indirect income produced by a given value of purchases is determined by the ratio of indirect income to product value, which varies according to the type of goods and type of establishment involved in the transaction. The indirect basic income and employment in the Study Area due to the project is calculated in this study by applying the income-and-employment-to-value-of-purchases ratio derived from RIMS (for county-specific data) to the total value of materials purchased by the utility in the Study Area. Earnings and employment multipliers have been estimated for Dauphin County. The earnings multiplier was estimated to be \$92 (per \$1,000 of purchases), and

¹The 126 operation workers on site were added to the construction workers. The average annual wage (including overtime) for the construction workers was \$18,000. For operations workers, the average was \$14,254.

²Includes 28.41 percent of the 126 operations worker (36 workers), the same percent as resided in the Study Area in 1978.

the employment multiplier was estimated at .0115 (per \$1,000 of purchases). (Drake, personal communication, 1980.) Although a detailed quantitative analysis of indirect basic income and employment effects was not possible given the approximate nature of purchase estimates, an order-of-magnitude estimate of the purchases made in the Study Area and the resulting indirect basic income and employment was made. It is estimated that in 1972 the value of purchases made in the Study Area for the construction of the project was about \$100,000 (constant 1972 dollars) consisting primarily of chemical and hardware supplies and bulk construction materials. Since little is known about the specific sectors from which purchases were made, it is assumed that they were mainly in the wholesale trade sector. This assumption is undoubtedly appropriate for the majority of local purchases, although some materials (e.g., sulphuric acid) were produced locally. For the majority of goods, however, local wholesalers simply served as distributors for materials and supplies manufactured elsewhere. These purchases would have created only about \$9,200 in additional earnings and no more than one additional job, which we assume was filled by a Study Area resident.

"Other" basic employment and income effects of the project in 1972

The construction of a large facility such as a nuclear generating plant may result in some wage-induced effects that are classified here as "other" basic employment and income. Wage-induced effects might occur in agricultural areas, in areas dependent on low-cost labor, or in areas where labor markets are very tight. In such areas, the higher wages paid at the construction site might entice workers to quit their jobs with existing employers and go to work at this site. Should this happen, existing employers might find it very difficult to replace these employees except at higher wages, which they might not be able to afford. In this case, there would be a decrease in employment and income, which would be categorized as "other" basic employment and income.

None of these effects were apparent in the Study Area. One Middletown school-teacher resigned to work "on the island" for several years; there were other such isolated instances of competitive labor market effects, but they were not pervasive and in no case was the result a permanent drop in employment.

Total basic employment and income effects of the project in 1972

Total basic employment and income is the sum of the three basic components—direct basic, indirect basic, and "other" basic. As shown in Table 4-3, there were 2,873 basic jobs by place of work added to the Study Area economy. These jobs generated basic income of \$51.2 million. Many of these jobs, however, were filled by workers who

TABLE 4-3

TOTAL PROJECT-RELATED BASIC EMPLOYMENT AND INCOME FOR
THE STUDY AREA BY PLACE OF WORK AND PLACE OF RESIDENCE
1972

Type	Place of Work	Place of Residence
Basic Employment		
Direct ^a	2,872	258
Construction	2,746	222
Operations	126	36
Indirect	1	1
Other	0	0
TOTAL	2,873	259
Basic Income ^b		
Direct ^a	\$51,224	\$ 4,509
Construction	49,428	3,996
Operations	1,796	513
Indirect	9 ^c	9
Other	0	0
TOTAL	\$51,233	\$ 4,518

^aFigure for Direct Basic Employment is the sum of direct construction and operations employment. Figure for Direct Basic Income is the sum of direct construction and operations income.

^bThousands of 1972 constant dollars.

^cAt the county average wage of \$9,265 for 1972 (BEA, 1972).

Source: Social Impact Research, Inc., 1980.

lived outside the Study Area. Only 259 jobs and \$4.5 million in income accrued to area residents during 1972.

Nonbasic employment and income due to the project in 1972

Nonbasic employment and income, the final component of project-related employment and income effects, result from the expenditure (and re-expenditure) of basic income in the local economy. The amount of nonbasic employment and income caused by the project in the local economy is determined primarily by the interaction of two factors: (1) the amount of effective basic income created by the project, and (2) the size of the nonbasic-to-basic employment and income multipliers in the local economy.

Effective basic income. An unusually high proportion of the project-related basic income in the Study Area was earned by workers who were transient residents or who lived outside the Study Area and who, therefore, spent a smaller proportion of their income in the Study Area than did project-related residents who earned the same income. This reduced the effect of the project-related basic income on the local economies by diminishing the amount available for multiplication. To account for this, the total project-related basic income earned in the Study Area was adjusted to make each dollar of project-related basic income equivalent in effect on the economy of the Study Area to an average dollar of basic income earned there. Two principal factors affected the amount of effective basic income resulting from the project—the residential location of the workers earning the basic income and the incidence of outside financial commitments, such as for the maintenance of a household. The effects of these factors were analyzed by dividing the project-related basic workers into four groups:

1. Nonmovers—employees who resided in the Study Area prior to their employment on the project and who did not move because of this employment;
2. Movers accompanied by families—employees who moved into the Study Area because of their employment on the project and who were accompanied by families;
3. Movers unaccompanied by families—employees who moved into the Study Area because of their employment on the project and who were not accompanied by families (including single employees); and
4. Daily long-distance commuters—employees who lived outside the Study Area but commuted daily into the Study Area to work at the project.

An adjustment for the basic income earned by each group was then made individually.

Table 4-4 shows the distribution of project-related basic employees and basic income among the four groups for the Study Area. In 1972, only about 9 percent of the 2,873 project-related basic jobs in the Study Area was held by workers residing there.

Based on information about residential location and outside financial commitments, interviews with workers in different groups, and examination of the cost and availability of goods and services in the local economy, the basic income of each group was weighted to reflect the average proportion of earnings spent in the local economy by members of the group and their households.

Nonmovers were treated as the base and weighted by a factor of 1.0. It was assumed that movers accompanied by their families would have spending patterns similar to the nonmovers, so their basic income was also weighted by a factor of 1.0. For the other two groups, the reduction in the Study Area spending, as compared to the nonmovers, is reflected in smaller weighting factors. Local informants estimated monthly expenditures within the Study Area, by budget category, for those employees living in the Study Area accompanied by their families and for those whose families were absent. The ratio of the expenditures was about 0.6. This is the weighting factor used for the unaccompanied movers. A similar calculation was done for daily commuters. The estimate given represents the maximum economic impact of these workers, as they spent little in the Study Area. The total effective basic income for the Study Area is estimated to have been about \$3.8 million for 1972 (see Table 4-4).

Nonbasic-to-basic multipliers. The second factor determining the nonbasic employment and income effects of the project in the Study Area is the nonbasic-to-basic employment and income multipliers. Based on the RIMS analysis, the appropriate multipliers for Dauphin County were \$1,000 of effective basic income to result in 0.0415 nonbasic jobs and \$256 in nonbasic income in the county (by place of work).¹ The RIMS multipliers were derived from data on Dauphin County and, therefore, required adjustment to be applicable to the Study Area analysis, where the multipliers were expected to be smaller due to the smaller size of the Study Area economy. This

¹These figures are in constant 1972 dollars and are based on the 1976 national input-output table. Since the structure of the Dauphin County economy did not change substantially between 1972 and 1976, the 1976 relationships are considered appropriate for this analysis.

TABLE 4-4

PROJECT-RELATED BASIC EMPLOYMENT AND INCOME
FOR THE STUDY AREA BY WORKER CATEGORY
1972

Type	Non-Movers	Accompanied Movers	Unaccompanied Movers	Daily Commuters	TOTAL
Basic Employment					
Direct	90	22	146	2,614	2,872 ^d
Indirect	<u>1</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>1</u>
TOTAL	91	22	146	2,614	2,873
Basic Earnings ^a					
Direct	\$1,605	\$393	\$2,604	\$46,622	\$51,224
Indirect	<u>9^b</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>9</u>
TOTAL	\$1,614	\$393	\$2,604	\$46,622	\$51,233
Weighting Factor	1.0	1.0	0.6	0.005 ^c	—
Effective Basic Income	\$1,614	\$393	\$1,562	\$233	\$3,802

^aIn thousands of 1972 dollars.

^bProject-induced indirect basic income.

^cThis is a high-side estimate.

^dIncludes the 126 operations workers. Distribution calculated using the known proportions for 1978. All operations workers who were movers were assumed to be accompanied by their families.

Source: Social Impact Research, Inc., 1980.

adjustment was made by applying the results of research on the size and distribution of nonbasic response to increased basic activity in size-ordered economic systems¹ (Anderson, 1980). Data from this research can be used to calculate the ratio of nonbasic response to an increase in basic income among economies in a system according to the position of the economy in a six-order size hierarchy. Placement of an economy in the hierarchy is based on the total personal income of residents in the economy's area. The Study Area, with total personal income of approximately \$63.8 million in 1972, was in the second order, while Dauphin County, with total personal income of approximately \$948.7 million in 1972, was in the sixth, or largest, order.

Based on this categorization, the nonbasic-to-effective-basic-income multipliers in the Study Area were expected to be only 58.7 percent of those of Dauphin County, indicating that the appropriate multipliers for the Study Area were for \$1,000 of effective basic income in the Study Area to result in .0244 nonbasic jobs (0.587×0.0415) and \$150 in nonbasic income ($0.587 \times \256). When applied to the \$3,802 thousand of effective basic income, these multipliers give an estimated nonbasic response in the Study Area of 93 jobs and \$570 thousand in income by place of work.

Approximately fifty interviews were conducted with local business owners to determine if extra persons were hired to accommodate the nonbasic demand. Employment over the study period was obtained from each informant. Virtually all informants stated that their employment had either been constant or had risen gradually over the study period and that none of the increased employment was due to the effect of TMI. No instance of a peak in employment, coinciding with peak nonbasic demand in 1972, was evident. Given that the nonbasic income estimate (\$570 thousand) is less than 1.0 percent of the total personal income for the Study Area, it is not surprising that local informants did not perceive the effect.

Interviews with local businesses regarding the residency distribution of their employees suggest that about 79 (85 percent) of these 93 nonbasic jobs were filled by Study Area residents and that the remaining 14 jobs were filled by outside commuters. Study Area residents, therefore, obtained 79 nonbasic jobs and about \$485 thousand in nonbasic income from the project in 1972.

¹The size of the economy was measured by total personal income of residents.

Total employment and income due to the project in 1972

The sum of the four components of employment and income generated by the TMI plant—direct basic, indirect basic, "other" basic, and nonbasic—is the total employment and income created in the Study Area by the project. As shown in Table 4-5, the total number of new jobs created in the Study Area in 1972 by place of work was estimated at 2,966. This employment generated \$51,803 thousand in income in the Study Area. Employment and income effects on the Study Area by place of residence were substantially smaller. The project provided employment for 338 residents, who earned about \$5 million from project-related jobs.

4.4.1.2 Employment and Income Effects of the Project in 1978

The purpose of this section is to describe the economic effects of the Three Mile Island plant during a typical recent year of operation. Ideally, the year chosen would be later than the completion of construction on both units, so that only the operating work force effects are measured.

TABLE 4-5

TOTAL PROJECT-RELATED BASIC AND NONBASIC
EMPLOYMENT AND INCOME FOR THE
STUDY AREA
(Place of Work and Place of Residence)
1972

Type	Place of Work	Place of Residence
Employment		
Basic	2,873	259
Nonbasic	<u>93</u>	<u>79</u>
TOTAL	2,966	338
Income ^a		
Basic	\$51,233	\$4,518
Nonbasic	<u>570</u>	<u>485</u>
TOTAL	\$51,803	\$5,003

^aIncome in thousands of 1972 dollars.

Source: Social Impact Research, Inc., 1980.

Although Unit 1 began operations in 1974, Unit 2 was not completed until December of 1978, and the accident occurred in March of 1979. Therefore, there is no complete year of operation of both units. This study will use 1978 as the focal year, in order to preserve comparability with the other sites, which also, for the most part, use 1978. Economic effects of the remaining construction work force (330) and the operations work force (528) will be disaggregated wherever possible.

Direct basic employment and income effects of the project in 1978

As in 1972, all direct income from and all employment at TMI and are attributed to Londonderry Township (and therefore the Study Area) for analysis of the economic effects on a place of work basis. During 1978, there was one 6-week refueling outage which required an additional 100 workers, or nearly 12 extra person-years of labor. It was assumed that these workers were paid at the same annual rate as the other 318 construction workers in 1978, \$20,191 (1972 constant dollars). There were also 528 operations workers on site whose annual average wage was \$14,254 (1972 constant dollars). Thus, the average employment at TMI for 1978 was 858, which resulted in \$14.189 million of basic income.

To calculate the economic effect on a place of residence basis, an estimate was made of the residential distribution of the 858 workers. Construction workers were distributed according to the pattern for 1972, as there is no evidence of a change in hiring practices or in residential preferences. Thus, about 27 of the 318 construction workers were residents of the Study Area. In the refueling operations, it is estimated that 1 worker resided in the Study Area. Data provided by Met-Ed regarding the actual residential distribution of the 528 operations workers indicate that 150 resided in the Study Area. Together, these 178 residents of the Study Area earned \$2.703 million in 1978.

Indirect basic employment and income effects of the project in 1978

Met-Ed was able to provide a computer listing of all purchase orders for the construction and operation of Unit 2. Orders for 1978 from suppliers located in the Study Area were aggregated. The total was nearly \$200,000 (1972 constant dollars), of which 75 percent was with a manufacturer of sulphuric acid used in operating the unit. The RIMS multipliers were used to convert indirect basic purchases to income and jobs. This resulted in an estimated \$18,400 in indirect basic income and 2 new jobs. Both jobs were assumed to be filled by residents of the Study Area.

"Other" basic employment and income effects of the project in 1978

As in 1972, no "other" basic employment or income were found to be attributable to the TMI plant. There were no discernible wage or tax effects of the operation of Unit 1 which might produce "other" basic effects.

Total basic employment and income effects of the project in 1978

The total basic effects are the sum of the direct, indirect, and "other" basic effects. They are shown in Table 4-6. The estimated total basic employment by place of work in 1978 was 860, which resulted in \$14.2 million of income. Of these basic jobs, 180 were held by persons residing in the Study Area who had earnings of about \$2.7 million in 1978. These figures are substantially smaller than the comparable figures for 1972 (the peak construction year) due to the great reduction in the work force between these two years (see Table 4-2).

Nonbasic employment and income effects of the project in 1978

In order to calculate the induced effects of the expenditure of the basic income, the total basic income was once again weighted by the mover status of those who earned it. Table 4-7 shows the distribution of workers by status—nonmovers, movers accompanied by their families, movers unaccompanied by their families, and daily commuters from outside the Study Area. Mover status of the 150 operations workers residing in the Study Area was provided by a key informant in Met-Ed's personnel department who was a native of Middletown. Refueling and construction workers were assumed to be distributed as in 1972 (see Table 4-4), except that no refueling workers were accompanied by their families. The same weights were used for 1978 as were used for 1972 in order to calculate effective basic income.

The analysis shows that \$2.6 million in effective basic income was generated in the Study Area in 1978. Using the RIMS multipliers to convert the effective basic income implies that 64 nonbasic jobs and \$396,150 of nonbasic income were induced by the operation (and remaining construction) of Three Mile Island. The figures of .0415 nonbasic jobs and \$256 in nonbasic income per \$1,000 of effective basic income for Dauphin County are deflated to .0244 jobs and \$150 for the Study Area. Using the previously stated residential distribution, it is estimated that 54 (85 percent) of these employees resided in the Study Area and earned \$336,727 of nonbasic income. The remainder of the jobs were filled by daily commuters who resided outside the Study Area.

TABLE 4-6

TOTAL PROJECT-RELATED BASIC EMPLOYMENT AND INCOME FOR THE
STUDY AREA BY PLACE OF WORK AND PLACE OF RESIDENCE
1978

Type	Place of Work	Place of Residence
Basic Employment		
Direct		
Operations (Unit 1)	528	150
Refueling (Unit 1) ^a	12	1
Construction (Unit 2)	318	27
Indirect	2	2
Other	—	—
TOTAL	860	180
Basic Income ^b		
Direct		
Operations (Unit 1)	\$7,526	\$2,138
Refueling (Unit 1)	242	20
Construction (Unit 2)	6,421	545
Indirect	18	18
Other	—	—
TOTAL	\$14,207	\$2,681

^aIncludes maintenance workers. The number of workers was estimated by the contracts and by union managers, and subtracted from the total construction work force of 330, supplied by Metropolitan Edison.

^bThousands of 1972 constant dollars.

Source: Social Impact Research, Inc., 1980.

TABLE 4-7

PROJECT-RELATED BASIC EMPLOYMENT AND INCOME FOR THE
STUDY AREA BY WORKER CATEGORY
1978

Type	Non- Movers	Accom- panied Movers	Unaccom- panied Movers	Daily Commuters	TOTAL
Basic Employment					
Direct					
Operations	117	33	—	378	528
Refueling	1	—	—	11	12
Construction	7	3	17	291	318
Indirect	<u>2</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>2</u>
TOTAL	127	36	17	680	860
Basic Earnings ^a					
Direct					
Operations	\$1,668	\$470	—	\$5,388	\$7,526
Refueling	20	—	—	222	242
Construction	141	61	343	5,876	6,421
Indirect	<u>18</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>18</u>
TOTAL	\$1,847	\$531	\$343	\$11,486	\$14,207
Weighting Factor	1.0	1.0	0.6	0.005	—
Effective Basic Income	\$1,847	\$531	\$206	\$57	\$2,641

^aThousands of 1972 dollars.

Source: Social Impact Research, Inc. 1980.

Total Employment and Income Effects of the Project in 1978.

Table 4-8 shows the 1978 total employment and total income due to the project on both a place of work and place of residence basis. The total number of new jobs created in the Study Area was 924, which produced \$14.6 million in income. Of this total, Study Area residents held about 234 jobs and earned \$3.0 million.

4.4.2 Effects of the Project on the Study Area Economy, 1967-1978

The Three Mile Island plant produced economic impacts through the on-site employment of workers, the local purchases of goods and services, and the payment of taxes to the county and Study Area. This section summarizes the project's economic effects on the Study Area on a place of work basis.

To give some sense of the magnitude and duration of the employment and income effects of the project on the Study Area economy, the annual employment and income due to the project have been estimated. It was assumed that the ratio of direct basic employment and income to total project-related employment and income remained constant at the 1972 level from 1967 to 1972, then increased between 1972 and 1978 at a constant annual rate. This assumption is made because direct basic employment and income dominate the total income and employment effects.

TABLE 4-8
TOTAL PROJECT-RELATED BASIC AND NONBASIC
EMPLOYMENT AND INCOME FOR THE
STUDY AREA
(Place of Work and Place of Residence)
1978

Type	Place of Work	Place of Residence
Employment		
Basic	860	180
Nonbasic	<u>64</u>	<u>54</u>
TOTAL	924	234
Income ^a		
Basic	\$14,207	\$2,721
Nonbasic	<u>396</u>	<u>337</u>
TOTAL	\$14,603	\$3,058

^aThousands of 1972 dollars.

Source: Social Impact Research, Inc., 1980.

Table 4-9 shows the annual average direct basic employment and income by place of work from 1967-1978 and the total employment and income for that period. Estimated total employment in the Study Area was over 1,000 each year between 1969 and 1977 and over 2,000 for all but three of these years. The estimated effect of the project on employment by place of work was dramatic, as shown in Figure 4-2. In 1972, well over 60 percent of all jobs in the Study Area were estimated to be project-related. The presence of the project-related jobs in 1972 more than tripled the total number of jobs in the Study Area economy as compared to 1966. By 1978, the percentage of the Study Area jobs that were due to the project decreased to about 30 percent.

TABLE 4-9
ESTIMATED ANNUAL EMPLOYMENT AND INCOME EFFECTS
BY PLACE OF WORK^a
1967-1978

Year	Employment		Income ^b	
	Direct Basic	TOTAL	Direct Basic	TOTAL
1967	31	32	N/A	N/A
1968	389	402	\$6,047	\$6,115
1969	1,172	1,210	18,357	18,564
1970	2,077	2,145	42,009	42,484
1971	2,716	2,805	61,851	62,550
1972	2,872	2,966	51,224	51,803
1973	2,594	2,698	50,423	51,142
1974	1,639	1,716	30,485	31,009
1975	1,795	1,893	32,312	32,963
1976	2,216	2,353	38,881	39,780
1977	1,971	2,108	33,416	34,288
1978	858	924	14,189	14,603

^aBased on a constant ratio of direct basic employment to total employment and income for the years 1967-1972; for the years 1973-1978, the ratio is adjusted at a constant annual rate to reach the 1978 ratio.

^bConstant 1972 dollars.

Source: Metropolitan Edison, 1980; Social Impact Research, Inc., 1980.

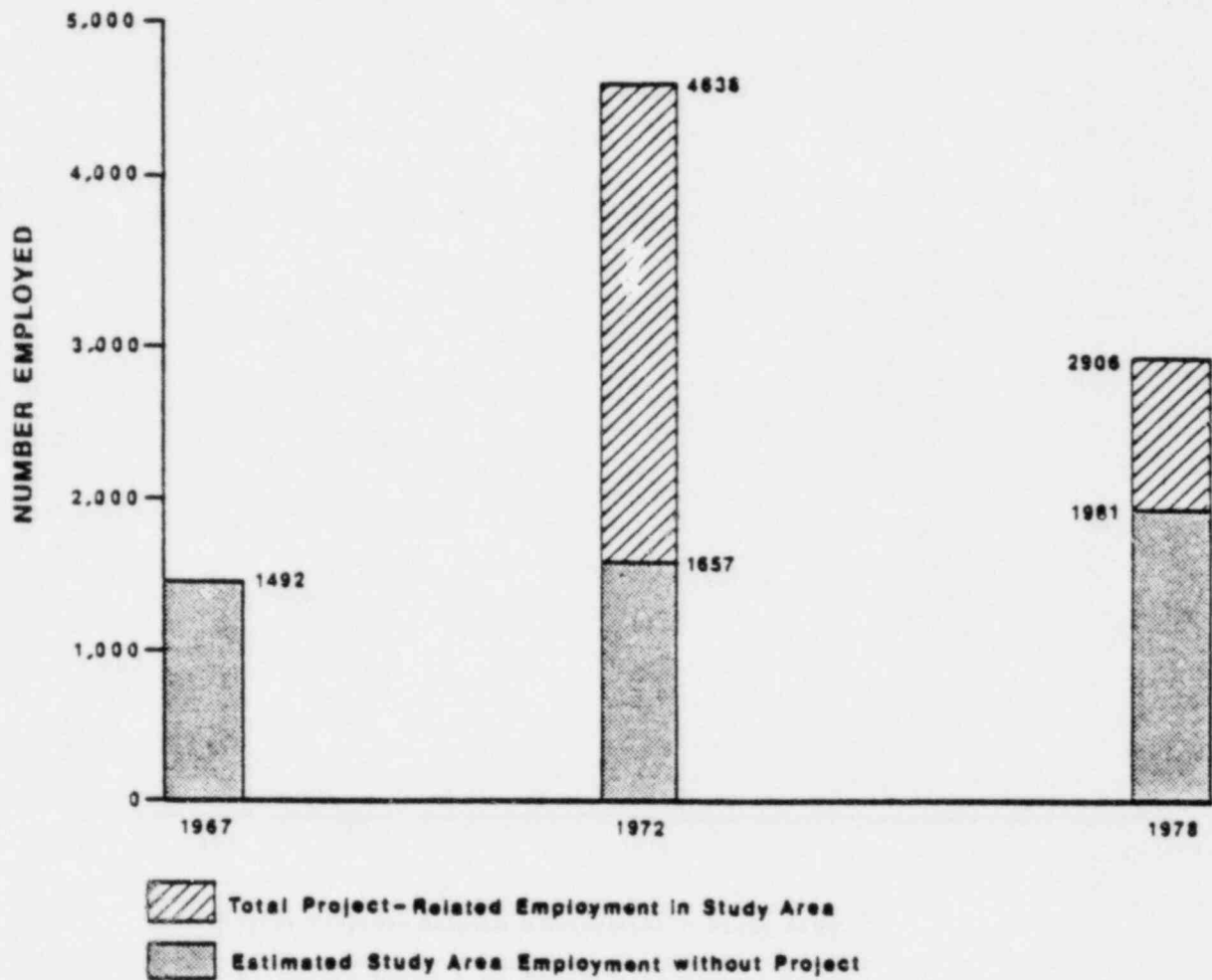
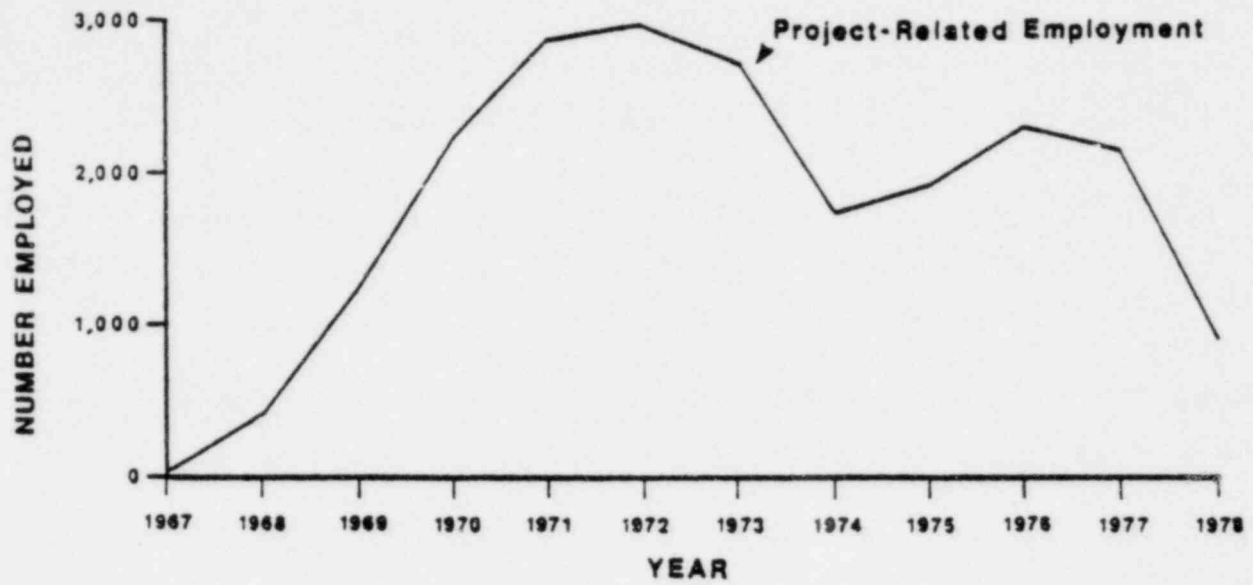


FIGURE 4-2. Project-Related Employment by Place of Work in Study Area, 1967-1978.

4.4.3 Effects of the Project on the Residents of the Study Area

The employment and income effects of the project on the residents of the Study Area for each year of the study period are shown in Table 4-10. These estimates were derived utilizing the same assumptions about constant direct basic-to-total ratios as in the previous analysis. Direct basic income was calculated separately for operations and construction workers, because the ratio of operations-workers/total-direct-basic-workers is different for the place of work and place of residence. Although TMI had a very dramatic effect on the economy of the Study Area in terms of employment and income by place of work, and the economic structure of the local economy was consequently substantially transformed during the peak construction years, the effect of the project on the resident labor force of the Study Area was much less pronounced.

TABLE 4-10
ESTIMATED ANNUAL EMPLOYMENT AND INCOME EFFECTS
BY PLACE OF RESIDENCE^a
1967-1978

	Employment		Income ^b	
	Direct Basic	TOTAL	Direct Basic	TOTAL
1967	2	3	N/A	N/A
1968	34	45	\$27	\$30
1969	108	141	1,602	1,778
1970	185	242	3,548	3,937
1971	245	321	3,021	3,352
1972	258	338	4,509	5,003
1973	252	331	4,522	5,034
1974	139	183	2,569	2,869
1975	214	282	3,453	3,869
1976	263	348	4,345	4,884
1977	258	342	3,981	4,489
1978	178	234	2,703	3,058

^aBased on a constant ratio of direct basic employment to total employment and income for the years 1967-1972; for the years 1973-1978, the ratio is adjusted at a constant annual rate to reach the 1978 ratio.

^bConstant 1972 dollars.

Source: Social Impact Research, Inc., 1980.

In 1972, about 90 Study Area residents who had lived in the area prior to the project were employed in jobs at the project itself. Another 168 persons had moved into the Study Area for employment in such jobs. In addition, approximately 80 Study Area residents obtained work in the indirect and nonbasic jobs created by the project in the Study Area.

Figure 4-3 shows that, although the project-related jobs were a substantial proportion of the total number of jobs in the Study Area economy in 1972, they accounted for less than 6 percent of the jobs held by Study Area residents. The relatively dense settlement pattern, the scattered industrial locations, and the high rate of intercommunity, work-residence commuting diffused the effects on unemployment/underemployment/employment opportunities for any particular location. In general, interviews with representatives of the major employers and with a number of Study Area residents indicated that, because of commutation patterns, the construction of the TMI plant was considered beneficial, but not critical, to the employment opportunities for Study Area residents.

Because the project employed such a small proportion of the Study Area residents, the income generated in the Study Area did not substantially affect the median family or per capita personal income of Study Area residents. This is not to say, of course, that the employment and income from project-related jobs were not significant for the standard-of-living of individuals and families affected. Nonetheless, this employment—90 local residents at the project site during peak construction, another 80 residents in project-created jobs in other sectors, and an additional 168 in-migrant workers—was insufficient to affect the overall Study Area standard-of-living. This was particularly true since at least some of the 90 nonmovers at the project were employed in nonconstruction jobs that generally did not pay exceptionally high wages.

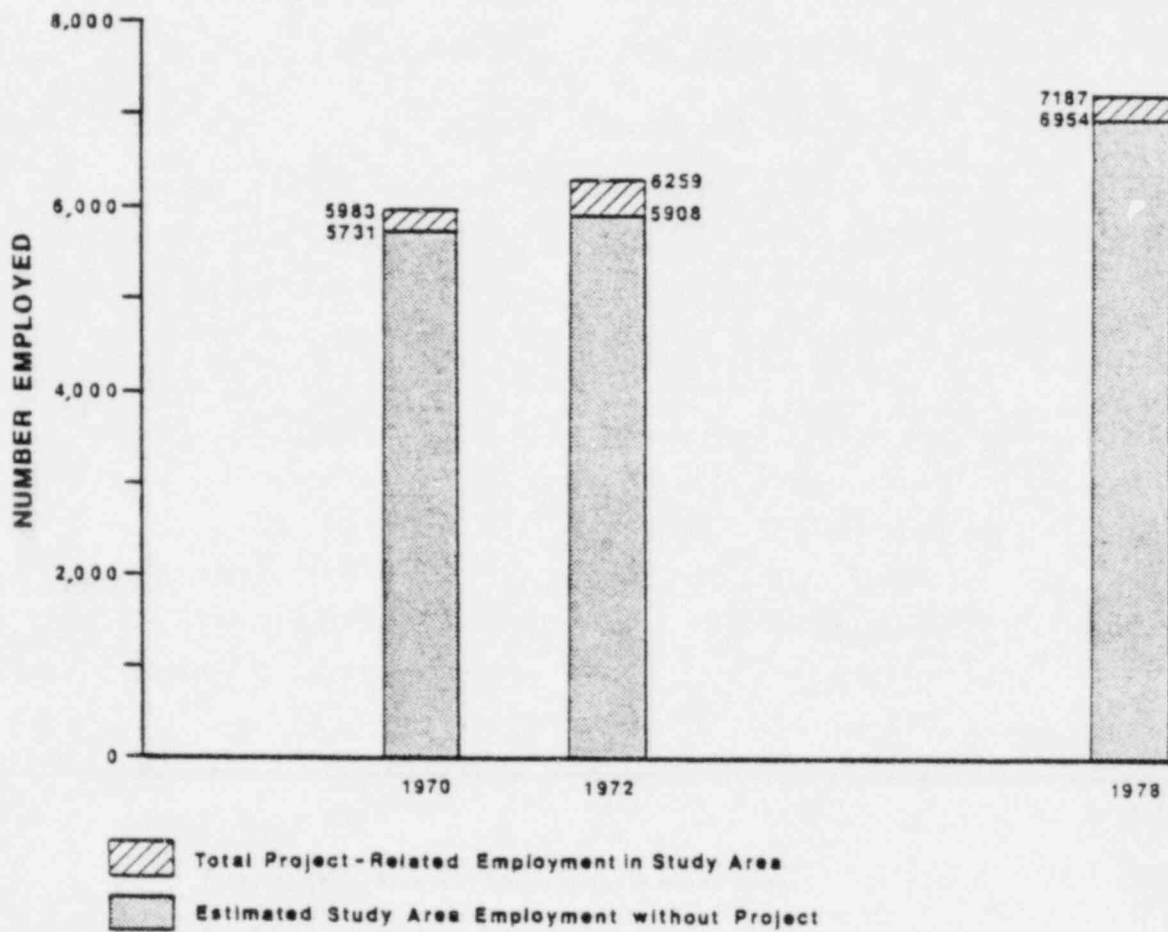
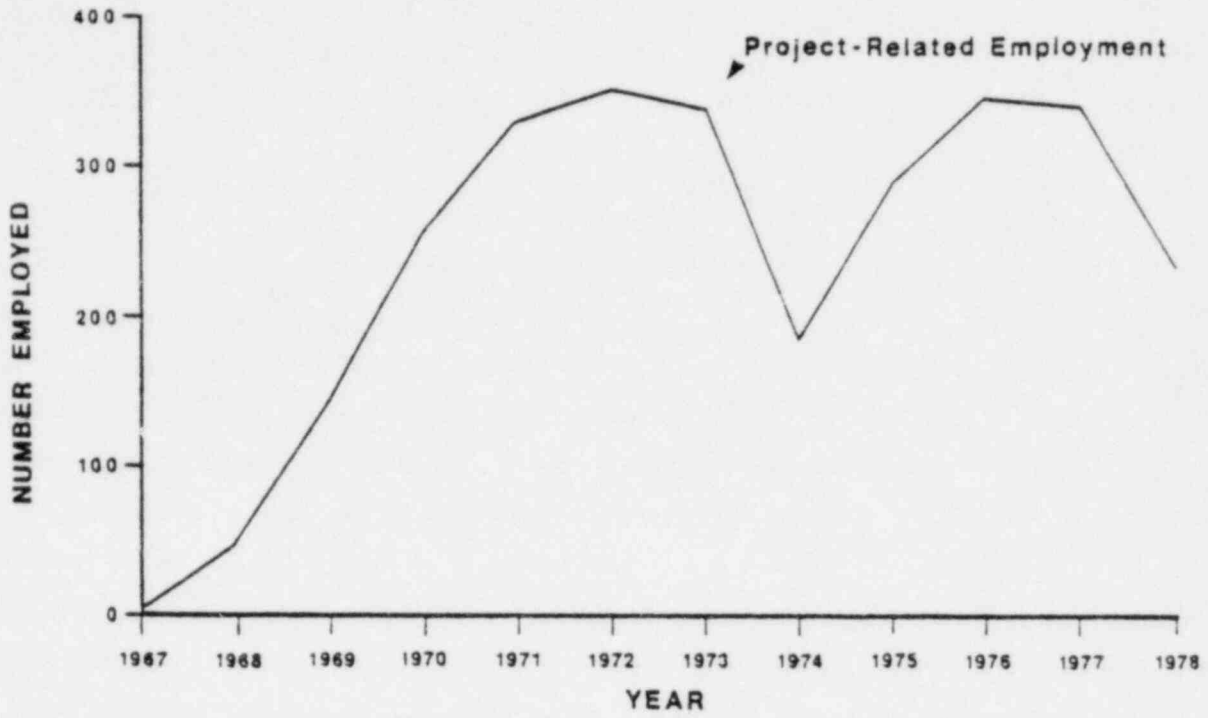


FIGURE 4-3. Project-Related Employment by Place of Residence, 1967-1978.

CHAPTER 5: POPULATION

5.1 Introduction

The purpose of Chapter 5 is to determine the population effects of the Three Mile Island project in Middletown and Royalton, and Londonderry Township, and to explain the relationship between the project and its population effects. The first step is to examine the demographic trends in the Study Area. The second step is to determine the demographic implications of the basic and nonbasic employment created by the project. Two sources of population increase are considered: increases due to the in-migration of workers and their household members for project-related employment, and increases from diminished out-migration of local residents and their household members due to project-related employment. These estimates are formulated in an annual series, which are then stated as a percentage of the Study Area population to measure the population impacts of the project. Further demographic effects will be addressed in Chapter 8, where the impacts on groups in the Study Area will be considered.

5.2 Demographic Trends

After an initial population decline about the turn of the century, the overall trend in population size in the Study Area has generally been upward. The historical data are shown in Table 5-1 and Figure 5-1. The population of Royalton has been essentially constant at about 1,100 since 1900. Londonderry Township was also constant at about 1,200 until 1950. Since that time, the effects of suburbanization into this rural area have become increasingly apparent. The township grew especially fast (6.7 percent per year) from 1950 to 1960. The township continued to increase in population from 1960 to 1970 when the Study Area as a whole lost population. Middletown has grown somewhat less rapidly since 1940 (annual growth rate of 2.3 percent), and lost population during the decade 1960-1970. The phase-out of Olmsted Air Force Base (one-quarter mile outside Middletown) occurred between 1946 and 1966, and accounts for the loss. Annual data are not available prior to 1970, but local informants indicate that the trend in population was upward by 1970, and that the population may have been as low as 7,000 in 1966 (nearly a 30 percent decrease from the 1960 level). This loss occurred just prior to the beginning of the study period of this report.

TABLE 5-1
POPULATION TRENDS IN THE STUDY AREA
1900-1980

Year	Middletown	Royalton	Londonderry	TOTAL
1890 ^a	5,080	Part of Londonderry	2,381	7,461
1900 ^b	5,608	1,106	1,385	8,099
1910 ^b	5,374	1,033	1,124	7,531
1920 ^b	5,920	1,156	1,197	8,273
1930 ^c	6,085	1,117	1,175	8,377
1940 ^c	7,046	1,201	1,307	9,554
1950 ^d	9,184	1,175	1,595	11,954
1960 ^d	11,182	1,128	3,053	15,363
1970 ^e	9,080	1,040	3,453	13,573
1973 ^e	9,709	1,104	3,750	14,563
1977 ^f	10,703	1,041	4,364	16,108
1980 ^g	10,970	1,050	4,780	16,800

^aPopulation, Vol 1. Thirteenth Census of U.S., taken in 1910. 1913.

^bPopulation, Vol 1, p. 592. Fourteenth Census of the U.S., taken in 1920. 1921.

^cPopulation, Vol 1, p. 917. Sixteenth Census of U.S., taken in 1940. 1942.

^dCensus of Population 1960, pp. 40-25, Table 7. U.S. Department of Commerce, the Eighteenth Decennial Census of the U.S. 1961.

^eU.S. Department of Commerce, Bureau of the Census, Current Population Reports, Series p-25 #686, "1973 Population Estimates and 1972 Per Capita Income Estimates for Counties, Incorporated Places, and Selected Minor Civil Divisions in Pennsylvania," issued in May 1977.

^fU.S. Department of Commerce, Bureau of the Census, Current Population Reports, Series p-25 #777, "1976 Population Estimates and 1975 and Revised 1974 Per Capita Income Estimates for Counties, Incorporated Places, and Selected Minor Civil Divisions in Pennsylvania," issued in January 1979.

^gPersonal communication, Anna Breinich, 27 July 1980. Tri-County Regional Planning Commission estimates.

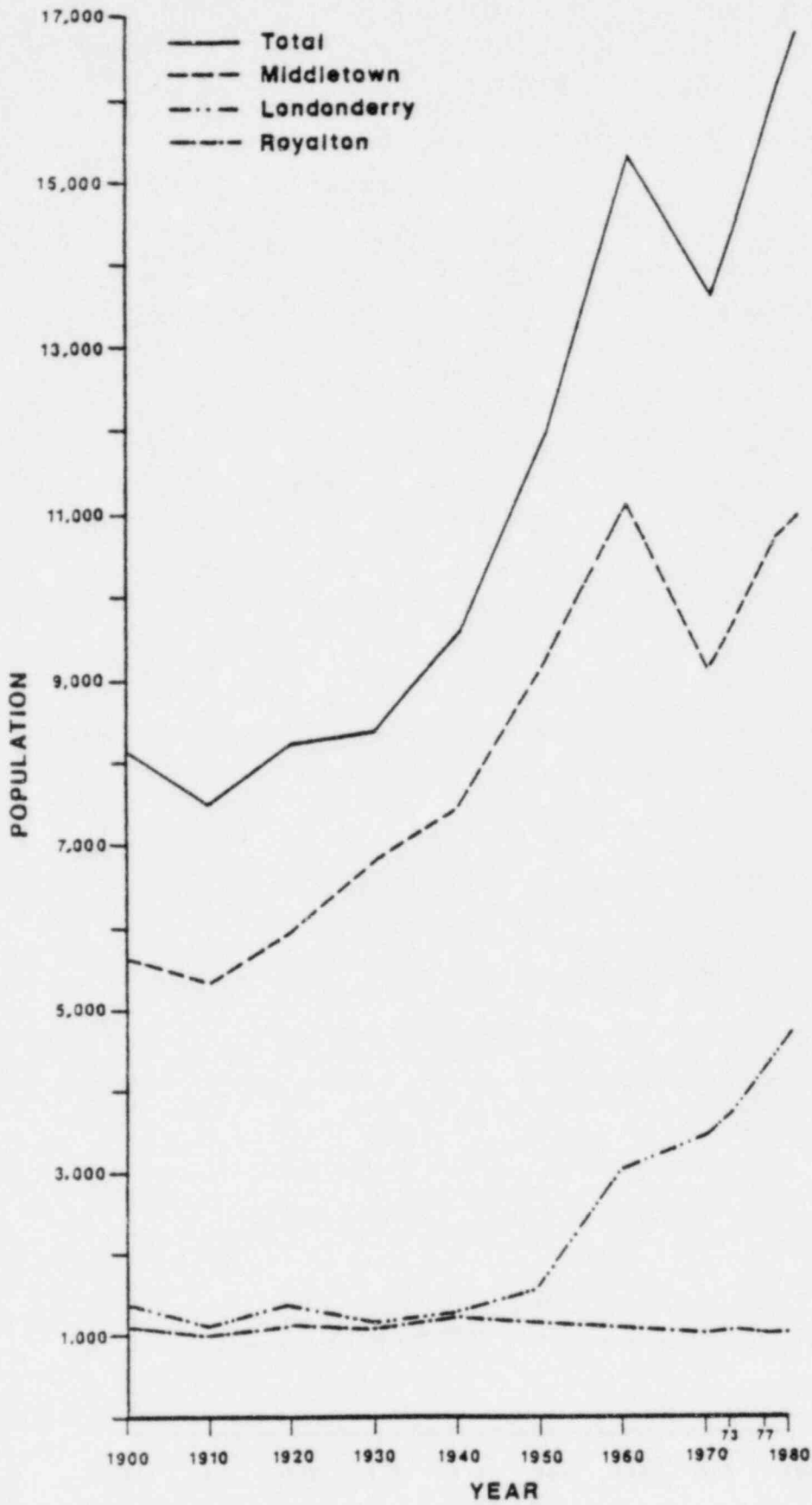


FIGURE 5-1. Population of Middletown, Royalton, and Londonderry, 1900 - 1980.

As would be expected from the differential growth patterns, the compositions of the subareas within the Study Area were somewhat different. The historical boundaries for the three voting wards in Middletown, as shown in Figure 5-2, are coincident with census tracts. Royalton and Londonderry Township share a census tract with Conewago Township; the latter has been subtracted from the Study Area calculations on a simple proportional basis. Thus, demographic patterns can be disaggregated within the Study Area for 1960 and 1970.¹

Middletown's first ward, south of the railroad tracks, had an increasing concentration of elderly residents. In 1960, the percentage of elderly residents was 12.7, and in 1970 it was 15.3; there was a somewhat greater percentage of elderly females than elderly males. In 1960, the first ward's percentage of elderly was lower than the Dauphin County rate of 15.0 percent, but in 1970 it was higher than the county's rate of 13.7 percent.

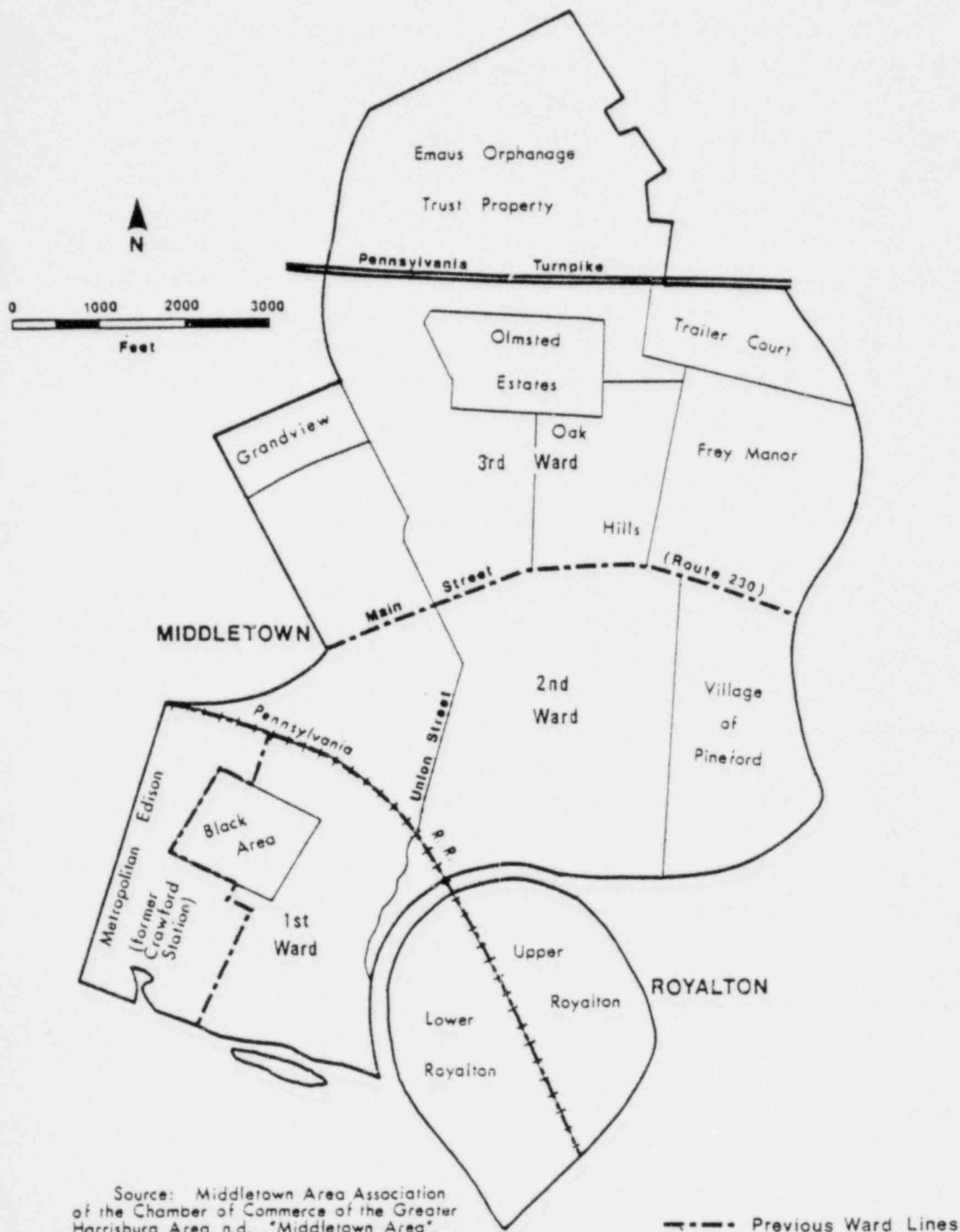
In 1960, the household size in Middletown's first ward was considerably larger than the Dauphin County average (3.42 versus 3.13), but by 1970 was closer in size (3.03 versus 2.91). Both the ward and the county changes reflected the national trend towards smaller average household sizes during this period. In both 1960 and 1970, the first ward migration rates were similar to the county as a whole, although the in-migrants were less likely to come from outside the SMSA in both periods (5.5 percent in 1960 and 3.1 percent in 1970, versus 10 percent for the county in both periods). Most of the in-migrants to this ward came from nearby areas.

The black population in Middletown has always resided almost exclusively in the first ward. Blacks comprised about 16 percent of the 1960 first ward population of Middletown. In 1970, the size of the black population had decreased but, due to the overall population decline, the percentage of black residents was unchanged.

The second ward, located between the railroad tracks and Main Street (PA-230), consists of two distinct areas. The eastern portion formerly contained Pineford Acres, a housing development for Olmsted Air Force Base personnel. This housing was razed after

¹Sources for these data are the fifth count Census Tract data for 1960 and 1970.

FIGURE 5-2. SUBAREAS IN MIDDLETOWN AND ROYALTON



Source: Middletown Area Association of the Chamber of Commerce of the Greater Harrisburg Area, n.d., "Middletown Area".

--- Previous Ward Lines

Olmsted closed, which resulted in a 42.5 percent population decline (from 4,694 to 2,701) between 1960 and 1970 for the second ward.

Approximately 1,500 military personnel men and their family members had lived in Pineford Acres in 1960. This loss, along with the general out-migration associated with the closing of the base, resulted in a drastic increase in the proportion of the population who were elderly. In 1960, the second ward had relatively fewer elderly than did Dauphin County as a whole (12.8 percent versus 15.0 percent), while in 1970 there were relatively more (22.7 percent versus 13.7 percent), although the absolute number of elderly had decreased. Other indicators of an out-migration of families with children are: (1) the number of children in school decreased 36 percent in the second ward although it increased 9 percent in the total Study Area, and (2) the average household size in the second ward declined more than twice as rapidly as did the household size in the county (0.5 persons per household for the ward compared to 0.22 persons for the county).

The third ward, north of Main Street, has more modern suburban-type housing than does the other two wards. This area gained 11 percent in population between 1960 and 1970 (from 3,882 to 4,307). The proportion of elderly increased, but was still well below the county average. The average household size in the ward dropped somewhat faster than the county average, but was similar to the Study Area as a whole.

Finally, Royalton and Londonderry Township comprise the fourth census tract. Although Royalton's population was stable between 1960 and 1970, Londonderry grew very rapidly. This reflects the increasing suburbanization of the township, which is also evident from a 39 percent increase in the school age population. Royalton has a substantial number of elderly, but the tract's proportion of elderly remained constant at 11 percent, below the county average for both years. Along with the third ward, Londonderry is more likely than other portions of the Study Area to attract in-migrants from outside the SMSA.

5.3 Changes in the Population during the Study Period

The study period runs from 1967, the year the project began, through 1978. Annual population estimates or data on the demographic characteristics of the Study Area prior to 1970 are unavailable. Consequently, much of the focus in this section is on description of the population in the Study Area in 1970, with discussion of the direction

and magnitude of change that is thought to have occurred during the rest of the study period.

As was indicated previously (see Table 5-1), the population in the Study Area declined between 1960 and 1970. However, the population of the Study Area grew rapidly throughout the study period, from 1967 through 1978, and may have nearly doubled during this period. This growth was especially evident in both the third ward of Middletown and in Londonderry Township.

Very few data are available on specific demographic characteristics of the Study Area after 1970. The major demographic trends noted by Study Area residents were the increasing suburbanization of Londonderry Township and resulting in-migration of commuters, and a continuing recovery from the effects of the closure of Olmsted Air Force Base. Middletown's population had all but regained its 1960 level by 1980. The recovery is especially noteworthy considering that, as a result of Hurricane Agnes (1972), 20 percent (139 houses) of Middletown's first ward housing stock was razed after it was acquired by the Dauphin County Redevelopment Authority.

5.4 Population Effects due to the Project

5.4.1 Overview

Population effects directly attributable to the construction and operation of Three Mile Island have been considered in two categories:¹ population change due to in-migration, and population change due to diminished out-migration. For both categories, employment due to the project was the force behind the population change.

In Chapter 4, the number of plant-related workers in Middletown, Royalton, and Londonderry Township was determined for both basic and nonbasic employment. The number of workers who moved into the Study Area and the number of workers who were already residents of the Study Area were determined for this plant-related employment. The following sections present estimates of the two categories of population effects due to the construction and operation of the Three Mile Island plant.

¹Although it is possible that a project could cause out-migration or prevent in-migration, or both, neither case appears to apply for Three Mile Island, and therefore neither one is pursued.

5.4.2 Population Effects in 1972

Population Change due to In-migration

The principal long-term demographic effects attributable to Three Mile Island Units 2 and 3 are those resulting from workers and accompanying household members immigrating to the Study Area because of project-related employment. In 1972, the project created an estimated 338 jobs for Study Area residents, of which 259 were basic and 79 were nonbasic. As was shown previously (see Table 4-4), 168 of the basic jobs went to movers; 22 went to movers with family present, and 146 went to movers who were single or with family absent. Of the 79 nonbasic jobs, it is estimated that 53 of the nonbasic jobs were filled by nonmovers or by family members of other project-related workers, and 26 were filled by other in-migrants (since only about two-thirds of the persons residing in the Study Area in 1970 were there in 1965).

The demographic effects associated with the basic workers (both construction workers and operations personnel) at Three Mile Island were estimated by multiplying the number of movers with family present by the average family size of 3.25. The family size estimate was taken from the recent Battelle study on construction workers, which found that, among movers, over 70 percent of those surveyed had family sizes between 3.2 and 3.3 (Malhotra, 1979:211). Nonbasic workers' population effects were estimated using the Pennsylvania state average household size of 3.53. Table 5-2 shows the employment components and the resulting population changes. The population increase due to in-migration is estimated to have been 310 persons in 1972.

Population Change due to Diminished Out-Migration.

Population increases from the construction of the Three Mile Island station may also have resulted from diminished out-migration. When workers who would normally leave an area to obtain employment stay because they find work at local jobs, the population is increased over what it would have been without those jobs. The maximum population effect from reduced out-migration occurs if all locally hired residents are mobile, perceive other job opportunities, and will out-migrate without replacement if not employed at the plant. The minimum population effect occurs if the best alternative for these locally hired residents is to remain in the Study Area, either at their current jobs or unemployed, in which case there will be no population increase from diminished out-migration.

TABLE 5-2

EMPLOYMENT AND POPULATION INCREASE
DUE TO IN-MIGRATION TO THE STUDY AREA
1972

Employment	Population		TOTAL
	Workers	Additional Household Members ^a	
Operations Movers with Family	8	18	26
Construction Movers with Family	14	32	46
Construction Movers without Family/Single	146	0	146
Nonbasic Movers	26	66	92
TOTAL	194	116	310

^aBasic movers are assumed to have households of average size, 3.25 (Malhotra); nonbasic movers are assumed to have households of average size, 3.53 (Pennsylvania state average). Note: Middletown's persons per household in 1970 was 2.96.

A realistic position between these extremes can be obtained by examining the out-migration trends in the Study Area. During the study period, the Study Area's population increased rapidly. There is no evidence of out-migration by any age group. There are indicators that the black population diminished after Hurricane Agnes, but this was due to a loss of housing stock rather than a loss of job opportunities. The employment created by the project, particularly that available to local residents of the Study Area, was only a small fraction of the total employment opportunities in the labor market area. Although some of the 91 basic and 53 nonbasic nonmovers who were employed in project-related jobs might have out-migrated had those jobs not been available, examination of the available data and interviews with area residents and employers indicates that this number probably would have been very small. The lack of population response to the employment slowdown in 1973 supports this analysis. Consequently, for the purposes of estimating total population effects, no diminished out-migration is attributed to the project.

Total Population Effects in 1972.

The population effect of the project in 1972 is the sum of the increase due to in-migration and the increase due to diminished out-migration. Since no diminished

out-migration has been attributed to the project (see Table 5-2 for the 1972 total estimated population effects). There was an increase of 310 persons—194 workers and 116 additional household members in the Study Area. This represents about 2 percent of the total Study Area population. Local residents were aware, of course, that households associated with the construction of TMI resided in the Study Area. However, since they constituted such a small portion of the total population, it is not surprising that the population effects were viewed as minimal. The households associated with the nonbasic workers were indistinguishable from other growth occurring in the Study Area, which further minimized their perceived small proportion of the total.

5.4.3 Population Effects in 1978

Population Change due to In-migration

As during the construction period, the Study Area population increased during the operations period as a result of the employment of in-migrants in basic and nonbasic jobs. In 1978, as discussed in Chapter 4, nonbasic employment in the Study Area due to operation of the plant was not large, perhaps 54 jobs. It is estimated that about two-thirds of these jobs (36) were filled by previous residents of the Study Area and one-third (18) by in-migrants. The number of operations and construction workers who in-migrated to the Study Area in 1978 to work at the nuclear facility was an estimated 53 workers.¹ Assuming the operations workers had households with characteristics similar to those of the state as a whole, and the construction workers had the same characteristics as in 1972, demographic increase attributable to plant operations is the product of the number of 1978 work force movers and the average household size. The demographic effect of these movers was 208 persons for 1978, as shown in Table 5-3.

Population Change due to Diminished Out-Migration

As in 1972, consideration of the estimated numbers of nonmovers employed in project-related jobs (163 in the Study Area) and the availability of alternative employment in the area resulted in no discernible population effects due to diminished out-migration for the Study Area in 1978.

¹No population increase was assigned as an effect of the maintenance, repair, and refueling workers since they were temporary employees.

TABLE 5-3
 POPULATION INCREASE
 DUE TO IN-MIGRATION TO THE STUDY AREA
 1978

Employment	Workers	Population	
		Additonal Household Members	TOTAL
Movers with Family Present			
Construction	3	7	10
Operations	33	84	117
Movers without Family/Single			
Construction	17	0	17
Operations	0	0	0
Nonbasic Movers	<u>18</u>	<u>46</u>	<u>64</u>
TOTAL	71	137	208

Source: Union managers, Metropolitan-Edison Company, 1980.

Total Population Effects in 1978

The total population effects of the project are, therefore, those resulting from in-migration. In 1978, the Study Area population was increased by an estimated 208 persons, representing just over 1 percent of the total population at that time.

5.4.4 Summary

The estimated annual population effects of the project, as shown in Table 5-4, were based on the calculations for population increases in 1972 and 1978. These estimates assume a constant relationship between population increase and total work force, and are weighted for the ratio of construction to operation workers on site. As seen in this table, the population effect due to the project peaked in 1977 but, in percentage terms, the largest impact occurred in 1976, when it accounted for about 2.3 percent of the estimated Study Area population. The bimodal distribution of project-related population resulted from the cutback in construction activity during 1973-1974 due to budget constraints, and the build-up in 1976 to finish Unit 2, along with the increasing number of operations workers on Unit 1.

Based on this analysis, it appears that the population effects of the project on the Study Area were barely discernible, considering the magnitude of the project and the size

TABLE 5-4

POPULATION INCREASE
DUE TO IN-MIGRATION OF PROJECT-RELATED WORKERS AND
HOUSEHOLD MEMBERS
1967-1978

Year	Work Force ^a		Total ^b Study Area Demographic Effect	Study Area ^c Population (Estimated)	Percent of Study Area
	Construction	Operations			
1967	30	1	3	NA	NA
1968	375	14	42	NA	NA
1969	1,108	64	129	NA	NA
1970	1,991	86	223	13,573	1.64
1971	2,591	125	295	13,895	2.12
1972	2,746	126	310	14,225	2.18
1973	2,387	207	302	14,563	2.10
1974	1,331	308	233	14,935	1.56
1975	1,453	342	256	15,316	1.67
1976	1,804	432	313	15,707	1.99
1977	1,487	484	306	16,108	1.90
1978	330	528	208	16,335	1.27

^a Assumes the refueling and repair personnel can be aggregated with the construction workers. Corresponds to Tables 2-1 and 2-2.

^b Estimated from Table 5-2 and 5-3:
1972: $2746x + 126y = 310$ $x = .0975255$ These constants were then applied to the annual
1978: $330x + 528y = 211$ $y = .3329859$ construction and operations work force to
estimate the total demographic effect.

^c Based on constant annual rate between known points: NA up to 1970 due to base closing; 2.37 percent per year to 1973; 2.55 percent per year to 1977; 1.41 percent for 1978 (the annual rate of increase between 1977 and 1980).

NA: Not available.

Source: Social Impact Research, Inc., 1980.

and duration of the construction period. It is obvious that population effects of the project did not dominate population changes in the area. The population effects were moderated by the availability of labor within commuting distance and the density of settlement in the region, both of which served to dissipate population effects.

CHAPTER 6: SETTLEMENT PATTERNS AND HOUSING

6.1 Introduction

The purpose of Chapter 6 is to identify the effects of the Three Mile Island nuclear plant on settlement patterns and housing in the Study Area. In this chapter, the historical trends are examined with particular attention to the changes that took place during the study period, 1967-1979. Based on an analysis of the preceding chapters, estimates are made of the plant's effects on new construction, upgrading of existing housing, and conversion of seasonal housing. The effects on cost and availability of housing units are discussed, based on key informant interviews and on information describing the numbers and specific locations of project-related persons. The chapter concludes with a summary of the effects of the Three Mile Island project on settlement patterns and housing in Middletown, Royalton, and Londonderry Township.

6.2 Settlement Patterns

6.2.1 Factors Influencing the Settlement Patterns of the Study Area

The settlement patterns of the Study Area were influenced to a large extent by natural features, transportation routes, and proximity to major employers outside the Study Area.

The Study Area lies in the piedmont region of Pennsylvania, approximately twenty miles south and forty miles east of the first ridge of the Appalachian Mountains. The land is rolling and typical of the piedmont area. Small hills rising to 400 and 500 feet above sea level are common. One hill, Round Top, rises to a height of 800 feet. Some of the slopes are too steep for profitable farming and are now woodlands or abandoned fields. The existing roads through the slopes are narrow in many places, with hazardous curves and inclines. (MASD Long Range Plan, 1969.) However, a major portion of the land slopes gently enough to be excellent for agriculture. The land is comparatively rich and the water supply is abundant.

Although Swatara Creek divides Middletown from the remainder of the Study Area, it has not presented a significant natural barrier to transportation or development. There has always been a crossing at Pine Ford, where the current Village of Pineford is located. In addition, a bridge called "Fisher's Bridge," has existed for many years and has retained the name of its founder, George Fisher, even though the bridge has washed away many times and been rebuilt at a variety of crossings.

The Susquehanna River, which presents a more formidable natural barrier, is about a mile and a half wide at the mouth of Swatara Creek. Historically, a ferry service joined Goldsboro on the western shore to Middletown and Royalton on the eastern shore, but in recent years contact between residents on the two shores has been much more limited.

Historically, Middletown's economic development was heavily influenced by its location on major transportation routes between Philadelphia and Pittsburgh. It became the market center for the surrounding area with a resulting urban settlement pattern. All of the first ward, most of the second ward, and a portion of the third ward near Union Street, were built up by 1890.¹ Manufacturing activities developed near the railroad, while commercial activities centered around Union, Main, Wilson, and Emaus streets.

After WW II, the undeveloped (eastern) portion of the second ward was acquired by the federal government which then built a housing area for married enlisted military personnel. The 700 housing units were meant to be temporary and were not well constructed. During the 1950s and 1960s, suburban-type housing appeared throughout the third ward, excepting the northern-most section, which was held by the Emaus Orphanage Trust. The Emaus trustees still own the majority of the land in the third ward and some land in the second ward; homeowners on "ground rent" land pay nominal annual fees (about \$15) to the trustees for the land, but are exempt from the 1 percent real estate transfer tax when their homes are sold.

Londonderry Township remained almost exclusively rural and agricultural until the beginning of the study period. Family owned and operated dairy farms are scattered throughout the township. There are also chicken farmers, truck farmers, and farmers who grow wheat, corn, and hay. During the 1950s and 1960s, two trends tended to change the land use and promote population growth: (1) plots of farmers' land were subdivided into small residential developments (about 20 homes), and (2) more farmers began subdividing plots so their children could build homes. As noted above, these factors resulted in the population almost doubling (1,595 to 3,053) between 1950 and 1960. The increase was facilitated by improved transportation links to the Harrisburg metropolitan area.

¹Although the ward lines for voting purposes have changed in the last decade, this reference is to the former ward boundaries (i.e., the Pennsylvania Railroad tracks and Main Street) unless otherwise specified.

Royalton developed in a fashion similar to the older portions of Middletown. There was very little new construction in Royalton in the 1950s and 1960s, and the settlement patterns remained unchanged.

The three municipalities are separate political jurisdictions, and each has its own government bodies and buildings. Royalton and Londonderry each have a borough/township hall and one elementary school. Londonderry also has a golf course (acquired when Olmsted Air Force Base closed) and a fire station. Other public facilities in these two municipalities are quite limited.

Middletown has a borough hall, a police station, three fire/rescue stations, a library, three large parks, several small parks, two community buildings (one the former high school), one public junior high school, three public elementary schools, and two private schools (K through 12).

Middletown has preeminence as a locus of social interactions. The majority of clubs, churches, and associations in the Study Area are in Middletown, which has some thirty organized clubs, fourteen churches, a swim club with its associated activities, card clubs, auxiliaries that support the fire and rescue companies, a library, and so forth. Londonderry has a civic association, an athletic association, a citizen's band (CB) club, six small churches, and a diet workshop, as well as a few less formal associations. Royalton has one church and two grocery stores, one of which serves as an informal meeting place.

The majority of consumer dollars in the Study Area are spent in Middletown, which has a wide range of consumer goods and services. Recently, however, two rather large shopping malls, as well as one small one, have been built east of Harrisburg, and more local dollars now leak to those businesses outside the Study Area. Nonetheless, many Study Area residents still do much of their shopping in Middletown.

As would be expected, land uses in the Study Area are diverse. They are summarized in Table 6-1. Middletown land has had primarily residential and public uses. Most of Middletown's unused land is held by the Emaus Orphanage Trust and is located north of the Pennsylvania Turnpike. A portion of this land is farmed. Royalton is primarily residential, but has a large amount of unused land. Some of the unused land was formerly occupied by the brickyard and quarry; this land is currently being held by a development corporation. Londonderry is 85 percent agricultural and unused land.

TABLE 6-1
LAND USE IN THE STUDY AREA
1976

Land Use	Middletown		Royalton		Londonderry		TOTAL	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Residential	483.42	45	46.57	25	1,190.43	10	1,720.42	13
Commercial	70.06	7	3.05	2	57.58		130.69	1
Mining/Wholesale Manufacturing/ Construction	23.83	2			22.53		46.36	
Public/Semi-public	208.74	20	10.79	6	460.90	4	680.43	5
Agriculture	114.63	11			7,460.92	65	7,575.55	59
Unused	<u>164.96</u>	<u>15</u>	<u>129.20^a</u>	<u>68^a</u>	<u>2,363.25</u>	<u>20</u>	<u>2,657.41</u>	<u>21</u>
TOTAL ^b	1,065.64	100	189.61	100	11,555.61	100	12,810.86	100
Percent of Study Area		8.3		1.5		90.2		

^a96.9 acres (51 percent of the land) is listed in the original source as "mining, construction, wholesale." Local informants state that a brickyard and quarry which closed in the early 1960s occupied at least 40 acres, but that the land is currently unused. As there is no other land that meets this description, and there is at least twice as much unused land as used land in the borough, these acres were reallocated.

^bTotals may not add exactly due to rounding.

Sources: Land Use and Coordination Program, 1976; Social Impact Research, Inc., 1980.

Londonderry's use of public and semipublic land includes the government buildings; a reservoir for Middletown's water supply which is located on one of the higher hills; and a large state game preserve located in the township. The balance of land is residential.

6.2.2 Population Distribution

In Londonderry Township, suburbanization has continued throughout the study period. However, developments continue to be relatively small (under 40 homes), in part because most of the land does not percolate well and there is no sewer system. Housing developments have been scattered (in no particular pattern) throughout the township, and by 1978 there were some twelve of them with more than six homes.

The population of Royalton has not changed its basic distribution for half a century. There have been no new building for many years, partly because of a lack of public services. Until 1973, water availability in the first ward in Royalton depended on individual wells. A sewage system was installed in 1978; prior to that time, some residents still used outhouses. The sewage system cost about \$100,000 less than the bonds issued to pay for it—the balance was used to pave some of the streets that had never been paved and to re-pave others in need of repair. However, many streets in Royalton still do not have sidewalks, curbs, or gutters. The lack of such amenities has not been conducive to development of new residential areas within the borough.

Changes in the distribution of population in Middletown are directly related to changes in the housing stock described in Section 6.3. The ward lines were originally drawn so that each ward had approximately the same number of persons. Current differences in ward populations indicate, however, that a redistribution has occurred. In 1960, the first ward had 2,606 persons; the second ward was nearly twice as large with 4,694 residents—chiefly because of the 1,000-1,500 residents in military housing at Pineford Acres. The difference did not affect local politics, however, since most military personnel did not vote in local elections. The third ward was growing—3,882 residents—but it also housed a significant number of military personnel. Local informants perceive that the third ward was hardest hit by the closing of Olmsted, but in 1970 it had twice as many people as the first ward and almost twice as many as the second ward. This can be accounted for by the fact that, although the base housing at Pineford Acres was razed, the housing formerly occupied by military families in the third ward was refurbished by FHA and VA, and sold in the late 1960s at very favorable prices and terms. The third ward has continued to develop since 1970 and, by the end of the study period, all but the Emaus Orphanage property was fully developed.

6.3 Housing

6.3.1 Housing Prior to Construction of the Three Mile Island Station

The housing characteristics of the Study Area reflect the demographic and economic trends in the region. By 1960, the housing stock in the Study Area was quite diverse. Table 6-2 shows the composition of the stock in 1960 and 1970.

Construction of housing in the Study Area was slow during the 1940s. Much of the housing was constructed under the Lanham Act, which authorized federal assistance to provide housing for communities impacted by military expansion during WW II. Because of the housing shortage, it was common in the Study Area for newlyweds and others who would normally form new households to continue to live with their parents. After the war, housing construction increased significantly, especially in Londonderry Township. This was a period of increasing prosperity, and it was common for young couples with small children to be given or sold land on the family farm, on which they built new homes. Also, farmers sold small plots (3-5 acres) to people from Middletown who could afford to move out of town (doctors, lawyers, Air Force officers). The number of housing units in the Study Area peaked in 1960 at 4,946 units.

The closing of Olmsted Air Force Base had implications for housing in both the public and the private sector. Responsibility for the temporary base housing at Pineford Acres was assumed by the Borough of Middletown. The existing houses were razed in the late 1960s, and a contract was let to redevelop the property. At the time of the 1970 Census, the land had few housing units, which accounts for the net decrease of about 400 units. In the private sector, Olmsted Estate homes had been built with a federal subsidy, and housed mainly base employees. When the base closed, many of the rental units in this area were rehabilitated and re-sold by the Federal Housing Authority and the Veterans' Administration. Thus, the percentage of rental units in the Study Area decreased and the number of owner-occupied units continued to increase. Despite the closing of the base, both the number and the percentage of vacancies declined, partially because persons at Pineford Acres relocated to other parts of the Study Area.

The majority of the housing in the Study Area consists of single family dwellings. There are also a number of smaller apartment buildings and older houses divided into several units. One of the more interesting components of the housing stock is what is known as "doubles." Locals distinguish this type of dwelling from the more modern duplexes, although structurally there is no difference. Located in the older portions of

TABLE 6-2
HOUSING CHARACTERISTICS
1960 and 1970

Housing	1960 ^a		1970 ^b	
	Number ^d	Percent of Total Units	Number	Percent of Total Year-Round Units
Total Housing Units	4,946		4,538	
Total Year-Round Units	N/A		4,533 ^c	
Total Occupied Units	4,512	91	4,354	96
Tenure				
Owner Occupied	2,876	58	3,112	69
Renter Occupied	1,636	33	1,242	27
Vacancies				
For Sale	34	1	32	1
For Rent	170	3	65	1
Other Vacancies	231	5	82	2
Units in Structure				
1	3,849	78	3,622	79
2	350	7	454	10
3-4	469	9	332	7
5-9	237	5	0	0
10+	41	1	175	4
Year Structure Built				
1939 or Earlier	2,622	53	2,262	49
1940-1949	934	19	566	12
1950-1959	1,390	28	1,222	27
1960-1964			340	7
1965-1968			145	3
1969-1970			48	1
Percent built after 1960				12

^aDepartment of Commerce, U.S. Censuses of Population and Housing: 1960, Special Report PHC (1)-5 Harrisburg, Pennsylvania, SMSA.

^bDepartment of Commerce, U.S. Censuses of Population and Housing: 1970, Special Report PHC (1)-5 Harrisburg, Pennsylvania, SMSA.

^cCensus data conflict: a base of 4,533 is used for Tenure and Vacancies, and a base of 4,583 is used for Units in Structure and Year Structure Built.

^dTotals may not add exactly due to rounding.

N/A: Not available.

Middletown, doubles are thought of as two separate homes which share a common wall, and the residents live in "half a double." Historically, many were owned by one family, with kin occupying the two halves; thus disagreements were minimized on questions such as exterior maintenance. This practice is much less common now, and the halves are bought and sold much like any other unit.

6.3.2 Changes in the Housing Stock during the Study Period

The additions to the housing stock during the study period are shown in Table 6-3. In Middletown, nearly all the additions have been multiple-unit structures. About five new single-family dwelling permits were issued each year. Between 1970 and 1972, the largest addition was the Village of Pineford in the second ward with 743 units. These units are a combination of high rise apartments, townhouses, and garden apartments. The facilities in the development include a community building, a swimming pool, several tennis courts, and a convenience store. In the mid-1970s, Frey Village Home for the Elderly was constructed in the third ward. This private development contains fairly expensive units (about \$42,500 when it opened), primarily of the condominium type, that require a monthly maintenance fee. Several levels of care are provided. A second home for the elderly and handicapped, the Interfaith Apartments, began construction in 1978 under a HUD program. Rents are graduated according to the income of the residents.

There have been several other changes in the Middletown housing stock. A few small apartment buildings have been added to the stock and some older homes have been converted to multifamily housing. Two low-income housing projects were added to the first ward by Dauphin County Housing Authority. The first, Essex House, which provides homes for the elderly, has a mixed racial composition. The second, Genesis Court, which provides low-income housing, is virtually all black. As mentioned above, there was also a significant loss to the housing stock as a result of Hurricane Agnes. About 140 properties in the first ward (20 percent) were acquired and razed by the Dauphin County Redevelopment Authority. In some cases, the property on higher ground has been replatted into larger lots and will be resold on the condition that all new structures be flood proofed.

The housing stock in Royalton changed very little during the study period. There were very few additions, and the deletions were, for the most part, structures severely damaged by Hurricane Agnes. There was some upgrading of the housing stock in Lower Royalton through loans acquired from the Redevelopment Authority.

TABLE 6-3
BUILDING PERMITS ISSUED^a IN STUDY AREA
1970-1978

Year	Study Area			TOTAL
	Middletown	Royalton	Londonderry	
1970	318	—	20	338
1971	294	1	19	314
1972	130	1	21	172
1973	56	2	23	81
1974	8	—	23	31
1975	77	—	26	103
1976	54	—	32	86
1977	7	—	46	53
1978	<u>149</u>	<u>9</u>	<u>28</u>	<u>186</u>
TOTAL	1,113	13	238	1,364
Percent of 1970 Stock	35	4	26	30

^aExcludes repairs, remodeling, swimming pools, etc.

Sources: Housing Phase VIII, 1978, Tables 37-39; Housing Phase IX, 1979, Tables 6-8; Tri-County Regional Planning Commission.

In Londonderry Township, suburban development continued to add to the housing stock. Most of the developments are small, reflecting the lack of a sewer system and difficulty in meeting percolation tests of the health department. They are scattered all over the township and do not cluster in any pattern. A second addition to the stock was five mobile home parks, built during the early 1970s.

Together, these trends have added substantially to the housing stock in the Study Area. Overall, there appear to be about 30 percent more units than there were in 1970. The majority of the growth in Middletown was multiple-family units; the growth in Londonderry was nearly all single-family units.

6.3.3 Effects of the Three Mile Island Station on Housing in the Study Area

6.3.3.1 Introduction

The effects of the Three Mile Island plant on housing have been divided into three categories: (1) effects on the size of the housing stock due to project-related demand; (2) effects on the characteristics of the housing stock; and (3) effects on the housing market in terms of cost and availability of housing units.

6.3.3.2 Effects on the Size of Housing Stock due to Project-Related Demand

Based on the characteristics of the workers and the numbers of accompanying household members described in Chapters 4 and 5, the project-related demand for housing is estimated as shown in Table 6-4. The estimated project-related housing demand in the Study Area peaked at 146 units in 1972, and was 51 units in 1978. Figure 6-1 shows the relationship between the demand for housing units by project-related movers and the additional supply of housing in the Study Area. Workers made use of the housing at the Village of Pineford, sometimes living two and three workers to a unit. The development also appears to have met an indigenous housing demand since the vacancy rate did not increase subsequent to plant construction.

TABLE 6-4
HOUSING REQUIREMENTS OF PROJECT-RELATED POPULATION
1967-1978

Year	Number of Project-Related Housing Units Required			TOTAL
	Construction Workers without Families	Construction Workers with Families	Operations Workers with Families	
1967	2	—	—	2
1968	17	2	1	20
1969	50	6	4	60
1970	90	10	5	105
1971	117	13	8	138
1972	124	14	8	146
1973	108	12	13	133
1974	60	7	19	86
1975	66	7	21	94
1976	82	9	26	117
1977	67	8	30	105
1978	15	3	33	51

Note: Movers with families are assumed to require one housing unit each; movers without family (workers "doubling up") are assumed to require 0.85 housing units each (Malhotra, 1979). Yearly totals for construction/refueling workers include 5.317 percent who are without families in the Study Area and 0.51 percent who are with families in the Study Area. Operating workers include 6.25 percent who are with families in the Study Area.

Sources: Social Impact Research, Inc., 1980; Mountain West Research, Inc., 1980.

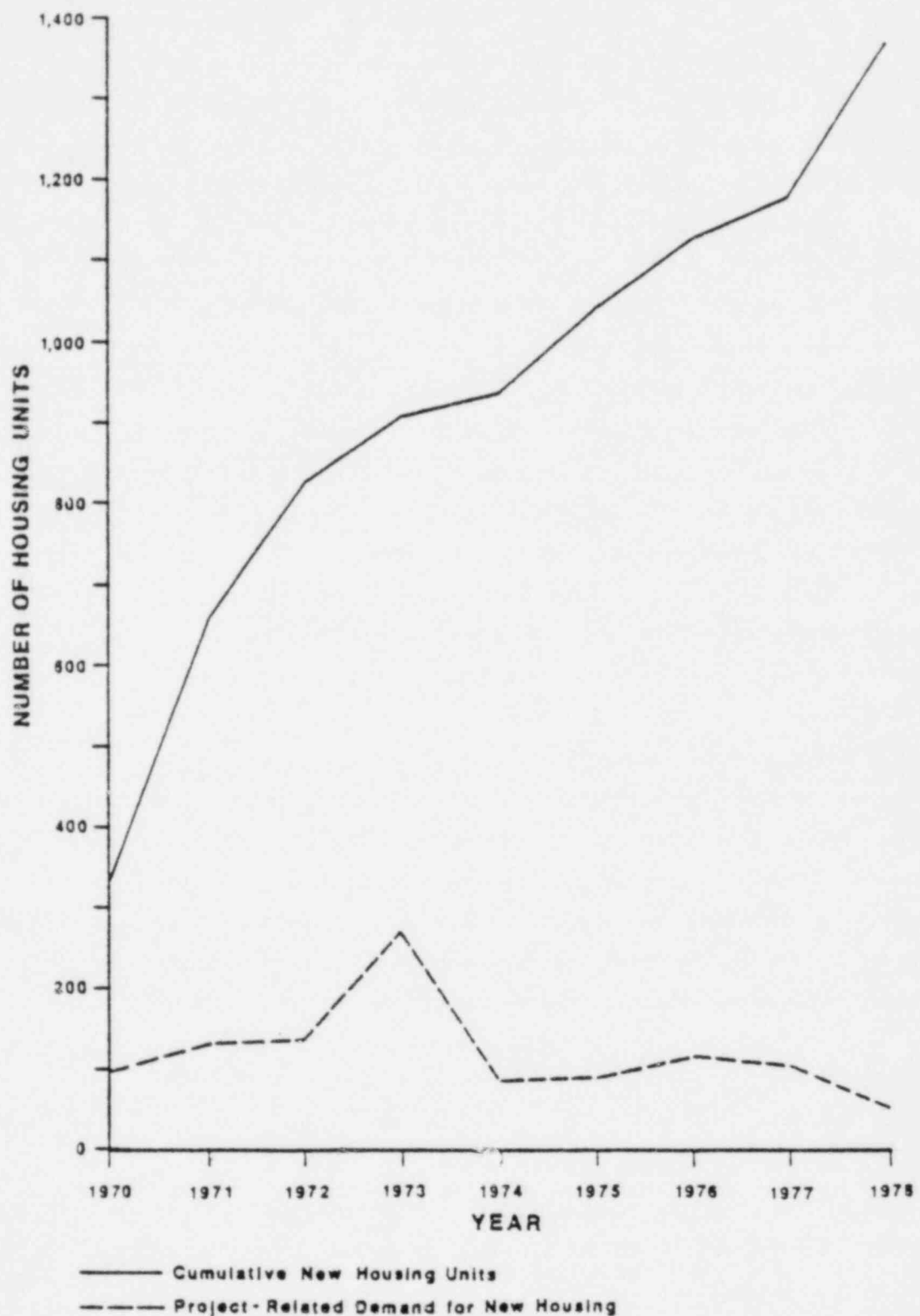


FIGURE 6-1. Project-Related Demand for Housing and Cumulative Housing Units Constructed in Study Area, 1970-1978.

There are conflicting reports as to whether the mobile home parks were originally developed in response to project-generated demand. While many local residents believe the parks are project-related, three park owners say they never had more than six TMI workers. Given the small number of project-related workers, especially in Londonderry Township, it seems unlikely that these workers alone would have supported new mobile home park developments.

6.3.3.3 Effects on the Characteristics of the Housing Stock

Families in the Study Area had a history of renting out rooms in their homes, particularly to weekly commuters with civilian jobs at Olmsted Air Force Base who came down from the depressed coal regions to the north. Local informants say that, although this rental tendency was accelerated at the time of peak construction, many units reverted to simple single-family dwellings as construction diminished. This pattern also occurred among farmers in Londonderry Township. The practice of renting out their spare rooms resulted in extra income for some local residents. There is no evidence of conversion of summer homes to accommodate workers, primarily because all such homes in the Study Area are located on Susquehanna River islands and are without road access.

6.3.3.4 Effects on the Housing Market

Because the project site was in the Study Area, the demand for housing by project-related workers was substantial, particularly during the peak construction years. Rental units, especially short-term rental units, were filled early in the project period. Nevertheless, the large pool of housing within easy commuting distance of the project site and the relatively small number of workers moving into the area for project-related work, prevented a major impact on either housing cost or availability. Competition among communities was sufficient to prevent large cost effects in the Study Area.

6.3.3.5 Summary of Housing Effects

The housing effects in the Study Area appear to have been minimal in the purchase market and to have tightened the rental market. However, alternatives to locating in the Study Area were available throughout the greater Harrisburg SMSA. This tended to prevent serious shortages or price inflation of housing in the Study Area.

CHAPTER 7: LOCAL GOVERNMENT AND PUBLIC SERVICES

7.1 Introduction

The purpose of Chapter 7 is to describe the basic structural components of the local government in the Study Area, indicate the level of services, and describe specific areas of services over the study period. The objective is to focus on changes in public services that resulted from the construction and operation of the Three Mile Island plant. The discussion is designed to highlight changes associated with significant social or political consequences rather than to provide a detailed fiscal analysis of the Study Area government.

Once the background description of the local government is outlined, a summary of the budgets for the study period will be presented. Discussions of revenues and expenditures will concentrate on the response the local area made to the increased revenues resulting from plant construction and operation. This examination will include both increased expenditures and reduced tax rates.

The discussion of public services focuses on employment and service trends in four areas—education, transportation, public safety, and social services. These services have been chosen because they are thought to be responsive to socioeconomic change in the community, they are often cited as impacted services in the literature, and they would be indicative of other public services effects experienced in the Study Area.

7.2 Government Structure

The Study Area includes three separate and distinct local jurisdictions—Middletown Borough, Royalton Borough, and Londonderry Township. Londonderry Township is one of twenty-five townships in Dauphin County, and the boroughs are among sixteen such jurisdictions in the county. A township is a subcounty area with the status of a legal municipality, originally established for administrative purposes, while boroughs are small towns within townships. In Pennsylvania, townships and municipalities designated as boroughs have a high degree of administrative autonomy in such matters as regulating taxes (by determining millage tax rates, for example), governmental structure, zoning and planning policy, and local public services. Such activities are somewhat influenced by the county, which is responsible for providing social and judicial services, certain funds, and planning expertise.

Both Middletown and Royalton had mayor-council forms of government throughout the study period. Middletown elected three councilmen from each of its three wards. Historically, the Borough Council was heavily Republican, but in recent years more Democrats have been elected. The council elects its own president, who presides at the regularly held meetings. The elected mayor also attends the council meetings, casts the deciding vote in case of a tie, and can veto any regulation or ordinance passed by the council. Other regular attendants at council meetings are the Borough Solicitor, a part-time attorney who drafts ordinances to be considered; the Borough Manager, who is appointed by the council to serve as a full-time chief executive officer of the borough; and the full-time Borough Secretary.

At the beginning of the study period, the council's work was supported by a number of boards and commissions, such as the Library, Zoning Hearing, Planning, Police Civil Service, and Historical Restoration committees, which also met regularly. During the study period, other committees were added, including the Environmental Advisory Council, Shade Tree Commission, Human Relations Committee, Code Hearing Board, and the Olmsted Regional Watershed Authority. These committees were composed of citizens appointed by the council, and had a large amount of autonomy in decision making. By the end of the study period, some forty-nine citizens were serving on one of these committees. Together with the mayor, solicitor, and councilmen, some sixty citizens were actively participating on a regular basis in administering borough affairs.

The main duties of the Borough Mayor were to serve as the ceremonial head of the borough, to preserve order, to enforce borough ordinances and regulations, and to remove nuisances. The Borough Mayor also served as the main contact point for the general public with the local government. Thus, complaints and problems were typically funneled through the mayor.

Because the mayor had responsibility for preserving order and protecting the public, he had control of the police department. However, the Borough Council had responsibility for the police budget, for the appointment of police officers, and for determination of the weekly hours of employment of the officers. Council consulted with the Police Civil Service Commission to make these decisions.

Borough employees reported to the Borough Manager. These included other administrative/clerical staff, the electric, water, garbage, and sewer staffs, parks and library personnel, and the roads and maintenance crews. During the study period, the

total number of borough employees in Middletown increased from about seventy to about eighty-five (21 percent increase) with about eight extra high school students hired during the summer. The largest increases were in the administrative staff and the water department.

The borough government structure in Royalton is similar to that in Middletown, except that it is much smaller because its population is only about one-tenth as large. The Borough Council is composed of eight members, four from each of the two voting wards. Historically, some members of council served for repeated terms, up to 30 years. During the study period, the council was composed of younger men, including some who were newcomers to Royalton. There was a much greater turnover during the study period than there was previously, and there was frequently a vacancy on the council. It became more difficult to get enough people willing to serve on the council once the core of perpetual incumbents was eliminated. Royalton also has an elected mayor who serves for a nominal fee (\$15/month plus \$10 expenses), and whose duties are similar to Middletown's mayor, though more limited in scope.

The number of borough employees in Royalton nearly doubled during the study period, from six to eleven. Major increases were in administration and in public safety. As in Middletown, the council's work is supported by seven committees; but in the case of Royalton, the committees are composed of members of the Borough Council. The committees in Royalton are closely tied to the provision of basic services—highways, police, fire, electric, parks and buildings, budget and finance, and ordinance and sanitation. The provision of public services is closely coordinated with Middletown. For instance, emergency management is handled through the Middletown Communications Center, there is no fire house within Royalton's boundaries (Royalton uses the Middletown Fire Department), and Royalton buys water and sewer services from Middletown.

Londonderry Township was governed by a three-member Board of Supervisors throughout the study period. The supervisors were elected at large and served in both executive and legislative capacities. As with the boroughs' governing bodies, the supervisors regularly held monthly meetings as well as special meetings when necessary.

The township is still relatively rural, and as a consequence, fewer services were provided by the governing body than in the boroughs. Water was provided by wells, and sewerage by individual septic tanks. Poor soil characteristics limited the possible

population density prior to the study period. Volunteer fire companies in Middletown provided fire protection on a fee basis, and the Pennsylvania State Police provided for other public safety needs. When Olmsted Air Force base closed, the township acquired the base golf course and adjacent private lands which it developed into multipurpose recreational facilities. In addition, the township maintained a second recreational area with a little league field, picnic area, tennis courts, and park area.

During the study period, there was increased interest in planning and zoning. A planning commission was formed and a Comprehensive Plan was adopted in 1976. In the period 1972-1975, ordinances were passed regulating subdivisions and land development, mobile home parks, building codes, sewage disposal, and junkyards. Although the township had grown rapidly for some time previously, the need for such regulations was perceived during the study period.

7.3 Budgets for Major Government Jurisdictions during the Study Period

The budgets of three taxing districts—Middletown, Royalton, and Londonderry Township—reveal much about the resource base and governmental priorities in these areas. Revenues to the general fund of each jurisdiction are analyzed to identify major shifts in resource availability—either in magnitude or in source—with special attention to the implications of the presence of the Three Mile Island plant. Expenditures are then examined for the three municipal jurisdictions to identify major shifts in the magnitude or proportion of funds allocated to various categories of public services.

7.3.1 Revenues

The annual total revenues received by each of the jurisdictions increased substantially over the study period. Property taxes constituted an important source of locally generated revenues for all jurisdictional units throughout the study period. Revenues were also received from nonbusiness licenses, permits and fees, from state sales and income tax diversions, and from other miscellaneous sources. As shown in Table 7-1, revenues other than taxes provided important sources of income over the study period.

7.3.1.1 Middletown Borough

With the exception of 1975, between 1967 and 1976 Middletown's annual revenues (in constant 1972 dollars) steadily increased—from \$1.152 million to \$1.884 million—at an average annual rate of 5.6 percent. This was a much more rapid rate of growth than the

TABLE 7-1

MIDDLETOWN BOROUGH—REVENUE RECEIPTS^a

Year	Real Estate Tax	Act 511 Taxes ^b	Total Taxes	Miscellaneous Revenues ^c	TOTAL REVENUES (Current Dollars)	TOTAL REVENUES (Constant 1972 Dollars)
1967	\$54,996	\$ 4,800	\$59,796	\$ 877,141	\$ 936,937	\$1,152,444
1968	59,180	5,895	65,075	980,682	1,045,757	1,236,119
1969	62,205	8,145	70,350	1,025,875	1,096,225	1,238,672
1970	60,071	47,314	107,385	1,142,526	1,249,911	1,351,255
1971	63,340	61,494	124,834	1,305,028	1,429,862	1,480,188
1972	68,835	62,024	130,859	1,546,301	1,677,160	1,677,160
1973	72,301	115,929	188,230	1,738,982	1,927,212	1,826,741
1974	80,404	114,673	195,077	1,937,929	2,133,006	1,824,641
1975	75,630	103,019	178,649	2,082,218	2,260,867	1,787,297
1976	79,346	140,334	219,680	2,290,327	2,510,007	1,884,390

^aNot included in these figures are the State Liquid Fuels revenues and the nonrevenue receipts such as loans and transfers from local funds.

^bThe "Act 511" taxes include the following taxes: per capita, earned income, real property transfer, mercantile, amusement, and occupational privilege.

^cMiscellaneous revenues include the following sources of revenues: licenses and permits, fines, state and federal grants, state highway aid, county grants, waste and refuse disposal, highway services, sanitary sewer rents and charges, and income from public service enterprises.

Source: Commonwealth of Pennsylvania, Local Government Financial Statistics, 1967-1976.

rate of population growth over a similar period, which is estimated at around 2 percent per year.

Over the study period, revenues from most sources showed steady gains. One exception was that the assessed valuation dropped due to a reassessment in 1975 (the millage rate was constant at 7.0 mills during the whole study period). Also, there were noticeable increases in the Act 511 revenues between 1969 and 1970 and 1972 and 1973, both attributable to changes in per capita (head) taxes.

The most significant "Miscellaneous Revenue" for Middletown is the amount generated by the resale of electricity. Middletown has a fixed price contract that allows it to buy power from Metropolitan-Edison at the rate of 1 cent/kwh in perpetuity. At various time in the past, this rate has been higher than that charged to other wholesale customers. At this time, it is significantly less than average. For instance, in 1977 the average cost/kwh to all GPU customers was 4.14 cents. By buying at the much reduced rate and re-selling the electricity at rates that are still favorable to residents, Middletown is able to generate approximately 60 percent of its revenues from this source alone. To date, court challenges of the contract by Metropolitan Edison have been unsuccessful.

7.3.1.2 Royaltown Borough

In Royaltown, as shown in Table 7-2, total revenues nearly doubled (in 1972 constant dollars) between 1967 and 1976. Prior to 1971, the town revenues came almost exclusively from public service enterprises (85 percent of the total revenue in 1967; 80 percent in 1970). Beginning in 1971 with the "Act 511" tax and followed by a property tax of 30 mills (the legal limit in Pennsylvania) in 1972, the revenue base in Royaltown began to diversify. Still, in 1976 public service enterprises comprised 66 percent of the total revenues. The main such source of funds is the re-sale of electricity purchased from Metropolitan-Edison. Although Royaltown has no special contract with Metropolitan-Edison, and therefore, purchases at the normal wholesale price per kwh, a substantial amount of revenue is generated in this fashion. For instance, a major portion of the increased revenues between 1975 and 1976 was due to a \$30 thousand increase in revenues from public service enterprises.

The overall growth in revenue during the study period was significant, but erratic. The average annual rate of increase (in constant 1972 dollars) was 5.6 percent. However, there was a significant decrease in revenues for 1970, prior to the institution of the new taxes, and decreases each year from 1973 to 1975.

TABLE 7-2
ROYALTON BOROUGH--REVENUE RECEIPTS^a
 1967-1976

Year	Real Estate Tax	Act 511 Taxes ^b	Total Taxes	Miscellaneous Revenues ^c	TOTAL REVENUES (Current dollars)	TOTAL REVENUES (Constant 1972 Dollars)
1967	—	—	—	\$51,798	\$51,798	\$63,712
1968	—	—	—	59,303	59,303	70,098
1969	—	—	—	70,264	70,264	79,394
1970	—	—	—	65,475	65,475	70,784
1971	—	\$ 7,568	\$7,568	64,957	72,525	75,078
1972	\$12,494	7,496	19,990	79,657	99,647	99,647
1973	13,594	7,258	20,852	83,304	104,156	98,726
1974	14,495	6,814	21,309	93,445	114,754	98,164
1975	16,717	9,827	26,544	82,975	109,519	86,576
1976	14,275	17,146	31,421	106,691	138,112	103,688

^aNot included in these figures are the State Liquid Fuels revenues and the nonrevenue receipts such as loans and transfers from local funds.

^bThe "Act 511" taxes include the following taxes: per capita, earned income, real property transfer, mercantile, amusement, and occupational privilege.

^cMiscellaneous revenues include the following sources of revenues: licenses and permits, fines, state and federal grants, state highway aid, county grants, waste and refuse disposal, highway services, sanitary sewer rents and charges, and income from public service enterprises.

Source: Commonwealth of Pennsylvania, Local Government Financial Statistics, 1967-1976.

7.3.1.3 Londonderry Township

Table 7-3 shows that revenues in Londonderry Township increased nearly five-fold during the study period. This is remarkable, given revenue decreases in 1974 and 1975 (in constant 1972 dollars), and given the elimination of the residential property tax in 1970. The increases came from three sources. The first was the Earned Income Tax (authorized under Act 511), which was collected by place of residence. These taxes increased substantially during peak construction, even though the number of workers residing in Londonderry Township was small. This is because workers residing in states other than Pennsylvania paid the entire 1 percent tax to Londonderry Township. For residents of Pennsylvania, the tax is split between the municipality and the school

TABLE 7-3

LONDONDERRY TOWNSHIP-REVENUE RECEIPTS^a
1967-1978

Year	<u>Act 511</u> ^b				Total Taxe ^a	Miscellaneous Revenues ^c	Total Revenues	Constant 1972 Dollars
	Real Estate Tax	Earned Income (Place of Residence)	Occupational Privilege Tax (Place of Work)	Total Act 511				
1967	8,053	8,537	N/A	9,387	17,440	27,972	45,412	55,857
1968	7,837	28,659	N/A	28,668	36,505	59,331	95,836	113,281
1969	8,047	52,405	N/A	52,418	60,465	67,343	127,808	144,416
1970	589	62,731	37,170	99,901	100,490	80,692	181,182	195,872
1971	225	97,135	43,829	140,964	141,189	106,938	248,127	256,860
1972	7	157,427	58,527	215,954	215,961	146,868	362,829	362,829
1973	8	135,629	43,285	178,914	178,922	223,687	402,609	381,620
1974	—	108,853	34,941	143,794	143,794	293,878	437,672	374,399
1975	—	96,581	23,540	120,121	120,121	218,460	338,581	267,653
1976	—	90,351	27,961	118,312	118,312	254,062	372,374	279,560
1977 ^d	—	140,854	28,605	169,459	169,459	282,016	451,475	320,878
1978 ^d	—	130,735	17,055	147,790	147,790	285,105	432,895	288,021

^aNot included in these figures are the State Liquid Fuels revenues and the nonrevenue receipts such as loans and transfers from local funds.

^bThe "Act 511" taxes include the following taxes: per capita, earned income, real property transfer, mercantile, amusement, and occupational privilege.

^cMiscellaneous revenues include the following sources of revenues: licenses and permits, fines, state and federal grants, state highway aid, county grants, waste and refuse disposal, highway services, and sanitary sewer rents and charges.

^dPreliminary.

Source: Commonwealth of Pennsylvania, Local Government Financial Statistics, 1967-1976; Mrs. Ackard, personal communication, 1980.

district in which the employee resides. Judging from the taxes collected in 1976, when there were still 1,804 construction workers on site, we can infer that the project-related earned income taxes collected due to the presence of TMI workers may have peaked in 1972 at about \$67 thousand. It is not possible to make a similar estimate for 1978.

Second, the Occupational Privilege Tax (also an Act 511 tax) generated local income. This flat \$10 annual tax, collected by place of work, was collected for every worker at TMI who had not already paid the tax to another jurisdiction. This tax also covaries with the TMI work force. Local informants estimate that no more than \$5,000 was due to non-TMI workers in the township. Thus, in 1972, some \$53,500 would have been due to the TMI project.

Third, there were increases in miscellaneous revenues. Although some of the increase was due to federal grants and increases in state highway funds, the principal difference was due to income from Sunset Golf Course fees.

7.3.1.4 Summary of Revenues

The presence of the Three Mile Island plant had very little effect on taxing jurisdictions in the Study Area because the local municipalities did not receive direct property tax payments, a major source of revenue found in other parts of the country. Estimates of other local taxes collected in connection with the work force constituted a modest percentage of the total budget, even during peak construction, except in Londonderry Township. In 1972, tax collections due to TMI in Londonderry may have been as great as \$126 thousand, or 35 percent of the total revenues for the township.

7.3.2 Expenditures

In addition to the total size of a governmental budget, the distribution of expenditures is a useful indicator of the demands made for various services. Because the relationship between budget expenditures and public need/demand is ambiguous, the expenditure patterns of the three municipal units (Middletown, Royalton, and Londonderry Township) will be examined only briefly before the focus of analysis shifts to more detailed consideration of the provision of four key governmental services—education, public safety, transportation, and social services.

7.3.2.1 Middletown Borough

The expenditure pattern for Middletown over the study period is shown in Table 7-4. The growth in total dollars expanded from \$1.2 million in 1967 to \$1.8 million in 1978 (constant 1972 dollars). Significant increases occurred in 1968, 1971, and 1973. Growth of expenditures averaged 4.8 percent per year. This was greater than the average rate of population growth, and resulted in significant gains in expenditures per capita, from \$107.23 in 1967 to \$201.13 in 1976 (constant dollars).

The proportional distribution of expenditures did not change dramatically over the study period. Most categories were relatively constant. In years when larger capital outlays occurred (1968, 1971, 1974), the percent of total expenditures used to run public service enterprises was somewhat lower. The only other change that occurred was a significant increase in expenditures for urban renewal, concentrated in the first ward.

7.3.2.2 Royalton Borough

As shown in Table 7-5, Royalton expenditures nearly doubled during the study period (constant 1972 dollars). The annual rate of increase averaged 5.3 percent. Expenditures per capita also increased dramatically, from \$55.55 in 1967 to \$96.46 (constant 1972 dollars). Growth was erratic, however, with substantial increases in 1968 and during the period 1971-1973, and substantial decreases in 1969-1970 and 1974. Increases and decreases tended to be associated with changes in capital outlays. A one-time expenditure for urban renewal in 1973 resulted from a federal grant to cover clean-up of Hurricane Agnes; excluding this expenditure would imply a steady growth from 1971 on.

There were considerable variations in the proportion of expenditures allocated to each category over the study period. As a proportion of total expenditures, general government expenses ranged from 4 percent in 1967 and 1973 to 10 percent in 1969 and 1970. Similarly, the expenditures for street and highway maintenance ranged from 10 percent in 1967 and 1976 to 25 percent in 1969, with no regular pattern over the period. The cost of operating and maintaining public service enterprises (primarily electricity) grew from 39 percent of the budget in 1967 to 60 percent in 1976; the growth in percentage terms was steady except for 1973. Generally, the proportional allocation of the borough budget has fluctuated substantially from year to year.

TABLE 7-4
STUDY AREA BUDGET, MIDDLETOWN
1967-1976
(Thousands of Dollars)

Expenditures	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
General Government	\$ 56	\$ 59	\$ 65	\$ 64	\$ 68	\$ 98	\$ 102	\$ 115	\$ 118	\$ 129
Public Service										
Enterprises	422	438	463	515	596	787	914	876	899	899
Sanitation	184	182	186	205	230	283	296	312	349	352
Health Service	—	—	—	5	10	9	15	—	5	—
Public Safety	103	107	126	135	162	160	170	197	226	287
Urban Renewal	—	—	6	—	—	—	16	2	30	215
Streets/Highways	67	69	89	94	134	86	115	115	111	112
Parks and Recreation	7	13	24	22	30	41	48	53	66	69
Library	5	6	7	8	9	9	12	12	13	20
Interest and Other Expenditures	38	31	64	55	63	81	98	131	130	190
Total Operation and Maintenance ^a	884	906	1,031	1,105	1,304	1,555	1,787	1,815	1,947	2,274
Total Capital Outlays	91	366	210	181	342	77	281	458	201	159
Expenditures Per Capita ^b	87.18	113.75	111.03	141.66	181.25	179.80	227.72	250.40	236.60	267.91
TOTAL EXPENDITURES^a										
In Current Dollars	\$ 975	\$1,272	\$1,241	\$1,286	\$1,646	\$1,632	\$2,068	\$2,274	\$2,148	\$2,433
In Constant 1972 Dollars ^a	\$1,199	\$1,503	\$1,403	\$1,390	\$1,704	\$1,632	\$1,960	\$1,945	\$1,698	\$1,826
Annual Rate of Change		25%	-7%	-1%	23%	-4%	20%	-1%	-13%	8%

^aTotals may not add exactly due to rounding.

^bNot expressed in thousands of dollars.

Source: Commonwealth of Pennsylvania, Local Government Financial Statistics, 1967-1976.

TABLE 7-5
STUDY AREA BUDGET, ROYALTON
1967-1976
(Thousands of Dollars)

Expenditures	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
General Government	\$ 2	\$ 5	\$ 6	\$ 5	\$ 5	\$ 7	\$ 5	\$ 7	\$ 7	\$ 12
Public Service Enterprises	20	22	23	26	31	42	44	53	61	80
Sanitation	3	4	6	7	7	8	8	8	11	10
Health Service	—	—	—	—	—	—	—	.084	.682	.219
Public Safety	2	2	2	4	3	2	5	6	6	5
Urban Renewal	—	—	—	—	—	—	16	—	—	—
Streets/Highways	5	14	14	8	10	16	16	15	22	14
Parks and Recreation	—	.773	—	.150	—	—	—	—	.103	.750
Interest and Other Expenditures	2	4	4	3	1	.049	7	6	2	2
Total Operation and Maintenance ^b	35	53	55	54	58 ^a	76	102	95	109	125
Total Capital Outlays	15	28	4	—	4	3	12	—	—	9
Expenditures Per Capita ^c	45.16	72.03	52.10	52.01	59.60	76.49	110.41	91.23	104.71	128.48
TOTAL EXPENDITURES^b										
In Current Dollars	\$ 51	\$ 81	\$ 59	\$ 54	\$ 62	\$ 79	\$ 115	\$ 95	\$ 109	\$ 134
In Constant 1972 Dollars	\$ 63	\$ 96	\$ 66	\$ 58	\$ 64	\$ 79	\$ 109	\$ 81	\$ 86	\$ 100
Annual Rate of Change		53%	-31%	-12%	10%	24%	37%	-25%	6%	17%

^a\$27 not accounted for in published figures.

^bTotals may not add exactly due to rounding.

^cNot Expressed in thousands of dollars.

Source: Commonwealth of Pennsylvania, Local Government Financial Statistics, 1967-1976.

7.3.2.3 Londonderry Township

Table 7-6 shows that expenditures in Londonderry Township increased as they did elsewhere in the Study Area. In constant dollars, the increase was nearly five-fold, and averaged 18.9 percent per year. Expenditures per capita also rose dramatically, from \$27.78 in 1967 to \$94.83 in 1976 (constant 1972 dollars). Except for 1973, when there was a very large expenditure for land adjacent to the federal portion of Sunset Park, total operation and maintenance expenditures increased in a fairly regular pattern. The costs of developing the land as a golf course appear as capital expenditures for 1974-1975. Once the Sunset Golf Course was opened in 1976, it was operated as a public service enterprise, and its operating expenses added considerably to township expenditure requirements. There was also a sizable jump in the expenditures for public safety for the volunteer fire district in 1976, as the township helped to defray some of the expenses. Street and highway maintenance varied from a low of 9 percent of the budget in 1968 and 7 percent in 1975 to a high of 32 percent in 1967. Capital expenditures have shown steady growth, except for the extraordinary expenses associated with Sunset Golf Course.

7.3.2.4 Summary of Expenditure Patterns

As shown in Table 7-7, all three of the municipal units experienced significant growth in expenditures over the study period. The only major shifts noted were increases in the public service enterprise expenditures of Royalton and Londonderry. For these municipalities, public service enterprises are increasingly important sources of revenue, which have associated expenditures for maintenance and operation. Both the revenue and expenditure analyses reflect this fact.

All three areas also showed increases in per capita expenditures. Londonderry Township showed the most dramatic increases, but these appear to be mainly associated with the development of the Sunset Golf Course rather than with income attributable to Three Mile Island. Although revenues from TMI peaked in 1972, there is no evidence of expenditures in any category peaking in that year.

Selected public services and facilities are examined in the next section to better illustrate how the Three Mile Island plant affected the demand for services, the source of funding, and the resultant effects on the cost and availability of public services and facilities in the Study Area.

TABLE 7-6
STUDY AREA BUDGET, LONDONDERRY TOWNSHIP
1967-1976
(Thousands of Dollars)

Expenditures	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
General Government	\$ 3	\$ 4	\$ 5	\$ 7	\$ 6	\$ 16	\$ 17	\$ 20	\$ 26	\$ 33
Public Service Enterprises	—	—	—	—	—	—	—	—	—	145
Sanitation	—	—	—	—	—	—	—	—	—	.798
Health Service	—	—	.583	.911	1	2	3	4	5	6
Public Safety	1	1	1	4	4	5	8	9	10	60
Streets/Highways	18	17	20	29	48	51	60	40	33	73
Parks and Recreation	—	10	8	22	68	56	232	74	79	18
Interest and Other Expenditures	2	7	10	10	14	24	37	35	26	35
Total Operation and Maintenance ^a	25	39	45	75	141	154	358	182	181	370
Total Capital Outlays	32	148	57	98	41	66	83	109	280	66
Expenditures Per Capita ^b	18.52	61.32	33.25	50.16	52.64	63.77	127.79	84.32	133.33	126.31
TOTAL EXPENDITURES^a										
In Current Dollars	\$ 56	\$187	\$101	\$173	\$182	\$220	\$441	\$291	\$460	\$436
In Constant 1972 Dollars	\$ 69	\$221	\$115	\$187	\$188	\$220	\$418	\$249	\$364	\$327
Annual Rate of Change		218%	-48%	63%	.5%	17%	90%	-40%	46%	-10%

^aTotals may not add exactly due to rounding.

^bNot expressed in thousands of dollars.

Source: Commonwealth of Pennsylvania, Local Government Financial Statistics, 1967-76.

TABLE 7-7
 STUDY AREA EXPENDITURES BY JURISDICTION
 1967 and 1976
 (Constant 1972 dollars)

Expenditures	1967	1976
Total Expenditures ^a		
Middletown	\$1,199.00	\$1,826.00
Royalton	63.00	100.00
Londonderry Township	69.00	327.00
Per Capita Expenditures		
Middletown	\$107.23	\$201.13
Royalton	55.55	96.46
Londonderry Township	22.78	94.83

^aThousands of dollars.

Source: Social Impact Research, Inc., 1980.

7.4 Selected Public Services

The emphasis of this section on a selected group of public services is necessary in order to keep the scope of the case study manageable. At the same time, the services selected are felt to be representative enough of local government activity that generalizations about public sector effects of the plant can be made. The services examined are education, transportation, public safety, and social services.

The approach is to focus on demand-for-services effects on the one hand and supply-of-revenue effects on the other. Once these have been individually treated, conclusions are drawn with respect to overall effects on the availability and cost of public services.

7.4.1 Education

The provision of educational services in Dauphin County was primarily the responsibility of the individual school districts, although support and special programs were provided by the county. School board members were elected, and a school superintendent served as the administrative officer. Funds for education were provided largely from taxes generated from property owners in the respective districts. Financial assistance in the form of state school aid was provided from state funds, with the amount

determined by a formula based on enrollment and the equalized property valuation in the district. Federal funds were sometimes available for specific programs. In addition, the Harrisburg Area Community College (HACC) received public funds and provided post-secondary education to county residents. This analysis focuses principally on the Middletown Area School District (MASD) and the Lower Dauphin School District (LDSD), which served the Study Area communities.

7.4.1.1 Demand for and Provision of Educational Services

The Study Area is served by two school districts. Middletown and Royalton are part of the Middletown Area School District (MASD), which also includes Lower Swatara Township. Londonderry is part of Lower Dauphin School District (LDSD), which also includes three other townships and Hummelstown Borough. In addition, there are two private schools for elementary students in Middletown. Private high school education is available at Bishop McDevitt High School in Harrisburg. These factors in combination with trends occurring outside the Study Area compounded the changes in the demand for and provision of educational services in the Study Area. In the case of MASD, about 70 percent of the district students resided in the Study Area in 1970. In Londonderry, the proportion is smaller; the only school in the township is Londonderry Elementary, located in the center of the township and attended only by township residents. In 1972, 666 (32 percent) of the 2,080 elementary students in the LDSD attended Londonderry Elementary.

As shown in Table 7-8, the two school districts declined in enrollment during the study period. There was an initial rise that peaked in 1971-1972 for the MASD and 1969-1970 for the LDSD and the county as a whole. After these peaks, there was a steady decline in enrollment for the MASD and Dauphin County, and a more erratic decline for the LDSD. The rate of decline in the Study Area was somewhat slower than for the county as a whole, due mainly to the suburban character of both school districts. In neither case does there appear to be a correlation between the pattern of decline and the number of construction workers at Three Mile Island.

However, the demand for educational services due to Three Mile Island was derived indirectly by estimating the number of students in the school systems due to the project. The basis for the estimate was Malhotra's figure of approximately 0.8 school-aged children per worker family (Malhotra, 1979). Using population and worker data in Chapter 5, it is estimated that 33 additional school-aged children were present in the

TABLE 7-8

AVERAGE YEARLY ENROLLMENT
 MIDDLETOWN AREA SCHOOL DISTRICT, LOWER DAUPHIN SCHOOL DISTRICT,
 and TOTAL DAUPHIN COUNTY SCHOOLS
 1967-1979

Year	Middletown Area School District	Lower Dauphin School District	Total Dauphin County Schools
1967-68	3,102	4,021	47,809
1968-69	3,113	4,069	47,986
1969-70	3,166	4,135	48,435
1970-71	3,248	4,077	47,191
1971-72	3,275	3,993	46,549
1972-73	3,255	4,027	46,345
1973-74	3,197	4,052	46,038
1974-75	3,122	4,004	44,428
1975-76	3,090	3,981	43,811
1976-77	3,064	3,995	42,895
1977-78	2,962	3,432	39,934
1978-79	2,872	3,893	40,127
Annual Average Decrease	0.7%	0.3%	1.6%

Sources: Public School Financial Statistics Reports, 1967-1979; Social Impact Research, Inc., 1980.

MASD and 5 additional children were present in the LDSD in 1972, as shown in Table 7-9. In 1978, these figures were 35 children and 8 children, respectively. According to the two school superintendents, the enrollment effects of the construction and operation of Three Mile Island were not discernible; the percentage estimates (as shown in Table 7-9) are consistent with their observations.

7.4.1.2 Availability of Revenues

Local taxes paid to the school districts are a combination of: (1) real estate taxes; (2) 0.5 percent earned income tax for residents of the school district; (3) a per capita tax; (4) a real estate transfer tax; and (5) an occupations tax. School districts also receive a portion of the PURTA pool of real estate taxes paid by public utilities. The amounts of these taxes were determined by individual school boards, so they varied independently, but generally the taxes rose during the study period. For instance, the MASD only collected a \$15 per capita tax in 1966. This rose to \$25 in 1968 and a \$5 occupations tax was added. By 1978, the occupations tax was up to \$105, but by that time housewives had been excluded from paying the tax. LDSD has a completely separate schedule of taxes which, in 1966, included a \$5 per capita tax, an earned income tax of one percent, a real estate transfer tax of 1 percent, and an occupations tax of \$37.50. Property tax rates also varied by municipality within the school district. However, the average millage assessed within each school district is shown in Table 7-10.

Millage rates for both school districts have fallen over the study period, though not in a regular pattern (see Table 7-10). MASD had a low rate for 1967, but its pattern of decline after 1968 was similar to that of LDSD. Statewide, MASD ranked 256 out of 505 school districts in the state in 1978-1979, and LDSD ranked 139 in its equalized mill rates. There is no evidence in either school district that the millage rate was affected by the construction of TMI; this is to be expected since essentially no direct property taxes were paid by the utility to the school districts. The other local taxes collected by the school district only applied to legal residents of the school district; since construction and operations workers were such a small percentage of the total population even at peak construction, the revenue impacts from these taxes are only a small portion of the overall budgets.

The only discernible direct revenue effect of the construction of TMI was a special one-time real estate transfer tax of \$250,000 collected by LDSD at the time of the transfer of Unit 2 from Jersey Central Power and Light to Metropolitan Edison. This

TABLE 7-9

ENROLLMENT IMPACT ON STUDY AREA SCHOOL DISTRICTS
1972-1973 and 1978-1979

District and Years	Total Enrollment	Project-Related Enrollment	Project-Related Enrollment as a Percent of Total Enrollment
Middletown Area School District			
1972-73	3,255	33	1.0
1978-79	2,872	35	1.2
Lower Dauphin School District			
1972-73	4,027	5	0.1
1978-79	3,893	8	0.2

Sources: Public School Financial Statistics Reports, 1967-79; Social Impact Research, Inc., 1980.

Note: Includes nonbasic movers in the calculations. Assumes 87.5 percent of the Study Area residents in 1972 resided in the MASD and 12.5 percent in the LDSD. Calculations also assume 82 percent of the Study Area residents in 1978 resided in the MASD and 18 percent in the LDSD. Excludes students residing in the school districts but outside the Study Area.

TABLE 7-10
SCHOOL EXPENDITURES

Year Beginning	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
<u>Middletown Area</u>												
<u>School District</u>												
Revenue Sources												
(Percent of Budget)												
Local	48	51	48	46	47	45	46	48	48	51	49	54
State	49	43	48	51	50	51	51	49	48	44	48	42
Federal	3	6	4	4	3	4	3	4	4	4	3	5
Millage	25.5	30.3	32.4	28.7	33.9	29.5	30.8	27.2	25.4	25.3	24.4	22.7
Total Budget ^a	2,003	2,660	2,874	3,082	3,193	3,898	3,904	3,888	4,311	4,400	4,601	4,859
Per Pupil Cost ^a	.65	.85	.91	.95	.97	1.20	1.22	1.25	1.40	1.44	1.55	1.69
Annual Change		31%	7%	4%	2%	24%	2%	3%	12%	3%	8%	9%
Total Budget ^b	2,463	3,144	3,247	3,332	3,305	3,898	3,701	3,326	3,408	3,304	3,270	3,233
Per Pupil Cost ^b	.79	1.01	1.03	1.03	1.01	1.20	1.16	1.07	1.10	1.08	1.10	1.13
Annual Change		27%	2%	0%	-2%	19%	-3%	-8%	3%	-2%	2%	3%
<u>Lower Dauphin</u>												
<u>School District</u>												
Revenue Sources												
(Percent of Budget)												
Local	44	44	41	40	39	42	46	48	49	55	55	57
State	55	54	57	57	58	55	51	50	47	41	42	39
Federal	1	1	2	2	3	4	2	2	4	4	3	4
Millage	28.0	28.6	30.2	28.8	28.9	29.8	25.6	26.5	22.8	24.2	25.7	24.0
Total Expenditures ^a	2,298	3,042	3,425	3,762	4,005	4,221	4,723	5,058	5,439	5,631	5,944	6,449
Per Pupil Cost ^a	.57	.75	.83	.92	1.00	1.05	1.17	1.26	1.37	1.41	1.74	1.66
Annual Change		31%	11%	11%	9%	5%	11%	8%	8%	3%	23%	-4%
Total Expenditures ^b	2,827	3,596	3,870	4,067	4,146	4,221	4,476	4,327	4,300	4,227	4,225	4,291
Per Pupil Cost ^b	.70	.88	.94	1.00	1.04	1.05	1.10	1.08	1.08	1.06	1.23	1.10
Annual Change		25%	7%	6%	4%	1%	5%	-2%	0%	-2%	16%	-11%

^aRounded to the nearest \$1,000 in current dollars.

^bRounded to the nearest \$1,000 in constant 1972 dollars.

Sources: Public School Financial Statistics Reports, 1967-1979; Social Impact Research, Inc., 1980.

money was added to the capital expenditure fund (LDSD Superintendent, personal communication, 1980).

State and federal support for the schools in the Study Area gradually rose, peaking in the early 1970s and declining thereafter. Federal aid for both school districts was usually less than 5 percent of the total budget. State aid varied between 42 percent (1978) and 51 percent (1970, 1972, 1973) of the MASD budget; for the LDSD, state aid varied between 39 percent (1978) and 57 percent (1969, 1970).

The overall budgets in both school districts rose during the study period. In constant dollars, the increase for the MASD was 31 percent, for an annual average rate of 2.5 percent. For the LDSD, the increase was 51.8 percent, for an annual average rate of 3.9 percent. Per pupil costs also increased during this period for both school districts. For the most part, the gains in constant dollars were slow but steady. As shown in Table 7-11, the percentage spent in administration and instruction decreased for both school districts, while operations, maintenance, and fixed charges increased.

7.4.1.3 Summary of Education Effects

There were no discernible costs or benefits to the two school districts in the Study Area. Neither district received significant additional revenues due to the construction of Three Mile Island. There was no change in the pattern of expenditures over the study period that can be attributed to TMI, and the additional demand for service generated by project-related students was very small.

7.4.2 Transportation

The responsibility of the Study Area governments for transportation was limited to roads and highways. The Commonwealth of Pennsylvania had the responsibility to construct and maintain all roads specified as state routes, which included the Pennsylvania Turnpike and Pennsylvania routes 441, 283, and 230 in the Study Area. The municipalities were responsible for the remainder of the roads in the Study Area.

In practice, the local municipalities contributed to the maintenance of PA-441 and PA-230 (the other two state routes are limited access freeways). Given the many demands on state resources with the resulting delay in addressing problems, local road crews often repaired potholes or removed snow from the state roads along with the municipal roads.

TABLE 7-11

PERCENTAGE BREAKDOWN OF PER PUPIL COSTS
 MIDDLETOWN AREA SCHOOL DISTRICT (MASD) AND LOWER DAUPHIN SCHOOL DISTRICT (LDSD)
 1967-1968 and 1978-1979

District and Years	Administration	Instruction	Pupil Personal Services	Operation and Maintenance	Fixed Charges	Transportation	Other ^b
MASD ^a							
1967-68	7.0	68.0	0.5	12.0	6.0	4.0	3.0
1978-79	4.0	61.0	2.0	13.0	10.0	3.0	6.0
LDSD ^a							
1967-68	5.0	71.0	0.4	10.0	6.0	6.0	2.0
1978-79	3.0	59.0	3.0	15.0	11.0	6.0	3.0

^aTotal budget in current and constant dollars are shown in Table 7-10.

^bIncludes costs for health, food services, student body activities, and community services.

Sources: Public School Financial Statistics Reports, 1967-79; Social Impact Research, Inc., 1980.

7.4.2.1 Demand for Services

The major effects of the project on the principal transportation links in the county, and on demand for transportation-related services, especially in the Study Area, were the consequence of increased automobile traffic, particularly at shift changes. The concentration of 2,872 workers in one place in 1972 necessarily resulted in increased traffic flows in the vicinity of the project site. Although traffic was dissipated relatively quickly due to the plant's proximity to Interstate 283 and its interchanges, PA-441 near the plant entrance nonetheless experienced noticeable congestion. Other areas noted as receiving increased traffic from the project were Geyer's Church Road, PA-230 east of Geyer's Church, and small feeder roads. While the general level of traffic also may have increased over this period due to the nearby entrance to the TMI Visitor's Center and to a general increase in economic activity in the area over the same time period, the project's contribution to increased traffic in the immediate vicinity of the entrance was substantial. Table 7-12 provides a traffic count in the vicinity of TMI for selected years.

TABLE 7-12
TRAFFIC COUNTS IN THE VICINITY OF
THREE MILE ISLAND^a
(Selected Years)

Year	Route 441 at Royalton ^a	Route 230 at Geyer's Church ^a
1963	5,900	18,500
1966	6,200	18,000
1972	10,900	12,900
1975	8,800	12,800

^aCounts in both directions aggregated.

Source: Pennsylvania Department of Transportation, 1980.

Local highway officials who were interviewed thought that the construction and operation of the project did not have a substantial effect on the maintenance requirements in the Study Area. Other local informants tended to minimize the inconvenience of the traffic effects throughout the Study Area, though some congestion on Geyer's Church Road and PA-441 was noted. In Middletown, at least part of the explanation lies with residents' historical experience with traffic. Some 10,000 civilians had been employed at Olmsted Air Force Base just prior to its closing, and previously there had been an even larger work force. Shift changes at Olmsted had regularly resulted in traffic tie-ups at several major intersections in Middletown and many parents had not allowed their school-aged children on the streets between 3:30 p.m. and 5:30 p.m. because of the traffic hazard. The TMI-related traffic was thus modest in comparison.

7.4.2.2 Availability of Revenues

Revenues for transportation were not affected by the Three Mile Island project. Local municipalities did not benefit significantly from taxes paid by the utility, and thus remained dependent on their usual sources of revenues for transportation expenses. For local municipalities, these sources consisted primarily of state liquid fuels taxes and state and federal grants. The only major roads or improvements made in the Study Area during the study period were Route 283 and its "Airport Extension," which considerably relieved congestion on PA-230. Both state and highway maintenance increased in all three municipalities in the Study Area (see Section 7.3.3). However, changes in expenditures were not attributable to the TMI project.

7.4.2.3 Summary of Traffic Effects

During the peak construction period, increased traffic from the Three Mile Island work force created congestion and some inconvenience along PA-441. Increased traffic was noted along Geyer's Church Road and PA-230, especially during shift changes. There is no indication, however, that project-related traffic had a substantial effect on road maintenance requirements or that there was a sufficiently large shift of residential location due to the project to affect long-term transportation patterns in the Study Area. Through 1978, therefore, the effects of the project on the cost and availability of highways and roads was small.

7.4.3 Public Safety

The major elements of the public safety services by local governments include police, fire, rescue, and civil defense preparedness and communications. At the county

and local level, public safety services, like transportation services, were provided by a number of overlapping sources. The state police had responsibility for patrolling state and interstate highways. They also handled law enforcement on county roads and provided police services for local government units, particularly townships. Cities, boroughs, and townships typically either used this contractual arrangement or maintained a local police department throughout the study period; Londonderry Township relied on the state police. Middletown and Royalton maintained their own police department. Fire protection is provided by four volunteer fire companies in the Study Area. Royalton uses the three Middletown companies, and Londonderry Township has its own. All four companies have cooperative agreements with each other, as well as with other nearby units.

Ambulance and emergency services for Middletown and Royalton are coordinated through a communications center located on the police department premises, which is staffed 24 hours a day. Similar services for Londonderry are coordinated through the Dauphin County communications center, which also coordinates with Middletown.

7.4.3.1 Police

In Middletown, the size of the police force changed very little during the study period, according to local informants (Study Area city managers, personal communications, 1980). Statistics are available from 1974 to date and indicate an increase from 16 officers to 18 officers. There were corresponding modest increases in the police budget. There was a consistent increase in calls for service over the study period, but the available FBI Uniform Crime Reports substantiate the local observation that increased crime was mainly vandalism and burglaries (police corporal, personal communication, 1980). There is no indication of increases in police activities due to the construction of Three Mile Island.

Royalton and Londonderry did not have full-time police forces. Royalton had a part-time police force of two men over most of the study period, although towards the end of the study period, there was some talk of adding a third officer and/or hiring someone full-time. Royalton depended on adjacent police departments and on state police to handle extraordinary cases. Londonderry relied entirely on the state police.

None of the three jurisdictions evidenced increased revenue demands or service demands as a result of the Three Mile Island project. Although there were two bars in

the Study Area that were frequented by construction workers, and considerable traffic was noted at shift changes, there was no noticeable increase in calls for service associated with either phenomenon. The tax dollars to the municipalities were not large and had no discernible effect on the police budgets.

7.4.3.2 Fire and Ambulance

Interviews with ten firefighters in the Study Area and a review of local records provided substantial information concerning fire and ambulance facilities. The three fire companies in Middletown received funding from Middletown and Royalton boroughs. Although the allocation was equal for the three companies, chiefs of each company worked in coordination with each other at budget time if one company needed new equipment. Until 1974, the Liberty Fire Company was located on Catherine Street in Middletown's Second Ward (the historical building now houses the library), but moved to its new federally funded quarters that year. Liberty was the only company with an aerial ladder. Union Hose Fire Company had the ambulance unit that was used for car wrecks and similar accidents. Rescue Hose Fire Company, located in the First Ward, had the river rescue unit. Most of the volunteers from Royalton belonged to the Rescue Hose Fire Company. During the study period, Londonderry also acquired an ambulance and rescue unit. Some funding for firemen was available from the state-administered Firemen's Relief Fund Association. These funds could not be used for major apparatus, but could be used to buy personal gear for the firemen, such as boots, coats, and hats. The firemen's insurance premiums were also paid from this fund.

Over the study period, the fire companies became much more professional. The training programs became more formal, and the distinction between active fire fighters and the more social-oriented members of the fire companies became somewhat delineated (see Chapter 8 for a discussion of the social component).

Both construction and operations workers associated with Three Mile Island were members of all the fire companies, especially the Rescue Hose Fire Company. However, local informants were not able to discern any effect of TMI on the demand for service or revenues.

7.4.3.3 Civil Defense

Although township and borough officials are involved with planning and implementation of civil defense actions, official responsibility lies with Dauphin County

and the Commonwealth of Pennsylvania. Local funds allocated for this purpose increased gradually over the study period. No project-related effects on the demand for or the availability of funds were noted by 1978 (Ryan personal communication, 1980; Murray, personal communication, 1980).

7.4.3.4 Summary of Public Safety Effects

There were no discernible effects on public safety due to the project. There was no appreciable increase in demand for service or in revenues over the study period. Any issues that arose in connection with public safety were not a major concern of local residents (see Chapter 9).

7.4.4 Social Services

No social services are funded by the three municipalities. Services such as public assistance, aid to families with dependent children, general assistance, medical and mental health programs for the indigent, and programs for the unemployed, are the responsibility of the county and the state. Study Area residents must go to Harrisburg to receive such services. The only social service located in the Study Area is a day-care center for low-income working mothers (Munzenrider, personal communication, 1980). During the study period, there was no evidence of increased demands or revenues due to the Three Mile Island project.

CHAPTER 8: SOCIAL STRUCTURE

8.1 Introduction

The purpose of this chapter is to identify and examine the effects of the project on the social structure of the Study Area. The basic approach followed in this chapter is: first, to identify the major functional social groups in the Study Area at the beginning of the study period, develop a profile of each group, and describe the major features of the relationships among the groups in the Study Area; and second, to distribute the economic, demographic, housing, and local government effects of the project (identified in Chapters 4 through 7) among the groups in the study.

Changes in the profile of the groups and in the relationships among groups during the study period (1967-1978) are identified, and the role of the project in those changes is determined. Much of the information is based on interviews with key informants who represented the groups in the Study Area.¹ Secondary data were also used to substantiate the information provided by the key informants and to further define the groups. Finally, the description and analysis of this chapter were presented to residents of the Study Area to confirm the validity and completeness of the information.

8.2 Social Structure at the Beginning of the Study Period (1967)

8.2.1 Identification of the Social Groups

A premise of this study is that relationships among people in a community² are structured and that people in a community group into functional entities that can be identified and described. Persons in the community are aggregated into such entities so that they share important socioeconomic characteristics. We assume that persons who share characteristics will be similarly affected by a major external event, and that their

¹The discussion represents a synthesis of the information obtained through interviews with Study Area residents. In order to protect the confidentiality of the information provided by these persons, statements are not attributed to specific people. Persons interviews are included in the list of Personal Communications at the end of this report.

²Using Warner's (1978) definition of community—that combination of social units and systems that perform the major social functions having locality relevance. (Functions include: production, distribution, consumption, socialization, social control, social participation, and mutual support.)

response to the event will be similar. The effects of an event and responses to the event will be different for people with different characteristics.

The selection of the social groupings is based primarily on an examination of the historical development of the Study Area and on interviews with key informants regarding the organization and structure of the Study Area communities, supplemented with personal observations and secondary data. In 1967, six groups were identified as the important functioning social units of the Study Area: (1) farmers, (2) other Londonderry longtime residents, (3) residents of the newer developments, (4) Royalton residents, (5) black residents, and (6) other residents of Middletown's first and second wards (old Middletowners). It should be noted that the boundaries between these groups are somewhat indistinct: there is some overlap in membership between groups because the groups are not altogether internally homogeneous. This chapter will profile the groups and will explore the changes in these groups and their interrelationships. The role of the plant in these changes then will be ascertained.

8.2.2 Group Profiles

Based on a review of the literature on community organization, social structure, and large-scale project effects, seven attributes were identified that seemed most critical to the specification and description of the groups, to the social structure of the Study Area, and to the analysis of the effects of the nuclear project on the groups and the social structure. These seven attributes were:

- (1) Size of the group;
- (2) Livelihood of group members;
- (3) Demographic characteristics;
- (4) Geographic location (residential and occupational);
- (5) Property ownership characteristics;
- (6) Dominant attitudes and values toward growth, environment, community participation, and planning; and
- (7) Patterns of interaction among group members (cohesion).

In many cases, the groups so identified are true sociological groups that engage in normative, regular face-to-face interaction. In other cases, the profiles characterize aggregates of sociological groups which occupy a similar place in the social structure. The sociological groups could be aggregated in a variety of ways; the criterion for this

study is that members of a group occupy a similar place in the social structure and it is assumed that the effects of a nuclear plant will be similar for members of the group.

On the basis of these seven attributes, a profile of each group at the beginning of the study period was developed by synthesizing secondary data, information from key informants, and records of public occurrences. The purpose of these profiles is to explicate the social structure and provide a basis for the analysis of project effects. Therefore, the approach has been to describe the model characteristics of the group and to give some indication of the diversity within the group.

The patterns of interaction among group members will be examined for three spheres of activity: economic, political, and social. The discussion on the economic interactions among group members will focus on two elements: employment and income. The discussion on political interactions will focus on political control, representation, and participation; and the discussion of social interaction will consider the participation or control of formal social organizations and the degree of informal social contact.

8.2.2.1 Farmers

Nearly all the farmers in the Study Area are located in Londonderry Township. The township has about 30 farms that provide full-time support for their owners and perhaps another 70 which provide substantial income. The farms are scattered throughout the township, which was historically entirely agricultural. Full-time farms are mainly dairy farms, although there is one chicken farm. The main crops produced are corn and soybeans. The average size of these farms is about 150 acres, and most are owned free and clear.

The farmers are all white and most have lived in Londonderry all their lives. In many cases, married children live in houses on or adjacent to the family farm. During the Depression and even into WW II, many of the married children lived with their parents, but now most have separate dwellings.

A very strong value of this group was the preservation of farmland. Many farms were split when the Pennsylvania Turnpike crossed the township in the 1950s. Major losses of farm acreage also occurred when land was sold for the Londonderry Elementary School in the mid-1960s and the Big M Merchandise Mart, a discount department store.

In addition, land has been lost to suburban development. Although some farmers, especially those with less profitable farms, favored development and actively promoted subdivision of their land, the core of the farmer leadership opposed such practices.

Farmers attended a variety of churches. The major church in the township was Geyers United Methodist Church. There was a full range of denominations in Middletown, and those of other faiths either attended those churches or attended church outside the Study Area.

Group interaction

Although there is some loaning of equipment, the majority of the economic transactions of the farmers occur outside the township. Farm supplies and equipment are obtained from Elizabethtown or the West Shore, which are outside the Study Area; consumer goods are obtained in Middletown or outside the Study Area.

Prior to the beginning of the study period, township politics were dominated by the farmers, who served as supervisors or members of the various committees. Nearly all were conservative Republicans. One of the benefits farmers received with political control was control over desirable township employment. For instance, by working as a member of the road crew for only a few days (14) each year, the employee was eligible for full medical coverage for his whole family for the whole year. Many farmers took advantage of this policy.

Much of the township business was conducted informally among the farmers. This pattern appears to have worked well and to have been acceptable to other groups as well. This was particularly evident before the rapid growth of the township began in the early 1960s and before the bureaucratic requirements of even rural government officials required full-time attention.

Social interactions among the farmers were frequent and the result of numerous bonds. Before Londonderry Elementary School was built in 1955, Londonderry had a dozen one-room schoolhouses (including one on Three Mile Island, to which the teacher rowed). These very small neighborhood schools promoted solidarity among longtime residents, their children, and their grandchildren. This solidarity was diluted with the state consolidation of school districts that occurred in 1965; Londonderry students then went to junior high and high school with students from four other municipalities. In

addition, there was substantial intermarriage among the farm families, many of whom were already interrelated. The women had a small Farm Wives Group, but the majority of the social interaction was clearly home-and-family centered.

8.2.2.2 Other Londonderry Longtime Residents

The members of this group were born and raised in Londonderry Township, but they were not farmers. The group numbered about 1,500 at the beginning of the study period. Most of its members were blue collar workers who worked in construction, in large businesses in the area (i.e., the Hershey Chocolate Factory and Bethlehem Steel), or in small businesses in Middletown. Civilian jobs at Olmsted Air Force Base and jobs with the Commonwealth in Harrisburg were considered good jobs for this group.

Members of this group are scattered throughout the township. They are all white, most of them own their homes, and a small number have businesses in the township.

Historically, this group was very religious. Many attended Geyer's Church, as had their parents. However, by the early 1960s, some of the young adults from this group were attending different churches than their parents, or not attending at all. This group had strong traditional values that were reflected in their concerns regarding school consolidation. Parents felt that contact between their children and outsiders from other townships (and newcomers to Londonderry) might result in "booze" problems (later, "dope" problems) for the young people. Concern over such problems had a cohesive effect on the group.

Between 1950 and 1958, this group sponsored a Civic League which promoted better schools, roads, etc. It also sponsored the first Girl Scout and Boy Scout troops in the township. Again, this illustrated the traditional, family-centered values of this group.

Intragroup interaction

Most members of this group worked outside the Study Area, which somewhat diluted the interactions among them, as compared to the farmers. However, a few were employers in the township who employed other longtime residents.

Although this group was not as politically active as the farmers, they had substantial input into political decisions. Generally, members of the group were well

informed about township business, and were satisfied with how business was conducted. The first elected or appointed Democrats in the township were from this group, but the majority of the group were Republicans.

As with the farmers, there was substantial intermarriage among members of this group. The family ties so generated formed the basis for much of the social interaction that occurred. During the 1950s, an increasing proportion of the younger generation remained in the township. This was partly due to the improved elementary education available after Londonderry Elementary School was built, and partly due to the post-war prosperity which enabled young families to purchase cars and commute to jobs outside the Study Area while continuing to reside near their parents.

Another basis for the cohesion of the longtime residents was their active participation in social and civic groups. They participated in such groups much more than farmers did.

8.2.2.3 Residents of the Newer Developments

Residents in the newer developments are a diverse group, with several subgroups, but they share important socioeconomic characteristics. They live in the housing built after WW II. Those desiring a more rural lifestyle settled in Londonderry Township. Some located in small suburban-type developments, and others in scattered plots of 3 to 5 acres. Those desiring a more urban environment located mainly in Middletown's third ward. Military housing at Pineford Acres had not yet been razed, so some newcomers resided there as well. In all, perhaps 4,450 of the estimated 12,000 Study Area residents belonged to this group at the beginning of the study period. Residents who lived in the newer developments were often blue-collar in the late 1950s and early 1960s. They were lower-middle class families who nevertheless could afford the necessary down payments and wanted more modern amenities. Many were Olmsted Air Force Base employees. Others worked for AMP, Inc. (electronics), in construction, or at the candy factories in Hershey. Some were children of longtime residents, especially in Londonderry Township.

By the beginning of the study period, the proportion of white collar workers in the newer housing developments was increasing. However, closure of Olmsted Air Force Base caused many of those with less seniority to move outside the area, while those with more seniority tried to stay and commute to other military installations or took early retirement. The Capital Campus of Pennsylvania State University was just opening, and

the majority of its faculty that located in the Study Area lived in the newer neighborhoods. With improved transportation, an increasing number of white collar workers in Harrisburg were locating in the newer neighborhoods in the Study Area.

The age composition of people in the newer developments reflected the fact that these areas mainly housed families with children. Between 1960 and 1970, the number of children enrolled in school increased 17.7 percent in Middletown's third ward, and 38.9 percent in Londonderry Township. In both 1960 and 1970, these areas had more persons per household than Middletown's other two wards or Dauphin County as a whole. Although household size dropped in all subareas between 1960 and 1970, as it did nationally, it dropped least rapidly in the parts of the Study Area with newer housing.

As compared to Londonderry or Middletown's first two wards, Middletown's third ward had the lowest percentage of persons who had resided in the same house five years earlier; 1960—46 percent, and 1970—55 percent. The third ward also had the highest percentage of persons who had lived outside the SMSA five years earlier; 1960—21 percent, and 1970—14 percent.

Similar statistics for Londonderry Township reflect the fact that the composition of the newer developments was changing and affecting the overall composition of the township. In 1960, Londonderry had the highest percentage (57 percent) of persons residing in the same house five years earlier, and its proportion of residents (9 percent) from outside the SMSA was less than half the rate of Middletown's third ward. However, by 1970, although the percent living in the same house was still the highest (65 percent) among the four census tracts, residentially mobile persons were increasingly from outside the SMSA (13 percent).

At the beginning of the study period, virtually all the residents of the newer areas owned their own homes. Prior to the closing of Olmsted, there had been a significant minority who rented in the Olmsted Estates area. However, by the beginning of the study period, these homes were being sold with low down payments and very favorable terms. Although a few of those living in the newer homes also owned small businesses, the majority owned only their own homes.

As compared to other residents in the Study Area, those in the newer sections were more likely to be Democrats. The first Democratic councilmen in Middletown

came from the third ward. Democrats were very uncommon in Londonderry Township before new people began to move in, but by the end of the study period, the township was nearly half Democratic.

Those living in the newer developments favored planned growth, and zoning was seen as a useful tool to this end. In Middletown, this group lived adjacent to the Emaus Orphanage Trust property, the only remaining undeveloped land in the borough, and they took an interest in its planned development. In Londonderry, at the beginning of the study period, development had been slow enough and dispersed enough that planning and zoning were not issues.

For those living in Londonderry, an important consideration was quality education for their children. Both Londonderry Elementary and the Lower Dauphin School District had generally excellent academic reputations by the beginning of the study period. Special programs were available for gifted children and for children interested in wood or metal shop classes. The sports program was well developed, but not predominant. Local informants who located in Londonderry prior to the start of the study period mentioned the school system as an important factor in their location decision.

Intragroup interactions

The majority of the residents in the newer developments commuted to jobs outside the Study Area. A few had businesses in Middletown and thus interacted with others who traded in Middletown. In general, however, the level of economic interaction among members of this group was low.

Because of their geographical concentration in Middletown's third ward, those living in new developments had political representation on the Borough Council in Middletown. The members of this group, who were labeled "old Middletowners," were somewhat more likely to be interested and involved in local politics than the newcomers.

In Londonderry, at the beginning of the study period, newcomers tended not to be directly involved in township governance, although they were very active in other civic duties. For instance, in 1962, a group of 23 residents led by people living in the newer developments, organized the Londonderry Civic Association. Its goals were to obtain a pool and recreation area for the township, to improve road conditions, and to improve telephone service. The group realized only limited success and disbanded in the late

1960s. However, this effort indicated that members of this group had a strong interest in improving public services in Londonderry.

One of the most important mechanisms for establishing social ties within this group was child-centered activities. Participation in the Parent-Teachers' Association and other youth activities, such as fund raising, Boy Scouts and Girl Scouts, and baseball leagues was the most common way that parents in this group got to know each other. People in this group who did not have children generally had to make greater efforts to get to know other people. Since church membership throughout the Study Area was not group-specific, religion did not provide a built-in mechanism for social interaction, although it was used by those without children as a first step in getting to know others living in the newer developments. In general, the level of social interaction among members of this group was not as high as for other groups.

In Middletown, women from the newer developments who wanted to get to know each other formed a civic club. Although many members were new to Middletown, most shared the concern of having young children. This group also included nonelite local women who helped the newcomers get adjusted in Middletown.

8.2.2.4 Black Residents

Black residents in the Study Area have always lived in Middletown's first ward, in a well defined neighborhood. Although there were no blacks living outside this area, there was at least one white family living on most blocks in this area. At the beginning of the study period, about 450 blacks lived in this area.

Although some blacks had come to Middletown from Harrisburg or Steelton, most were born and raised in Middletown. There was a home for the elderly in the neighborhood where several lifelong black residents lived. Those blacks who did move into Middletown were generally seeking housing rather than jobs.

The largest employer of blacks was the steel plant at Steelton. A few also worked at local businesses in the Study Area or for Metropolitan Edison's Crawford Station, located adjacent to the black neighborhood. Women worked as domestics throughout the Study Area. In 1960, 55 percent of the blacks owned their homes, although their median income (\$4,500 in 1960 dollars) was lower than that of the Study Area (\$5,800).

Historically, blacks in Middletown had been Republican, but after the administration of Franklin D. Roosevelt, an increasing number became Democrats. Until the start of the study period, no black had ever served on the Borough Council, although there had been black constables and justices of the peace. The black population was relatively small and geographically bounded, and its members felt it was important to get along with other people in Middletown and to earn their respect by working hard, getting an education if possible, and not becoming "troublemakers." The extended family networks among the blacks reinforced these values.

Intragroup interactions

The black community was historically highly cohesive and the group was small enough so that everyone knew each other. Community facilities such as the three churches attended by blacks, the two small grocery stores, and the local bars provided outlets for interaction. Although there was some economic exchange among group members, the majority of the interaction was social. There was a substantial amount of visiting, primarily among relatives, especially on Sunday. Prior to the study period, the political influence of the blacks was limited, but black leaders were consulted by borough authorities on matters relevant to the community.

8.2.2.5 Old Middletowners

Most of the persons in the Study Area who referred to themselves as "old Middletowners" grew up in the balance of the first ward or the second ward. The 1892 boundaries of the borough describe the area even better, as they excluded the present village of Pineford and extended about four blocks up Union Street into the third ward. This area includes several large houses, especially along Union Street, which appear in The Historical Register.

Until Olmsted Air Force Base closed, Pineford Acres housed military personnel and thus was not really considered an integral part of Middletown. By the beginning of the study period, the base had closed and nearly all the residents had moved from Pineford Acres in preparation for disposal of the property.

The rest of the "old Middletowners", approximately 4,300 people, consisted of people who thought of themselves as working people. Many were, in fact, what would be characterized as blue-collar workers. Most of these residents worked in nearby industries, such as the base (until it closed), AMP, Inc., and the Bethlehem Steel mill in

Steelton. But, although it is true that there appear to be few independently wealthy families in Middletown, not all the residents of "old Middletown" were blue-collar workers. Those business owners who did not reside in the newer developments resided in the first or second wards. Although the number of family businesses at the beginning of the study period was perhaps 250 to 300, the families considered themselves part of the Middletown community in general, rather than as a special interest group. When Olmsted Air Force Base closed, the Chamber of Commerce became quite active and successfully organized to attract new industry to Middletown; thereafter, however, it resumed a relatively inactive status.

Finally, many Study Area professionals resided in this area, especially in the second ward. Doctors, dentists, ministers, school teachers, and lawyers were heavily concentrated in the second ward.

Before the study period, most of the old Middletown area was occupied either by people who had lived in Middletown all their lives or by people associated with the base. Some of the latter took rooms with the former, so there was a history of renting out rooms in family residences in Middletown. Most families owned only their own homes, but many also owned businesses, and some of the professionals owned rental property. The age distribution was somewhat older than in the third ward, as there was a substantial number of longterm elderly residents.

"Old Middletowners" had a strong commitment to the town and valued its heritage as the oldest town in Pennsylvania. They had a tendency to think of themselves as somewhat superior to people living in Highspire, Royalton, or even Londonderry. They were politically conservative, held traditional beliefs in the free enterprise system, and participated heavily in borough affairs. Most attended church and strongly believed in the importance of family ties. At the beginning of the study period, there was a renewed effort on the part of these people to renovate the exteriors of their older residences. Pride in the older neighborhoods was obvious at the time the site visits were made.

Intragroup interaction

Since many of the small employers in the Study Area resided in "old Middletown," they provided both jobs and goods and services to local residents. Many of the local businesses had an explicit "hire local" policy which tended to increase the intragroup interaction even further.

Another example of economic exchange among residents of old Middletown was that women from the first ward, both black and white, worked as domestics, mainly in the second ward in the homes of professionals. This arrangement was one of the ways that the races interacted outside the school situation.

The "old Middletown" group was very important politically in Middletown. Although Olmsted military persons were prohibited from running for public office, they participated extensively on boards and committees, and in various volunteer capacities. Professionals and businessmen also participated heavily and served both on the Borough Council and on the school board. However, the attitude of the blue-collar workers was to accept the paternalistic system—"Why make a fuss? They'll do what they want." They were less likely to get involved in politics.

Social interaction within this group was a function of family ties, school ties, location, and class. Much of the social interaction occurred between different generations of families who all resided in the area. It was not uncommon for a newly married couple in the first or second ward to move into the other half of the double they were raised in, or to move within a two block radius of one family or the other. Neighborhood ties were reinforced by school ties—friendships that formed in grade school and continued through high school remained constant among nearly all informants of all ages.

Perhaps this group's most notable instance of intragroup interaction was the social interaction of the wives of the professionals. Although the men belonged to Kiwanis, Rotary, Elks, and so forth, without respect to class or race, the Women's Club at the beginning of the study period was very exclusive. Its membership was limited to about 50 women, and generally a new person was not asked to join until a vacancy occurred. A system of "black-balling" was still being used; each member had to vote on a prospective new member, and one black-ball excluded the nominated woman. Generally, pre-screening obviated the need for the black-ball, but it was occasionally used. All the members in 1965 were wives of professionals except for one talented pianist who had been befriended by a club member; virtually all professionals' wives were members. About two-thirds of the membership resided in the second ward. As previously mentioned, those who did not belong to the Women's Club could belong to the Civic Club, but the memberships did not overlap.

8.2.2.6 Royalton Residents

The Royalton population was approximately 1,000 for most of this century. Most were employed in blue-collar jobs, and employment at the base or with the state was considered very desirable. Most local people in the Study Area (including Royalton) reported that about half the houses in Royalton were occupied by retired persons on fixed incomes. The actual percentage at the end of the study period when data were available was about 20 percent, which was still much higher than the national average. The unemployment rate in Royalton was also perceived to be higher than average, but no data are available to support this observation. Prior to the study period, virtually everyone in Royalton was a lifelong resident. Many people in Royalton owned their homes, but only a few families owned any additional property. Most additional property was in the form of rentals in Royalton.

There were no blacks in Royalton. The fact that they were excluded from Royalton was pointed out by informants throughout the Study Area, even though there were no blacks in other areas either. Some Royalton informants described that town's residents as having been raised to be prejudiced, but others disagreed that racial prejudice was a Royalton characteristic.

At the beginning of the study period there was no land use zoning in Royalton, nor were there zoning codes. Many of the older residents opposed such measures as an infringement on their rights. Consequently, land use in Royalton was unplanned. Those who owned rental properties also resisted efforts to upgrade borough services such as water and sewage disposal. (The WPA had offered to install the sewer during the 1930s.) The rental property owners felt that the added tax burden on property owners would force them to raise rents, thereby creating vacancies. Property owners continued to resist such improvements throughout the 1960s and about half the houses in Royalton had only 30 amp electric service at that time. Generally, the rental rates were among the lowest in the area. People from Royalton voiced an especially strong respect for property rights.

Intragroup interactions

Historically, a distinction was made between Upper Royalton and Lower Royalton, which were physically divided by the Pennsylvania Railroad tracks. People in Lower Royalton were perceived as being more likely to be unemployed, less likely to have finished high school, and more likely to have large families. Until about 1950, Lower

Royalton had no indoor plumbing, and at the beginning of the study period it did not have town water or a sewage system. Some residents lived in tar paper structures. Upper Royalton people, on the average, were better off in all these regards.

Economic transactions among Royalton residents consisted of landlord-tenant relationships and the provision of groceries. The two small grocery stores extended credit to local people, which helped during employment layoff periods. The stores also served as a place to socialize and exchange town news.

Until the beginning of the study period, the Royalton Borough Council was composed mainly of older men who were members of influential families. Upper Royalton and Lower Royalton each elected four members, and neither division appeared to dominate council decisions. The perception of other residents was that the council could not be fought and participation was, therefore, low.

There were very few formal organizations in Royalton, with only one church and two scout troops, but no fire companies, no civic organizations, and no social clubs. The local school used to be a center for social activity but, as the population aged, enrollment dropped. In 1955, Royalton had a total of 75 students through grade 10 (juniors and seniors went to Middletown), but by the beginning of the study period Royalton had only elementary school students. Thus, there were no easy ways for newcomers to be integrated into the community. People from Royalton were not outgoing to strangers.

8.2.3 Interaction among the Groups

Before the initiation of the Three Mile Island project, the interaction patterns among members of different groups varied considerably. The following discussion is intended to outline the dominant interactions among the six groups in the Study Area and to complete the description of the social structure of the Study Area. The same three spheres of interaction that were considered in the discussion of interaction within groups—economic, political, and social—are utilized to organize the discussion of the interaction among the groups.

8.2.3.1 Economic

In 1967, the majority of employed area residents held wage and salary jobs outside the Study Area although a few were employed in local businesses. This job situation

reduced the possibility for intensive interactions among the groups in terms of employment or income. Nevertheless, some economic activity involving Study Area residents in employer-employee, buyer-seller, and landlord-tenant relationships did occur.

Since Middletown was a local trade center, all the groups patronized Middletown businesses. However, people in the newer developments were more likely to shop outside the Study Area than were people in the other groups. Consequently, they were less likely to participate in Study Area economic exchanges. Farmers in Londonderry produced mainly for regional markets, but there was a small roadside produce stand and some local sale of milk and chickens. Middletown businesses employed residents from throughout the Study Area. However, Royalton businesses were more likely to hire from Royalton, and the same was true to a lesser extent in Londonderry. There were also economic exchanges among groups for housing. Landlords living in Middletown owned investment property in Royalton and rented housing there. Some of the more successful businessmen who had moved out to the newer homes in Londonderry Township owned rental property in Middletown, mainly in the second ward.

8.2.3.2 Political

Political power in Middletown prior to the study period was dominated by Republicans who were born and reared in Middletown, were employed in Middletown or at the base, and were better educated than the average resident. In many cases, elected officials made decisions which would never have passed a popular vote, but which the officials felt were for the good of the community. An example of this was the decision to remodel one of the schools. The Middletown residents, however, appeared to be reasonably satisfied with this arrangement.

In Londonderry, the farmers, with the assistance of other longtime residents, controlled most of the township governance. Generally, during the early 1960s, those in the newer developments did not participate in township politics. The newcomers who lived in the new developments were viewed as transients who had no real stake in the community. The few early efforts made by the newcomers in Londonderry to get involved in township politics were considered inappropriate.

From time to time it was suggested that Middletown and Royalton merge, particularly because they shared many municipal services. Members of groups in both

boroughs resisted the idea. People from Middletown thought that substantial capital investment would be required in order to bring Royalton up to Middletown code standards. People from Royalton, on the other hand, were proud of their community; they didn't appreciate outsiders characterizing them as "from Middletown." Given its small size and somewhat different value structure, people from Royalton wanted to keep a separate identity.

3.2.3.3 Social

Because the Study Area was composed of many groups and subgroups, the pattern of social interactions was complex. However, there were several institutions which provided opportunities for social interaction among the groups. Among these were the churches, the schools, the fire companies, and the civic/fraternal groups.

The three largest churches in Middletown were the Presbyterian, the Lutheran, and the Church of God. These churches had a reputation among some blue-collar workers of catering to the elite, especially the Presbyterian Church, but in fact there appears to have been a mixture of all groups represented. The same appears to have been true for most other churches in the Study Area—they provided a place where members of different groups became acquainted. The three exceptions were: the churches in the black area, which most blacks attended; the church in Royalton, which had a disproportionate percentage of people from Royalton (though others attended as well); and Geyer's Church in Londonderry, which was attended mainly by people from the township.

Schools provided an opportunity for parents to get to know each other and for students to form lifelong friendships. The most commonly mentioned way that people from different groups in Middletown and Royalton became acquainted was through having gone to school together or, somewhat less commonly, because their kids had gone to school together. Lacking these school ties, in-migrants to the area were somewhat disadvantaged in social interactions. Students in Londonderry all attended Londonderry Elementary, which served as a uniting force in the township. However, its size (600+) precluded the formation of the very close friendships that grew out of attending the pre-1955 one-room schoolhouses. There had been controversy over the consolidation of the schools for just these kinds of reasons (the controversy did not follow group lines). The common attendance at Lower Dauphin High School also brought the community together. Parents were concerned about their children coming into contact with

outsiders and being exposed to questionable behaviors. They were also concerned about the lack of discipline and the "newfangled" (e.g., Modern Math) curriculum. Working with other parents to address these problems brought the three groups in Londonderry together.

The civic and service clubs such as the Kiwanis, Rotary, Elks, Veterans of Foreign Wars, and so forth, as well as their Ladies' Auxiliaries, were located in Middletown and drew members from the whole Study Area including, in many cases, the black area. In some instances, the clubs were primarily social, and they provided an opportunity for group interaction. Those organizations with a service orientation provided an opportunity for different groups to work together for a common goal.

In Londonderry, there were two groups that functioned similarly, the Civic Association and the Londonderry Athletic Association. These were very important organizations where longtime residents could get to know residents from the newer developments. However, farmers did not participate in either of these associations to the same extent as the other two groups.

The fire companies provided additional intergroup interaction. Teens could become junior members at age 14 and active members at age 18. Although a black-balling system was in effect, it was rarely used. At the beginning of the study period, all companies had provisions in their charters for excluding blacks. In some cases these have been removed, but there are still virtually no blacks in the companies although all other groups are represented.

There were several classes of membership in a fire company. Active members were those who actually fought the fires and were mainly young (aged 18-30) blue-collar males. Men maintained active status in only one fire company. Social members, often former active members, used the fire hall for recreational activities and helped support the company. Social memberships in more than one company could be maintained. All four fire companies in the Study Area had Ladies' Auxiliaries which held activities at the fire halls. Together, these classes of membership meant that there was substantial community participation in the companies. For instance, a special issue of the Middletown Press and Journal (20 August 1980) listed the membership in the Liberty Fire Company at 1,300. Members of the company, however, estimated the participating membership at 150-200, with 25 who were very active firefighters and a core mainstay of

10-12 who were available for most fires. The Rescue Hose Company was even larger, with 3,500 members. Since at the beginning of the study period Londonderry was still receiving fire protection from Middletown (under a contract similar to Royalton's), the entire Study Area was involved in the the three Middletown companies.

Finally, since many of the people in the Londonderry new developments moved to the township from Middletown, this provided some social linkage between groups in the borough and the township.

8.2.3.4 Study Area Cohesion

The Study Area could not be characterized as highly cohesive. The political and school district boundaries dividing Londonderry from the rest of the Study Area necessarily limited some types of interaction. The geographical segregation of the blacks limited their interactions; also, the sense of a separate identity, the residential stability, and the political boundary separated Royalton residents. Still, there were important links among the groups, which have been detailed. Group leaders all knew each other and many interacted regularly. There were also numerous settings within which other Study Area residents got acquainted.

8.3 New Groups in the Study Area during the Study Period

No new groups developed in the Study Area during the study period, despite the project-related activity. The people in-migrating to the Study Area during this time, including the project-related workers, were incorporated into one of the six existing groups. Consequently, although the size and composition of some of the groups changed, the number of groups remained constant.

However, a significant new subgroup was added to those living in the newer developments. After Olmsted Air Force Base closed, the Borough of Middletown acquired Pineford Acres. The existing structures were then razed and the contents were sold for salvage. Subsequently, bids were received from developers and the land was sold to the Clabell Corporation to create a Planned Residential Development (PRD). When completed, the PRD consisted of over 700 apartments, townhouses, and garden apartments. It also included community facilities such as a grocerette, pool, community building, and so forth. These units were occupied by three types of people: (1) transients; (2) young adults who were not ready to purchase a home; and (3) the elderly who desired independent living. One of the two high-rise structures in the Village of

Pineford had a disproportionate number of elderly residents from other sections of Middletown who had sold their family residences because they were too large to maintain. During the study period, two other options became available for the elderly. First, Frey Village was built to accommodate elderly residents requiring various levels of care, including intensive care. These units were high-priced condominiums which were too expensive for many of Middletown's elderly. Second, by the end of the study period, virtually all the construction had been completed on the Interfaith Apartments, which provided living quarters for both the low-income elderly and the handicapped under a HUD 208 program.

The Village of Pineford was not considered really part of Middletown; neither by those who lived in the village nor by others in the borough. It was a self-contained community and its members were, in the main, either retired or employed outside the Study Area. They shopped in the Study Area, and participated somewhat in social activities, but generally speaking, residents of the Village of Pineford were even less integrated into the social structure than were other residents of the new developments.

8.4 Distribution of the Project Effects to the Groups

The effects of the Three Mile Island project on the economy, labor force, population, settlement patterns, and government (structure and services) of the Study Area were identified and described in Chapters 4 through 7. This section describes the distribution of those effects among the six groups in the Study Area for the two key years—1972 and 1978. The distribution described in this section was derived from available empirical evidence, key informant information, and analytic judgment. As part of the study methodology, this distribution was presented to key informants in each group for verification of its plausibility.

8.4.1 Economic

8.4.1.1 Peak Construction Period, 1972

In 1972, as shown in Table 8-1 and Table 8-2, an estimated 338 residents of the Study Area were working in project-related jobs. These 338 jobs (and workers) were distributed among the six groups as follows: farmers—0; Londonderry longtime residents—19; residents of the newer development—158; black residents—48; old Middletown residents—76; and Royalton residents—37. As can be seen, nearly half of the jobs in the Study Area went to residents of the the newer development. In proportion to the size of the group, the employment was probably most significant for the blacks.

TABLE 8-1

TOTAL PROJECT EMPLOYMENT EFFECTS IN THE STUDY AREA
THREE MILE ISLAND
1972 and 1978

Employment	1972				1978			
	Direct Basic	Indirect Basic	Non- basic	TOTAL	Direct Basic	Indirect Basic	Non- basic	TOTAL
Nonmovers	90	1	53	144	127	2	37	166
Movers Accompanied by Families	22	—	26	48	36	—	19	55
Movers Unaccompanied by Families	146	—	—	146	17	—	—	17
Daily Outside Commuters	2,614	—	14	2,628	678	—	10	688
Total Employment by Place of Work	2,872	1	93	2,966	858	2	66	926
Total Employment by Place of Residence	258	1	79	338	180	2	56	238

Source: Social Impact Research, Inc., 1980.

TABLE 8-2
THREE MILE ISLAND
EMPLOYMENT AND INCOME EFFECTS FOR STUDY AREA RESIDENTS
1972 and 1978

	Employment—1972			Employment—1978			Income ^a	
	Basic	Non-basic ^b	TOTAL	Basic	Non-basic ^c	TOTAL	1972	1978
Farmers	0	0	0	0	0	0	0	0
Londonderry Longtime Residents	16	3	19	10	1	11	291	160
Newer Development Residents	120	38	158	105	30	135	2,310	1,756
Black Residents	43	5	48	12	2	14	794	207
Old Middletown Residents	50	26	76	40	19	59	1,040	720
Royalton Residents	30	7	37	15	4	19	564	257
TOTAL^d	259	79	338	182	56	238	4,999 ^d	3,100

^aThousands of constant 1972 dollars.

^bAllocated according to population size.

^cTotals may not add exactly due to rounding.

^dTotals do not match Table 4-10 exactly due to rounding.

Source: Social Impact Research, Inc., 1980.

Total project-related income earned by Study Area residents in 1972 was estimated at about \$5 million, or about 10 percent of all project-related income earned in the Study Area. Those groups earning the largest amounts were: (1) the newer development residents, who earned \$2.3 million, or an increase of approximately \$375 per capita; and, (2) the old Middletown residents, who earned about \$1 million, or an increase of approximately \$225 per capita.

8.4.1.2 An Operations Year, 1978

By 1978, the number of project-related jobs in the Study Area (by place of work) had declined to an estimated 926. Residents in the Study Area held about 238 (25.7 percent) of these jobs. They were distributed among the six groups as follows: farmers—0; Londonderry longtime residents—11; newer development residents—135; black residents—14; old Middletown residents—59; and Royalton residents—19. About 166 of these jobs were filled by persons who were already residents of the Study Area, while the remaining 72 jobs were filled by movers.

Total project-related income earned by Study Area residents in 1978 was about \$3.1 million (constant 1972 dollars), or about 20.7 percent of all project-related income earned in the Study Area. Again, the groups earning the largest amounts were: (1) the newer development residents, who earned about \$1.8 million, or \$225 per capita; and (2) the old Middletown residents, who earned about \$720 thousand, or \$145 per capita.

8.4.2 Demographic

The demographic effects of the project on the county were estimated in Chapter 5 where the total increase in population for the 1967-1978 period was summarized (Table 5-4). Of the two possible components of increased population—in-migration and diminished out-migration—only in-migration was found to have had a measurable effect on the Study Area population, and that was relatively small. The new population was not distributed evenly among the six groups in the Study Area, as shown in Table 8-3.

In 1972, residents of the newer developments was the group that received the largest demographic impact—94 workers and 60 accompanying family members. It is estimated that about 3 percent of the members of this group were project-related. In relative terms, the black residents received the largest demographic impact, with about 11 percent of the 1972 black population employed in project-related jobs.

TABLE 8-3
DEMOGRAPHIC EFFECTS FOR STUDY AREA RESIDENTS
1972 and 1978

	1972										TOTAL Other Family Members	TOTAL Demographic Effect
	Construction					Worker Type						
	Family Present	Family Absent	Family Present	Operations Present	Nonbasic	Family Present	Operations Present	Family Present	Nonbasic	TOTAL Workers		
Londonderry Longtime Residents	1	8	1	1	1	11	7	18				
Newer Development Residents	7	69	5	13	13	94	60	154				
Black Residents	2	24	—	2	2	28	10	38				
Old Middletown Residents	3	28	1	8	8	40	29	69				
Royalton Residents	1	17	1	2	2	21	10	31				
TOTAL ^a	14	146	8	26	26	194	116	310				

	1978										TOTAL Other Family Members	TOTAL Demographic Effect
	Construction					Worker Type						
	Family Present	Family Absent	Family Present	Operations Present	Nonbasic	Family Present	Operations Present	Family Present	Nonbasic	TOTAL Workers		
Londonderry Longtime Residents	—	1	2	1	1	4	8	12				
Newer Development Residents	3	7	20	10	10	40	83	123				
Black Residents	—	3	2	1	1	6	8	14				
Old Middletown Residents	—	4	7	6	6	17	33	50				
Royalton Residents	—	2	2	1	1	5	8	13				
TOTAL ^a	3	17	33	19	19	72	139	211				

^aTotals may not add exactly due to rounding.

Source: Social Impact Research, Inc. 1980.

In 1978, the pattern was similar, though less pronounced. The resident population in the newer developments increased by 123—40 workers and 83 additional family members—or about 1.5 percent of the population of that group. The black population increased by 14—about 4 percent of their population in 1978. During the operations period, the Three Mile Island project contributed to the trend of white-collar professionals moving into the Study Area, especially into the newer developments. Still, the project was a very small part of this overall trend (see Chapter 5).

8.4.2.1 Settlement Patterns and Housing

The demographic effects of the project were small enough that they had very little effect on settlement patterns and housing. When the project was first announced, one of the benefits mentioned was that the influx of workers would occupy the housing that had been vacated when Olmsted Air Force Base closed. In fact, Middletown was well on its way to economic recovery by the year of peak construction (1972). The new businesses and industries that had located in the area apparently had a much larger demographic effect than did the plant construction at Three Mile Island. It may be true that the Village of Pineford filled more quickly than it otherwise would have without the construction of TMI; however, interviews with construction workers indicated they thought the apartments were too expensive—they rented them only as a last resort, doubling- or quadrupling-up to share the rent. There was no evidence of a marked increase in the vacancy rate as construction ended; the Village of Pineford was clearly a response to needs other than the Three Mile Island project.

The same appears to be the case for the mobile home parks in the Study Area. Nearly all these parks opened between 1971 and 1973, and many local respondents, especially in Londonderry Township, thought they were filled mainly with TMI workers. However, interviews with union officials (see Chapter 4) indicated that very few of the in-migrants or weekly commuters resided in Londonderry. Checks with the owners of the mobile home parks confirmed that very few workers (less than a dozen in all of Londonderry) ever lived in the mobile home parks. The primary residents of the parks had similar demographic characteristics similar to those who lived in the Village of Pineford, except that they earned somewhat smaller salaries. As with Pineford, the mobile home parks reported full occupancy at the close of construction.

Except for the period immediately following the closing of Olmsted, the housing vacancy rate in the Study Area has always been low. Historically, its proximity to the

base was a major factor in maintaining this low vacancy rate. During the study period, improved transportation links to Harrisburg and Lancaster, coupled with low rents as compared to larger urban areas, meant that the number of commuters grew substantially and filled the vacant units. Still, the Middletown housing market was part of the larger Harrisburg SMSA housing market, so that alternative housing was easily available. Thus, there were no noticeable housing costs or availability changes that were attributable to the TMI project.

8.4.2.2 Government and Public Services

Since there were no perceptible tax benefits to the local municipalities and school districts, the provision of public services did not change as a result of the TMI project. On the other hand, the increased demand for public services was also very minimal because the demographic effects were so small.

8.5 Changes in the Social Structure and the Role of the Effects of the Project

8.5.1 Changes in the Profiles of the Groups

This section describes the major changes in the profiles of each of the groups over the study period and examines the role the project's effects played in those changes. Although the number of suburban dwellers in the Study Area increased during the study period, the construction of the TMI plant had virtually no discernible effects on the profile of any of the groups.

8.5.1.1. Farmers

During the study period, there was very little change in the size or composition of the farming community. The trend towards subdividing the more marginal farmland continued, but this did not result in any substantial decrease in the size of the farmer group. Among the younger generation, there was somewhat less interest in religion than that evidenced by their parents, but they continued to share values regarding the preservation of farm lands.

During the study period, the economic and social interaction patterns of the farmers were modified less than their political interactions. Historically, the farmers had been conservative Republicans who dominated township politics. Newcomers to the area were much more likely to be Democrats or liberal Republicans. Over the study period, the assumption that the farmers would retain political dominance was increasingly questioned.

8.5.1.2 Other Londonderry Longtime Residents

During the study period, membership in this group grew gradually to an estimated 1,700 in 1978. Those who had been employed at the base generally found other jobs nearby—in the light manufacturing firms that located in the base warehouse space next to the airport, at the Fruehauf truck and trailer manufacturers, in the Hershey chocolate factories, in the steel mills, or in similar occupations. When they married, some of the young adults from this group located in the nicer mobile home parks. The pattern of extensive intragroup marriage as well as intermarriage with the farmers' groups continued during the study period. To the extent that this group had provided strong political support for the farmers or filled political positions themselves, they were also affected by the changing political alignment of the township.

8.5.1.3 Residents of the Newer Developments

This group grew much larger and more diverse during the study period. It is estimated that its size nearly doubled to about 7,850 in 1978. To the relatively more urban developments in Middletown and the rural developments in Londonderry Township was added the Village of Pineford and six mobile home parks. The continued development of Middletown's third ward, new small developments, and scattered developments in Londonderry Township also contributed to the substantial expansion of this group.

The composition of the group changed somewhat during the study period. The intragroup proportion of white-collar, well-educated, managerial, and professional workers increased. This was due, in part, to the expanding employment opportunities at the new Hershey Medical Center, the Capital Campus of the Pennsylvania State University, the Three Mile Island project, AMP, Inc., and so forth. It was also caused by increased commuting to Lancaster and the state government offices in Harrisburg. The racial composition of those in newer developments changed during the study period. The Village of Pineford housed some blacks, including subsidized welfare mothers as well as employed blacks. Perhaps more important for social interaction patterns, one black family also moved into Londonderry during the study period without incident. In addition, two families, one a nonfarm, longtime resident and the other a newcomer, adopted multiracial children.

The proportion of renters in this group increased substantially over the study period. In the late 1960s, virtually all those living in newer developments owned their

homes, with the exception of Olmsted Estates, where there were some renters. A substantial number of rental units were added during the study period, including not only the entire Village of Pineford and part of the mobile home parks, but also duplexes in Middletown's third ward. This change in tenure patterns tended to reinforce the perception of lifelong residents that those in the newer areas were transient and had less of a stake in the community.

Although those in the rental units did not, in fact, take an active part in local politics, the growing number of homeowners in the newer developments did, especially in Londonderry Township. There, they became much more involved in civic and other local social activities such as the Parent-Teacher Organization (formerly the Parent-Teacher Association), the Londonderry Athletic Association, and Geyer's Church. They also got elected to the School Board and were appointed to township commissions, thus becoming directly involved in local politics.

Shopping patterns for this group changed during the study period. In the 1960s, the majority of consumer dollars was still spent in the Study Area. But with improved transportation and the development of regional shopping malls, this group spent an increasing proportion of its funds outside the Study Area.

8.5.1.4 Black Residents

For blacks residents, the most significant events during the study period were Hurricanes Agnes and Eloise. These storms severely damaged a substantial portion of their housing stock, forcing many of them to relocate, at least temporarily, and thereby causing a temporary decrease in the size of the group. Genesis Court was built with HUD 208 funds by the Dauphin County Housing Authority, in part to solve the housing problems of low-income blacks. The residents of Genesis Court, however, were not well integrated into the remainder of the black community and the area functioned much like two totally separate neighborhoods. Many of the Genesis Court residents were not born and reared in Middletown. Problems of illegitimacy, juvenile delinquency, and school dropout rates were especially pronounced at Genesis Court, where the traditional social control mechanisms of black Middletown residents were not effective.

During the construction period, as previously mentioned, a significant number of blacks obtained TMI-related jobs. As construction activity decreased, blacks found jobs

in the steel mill or local businesses. A few retained work at TMI during the operations period.

8.5.1.5 Residents of Old Middletown

Due to the closing of Olmsted, the size of the "old Middletown" group was somewhat smaller at the beginning of the study period, but is estimated to have grown to about 5,000 by 1978. There were no major changes in the employment of this group after adjustments to the closing of Olmsted had been made. This group had the oldest age structure of any group in the Study Area and this pattern continued through the study period.

Social interaction patterns among this group changed during this time. The exclusive clubs began to advocate a more open membership policy. For instance, the Women's Club did away with the black-balling system and invited the members of the Civic Club to join. Towards the end of the study period, the Women's Club evolved into a more service-oriented club rather than a social and cultural club. Articles in the local newspaper invited interested women to join. The exclusive nature of the professionals' group broke down over the study period and greater interaction with other groups was facilitated by the change.

8.5.1.6 Royalton Residents

Three factors influenced changes that occurred in Royalton over the study period. First, Hurricane Agnes severely damaged some of the poorest housing in Lower Royalton. Redevelopment Authority funds became available to repair or replace (in the case of mobile homes) these homes. The effect of this disaster was to markedly improve the quality of the housing stock in Lower Royalton and to improve the overall appearance of the neighborhood. Some informants remarked that it now looks better than Upper Royalton. Second, during the study period, water and sewerage were added to Lower Royalton. The combined effect of these two factors was to improve the desirability of housing in Lower Royalton. This resulted in a modest moving of families across traditional Upper Royalton/Lower Royalton lines. Third, because housing was relatively inexpensive and children were permitted in Royalton, the study period was marked by an increasing influx of young couples who rented older houses, usually those vacated due to the deaths of elderly persons. By the end of the study period in 1978, 10 percent of the properties in Royalton were occupied by persons who had moved in that year, although the total population size had changed very little. This was in sharp contrast to the

historical lack of migration into Royalton. The result was an increasing proportion of "strangers" in town, since there were no established social mechanisms for integrating such a large number of newcomers. No negative social, economic, or political effects were discerned by this lack of integration; newcomers mainly kept to themselves and did not participate.

8.5.2 Changes in the Relationships among the Groups

There were several significant changes in the interrelationships among the groups over the study period. It is clear that the Study Area underwent substantial social change during the 1970s. It is during such periods of change, when traditional assumptions about values and interaction patterns are being questioned, that issues relating to the nuclear plant might be expected to be raised, at least in conjunction with other salient issues. Yet there is no evidence that the Three Mile Island project had any effect whatsoever on the composition or internal organization of the various groups. Examples of the kinds of changes that did occur are here presented.

8.5.2.1 Economic

Aside from the small number of additional jobs created by the project for Study Area residents, the structure of the local economy in the Study Area remained relatively unchanged during the study period. The entrance of the project into the local economy introduced a major new business. Because the Study Area was a component of a much larger economic system, the impact of the project in terms of employment and income was not particularly large—the proximity of Bethlehem Steel, Fruehauf Corporation, AMP, Inc., and other large manufacturers in the vicinity diluted the economic effects of the project. In general, this influence was not important in the economic arena in the Study Area, largely because of the unbounded nature of the Study Area economy. The number of jobs created by the project, though very large compared to the number of jobs located within the Study Area, was not particularly large when compared to the number of jobs in the whole county. Also, the number of local residents who obtained project-related jobs was too small to make much difference in any of the groups, or to the Study Area as a whole. Indeed, examination of the major economic relationships among the groups in the Study Area over the entire study period reveals few employer-employee linkages either within or between groups.

The major economic links in the Study Area throughout the 1967-1978 period were between buyers and sellers of merchandise. In general terms, the relationships among

the groups in these buyer-seller transactions did not change substantially over the study period, although there was increased leakage of consumer dollars out of the Study Area.

8.5.2.2 Political

The political structure of the Study Area changed in several respects during the study period. In Middletown, many changes can be summarized by examining the composition of the Borough Council. The council became increasingly Democrat over the study period, so that at the end of the period there were four Democrats and five Republicans. For the first time in Middletown's history, one council member was black (this individual was later elected mayor). Also, all but one of the council members commuted to jobs outside Middletown, whereas at the beginning of the study period more than half worked in Middletown. This reflected the increasing participation of persons who had significant ties outside the Study Area. In general, however, participation in borough affairs, such as membership on committees, declined and vacancies became increasingly difficult to fill. Because of a general lack of participation on the part of most of the newer residents who worked outside the area, fewer longtime residents were enthusiastic about performing a lot of unpaid work for people who did not seem to care.

Similar changes were occurring in Londonderry Township. By the close of the study period, it was estimated that half the registered voters were Democrats. Democrats were much more likely than Republicans to be new to the area and to live in the newer developments. They were also more likely to rely on rules and laws to make decisions than on traditional patterns. For instance, during the study period, the problem of sewerage became much more critical and obvious to all residents of the township. Those in the newer developments were much more likely to consult the State Department of Environmental Resources or seek legal help in resolving their individual problems (e.g., run-off) than were the longtime residents. Zoning and land use controls were related issues that arose during this period. One Republican candidate who was new to the area and favored public input to zoning decisions was the overwhelming victor in the Republican primary. He ran in the general election without the support of the party regulars (who ran another traditional Republican as an Independent), where he not only won, but was elected the President of the Supervisors, the chief elected office in the township. Among other changes, he eliminated both the provision for providing a full year of medical insurance at township expense for temporary employees, and the flat-rate fee collected by the township treasurer (as part of his salary) on all township capital

contracts. These changes in conducting township business represented a significant change for lifelong residents.

8.5.2.3 Social

The social interactions among the groups were changing over the study period as well. There was evidence both of increasing cooperation and integration of the groups and of increasing friction. One example of increased cooperation was shown by the rapid growth of the Londonderry Athletic Association during this period, which provided for increased interaction, especially between the residents of the newer developments and other Londonderry lifelong residents. In Middletown, there was increasing participation of blacks in civic functions. A black minister served on the Rotary's scholarship selection committee and, by the end of the study period, black students were among the finalists. Everyone worked hard to help their neighbors at the time of Hurricane Agnes. A grocery that had been flooded donated to the relief center all the food it was able to salvage. People from all over the Study Area helped shovel mud from basements and make minor repairs. Finally, as mentioned earlier, the group distinctions among social clubs were considerably lessened during the study period.

However, there was also evidence of increasing differences among the groups. Problems over "smells" from farms resulted in repeated confrontations between farmers and adjacent residents of newer developments in Londonderry. Londonderry Township and Middletown disagreed about the fee that Middletown should charge Londonderry for fire protection, causing Londonderry to form its own fire company. At the end of the study period, Londonderry was still raising funds to complete the fire hall and obtain better equipment. For the most part, this project served as a unifying factor in the township, although some felt it would have been better to continue under the old arrangements with Middletown and pay the increased fees. There was no evidence of either increased cooperation or increased friction caused by the Three Mile Island project.

CHAPTER 9: PUBLIC RESPONSE

9.1 Introduction

The purpose of this chapter is to give a summary and overview of the public response to the construction and operation of the Three Mile Island (TMI) project. The major issues that arose in connection with the project are described. These descriptions provide the background information necessary to understand Study Area residents' evaluation of and response to the project. Also provided is a perspective of the regional response to the project, including the regional public's development of socioeconomic concerns regarding the project and any subsequent socioeconomic effects brought about in the Study Area as a result of these concerns. The chronological description of the issues outlines the recorded responses at the state, regional, and national levels and the roles local groups played in this process. The focus of this chapter is broader than that of the immediately preceding chapters and includes regional and national responses to and participation in issues associated with the project. It is therefore not restricted to the Study Area.

The primary source of data for this section is a file of newspaper clippings compiled by the Metropolitan Edison Company (Met-Ed) that covered the years 1966 through 1979. It was supplemented by interviews with local informants.

9.2 Response during the Pre-Construction Period

The TMI project was officially announced in February 1967. However, preliminary information about Met-Ed plans to build a nuclear-fueled generating plant appeared in the press in the fall of 1966.

9.2.1 Announcement

In the fall of 1966, the Met-Ed announcements about a nuclear power station stressed the economic advantages of nuclear generation over coal-fired generation, as determined by extensive studies over a two-year period. Prior to announcing the site, both Met-Ed and General Electric engineers gave talks to civic groups such as the Lions and Rotarians regarding the benefits of nuclear power generation. The first site announcement appeared in February 1967, and included the names of proposed suppliers, contractors, architects, and engineers. Met-Ed officials met with borough officials and civic representatives in March 1967 to explain the economic advantages of the proposed

plant and describe permit and licensing procedures required by the Atomic Energy Commission (AEC). Economic advantages cited included the retention of Crawford Station personnel and the lessening of impacts from the closing of Olmsted Air Force Base.

At about this time, Met-Ed was cited by the Pennsylvania Air Pollution Control Commission for emissions from the coal-fired plant in Middletown, and residents approved of the proposed nuclear plant as a nonpolluting alternative. The economic advantages were recognized by area residents as a way to offset the impacts of the closing of Olmsted Air Base. The only concern raised by residents had to do with the possible disruption of fishing and water sports on the Susquehanna River, but this was perceived as less important than the positive effects to the economy and the reduction of air pollution.

9.2.2 Siting

The site of the plant, on Three Mile Island in the Susquehanna River, had been owned by Met-Ed since 1906 and thus did not involve any acquisition of land. Early press releases stressed that the plant would have little or no effect on recreation on the river. Persons licensed to use the island over the summer months would be provided with facilities on other property owned by the company. Relocation to nearby Shelly Island was mentioned. There was some concern expressed by the Tri-County Boat Club, which had some property along the shoreline. A Met-Ed official met with members of the boat club and owners of approximately sixty cottages on the island to describe plans for the plant and the necessity for removal of the cottages. The matter was resolved with little difficulty.

After construction was announced, some concern was voiced about preserving artifacts from the Susquehannock Indian culture that had existed on the island. Met-Ed donated \$2,500 to the Pennsylvania Historical and Museum Commission. A team of archaeologists worked at the site and the artifacts uncovered were described in the local media.

9.2.3 Permits and Hearings

AEC Construction Permit

Met-Ed filed a construction permit application with the AEC in May 1967. The estimated cost was \$116 million and the projected completion date was December 1971. In May 1968, the AEC Advisory Committee on Reactor Safeguards approved a provisional

construction permit for the plant. The application was not contested. The application was supported by representatives from the Greater Harrisburg Area Chamber of Commerce, the Middletown Area Association, and the Dauphin County Commissioners. The only objection raised concerned the site's proximity to Olmstead State Airport and the plant's ability to withstand the impact of a possible plane crash. The possibility of such an accident was not considered an adequate reason to deny the permit, and construction of Unit 1 began in May 1968.

In January 1969, the utility announced the addition of a second unit to be built at TMI. Hearings for Unit 2 were held in October 1969. The estimated cost was \$193 million, with completion expected in 1973. As in the hearings on Unit 1, the only objection raised concerned aircraft landing safety at the airport.

The provisional construction permit for Unit 2 was issued in November 1969, to become final after 45 days, barring a reversal during that period.

The Regional Context

In the Spring of 1967, along with the announcement of plans for the construction of the TMI plant, there was a great deal of regional media attention focused on the Susquehanna River's electric power generation capacity. Reports stated that more electricity would flow from a 50-mile stretch of the river than from any comparable area in the world, and that this electricity could satisfy the power needs of 3.0 percent of the total population of the United States.

During this period, the problem of air pollution was receiving attention throughout Pennsylvania, and nuclear power generation was seen as a viable solution to this problem.

9.3 Public Response during the Period 1969-1978^a

The construction period started with the issuance of the AEC construction permit for Unit 1 in May 1968 and continued until 1978 when the operating license for Unit 2 was issued. Unit 1 began operation in September 1974; therefore the years from 1974 to

^aA portion of the file of newspaper articles from 1971 through August 1974 was destroyed by fire at the Observation Center trailer in early 1979 and only a partial record remains. Key informants concur that no issues other than those mentioned were raised during this period.

1978 represent an overlap of construction and operations periods. The outstanding events during this period were the operating license hearings for Unit 1, which began in August 1972, and the hearings for Unit 2 in April 1977.

9.3.1 Operating License and Hearings

The first signs of community activity surrounding TMI surfaced in August 1972 with a notice that the Harrisburg-based "Citizens for a Safe Environment" had requested a public hearing on the issuance of the operating license for Unit 1. Their concerns were:

- (1) The island could be inundated by a future flood.
- (2) There were deficiencies in construction.
- (3) Low level radiation emissions posed a health hazard.
- (4) The emergency core cooling system was inadequate and had not been fully tested.
- (5) The creation of radioactive wastes and the associated human health risk had not been adequately addressed.

In December 1972, an environmental study prepared by the AEC recommended that the operating license be approved. Citizens for a Safe Environment, the Environmental Coalition on Nuclear Power, and the State of Pennsylvania were approved as intervenors in the operating license hearings. Citizens for a Safe Environment attempted and failed to obtain financial and technical support for their intervention. In May 1973, they asked the AEC to suspend construction pending a full review of safety and environmental concerns. In November 1973, both citizens' groups agreed to withdraw from involvement in the public hearings in exchange for a utility promise to install additional filtering systems at the plant. They cited lack of funds as the factor forcing them to discontinue their intervention. Unit 1 began operation on Labor Day, 1974.

In August 1976, in a draft supplement to the Final Environmental Statement, the NRC recommended issuance of an operating license for Unit 2. Licensing hearings were held in April 1977 in response to a petition by Citizens for a Safe Environment and the York Committee for a Safe Environment. The petitioners wanted workable warning and evacuation plans that could handle the estimated 18,000 persons living within a 5-mile radius of the plant who would have to be evacuated in the event of a disaster. Hearings finished in July 1977, and the operating license was granted by the NRC in February 1978.

In March 1978, the Citizens for a Safe Environment and the York Committee for a Safe Environment went to court to stay the operations licensing of Unit 2 on the basis that they had not been notified that the license had been granted. Although they were successful in securing a temporary injunction, it was later removed and Unit 2 became operational in September 1978. Both groups again challenged the operating license, this time on the basis of proximity to the airport, and a hearing was held in December 1978 to consider this concern. The operating license was upheld, and Unit 2 went into full commercial operation in January 1979.

9.3.2 Operation of Unit 1

The period beginning in 1974 with the onset of Unit 1 operations and continuing through 1978 was characterized by high levels of electrical power. The local press frequently mentioned this high power, and it was a source of local pride. In July 1976, Nuclear Engineering International ranked TMI Unit 1 first in the United States and eighth in the world among reactors that generated 150 megawatts or more of power.

The only persistent problem during these years was in the area of plant security. The utility was fined for lax security in October 1974, was charged again in July 1975, and then fined a second time in March 1976.

9.3.3 Other Issues

9.3.3.1 Transmission Lines

In December 1971, construction of the power transmission lines for Unit 2 was suspended pending an environmental impact analysis, which did not affect on-site construction on the island. There was no change in transmission line routes as a result of this action, nor any major public response.

9.3.3.2 Local Government Issues Related to Project Effects

In 1974, Met-Ed began a series of legal battles with Middletown over their 68-year-old contract for electricity. The price of electricity bought by Middletown had been set "in perpetuity," and Met-Ed sought to have it changed. Met-Ed was not successful and continued their efforts in court over the next four years.

9.4 Public Relations

The establishment of good public relations between Met-Ed and the local residents had been an important objective of the company since the project's initiation. Company officials gave talks to groups in the area even before a specific site had been

announced. By March 1967, the Middletown Press and Journal noted that Met-Ed's film on the proposed project had been shown locally "more than 'Gone With the Wind'" (Middletown Press and Journal, 16 March 1967).

When concerns were raised about the possible destruction of Indian artifacts at the construction site, Met-Ed helped finance archaeological excavation with a \$2,500 grant.

In the fall of 1968, the company encouraged employees at its Crawford Station in Middletown to pursue adult education courses to help prepare them for possible employment at the nuclear plant. Time and counseling on basic requirements needed to pass future qualifying examinations were made available to interested employees.

In May 1968, Met-Ed sent eight high school students from the area to the National Youth Conference on the Atom, which was sponsored by the National Science Teachers Association, the Future Scientists of America, and various electric utility companies. In the following year, Met-Ed increased its participation by sponsoring ten high school students and two high school science teachers to this conference.

Met-Ed, along with the Philadelphia Electric Company, sponsored Atomic Energy Clinics to enable Boy Scouts in the area to receive Atomic Energy Merit Badges. By 1968, about 500 boys had attended these clinics and received merit badges.

In March 1969, three table-top scale models of the nuclear plant were put on display in Middletown, and in June 1969, ground was broken for an information center directly across the river from the plant. Plans for the center and its 2-acre site included an overlook where visitors could view the plant, displays and explanations to familiarize visitors with plant operations, and a landscaped park and picnic area for the enjoyment of visitors. The center opened on 8 February 1970.

9.5 The Accident at Three Mile Island

The accident at Three Mile Island began at about 4:00 A.M. on 28 March 1979. Local response to the accident is documented in two published studies: Three Mile Island Telephone Survey: Preliminary Report on Procedures and Findings, NUREG/CR-1093; and The Social and Economic Effects of the Accident at Three Mile Island, Findings to Date, NUREG/CR-1215.

9.6 Summary

9.6.1 Public Concern Over the Station

Initially, there was little or no public concern over the nuclear plant at Three Mile Island. Met-Ed's application for Unit 1 to the AEC was unopposed in public hearings. At the hearings for a construction permit for Unit 2 only one question was raised—a state geologist living in Harrisburg asked about the plant's proximity to the airport. By the time of the hearings for the operating license for Unit 1, the Harrisburg-based Citizens for a Safe Environment had raised issues surrounding the safety of the plant. The group's membership was estimated at about 30, only 2 or 3 of whom actually lived in the immediate area. This group, along with the Environmental Coalition for Nuclear Power (a group from Philadelphia) and the York Committee for a Safe Environment, intervened at various times in the operating license process of both Unit 1 and Unit 2. There was no noticeable involvement of Study Area residents in this opposition.

9.6.2 Role of Study Area Residents in the Public Response

In October of 1978, one Study Area resident voiced concern over difficulty in breeding her goats, and some questions were raised about this being in some way connected with radiation levels at TMI. Other area residents noted problems with births among other farm animals. Met-Ed assigned a radiation specialist to study the problems, and the conclusion was that radiation from TMI was not implicated. This incident seems to be the only one that aroused much concern among Study Area residents prior to the accident in March 1979.

CHAPTER 10: EVALUATION AND SIGNIFICANCE OF THE SOCIOECONOMIC EFFECTS OF THE THREE MILE ISLAND PROJECT, 1967-1978

10.1 Introduction

The purpose of this chapter is to provide an overall summary of the effects of the project on the Study Area and on each of the groups in the Study Area. Included in this summary is a discussion of the evaluations made by the Study Area groups. This discussion focuses on the evaluation of both the individual effects and the cumulative effects of the project on each group in the Study Area and on the community as a whole. It is based on analyses of the public response and interviews with members of each group. These interviews focused particularly on the evaluation of these effects, and emphasized a clarification of the basis for evaluation as well as an explanation of the group's perception of the project's effects. Consequently, the evaluations presented in this chapter are premised on the analyses of the existing environmental and project effects developed in Chapters 4 through 8. A theoretical framework is utilized that defines evaluation—in both polarity and intensity—as a subjective assessment of the relationship between perceived objective change and subjectively felt needs and values. The method assumes that a reasonably accurate evaluation can be determined, in the aggregate, for the groups analyzed in the study through interviews with key informants, examination of the group profiles, and information on group behavior.

The time period of the study was eleven years: from 1967, when the location of the project at Three Mile Island was formally announced, until 1978, the last complete year prior to the accident at Unit 2. The study focused on delineating effects at two time periods—peak construction (1972) and an operations year (1978).

At peak construction, the project employed 2,872 workers on site. The total cost of construction was about \$1.1 billion. In 1978, 858 workers were employed at the plant.

10.2 Summary of the Socioeconomic Effects of the Three Mile Island Project

There are several factors which account for the small size of the preaccident socioeconomic effects of TMI, and for the residents' perceptions of these effects. The location of the Three Mile Island project in the greater Harrisburg SMSA meant that the economic effects of the project were less noticeable than they would have been in a rural setting. More than 90 percent of the 1972 work force commuted into the Study Area to

work on the island. Thus, the project-related employment (and therefore income) effects for the Study Area residents were modest and accounted for less than 6 percent of the total Study Area employment, even at peak construction. Furthermore, a third of this employment was in nonbasic jobs, which were difficult for the lay person to attribute to the project, and impossible for the study team to locate in the Study Area economy.

Because the employment effects of the project were small, the demographic effects were also small. In the Study Area itself, increased in-migration due to the project amounted to a maximum of 350 persons (see Table 5-4), and the total demographic effect declined in 1978. Again, about one-third of these persons were associated with nonbasic jobs, and were, therefore, not obviously project-related. During about the same period, from 1970-1978, the Study Area population increased by some 3,000 people. Thus, the approximately 250 direct basic workers and their families accounted for no more than 10 percent of the newcomers to the Study Area; over 90 percent of the in-migration that occurred during the study period was attributable to factors other than TMI. The increased demand for public services (housing, schools, roads, public safety) during the study period was due mainly to factors other than the construction of the Three Mile Island project.

Although the few people in the Study Area who did receive employment due to the project benefited economically, the Study Area population in general did not. The tax structure in Pennsylvania was such that those jurisdictions near the plant received no special tax advantages as a result of the plant. Property taxes paid by the utility were distributed throughout Pennsylvania. The local municipalities in the Study Area did receive modest tax benefits from Act 511 taxes, but the amount received as a direct result of the TMI project could not be precisely disaggregated, either by our study team or by local informants. Prior to this study, the attempt had not been made, and local officials minimized the significance of any increased revenues to their total budgets.

Consequently, there were no changes in expenditure patterns that could be attributed to TMI. Changes in the provision of public services were largely in response to other changes occurring in the area. There were no indirect modifications of migration patterns because of marked improvement in or degradation of the quality or level of public services; the population effects attributable to TMI were only those directly resulting from project-related in-migrants. Similarly, the housing effects of the project

were small and not differentiable from the much larger housing effects resulting from other factors.

Finally, the important changes that occurred in the social structure during the study period were due to the increasing urbanization and suburbanization of the Study Area and its overall increase in size. There was no indication that TMI-related workers were identified as a separate social group and no evidence that these workers had any discernible effect on intergroup interactions. The construction and operation of TMI itself was not a salient issue for most persons in the Study Area.

There are several additional potential effects of nuclear power plant construction which did not occur at Three Mile Island. First, the construction of the plant might have disturbed cultural artifacts or infringed on the heritage of an ethnic group. Archaeological studies unearthed a few arrowheads, etc., but revealed no evidence of significant artifacts on the island. Second, the project's location on an island in a relatively rural area meant that the environmental impacts of the plant on the surrounding population were minimized. Prior to the accident, there were few complaints about noise, dust, mud, run-off, or the like. Third, much of the material for construction of the plant came by railroad directly onto the island, thus minimizing truck traffic. The automobile traffic was significant, especially along PA-441 at shift changes. But the traffic effect was considerably less than the traffic effect of Olmsted Air Force Base. This historical experience with traffic problems due to major employers tended to mitigate the salience of this issue. Fourth, when the construction began, the project was not visible from the highway. Trees lining the Susquehanna effectively blocked any visual impact of the construction. When the visitors' center was opened, a short swath of trees was removed along the riverbank to permit a clear view. With this exception, the majority of the site still was not visible from the eastern shore. Only the cooling towers projected above the tree screen. The entire site was visible from many places in Newberry Township and Goldsboro, on the western shore, but the residents on the western shore received few other direct project effects prior to the accident, and were not concerned about the visual effect. Fifth, although all residents of the Study Area were in the Metropolitan-Edison service area, Middletown had a fixed-rate contract with Metropolitan-Edison for the provision of electricity. Therefore, the cost of electricity in Middletown was not affected by the construction of TMI, nor would the rates have been affected had TMI not been built. Many communities adjacent to the Study Area (such as Harrisburg and Elizabethtown) are outside the Metropolitan-Edison

service area, so their electricity rates were also unaffected. And finally, for several decades Metropolitan-Edison had owned the land on which the project was located, so there were no issues regarding land acquisitions for the site.

10.3 Evaluation of the Significance of the Socioeconomic Effects of the Three Mile Island Project^a

Prior to the accident on 28 March 1979, the Three Mile Island project made very little objective difference to the lives of most people in the Study Area. The subjective perception of the residents coincided with the small size of the actual effects which were described in Chapter 4, Table 4-9, and summarized in this chapter. The only possible exception to this generalization was that the employment of blacks during peak construction may have constituted a significant percentage of their total labor force, but the employment was not evaluated as significant to the group. In other cases, local informants said that the project had not made much difference, and it appears that this was, in fact, the case.

As construction neared completion, and TMI-2 approached the operations phase at the close of the study period, TMI remained a relatively unobtrusive entity in the community. While it was still seen to be a major employer in the area, it was certainly not the largest nor the most important. A modest amount of tourist traffic passed through the visitors' center, undoubtedly increased by the proximity of the Hershey Park facilities and chocolate factories. But overall, prior to the accident, the project was not a highly visible institution in the community.

^aNote that only a small portion of the field work for this section was completed prior to the accident. This may have introduced bias of unknown magnitude into the statements made, and therefore, the conclusion drawn. However, the evidence presented is internally consistent among pro- and anti-nuclear respondents, and among pre- and post-accident respondents.

PART II: THE ACCIDENT

The accident at Three Mile Island began at about 4:00 a.m. on Wednesday, 28 March 1979. During the two-week period immediately following the accident, both government officials and the general public evidenced a gradually increasing concern; however, by Monday, 2 April, this concern had begun to gradually decrease. Given the sense of urgency felt at that time, those first two weeks following the accident were set apart for intensive study. The next natural break, or point of transition, occurred in September/October 1979 with the release of the Kemeny Commission findings, the start of the cleanup, and the increased attention to the restart of Unit 1. More extensive reports on the social and economic consequences of the accident through October 1979 were previously published (NUREG 1215 and 1093). Although the effects of the accident will continue to be felt in the area for some time, this report covers only those effects evidenced through the summer of 1981.

The findings in this report are limited to the local consequences of the accident. It is widely recognized that the accident had pervasive implications nationally and internationally, but our attention here will be restricted to effects on the region that surrounds the station site.

In addition, the report covers only those considerations that typically fall within the purview of socioeconomic analysis. These include analyses of the responses by, and the effects on, individuals, businesses, and public and private institutions.

The data sources used to prepare this report vary depending on the topic. For the regional analyses, much of the data came from available secondary sources or statistics compiled after the accident by the State of Pennsylvania. Institutional analyses for the local areas nearest TMI (Middletown, Royalton, Goldsboro, Lower Swatara Township, Londonderry Township, and Newberry Township) were based on interviews with local officials. Analyses of the behavior and effects on individuals were based on personal interviews and available surveys.

Part II is organized chronologically and the analysis begins by describing what is known about the behavioral response of individuals, businesses, and public and private institutions during the two-week emergency period. Based on an understanding of what happened during the emergency period, the analysis turns to consider the effects of

events during the emergency period on local individuals, businesses, and institutions. Consideration is then given to the effects experienced in the local area in the two years following the emergency period. The report concludes by considering potential long-run implications of the accident.

A chronology of the emergency period was provided in Part I, Chapter 1 (see Table 1-1).

CHAPTER 11: EMERGENCY PERIOD BEHAVIOR AND EFFECTS

This chapter will describe the immediate responses of individuals, businesses/industries, and institutions in the region surrounding Three Mile Island (TMI). The objective is to delineate the range of behavior observed and to indicate the prevalence of the reactions wherever possible. It will also examine the effects of the accident during the emergency period, with particular attention to the magnitude of the effects, the significance of the effects, and an explanation for the pattern of effects.

11.1 Individual Responses and Effects

Both the survey data and interviews with people living near TMI indicate a substantial variation in the responses of individuals to the accident. At the extremes, some individuals were virtually oblivious to the situation while others were seriously traumatized.

Generally, the public appears not to have been alarmed on Wednesday, 28 March 1979. This was due, in part, to the fact that many people were not aware until that evening that an accident had occurred. Exceptions to the general lack of early concern included those who had close friends or relatives working at TMI. On Thursday, media reports indicated that the situation at TMI was under control, and the public seemed to have been reassured.

Evacuation Behavior. By Friday, March 30, individuals began to react to the developments in vastly different ways. Those who appear to have been less affected continued in their normal activities—they did not stay indoors or shut their windows; rather, they went about their business as usual over the weekend. It did not occur to them to evacuate, and few of their friends evacuated. Some persons reported being astonished to learn later how many had evacuated. Although by the weekend they were aware of a problem at TMI, the problem did not carry personal significance for them.

Others in the area did not evacuate but seemed to be more aware of the possibility of a necessary evacuation. In some cases, women and children were evacuated so their safety would be insured and so that those persons with official responsibilities would not have to be concerned about their families if a general evacuation were ordered. Individuals in this group who remained behind usually made preparations for leaving, such as filling the gas tank and packing, but never did evacuate.

The NRC survey (Flynn, 1979) showed that in those households having some people who evacuated and some who did not, there was a high sensitivity to the danger of the situation (86 percent reported that the situation seemed dangerous). The primary reasons given for some persons remaining behind were: (1) they were unable to leave their jobs, or (2) they would have left only had they received an evacuation order. Many (45 percent) felt that whatever happened "was in God's hands," and a large number (33 percent) were concerned about looters.

Those households having no one who evacuated exhibited a quite different pattern. The overriding reason given for staying was that they were waiting for an evacuation order; this reason was followed by the feeling that whatever happened "was in God's hands." The third reason for staying was that they saw no danger; this was mentioned two and a half times as frequently by members of those households in which no one evacuated as it was by members of those households having some members who evacuated and some who did not. Together, these three reasons suggested a greater confidence in authority in those households where no one evacuated. Although the desire to remain because of their jobs was something of a consideration for this group, it was not the overriding concern that it was for nonevacuees in households in which some persons evacuated.

Among those who did evacuate, there was variation in the responses. It is clear from individual descriptions of behavior during the first days of the accident that the decision to evacuate was perceived as requiring individual choices. Individuals were left with the responsibility for deciding not only if they would evacuate, but when, where, and how they would evacuate.

In a few households, the absence of an official evacuation order resulted in disagreement over whether or not to evacuate. About 12 percent of the respondents in the NRC survey said that members of their families somewhat disagreed or strongly disagreed over the decision. Most of these families did not, in fact, evacuate.

Considering the limited nature of the governor's advisory, the extent of the evacuation was substantial. The advisory was just that—an advisory, not an order to evacuate. Further, it only applied to pregnant women and preschool children within 5 miles of the station and less than 6 percent of the NRC sample fell under these criteria. However, both the NRC survey and the Pennsylvania Department of Health survey

indicated that roughly 60 percent (21,000 persons) of those residents within 5 miles of TMI evacuated. In the 5-10 mile ring, 44 percent (56,000 persons) evacuated. In the 10-15 mile ring, which contains most of the Harrisburg SMSA, 32 percent (67,000 persons) evacuated. Thus, it appears that approximately 39 percent (144,000 persons) of the total population living within 15 miles of the TMI station evacuated.

Since the majority of persons who evacuated were not doing so because of the governor's advisory, why did they decide to leave? The main reason given in four different surveys (NRC, Pennsylvania Department of Health, Kraybill, and Smith) was that the situation seemed dangerous. In personal interviews, evacuees said they were frightened by the reports they received (Lesniak, personal communication, 1979; Light, personal communication, 1979; and Kinney, personal communication, 1979). Another major reason for evacuating was the confusing information about the situation. Many assumed it was better to be safe than sorry and, in the absence of conclusive reassurance of the plant's safety, many chose to evacuate. A related reason for voluntarily evacuating was the desire to avoid the danger or confusion of a forced evacuation (Flynn, 1979).

The surveys showed that some types of people were more likely than others to evacuate. The NRC survey showed that females were more likely than males to evacuate. Of the children aged five and under, 66 percent were evacuated; of the pregnant women, it appears that 90 percent were evacuated. In the NRC study, no systematic relationship was found between income, education, and occupation levels, and evacuation behavior. However, according to the Kraybill study, the more highly educated were more likely to have evacuated. Information from the NRC survey, the Kraybill survey, and personal interviews indicated that older persons were less likely to have evacuated. In part, this was because they were less likely to be included, directly or indirectly, in the criteria outlined in the governor's advisory.

The greatest number of those who evacuated did so on Friday, 30 March 1979. Estimates of the percentage who left on that day range from 55 percent (Rutgers, 1979; Flynn, 1979), to 72 percent (Smith, 1979). It appears that most of those who evacuated had not considered doing so prior to Friday. Although a few households stayed in motels and hotels, the overwhelming majority of the evacuees (estimates ranged from 74 percent to 90 percent) stayed with friends and relatives. Most of the evacuees went to friends and relatives in Pennsylvania (Barnes et al (1979) estimated 67 percent, while

Flynn (1979) estimated 72 percent); for those who evacuated a significant distance within the state, the most likely destinations were Shamokin, Altoona, or Pittsburgh.

By the middle of the week following the accident, the perception of danger was considerably lessened. The median date of return to the area was Wednesday, 4 April 1979. However, the governor's advisory to pregnant women and preschool children was not lifted until 9 April, and schools within 5 miles of TMI did not open until 11 April. There was considerable variation in the amount of time evacuees remained out of the area, but as of summer 1981 no systematic study had been made of the decision-making process regarding returning to the area. Local informants cited the need to return to their jobs and a perception that the situation was under control as reasons for returning (Sides, personal communication, 1979; Kelley, personal communication, 1979).

During the two-week emergency period, the activities of at least half of the people in the area were disrupted (Flynn, 1979). During the week following 30 March, curfews were in effect over much of the area, and evening meetings were canceled. Since schools were closed and many of the children had evacuated, daytime activities involving children were canceled as well. The main changes in day-to-day activities mentioned by NRC respondents included staying indoors, canceling plans, being on edge, and getting ready to leave. Other responses frequently mentioned by various household members included being out of work, remaining home from school, spending additional time listening to the news, or working more than usual.

Economic Effects. Emergency period economic effects on area residents consisted of income losses (or gains) plus extraordinary expenses uncompensated by insurance.¹ These economic costs fell particularly heavily on evacuating households, but losses were also incurred by some who did not evacuate.

Loss of income among evacuating members of the labor force was not as pervasive as might have been expected. The NRC survey shows that slightly more than 33 percent of the evacuating labor force members lost work, and that just over half of these lost

¹It should be noted that the perspective of loss taken here is that of the local resident. Thus, if the resident is compensated by insurance, his loss disappears (assuming his share of the insurance payment is negligible). From society's point of view, however, compensation by insurance does not eliminate the costs of the accident.

pay. Thus, of the evacuees in the labor force at the time of the accident, only about one in five experienced a loss in pay. Based on the NRC survey, the median pay loss was \$110, although the mean was \$271, indicating that a few large losses were reported. (Flynn, 1979.)

Nearly all evacuating households experienced extra expenses associated with the evacuation. Median extra household expenses for evacuees was reported in the NRC survey to be \$100 but, again, the mean was substantially higher at \$198.

Economic effects during the emergency period were experienced infrequently by individuals who did not evacuate. Only 7 percent of nonevacuating households reported extraordinary expenses during the emergency period, and about 8 percent reported a loss of family income. Median extra expenses were reported to be \$51 and median income loss \$142.

The NRC survey results also imply that households within the 15-mile ring had received a total of \$1,215,000 in insurance compensation at the time of the survey (23 July through 6 August 1979). Independent data collected by the Pennsylvania Department of Insurance support the reliability of the survey findings. As of 10 August 1979, the private (nongovernment) claims within a 20-mile radius of TMI had been paid as follows (Pennsylvania Insurance Department, 1979):

\$1,212,388.	For relocation expenses
<u>85,937.</u>	For wage loss
\$1,298,325.	TOTAL

Thus, once the approximately \$1.3 million of insurance payments is subtracted from income loss and accident-related expenses, short-term economic costs borne by area households within 15 miles of TMI appear to be about \$18 million.

An additional perspective on the magnitude of these costs is attained by considering them relative to the number of affected households. For the 15-mile ring as a whole, costs per household averaged \$146. Relative to a mean family income of about \$17,000 (as estimated in the NRC survey), this amounts to a little less than 1.0 percent of annual family income. As would be expected, the burden on households that evacuated was relatively greater. The average cost per household for all households in the 0-15 mile ring with one or more evacuees was \$296, or about 1.75 percent of mean family income.

The costs of the accident to individuals may be mitigated by future insurance payments. A \$25 million class action suit against Met-Ed is pending with \$5 million earmarked for health monitoring. Businesses and individuals who were within 25 miles of TMI at the time of the accident are being asked whether they wish to participate, and will be asked later to submit claims against the \$20 million earmarked for this purpose. Also pending are claims by private individuals.

Health Effects. The primary document used to estimate the amount of radiation received by the general public is the "Population Dose and Health Impact of the Accident at the Three Mile Island Nuclear Station," prepared by the Ad Hoc Population Dose Assessment Group. This report estimated that the maximum additional radiation received by any individual off site was less than 100 millirems through 7 April 1979. The natural background radiation in the Harrisburg area is estimated to be 116 millirems per year. These figures can be put into context by noting that the background radiation in Denver, Colorado, is estimated to be 193 millirems per year, and the Environmental Protection Agency (EPA) guidelines for the level at which protective action (evacuation) should be considered is 1200 millirems per hour. Thus, it appears from the best estimates to date that the amount of radiation received off site was far below the level that would be considered a serious risk to health.

The Pennsylvania Department of Health has conducted extensive studies since the accident in order to determine whether there have been any changes in mortality or morbidity that can be attributed to TMI. To date, they have found no health effects at all. Factors that were examined included: incidence of spontaneous abortion, infant mortality, pregnancy outcome, neonatal hypothyroidism, and child growth and development.

Stress and Psychological Effects. The amount of stress experienced by people near TMI was a function of both the perceived threat to physical safety and the reliability of the information being used to ascertain the seriousness of the threat. The perceived threat varied considerably among individuals. For instance, responses to the NRC survey regarding perception of the seriousness of the threat at the time of the accident were as follows: very serious (48 percent); serious (19 percent); somewhat serious (21 percent); and no threat at all (12 percent). Generally, those closer to the plant were more likely to perceive the threat as serious than were those farther away. Those who thought TMI was a very serious threat at the time of the accident were

younger, female, more highly educated, and of higher income. Pregnant women were much more likely (64 percent) to view it as a very serious threat and much less likely to think it was no threat at all.

When asked, "Overall, how satisfied were you with the way you were given information during the emergency?", the median response for NRC respondents was in the middle of the four-point scale: half were either very satisfied (12 percent) or mostly satisfied (37 percent), and half were either very dissatisfied (22 percent) or mostly dissatisfied (29 percent). Generally, those farther from TMI were more likely to be satisfied with the information they received than were those closer to TMI. Those who were least likely to be satisfied were pregnant women (71 percent) and students (75 percent). There was a marked difference in overall satisfaction with information by evacuation status. Evacuees were much more likely to be dissatisfied (64 percent) than were nonevacuees (47 percent). (Flynn, 1979.)

Given the high degree of stress, it is not surprising that some of the people in the area reported experiencing psychosomatic symptoms because of the accident. Goldsteen's research indicated that persons in the area felt demoralized shortly after the accident, and that students experienced an average of one physical symptom—such as stomachache, headache, or insomnia. The NRC survey showed a higher level of stress symptoms for those persons living closer to TMI at the time of the accident for fifteen indicators.

Thus, the perceived threat, the lack of good information, the evacuation experience itself, and the psychosomatic symptoms indicate that part of the population experienced considerable stress at the time of the accident. At the same time, a significant minority of the residents were not at all worried about emissions from TMI and did not feel at all threatened.

11.2 Business Responses

As would be expected, given the substantial evacuation that took place on Friday and Saturday, 30 and 31 March, businesses in the vicinity of Three Mile Island faced a dual problem—a loss of customers and a loss of labor force. Nevertheless, most businesses operated throughout the emergency period and reported that by Thursday or Friday (5 and 6 April) their situations had returned to near normal.

Treatment of employees was highly variable. Evacuation does not seem to have been encouraged by employers, but individual decisions to leave do not seem to have been resisted. Three basic policies of compensation appear to have been used by firms. Some firms did not pay any employees who missed work, other firms compensated only those workers who fell within the definition of the governor's advisory, and a third group of firms compensated all of their employees who evacuated. The most prevalent policy appears to have been the first—no work, no pay. This was often rationalized by the observation that workers within the definition of the governor's advisory were eligible for insurance compensation. If other workers wished to leave, that was fine, but the businesses could not afford to subsidize their evacuation.

The business-interruption claims filed with the Nuclear Insurers¹ support the interpretation that extraordinary costs (i.e., wages paid to absent workers) were not commonly incurred. The claims data show that more than 75 percent of the claims were for loss of sales. In addition to claims for foregone sales, a few claims were filed for interruption or loss of production, some for extraordinary expenses in preparation for evacuation, and others for losses incurred in product testing. (Pennsylvania Insurance Department, 1979.)

In addition to coping with high absenteeism and, in many cases, low sales, numerous firms had to contend with two more problems—evacuation preparation and product/input protection. The possibility of a complete evacuation raised a difficult proposition for many of the area's large industrial facilities. Some of these industries have production processes that cannot be left unattended nor can they be easily shut down. The result, in the event of a forced evacuation, would have been damaged equipment and loss of goods-in-process. Contingency evacuation plans were worked out by some firms, but the shutdown times would have been relatively long (up to six or eight hours), and losses would have been great.

Employment and Unemployment. Studies regarding the employment losses due to TMI during the week immediately following the accident (30 March through 6 April) were carried out by the Pennsylvania Department of Commerce. In manufacturing firms,

¹Nuclear Insurers is the title used to refer to the pool of 253 companies that carry the property and liability coverage at Three Mile Island.

approximately 188,000 person-hours of work (an average 1.9 hours per employee) were lost during the week following the accident. Among nonmanufacturing firms, total losses amounted to just over 1 million person-hours. If the manufacturing and nonmanufacturing estimates are summed, the total loss in employment is approximately 1.25 million person-hours. Based on a 40-hour work week, this amounts to an approximate 8.5 percent loss in employment during the week following the accident in the areas surveyed. Thus, in the short period of time following the accident the employment loss was significant. In the context of average annual employment, however, the loss represents 600 person-years, or only a little more than one-tenth of 1.0 percent of average annual employment; the absolute magnitude of the short-term effects appears small.

Income. The NRC survey asked two basic questions about changes in income. First, all persons who evacuated were asked directly about income loss due to the evacuation. Within the 15-mile ring, this totaled about \$3.9 million. Evacuees were then asked whether, in addition to direct pay loss associated with evacuation, there was any other gain or loss in family income due to the accident. The response to this question resulted in an estimated net loss of \$2.8 million. When nonevacuees were asked a similar question about change in family income due to the accident, and they estimated a net loss of \$2.6 million. Thus, the NRC survey indicated a combined net income loss of \$9.3 million.

The order of magnitude of the income effects can be seen by multiplying a rough estimate of personal income per capita (\$8,000) by the estimated population of the 15-mile ring (about 370,000 persons). This gives a total personal income estimate of close to \$3 billion. The \$9 million income loss estimated in the NRC survey represents, therefore, about three-tenths of 1.0 percent of annual income in the area.

Sectoral Effects. The previously discussed estimates give an indication of the aggregate effects on economic activity in the area surrounding TMI. There were, however, certain sectors of the local economy that were particularly vulnerable to the effects of the accident, and these have been subjected to additional study.

Agriculture. The accident understandably raised questions about potential contamination of agricultural products grown or processed in the vicinity of the plant. Concerns were felt by farmers, processors, consumers, and industrial users of the area's

products. The Pennsylvania Department of Agriculture responded quickly to the emergency, and extensive testing was underway by Thursday, 29 March. The testing programs (principally of milk) uniformly failed to show levels of radiation that would be cause for concern. (Pennsylvania Department of Agriculture, 1979.)

Consumers and industrial purchasers of the area's agricultural products reacted immediately to the accident. Because of the potential concentration of Iodine-131, milk was the commodity which received the most attention. Local industrial concerns were careful to segregate, test, and monitor the use of locally produced milk, and several out-of-state dairies canceled their orders.

Similar effects were noticed in the sales of fresh agricultural products produced in the area, but it is difficult to know how much of the decline in sales can be attributed to customer resistance and how much to a lower number of customers because of the evacuation. In any event, the conspicuous effect on sales was limited to the week immediately following the accident.

More significant than these emergency period losses, however, was a clearly articulated apprehensiveness toward the Three Mile Island facility as it related to the health of the farm family, the farmer's livelihood, and the value of farm real estate. The concern of the farmer is easy to understand. Both income and wealth are tied to land, and if a force beyond the farmer's control threatens the productivity of land, the farmer is likely to feel very vulnerable. This vulnerability was further aggravated by lack of mobility. Livestock presented a problem regarding the potential need for evacuation, and this contributed to the farmers' perception of being locationally tied—a perception that was the opposite of that required by the potential evacuation.

Tourism. In April, there was an immediate and perceptible impact on the tourist industry in the Study Area due to the accident. Telephone contacts with the ten major lodging and convention centers in the area reported initial losses of nearly \$2 million in gross sales directly attributable to TMI. An attempt was made to extrapolate these findings to the tourist industry, and it was estimated that the total loss may have been between two and two and one-half times more than the initial estimate. This, however, fails to account for the fact that there was a very substantial influx of transients (such as media and technical personnel) into the area during the emergency period. Thus, while there was clearly a major interruption in the convention business, there was undoubtedly

some compensation for the lodging and restaurant trades, especially in the Harrisburg, Steelton, and Middletown areas. (Pennsylvania Department of Commerce, Bureau of Travel Development, 1979.)

Banking. The banking sector played a particularly important role in responding to the emergency. There were large demands for cash for the purpose of evacuation and in anticipation of possible evacuation. This situation was particularly dramatic in Middletown. The Commonwealth National Bank holds the deposits of a large proportion of the town's residents and, according to a bank spokesperson, by Saturday, 31 March, about 500 depositors had withdrawn enough to last them for a 4-5 day evacuation. The banking community recognized their necessary role in facilitating the plans of residents to evacuate. As a result, most banks reported little or no absenteeism among their employees, and many banks extended their business hours. (Ulsh, personal communication, 1979.) Extra shipments of cash were delivered from the Federal Reserve Bank in Philadelphia.

11.3 Institutional Responses

11.3.1 Emergency Preparedness Agencies

The accident at Three Mile Island strained existing emergency plans at all levels of government. Provisions at the federal level for interagency coordination in the event of an emergency were not effective in dealing with the accident at TMI. For instance, ad hoc communication strategies had to be devised during the emergency period. Also, federal agencies felt the necessity to assume responsibilities not specified in the existing plans, such as whether or not to recommend the administration of potassium iodide to the general public. Finally, responsibility for radiological monitoring and disaster assistance was the subject of "turf" disputes. (Human Sciences Research, 1979; Gorinson and Kane, 1979.)

The State of Pennsylvania was also hampered in the early days of the crisis by inadequate communication networks. It was difficult to transmit information from the site to the state agencies, from one state agency to another, and from the state agencies to county and federal officials, including NRC.

It appears from existing evidence that the county directors of emergency management were less plagued by interinstitutional friction and communication problems than were other levels of government. There was no ambiguity at the county level about

which agencies should assume particular functions. Vertical communications in both directions were limited mainly by difficulties above and below the county level, although there were a few cases of intercounty friction.

Although an emergency was not formally declared by the governor, the fact that there had been an accident was communicated through prespecified Civil Defense channels: (1) from Metropolitan Edison to the Pennsylvania Emergency Preparedness Agency; (2) from there to other state agencies, to federal agencies, and to the county directors; and (3) to the designated coordinators of the involved municipalities.

In some municipalities, this notification procedure caused difficulties. First, some municipalities had not designated a Civil Defense Coordinator; others had selected one but had not submitted the name for formal approval by the governor. Those municipalities without a coordinator on the governor's list (e.g., Royalton) were never formally notified of the accident. Second, because no formal emergency was declared by the governor, the municipal body normally in charge of public safety remained in charge rather than the Civil Defense Coordinator. Generally, this was the mayor or the township supervisor. Local officials stated that because no formal emergency was declared, the Civil Defense Coordinator had no legal authority to make decisions; but, in fact, all the emergency preparedness measures were being coordinated by the Civil Defense Coordinators at the various municipalities. Civil Defense Coordinators had to prepare as if an emergency had been declared when, in fact, it had not. Although the mayors and township supervisors were technically in charge, most received only secondhand information on the status of the plant—generally from their Civil Defense Coordinator or via the daily briefings and the news media. For officials on the West Shore, this was a particular problem since both the news briefings and the briefings for public officials were held in Middletown, some forty minutes (one way) away. Many of these municipalities did not have a single entity responsible for public safety even under ordinary circumstances; the de facto role of the Civil Defense Coordinator, despite the fact that no emergency was declared, further complicated a complex division of responsibility.

11.3.2 Responsibilities of Public Officials

All of the municipalities formally organized their emergency operations centers (EOCs) and response teams on Friday, 30 March. In some cases, police and fire personnel were on standby earlier, but it was not until Friday that emergency personnel went on

duty around the clock. Those in charge had responsibility for making several types of decisions. These included:

1. Preparing an evacuation plan for the entire municipality, should evacuation become necessary.
2. Notifying the residents once a plan was prepared. Generally, one-sheet flyers were mimeographed (Sunday, 2 May 1979) and distributed by firefighters.
3. In the case of two municipalities, issuing their own advisories for all elderly and disabled people to evacuate. All such people were asked to leave the area and stay with friends or relatives, if possible.
4. Developing detailed plans for coordinating with other agencies in the event of an evacuation order, looting, or any other serious development.

In these respects, except for the complexities noted, the municipalities responded much as they would have in any emergency. Where there were no problems concerning who was in charge, tasks appear to have been performed fairly smoothly, especially considering that no municipality had a prior detailed evacuation plan. One difficulty that was experienced, however, points to a general problem in formulating emergency response plans for a nuclear accident. At the county level, an initial effort was made to expand the 5-mile evacuation plan to a 10-mile plan and then to a 20-mile plan. This strategy was abandoned, however, when the logistical difficulties of having multiple plans became evident, and thereafter effort was concentrated on developing a 20-mile plan that could be scaled down if necessary. The 20-mile radius, of course, included considerably more people than either the 2-mile low population zone (LPZ) utilized in NRC siting criteria for TMI, or the 5-mile area designated in the relevant county emergency plans, and it required much more coordination.

In addition to the public agencies that had direct responsibility for dealing with the emergency, Hershey Park, approximately 10 miles from TMI, became involved on Friday, 30 March (Serff, personal communication, 1979). Shortly after 9:00 a.m. on that day, the Derry Township police requested that the sports arena be designated an evacuation center. Although the arena had been designated a fallout shelter in the 1950s, explicit plans had never been made for it to receive evacuees, and it had not been needed during previous emergencies (e.g., floods). Therefore, plans had to be formulated very quickly. The manager was informed that as many as 14,000 persons might arrive; in fact, only about 800 persons used the facility.

11.3.3 Local Government

In addition to the necessity of preparing for the evacuation of residents, the accident affected local governments in four other major ways. First, those municipalities which operated utilities (electric, water, sewage) had to develop operational contingency plans for each of the evacuation options (voluntary precautionary general evacuation and emergency general evacuation) being considered by state authorities. Second, difficulties in the existing institutional arrangements between municipalities became especially apparent. Third, the public facilities in Middletown were used for press conferences and news briefings. Fourth, some municipalities incurred out-of-pocket expenses during the emergency period (usually less than \$10,000), and municipal employees, volunteers, and elected officials contributed many hours of volunteer labor.

11.3.4 Schools

On Thursday, 29 March, one school principal asked the central administration of the Middletown Area School System what procedure to follow should an evacuation become necessary (Bartel, personal communication, 1979). He was told that normal emergency procedures would apply. Generally, these procedures appear to have been followed. Official dismissal began about 12:30 p.m. on Friday, March 30. Buses followed their normal routes, making three or four trips each, and all the children were gone within an hour. Parents were notified of the school closings by local radio stations, as would be the normal procedure during a snowstorm or similar emergency.

A different approach was followed on the West Shore. Newberry and Fishing Creek elementary schools were evacuated to a school more than ten miles from TMI. This strategy had the advantage of insuring the safety of the children. However, a few parents had difficulty in locating their children, which caused temporary panic. (Lesniak, personal communication, 1979.)

As with other institutions, the schools in the area faced problems for which they were not prepared (Bartel, personal communication, 1979). Although the preference of many administrators would be to dismiss children in the event of an emergency, the accident at TMI illustrated the necessity for developing a plan whereby the schools themselves could assume responsibility for evacuating the children, including some mechanism for alerting parents of the children's destination. Second, the schools needed a policy for dealing with the news media and a means of enforcing the policy. Some

reporters went directly to classrooms without the principal's permission or interviewed children on the playground without the principal's knowledge. Third, it was difficult to obtain accurate information for planning purposes and hard to know which informant to believe, especially since the Emergency Broadcast System was not activated. Some school administrators felt the same frustration as many other persons in the area—they felt they did not receive adequate, timely information for making decisions to protect the children.

11.3.5 Hospitals

The only hospital in the area that could remain in operation in the event of a serious radiological emergency was Hershey Medical Center. It had the capability of being sealed and pressurized and had extensive radiological emergency treatment facilities. Other hospitals would have needed to evacuate completely. Since hospitals are normally the recipients of victims of a disaster rather than the reverse, they were not prepared for a full-scale evacuation of their entire facilities.

Beginning on Friday morning, 30 March, hospitals in the area began to reduce their patient population. None but emergency cases were admitted, elective surgery was canceled, recuperating patients were sent home if at all possible, and kidney dialysis patients were moved to State College. An adequate staff was available to treat the reduced number of patients since many of the staff members evacuated their families and then returned to the area. For instance, the staff absentee rate at Holy Spirit Hospital never exceeded 20 percent, but its patient load was reduced to as low as 38 percent of full occupancy. The remaining patients were consolidated into a few wings, and other wings were closed (Frei, 1979). Hospitals in the area began to resume normal operations about Wednesday of the following week. By Friday, 6 April, most hospitals were back to normal.

11.3.6 Homes for the Elderly

Nursing homes in the area made ad hoc arrangements. Frye Village and the Odd Fellows Home in Lower Swatara Township were both evacuated, partly because administrators wanted to avoid the confusion of a forced evacuation and partly because they were short of staff. The elderly were transferred to hospitals and nursing homes outside the area. Other nursing homes prepared similar plans for evacuation but did not implement them.

11.3.7 Prisons

Expanding the evacuation zone to 20 miles placed several prisons in the evacuation zone. The Dauphin County Prison in Harrisburg faced problems that were typical of other correctional institutions in the area (Human Sciences Research, 1979). These included transportation of the prisoners, arranging for a host facility, and developing a logistical procedure for the actual transportation.

11.3.8 Summary

Institutions near TM^r were unprepared for a complete evacuation prior to the accident. One effect of the accident was to illustrate in the most graphic terms the difficulties of actually implementing any massive evacuation. Institutions responsible for evacuating people, especially dependent people, had not thought through the mechanics of how this could be done. Neither had they considered which records and equipment would have to be moved. Planning was further complicated by the fact that no one knew how long an evacuation might last.

By Sunday, institutions in the area had devised their own evacuation plans, usually in coordination with the County Civil Defense Director. Institution officials recognized the ad hoc character of these plans, given the conditions and time pressure under which they were developed. But even six months after the accident, few administrators of these institutions felt confident that their evacuation plans were adequate for insuring an orderly departure in the event of another accident.

CHAPTER 12: POST-ACCIDENT EFFECTS

12.1 Introduction

The period of the emergency at Three Mile Island was disruptive for the residents of the region surrounding the plant. Stress was interjected into the daily lives of many people, economic activities were interrupted, and local political and institutional structures came under pressure. However, most of the conspicuous signs of the emergency disappeared just as suddenly as the emergency had appeared. There was no damage to public and private facilities (other than to the nuclear generating plant itself), and by the second week in April most evacuees had returned to their homes, businesses were open, schools and other institutional facilities had reopened, and daily activities appeared to be much as they had been before the accident.

The presumption was made frequently by those at a distance from the plant site that real estate values would plummet, that tourism and agriculture would be adversely affected, and that the entire economic future of the area would be in question. Yet in the vicinity of the plant, real estate transactions continued to take place, dairy products were produced and sold, visitors came to have their pictures taken against the background of the Three Mile Island cooling towers, and industrial developments continued to move forward. A conspicuous characteristic of the post-accident environment was the discrepancy between the presumed severity of impact suggested by persons having little direct familiarity with conditions in the area, and the absence of continuing effects alleged by many living in the area.

This section examines the period from mid-April through the summer of 1981. The purpose is to identify the extent to which there appear to have been continuing effects of the accident on the individuals, businesses, and institutions of south-central Pennsylvania. Not surprisingly, the previously noted extreme generalizations are of little help in trying to describe conditions as they developed during the months following the accident.

12.2 Effects on Individuals

12.2.1 Economic Effects

An important conclusion of this research is that there are no apparent widespread continuing economic effects attributable to the accident. The NRC survey in August 1979 identified only a small proportion of households that reported continuing effects.

Among households that evacuated, 12 percent reported continuing effects; households that did not evacuate reported only 4 percent continuing effects.

The individuals who have suffered the most direct adverse economic impact are very likely the GPU common stockholders. The total value of their investment has dropped by about \$725 million since the accident. On the day before the accident, GPU common stock reached a high of 17 7/8. By October 1979, the stock was being traded at 8 or less. The stock reached a low of 3 7/8 in 1980, but hovered between 4 1/2 and 5 in the spring of 1981. Common stock dividends have been withheld several times.

12.2.2 Continuing Stress and Psychological Effects

There is some evidence that stress has persisted since the emergency period. In the late summer of 1979, nearly a quarter of the respondents in the NRC study still perceived TMI as a very serious threat to their safety. Only 28 percent felt it was no threat at all. Even more respondents (41 percent) were still very concerned about emissions from TMI, and somewhat fewer (25 percent) were not at all concerned. The fact that concern about emissions was considerably less prior to the accident (12 percent very concerned) than it was in July following the accident (41 percent very concerned) shows that TMI had clearly become a substantially greater source of stress. Many are still very concerned about the contamination in Unit 2 and about GPU's ability to clean it up without further risk to the public. Bromet's study indicated that "adverse mental health effects were seen in mothers (of preschool children) as long as one year after the accident" (Bromet, 1980:75).

It appears that many of the psychosomatic indicators of stress have returned to their pre-accident levels. Goldsteen's data for the Kemeny commission indicate that feelings of demoralization increased sharply during the emergency period, but these indicators of stress were short lived. Data from the NRC survey showed a similar pattern for comparable indicators. However, continuing somatic symptoms appeared to affect a small percentage of the population. Similarly, Mileti's study of unobtrusive measures of stress indicated a short-lived effect. Three measures included in the study were: (1) alcohol consumption, (2) auto accidents per vehicle mile, and (3) psychiatric admissions. The first two of these variables increased only during the first three days following Friday, March 30, while the third showed no change.

One local mental health official pointed out that persons who were "successful" in coping with stress from the accident are likely to feel confident in their ability to handle

future stress and were thus strengthened by the accident. On the other hand, those who didn't feel they could cope are less likely to feel confident that they can cope in the future. Since the accident was, in fact, out of the individual's control, those who tended to cope in a passive manner seemed to fare better than those who tended to cope in an active manner--factors which are contrary to most everyday situations.

A continuing source of low-level stress for local residents is the quality of existing evacuation plans. It is generally known that most areas did not have well developed plans prior to the accident but that they had developed plans (however rudimentary) by Saturday afternoon or Sunday morning. Since the accident, additional work has been done on the plans, by either county officials or municipal officials. In some cases, individual citizens have participated in working on the plans. Some municipalities have already spent dozens of person-hours on revising their plans since the accident. However, it appears to some that there are still problems with various plans. Examples of deficiencies mentioned by residents include: failure to take into account wind direction, failure to include an element for evacuating the elderly, and failure to adequately resolve the problem of the separation of parents and children if school is in session when an accident occurs.

The ongoing discussion regarding Three Mile Island is still quite technical and it is clear that in trying to understand what is currently occurring, many laypeople are still confused. This problem is further complicated by what appears to be continuing contradictory statements in the local press, such as differences of opinion about how much radiation was received by the local population, whether it is even possible to estimate the amount of radiation with any degree of certainty, and whether an evacuation or advisory was warranted by the facts. During the emergency period, Harold Denton was viewed by laypersons as a single source of reliable data. At present however, laypersons seem to feel that there is no similar source to reliably inform them about what happened in the past nor what is presently happening at TMI. For some, this continuing lack of clear, unambiguous information contributes to continuing stress. A solution used by some to deal with the stress has been to try not to think about TMI. One local informant described this adaptation to stress as "significant numbing."

12.2.3 Daily Activities

In many ways, day-to-day life has returned to normal in the area near TMI. People are back at their jobs or in school, and community meetings and activities are

proceeding as scheduled. The NRC survey showed that, although about 25 percent of the respondents experienced disruptions of activity (over and above evacuation) during the emergency period, 90 percent of the respondents said their normal activities in July 1979 were completely unchanged by the accident.

Still, there have been a few changes in daily routines in the two-year period following the accident: radiation levels are checked daily at several locations; some 10,500 citizens have toured the facilities on the island since April 1979; and in the immediate vicinity of the plant, the speed limit on the major access road to the island (PA-441) was reduced to 45 miles per hour. In addition, residents are disturbed, on occasion, by noisy activities on the island (loud sirens, loudspeakers) in the early morning hours. However, these changes are perceived to be relatively minor.

On the other hand, the intensity of feeling regarding TMI is perceived to make a qualitative difference in the daily lives of some residents. Many were apprehensive about the first anniversary of the accident and assumed that the event would lead to demonstrations. For the most part, however, the demonstrations in Harrisburg and Washington, D.C. were peaceful.

Immediately following the accident, there was quite a lot of discussion about Three Mile Island, as would be expected of any such event so heavily reported in the news. However, as it became clear how individuals felt, and particularly how deeply they felt, there was an implicit, and in some cases explicit, agreement to avoid the topic in order to avoid upsetting everyone. At present, TMI is discussed very little in day-to-day conversation, and the intensity of feeling has declined for the average citizen.

In the fall of 1980 it appeared that a pattern of decreasing contact was evolving between those seriously involved in the antinuclear movement and others in the area. This decreased contact seemed to be partly coincidental; there were so many meetings for members of antinuclear groups to attend and so much additional work to do, that the contacts of most of these informants were restricted to people who shared their sentiments. Since that time, two patterns have emerged. First, those who have remained heavily involved in antinuclear groups devote most of their energy to these groups. They have experienced more than two years of intense effort, have had many setbacks, and have spent some \$200,000 as intervenors. But there have also been successes: increased participation in decision making over preaccident levels (especially

in connection with the Programmatic Environmental Impact Statement for the cleanup of Unit 2); vindication by the courts that the NRC should not have allowed the krypton venting so soon; formation of a Citizens' Advisory Board; acquisition of federal support for the costs of intervention; and radiation-monitoring education. The stress on the individuals belonging to the antinuclear groups has thus been enormous.

The second pattern that has emerged is that some members of antinuclear groups have reduced their time and energy commitment to the groups and have tried to recapture their normal day-to-day routine. For these members, there is a serious commitment to the goals of the antinuclear groups and continuing moral support for those goals. But there is also a feeling that, for them, TMI will represent a threat for many years to come, and an intense level of involvement cannot be maintained indefinitely.

About a year after the accident, a local pronuclear group became active. The Friends and Family of TMI currently reports about 600 members. This group has sponsored an energy fair at a shopping mall, has developed an exhibit on waste management, and is actively involved in citizen education.

However, despite these efforts and the passage of time, opposition to the restart of Unit 1 remains high in the TMI area. As of October 1980, among a probability sample of residents living within 5 miles of TMI, 47 percent were opposed to the restart and 42 percent who lived between 41 and 55 miles from TMI were opposed to the restart (Houts, 1980). Other local studies report similar results. A study conducted in March 1980 by the Social Research Center of Elizabethtown College found 44 percent of the respondents opposed to operating either unit with nuclear fuel in the future; this was up from 35 percent in 1979. A Harris poll taken in April 1981 found Pennsylvanians philosophically opposed to nuclear power by a margin of 50 percent to 43 percent, but these same respondents were prepared to overlook this fact in exchange for lower electrical bills (52 percent would accept nuclear power versus 42 percent opposed to nuclear power).

12.2.4 Movement from the Area

Even though there is little evidence of continuing direct economic effects on individuals living near Three Mile Island, as noted in the previous sections, there continues to be a high level of sensitivity to living near the nuclear plant. The most

extreme behavioral response is the desire to pack up and leave the area. Given the economic and psychological costs associated with a move, this attitude would certainly be an indication of extreme distress. The respondents in the NRC survey (August 1979) were asked whether anyone in the household had considered moving because of the accident. In response to this question, 19 percent indicated that they had, and this response was given much more frequently by persons living nearest the station. In addition, those who said they had considered moving tended to be younger and more highly educated than respondents who reported that they had not considered moving.

Among those households that had considered moving, 22 percent reported that they had definitely decided to move. This implies that as many as 1,400 households within five miles of the plant (approximately 4 percent) reported that they intended to move because of the accident; the number that will actually move remains to be determined.

A study of the actual mobility of the population within five miles of TMI was recently completed by the Pennsylvania Department of Health. It covered mobility for the period of August 1979 to July 1980. Approximately 11 percent of the population had moved, which was a slightly lower rate than for the previous year and for the northeastern states in general. About 16 percent of the movers (1.8 percent of all households in the area) said TMI was the main reason they moved. Further analysis indicates that, although in-migrants have more positive attitudes towards TMI than out-migrants, attitudinal factors added virtually no explained variance to the usual demographic predictors of mobility. As an additional check on possible out-migration from the area immediately around the plant, elementary school enrollments since the 1974-1975 school year were obtained from local officials. As Figure 12-1 demonstrates, no significant change in enrollment was apparent between 1974-1975 and 1979-1980. Data for 1980-1981 elementary school enrollments in the 5-mile ring show 1,509 for Middletown, 1,200 for Fishing Creek and Newberry, 590 for Londonderry, and 175 for York Haven. In no case is there clear evidence of an effect of the accident, and our conclusion remains that even though many families living near the facility report stress and continuing threat due to the proximity of Three Mile Island, relatively few have been sufficiently concerned to relocate their homes because of the accident. The only odd points in otherwise smooth trend lines are: (1) the large increase in 1977-1978 enrollment in the Middletown Area School District (the current fourth grade is much larger than classes ahead or behind it, but the reason for this is not yet known); and

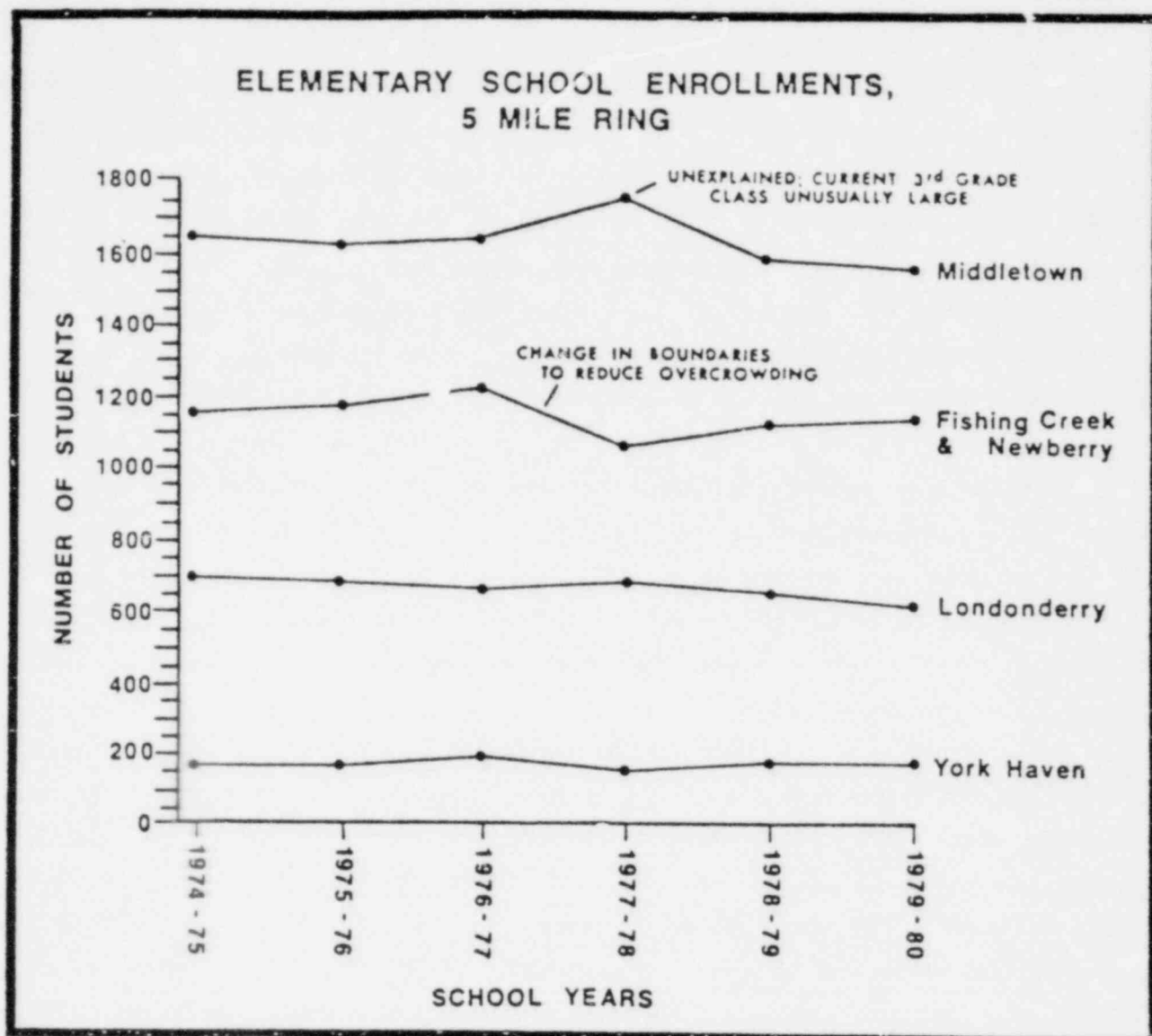


FIGURE 12-1

SOURCE: Mountain West Research, Inc., 1981

(2) the dip in enrollment between 1976-1977 and 1977-1978 for the Fishing Creek and the Newberry elementary schools. Population growth in the early 1970s was so great in this area that additional facilities were added to Newberry Elementary School. The school boundaries were redrawn when the school opened to relieve crowding at Fishing Creek and other nearby elementary schools. Since the bulk of the transfer was from Fishing Creek to Newberry, the enrollments for these two have been aggregated. The dip, therefore, represents children reassigned to other schools. However, the slope of the upward trend since the new boundaries were drawn is quite similar to the slope prior to the redistricting. This is particularly striking since the state as a whole has experienced an 18 percent decline in enrollments over the same time period that TMI-area schools have grown or remained stable.

12.3 Post-Accident Period Effects on the Local Economy

12.3.1 Evidence of Continuing Direct Effects on the Economic Base of the Area

By September 1979, six months after the accident, there was no evidence of continuing direct negative effects on the economic base of the area surrounding TMI. A study by the Pennsylvania Department of Commerce reported that a small proportion of both manufacturing firms (9.8 percent) and nonmanufacturing firms (4.1 percent) perceived a short-term image effect on their product.

The most vulnerable sectors—agriculture and tourism—have been subjected to studies in an attempt to determine the presence of long-term effects. Within ten miles of TMI, 7 percent of the farmers indicated that they were continuing to experience losses due to the accident. Beyond ten miles of TMI, 3 percent reported experiencing losses (Pennsylvania Department of Agriculture, 1979). The Department of Agriculture reported, however, that the loss of sales may be more closely related to the gasoline shortage than to the accident at TMI. In its 24 August report, the Department of Agriculture concluded that: "At this point in time, it does not appear that there has been a permanent decrease in sales or a resistance to the buying of agricultural commodities produced or processed in the TMI vicinity." (Pennsylvania Department of Agriculture, 1979.)

Concern with possible long-term effects on tourism led to a travel-industry sponsored survey of potential travelers to Pennsylvania. A total of 608 persons were interviewed over the period 26 April 1979 to 30 April 1979. The results indicated that only 2 percent of the respondents would avoid traveling to Pennsylvania because of

concerns regarding TMI and nuclear power. Given the proximity of the date of the survey to the emergency period, it seems unlikely that there are any continuing effects on tourism at this time (Pennsylvania Department of Commerce, Bureau of Travel Development, 1979). It would, in fact, be almost impossible to determine the actual extent of continuing effects on tourism because the industry was severely affected by several other factors that summer: a polio outbreak in Lancaster County, gasoline shortages throughout the area, and bad weather during the weekends. Each of these factors contributed to making the 1979 summer season less successful than usual, and it would not be possible to isolate any independent effects due to TMI, even if they existed.

Interviews with the Small Business Administration (SBA) and with the Bureau of Employment Security (BES) support the conclusion that there has been no continuing direct disruption of the area's economy. The SBA reported that a total of \$423,000 in loans had been approved to assist fifteen firms that had been seriously impacted by the accident. Most of these were general retailers or service-related businesses that suffered adverse financial impacts immediately after the accident. By late summer, very few additional applications were being filed, and those that were filed continued to deal only with short-term losses. The loan officer interviewed was unaware of any continuing disruption due to the accident. For purposes of comparison, the SBA officer pointed out that 35,000 loans had been made as a result of Hurricane Agnes in 1972 and that 1,500 loans had been made as a result of Hurricane Eloise in 1975 (Japak, 1979).

Information from the BES reinforced these conclusions. There were unemployment insurance claims in April 1979 and there have been a few continuations since that time but, at present, there is no evidence of any continuing economic dislocation due to the accident (Pennsylvania Department of Commerce, 1979).

12.3.2 Direct Effects of Changes in Metropolitan-Edison Employment

Since the accident, total employment at the Three Mile Island site has increased substantially for both GPU and Met-Ed. Prior to the accident, about 540 persons were employed on site; by late 1980, this figure had more than doubled (1,098). In current dollars, basic income at TMI increased from an average of about \$1.2 million per month to \$2.2 million per month over the same time period.

On the other hand, it was reported that Met-Ed laid off 700 subcontracted craft people in September 1980 to cut costs when the PUC denied a requested \$35 million rate

increase (Patriot, 27 September 1980). Five hundred of these jobs were located at the TMI nuclear plant. The effects of these layoffs may have been exacerbated by a decrease in other cleanup-related employment at the plant during this same time period. For instance, decontamination of the auxiliary and fuel handling buildings required nearly 200 workers between April 1979 and December 1979 (draft, Programmatic Environmental Impact Statement, pp. 5-6). As this cleanup period task neared completion, the number dropped to 82 in January 1980, then to 52 in February 1980.

Future employment at the TMI nuclear plant will vary considerably depending on the number of employees needed for a particular task. Accurate estimates of the number of employees needed for future cleanup efforts are not possible to obtain as they will depend, in part, on regulatory decisions which are not easily anticipated. For instance, estimates of the emergency work force needed for radiation mapping and damage assessment for the reactor building range from 0-500.

12.3.3 Indirect Effects on the Economy of the Area

Cost of Power. Although there is little evidence of continuing direct interference with economic activity due to the accident, many people mention increases in the price of electricity as a possible indirect effect of the accident. Metropolitan Edison Company (Met-Ed) and the Pennsylvania Electric Company (Penelec) had been granted rate increases by the Pennsylvania Public Utilities Commission (PUC) in late March 1979 to reflect the inclusion of TMI Unit 2 in their rate base¹. This increase was rescinded after the accident and, in an order entered 19 June 1979, Met-Ed and Penelec were prohibited from including any part of the capital assets of TMI Unit 2 in their rate base. Further, since TMI Unit 1 was not back in service by 1 January 1980, it was also removed from the rate base. The implication of these decisions is to prohibit the utility from earning any return on a substantial share of its assets. This imposes costs on the investors/owners of GPU, whose common stock has fallen by more than three-fourths since the accident.

¹The TMI station was constructed by GPU Service Corporation and is operated by Met-Ed. The station is owned jointly by GPU's three operating companies: Jersey Central Power and Light (25 percent), Metropolitan Edison (50 percent), and Pennsylvania Electric Company (25 percent).

The fact remains, however, that Met-Ed must now purchase power to replace power that would have been supplied by TMI. At present, this cost runs about \$24 million each month. This is estimated to be reduced to about \$10 million if Unit 1 is restarted. The PUC has been conservative regarding the amount of these increased costs that the utility is allowed to pass on to its customers. It appears that eventually all of the costs will be recoverable by the utility, provided that it can demonstrate that all reasonable steps were taken to minimize them.

The PUC maintains that the result of all this is that "the ratepayers of Metropolitan Edison Company and Pennsylvania Electric Company should be no worse off and no better off because of the incident" (Pennsylvania Public Utility Commission, 1979). This statement is confusing because it is not related to any of the principles laid down in the order of 19 June 1979, and because its truth clearly depends on the future (unknown) price of replacement power. In any event, customers in the Met-Ed, Penelec, and Jersey Central service areas are paying more for electricity now than they were before the accident because of the rate increases due to the costs of replacement power. The PUC presumes that these rates do not differ substantially from the rates that would have prevailed had the accident not occurred and had Unit 2 been included in the rate base. Discussions with area businessmen made it clear, however, that all of the rate increases were perceived by the public as being due to the accident. It is also true that rates will have to be raised further to cover the full costs of replacement power. If the Unit 1 restart is substantially delayed, the total price increases could be large even if the PUC continues to include cleanup costs from the rate base.

By the summer of 1981, increases in the cost of power were also quite noticeable to businessmen in the Met-Ed service area. A Lebanon Chamber of Commerce publication states that both residential and industrial increases in electric rates since the accident have risen much faster in the Met-Ed service area than in those areas serviced by nearby utilities. Individual businesses have been hit especially hard, and some firms are giving serious consideration to revising expansion plans and laying off personnel.

In the Pennsylvania Department of Commerce's study of manufacturing firms, a 10 percent increase in the price of electricity caused 22 percent of the firms to indicate that they would not expand in the area (if they were considering expanding), and caused 30 percent to report that their plans to remain in the area would be affected. Among the nonmanufacturing firms, 13 percent reported they would not expand in the area, and 33 percent reported that their plans to remain in the area would be affected by a

10 percent increase in the price of electricity. Even more significant, 62 percent of the nonmanufacturing firms reported that their plans to remain in the area would be affected by a 25 percent increase in electricity prices (Pennsylvania Department of Commerce, 1979). These data, combined with discussions with area businessmen, tended to reinforce the conclusions that much of the so-called image problem of the area was directly associated with potential effects on the cost of electricity. Significant price increases would undoubtedly affect some relocation or expansion plans and even the possibility of these effects could have serious consequences.

Other Indirect Effects. A few firms in the area that supplied the operating reactors have had layoffs which they attribute directly to the accident. These include firms that repair and check valves, and firms that supply specialized radiological equipment. On the other hand, other major employers in the area (Freuhoff, Bethlehem Steel) have increased their work forces in response to market demands from outside the area. There does not, as yet, appear to be a consistent pattern of indirect employment effects related to the accident.

Effects on the Value of Real Estate. One of the most common presumptions held by persons living outside the immediate vicinity of Three Mile Island is that the value of real estate must have been seriously affected. Even the surveys of area residents frequently produced responses that indicated concerns with potential effects on the value of real estate. Countering these presumptions has been a consistent and highly visible claim by local realtors that there have been no effects. For example, the 20 August 1979 issue of The Harrisburg Evening News ran a feature titled "Nuclear Clouds Cast No Shadows on Real Estate Values." The conclusion of the article was that real estate had not lost value. No evidence was presented except for specific instances of sales substantially in excess of purchase price, which, of course, does not take into account all the other relevant factors affecting market price. It is significant, however, that the public posture of the local real estate community is that there has been no effect. In the same article, the president of the Greater Harrisburg Board of Realtors was quoted as follows: "I don't see any change in property values due to Three Mile Island. Prices are still going up. It's business as usual."

A realtor who deals almost exclusively in the 5-mile radius of TMI provided additional insight on post-accident residential transactions. To date, he does not feel that the market has suffered because of the accident. His conclusions are based on

monthly data on listings, sales, and settlements over the period 1977-1981. Both listings and sales took a very noticeable dip in April 1979 but appear to have been normal since that time. Further, the settlement trend has not indicated that buyers are less prone to complete those sales that had been negotiated prior to the accident. However, like the rest of the country, real estate in general has suffered due to recent high interest rates and the shortage of mortgage money (Bitner, 1979 and 1981).

A study prepared for the Nuclear Regulatory Commission reported similar findings. "The accident at TMI in March 1979 had no measurable effects, either positive or negative, on the value of single-family residential properties close to the plant, within a twenty-five mile radius of the plant, or in any direction from the plant." (Gamble, 1981.) Differences between property values within five miles of TMI and in the greater Harrisburg area were attributed to trends in the quality of housing development which existed prior to the accident.

Two factors said to have helped to sustain sales are GPU's liberal transfer policy and the expansion of the work force at TMI. Although many of the additional workers are construction workers or other temporary workers, some are GPU employees who have been transferred to the site. GPU regularly pays closing costs and other similar costs for employees who, when they are transferred, sell their present home and buy another at the new location. If their present house does not sell, GPU buys it. Thus, these workers are not overly concerned about selling their residence when they are transferred from the TMI area since GPU will buy it if necessary. More recently, home buyers employed by GPU subcontractors have helped to maintain the market. (Bitner, 1981.)

The Pennsylvania Department of Community Affairs has compiled data comparing certain characteristics of property sales within five miles of TMI to those same characteristics for the entire Central Pennsylvania Multi-List Area. Units sold in the 5-mile radius averaged about 6 percent of the total area sales between early 1977 and mid-1979. Second quarter sales in 1979 were only 5 percent of the area total, but the figures show that this ratio was subject to considerable quarter-to-quarter variability. There did not appear to be any unusual developments during the second quarter in either the sales price or the sales-price-to-listing-ratio. However, the "average days on the market" increased. Real estate in the five-mile radius has traditionally been on the market a shorter period of time than for the area as a whole. This relationship changed significantly in the second quarter of 1979. By the third quarter, days on the market

were once again lower than for 1978, and slight increases in the fourth quarter were found throughout the 20-mile radius (Governor's Office of Policy and Planning, 1980). This lack of long-term effects is consistent with the observation that vacancy rates remain low near the plant, both for rental properties and owner-occupied properties.

12.4 Institutional and Political Effects

Very few of the health and social service institutions discussed in the context of the emergency period experienced any effects from the accident beyond the emergency period. Most have spent little or no time since the accident on refining their evacuation plans. Hospital occupancy is back to normal, and schools are in session. Clergy do not report any increase in counseling needs because of the accident and there is no evidence of accident-related increases at mental health facilities.

However, the accident has affected the organization of Civil Defense (CD) groups in some areas. In one case, the number of CD deputies has increased from two to seven; the additional men are receiving specialized training. In some areas, emergency personnel requested additional equipment from the municipal authorities—a small fiscal effect of the accident. The activities of the CD groups have generally increased markedly since the accident. Most municipalities have already put in many person-hours in revising evacuation plans, and are continuing to do so. In some cases, these efforts have involved members of both the general public and antinuclear groups.

Concern with evacuation plans increased when the January 1980 Rogovin study reported that the TMI plant came within 30-60 minutes of a meltdown which would have required the evacuation of thousands of people. The NRC responded by delineating that the utilities must notify the authorities within 15 minutes and the public within 30 minutes after detecting a nuclear accident (Patriot, 6 January 1980). Permission to restart Unit 1 is dependent, in part, on the quality of evacuation plans. All counties within a 20-mile radius of TMI were required to submit adequate evacuation plans to the NRC (Patriot, 20 January 1980). A drill to test the plans was held in June 1981, and the communications systems functioned effectively.

Claims for the economic losses sustained by municipal and county governments within a 10-mile radius of TMI have been settled for the most part. Claims of over \$50,000 were settled in November 1979 (Patriot, 1 November 1979). TMI-related state government costs were more than \$760,000 during 1979 (Governor's Office of Policy and

Planning, 1980:130). These costs, however, may have been offset by a state tax windfall related to Met-Ed's increased purchases of out-of-state electrical power. The excess Gross Receipts Tax on purchased power was estimated to be as high as \$18 million during the first two years after the accident.

Taxes paid by Met-Ed to local municipalities have increased since the accident. In the quarter preceding the accident, Earned Income Taxes for Middletown were \$5,800, while for Londonderry Township they were \$2,775. By the fourth quarter of 1980, these figures had risen to \$9,650 (up 66 percent) and \$3,600 (up 30 percent), respectively. Occupational Privilege Taxes for Londonderry increased 45 percent between 1979 and 1980.

Other institutional effects vary considerably by municipality. Since the accident, local officials have had an added pressure group to deal with. Half of the six municipalities in the local area have their own antinuclear groups. Members of these groups are committed to keeping TMI closed and have exerted pressure on their local elected officials to pass resolutions opposing the reopening of TMI. Those legislative bodies that have been requested to do so have passed such resolutions. The provisions vary among the municipalities but include: opposition to the restarting of both units; support of the restarting of both units if proper safeguards are established; abolition of the Price-Anderson Act; and an end to the nuclear exclusion provisions in homeowners' insurance policies. These groups also observe the efforts of local officials to obtain monitors and other safety equipment, to develop emergency plans, and to deal with the utility in general. Given the intensity of their feelings, the pressure they exert is not insignificant.

The accident at TMI has sensitized the population and has led to an increase in citizen participation. Many persons in antinuclear groups have started attending council/supervisor's meetings for the first time and local agencies have at least one or two meetings with much higher-than-usual participation. Reports of such meetings indicate that they are generally orderly, with the exception of the 20 June 1979 Middletown Borough Council meeting. The stated purpose of that meeting was to solicit the opinions of local residents about TMI so that the council could later frame a resolution. However, participants wanted council members to state their positions that same night and, therefore, cornered council members after the meeting was adjourned. Police escorts were required to assist the council in leaving the building. The original intent of the Middletown Borough Council was to defer passing a resolution until research findings

from the State of Pennsylvania and the President's Commission were available. However, when consideration was being given to restarting Unit 1 in August 1979, the council passed a resolution opposing the restart. Since the resolutions have been passed, participation at council/supervisor's meetings has dropped to more typical levels although a few individuals continue to participate at a higher level than they did in the past and to express their opinions on other topics as well. The other major forum in which local residents have expressed strong feelings is the public hearings on the cleanup of Unit 2 and the restart of Unit 1. The issue of the krypton venting elicited an especially strong negative response.

The antinuclear groups themselves represent an institutional addition to this area. Prior to the accident, opposition to TMI included the Three Mile Island Alert (TMIA), a Harrisburg-based group, and the Environmental Coalition on Nuclear Power (ECNP), a state-wide organization. Both of these groups increased their membership and operating funds substantially following the accident. In addition, three groups were formed in the immediate area: Persons Against Nuclear Energy, Middletown; Concerned Citizens of Londonderry; and the Newberry Township Steering Committee. Two additional groups farther south (the Anti-Nuclear Group Representing York, and the Susquehanna Valley Alliance) are concerned about the Peach Bottom station as well as TMI.

Although this proliferation of groups led to predictable disagreements regarding turf, methods of proceeding, and intergroup structure, efforts to resolve these disagreements have been reasonably successful. These intergroup connections are expected to be necessary for at least ten years. Although no systematic study of group membership size or characteristics is available, the antinuclear groups seem to include a cross-section of the population residing in the TMI region. Participation in the antinuclear groups has declined over time, according to local antinuclear informants. For instance, membership in TMI-Alert has declined from about 700 just after the accident to about 400, with only 25-30 persons remaining very actively involved. The decline in membership is attributed to the implementation of regulatory decisions and the lack of funds to intervene effectively. Antinuclear groups expect increased activity and participation when the decision to restart Unit 1 is made by the NRC (anticipated for October-November 1981). They expect that at that time there will be spurts of activity around specific issues, such as dumping the processed water from TMI into the Susquehanna. Nonetheless, they do not anticipate any substantial growth over the next two years.

CHAPTER 13: POTENTIAL FUTURE EFFECTS OF THE ACCIDENT

13.1 Introduction

The purpose of this report has been to present what is presently known about the social and economic consequences of the accident at Three Mile Island on the residents of the area surrounding the plant. Given that our research into the consequences of the accident is ongoing, we have thought of this report as an interim statement on findings to date. However, much of the current behavior in the area is shaped by speculation about the future. People are concerned about the implications of various proposed alternatives for the TMI facility and, since some of the concerns have serious implications, it seems appropriate to delineate them. Furthermore, it needs to be made explicit that the effects of the accident are not over, even though many of the effects of the accident appear to have dissipated in the post-accident period.

Uncertainty is a dominant characteristic of the situation presently surrounding the future of the generating facilities at Three Mile Island. There are three major areas of uncertainty. The first concerns regulatory treatment of both Unit 1 and Unit 2. Important decisions will continue to be made by the United States Nuclear Regulatory Commission, the Pennsylvania Public Utility Commission, and the Pennsylvania Department of Environmental Resources. These decisions will affect the timing of restart/rehabilitation alternatives, the technical characteristics of feasible options, and the financial condition of GPU. The second area of uncertainty concerns the technical characteristics of the rehabilitation plans GPU will propose to pursue. Questions of timing, safety, and environmental characteristics of the proposed plan will depend both on regulatory decisions and on the extent of the damage to the reactor core. Finally, there will continue to be uncertainty with respect to the financial capability of GPU to operate under the options that are presented to it by the regulatory authorities. Less easy to characterize, but equally important, will be the ability of GPU to gain the confidence of the regulatory authorities, the financial community, and the residents of the area.

The cumulative uncertainty that arises from the interaction of these contingencies is substantial and may itself be a source of adverse impact on the area. The purpose of the remainder of this section is to try to trace out these possible future

effects under the range of conditions that may ensue. Since the effects on individuals will be shaped in part by economic and institutional considerations, they will be covered last in this section.

13.2 Potential Future Economic Effects

13.2.1 Cost of Power

At the present time, there is substantial confusion about the effect of the accident on the price of electricity. There is no definitive work that establishes baseline electricity price projections in the absence of the accident, electricity price projections under different restart/rehabilitation scenarios, direct effects of any changes in price on area firms under each of the scenarios as compared to the nonaccident case, and indirect effects on the level of economic activity and on its spatial distribution among utility service areas.

The price effects of the accident could be substantial and, given the energy intensity of the industry in the local area, the long-term economic implications of these increases could be large. The effects might be of several types: reductions in the levels of production, employment, and income in the local area; spatial redistribution of growth in favor of utility service areas other than Met-Ed and Penelec; and redistribution of income from the customers of Met-Ed and Penelec to the sellers of surplus power, many of whom also are located in Pennsylvania.

13.2.2 Other Potential Future Economic Effects of the Accident

If there were no cost-of-power effects, the only other potentially significant aggregate economic impacts of the accident would be the stimulus received by the local economy associated with the rehabilitation or replacement of Unit 2 and the retrofitting of Unit 1. Depending on the plans finally decided upon, the area could receive a long-term economic stimulus equivalent to a major construction project.

If the cost of power does rise significantly, however, there will be direct effects on power users and subsequent secondary effects on all parts of the local economy. These, in turn, would induce demographic effects that could lead to impacts on community facilities, services, and finances.

13.3 Potential Future Effects on the Value of Real Estate, Locational Preference, and Settlement Patterns

The NRC survey established that a number of residents living in the vicinity of the plant had considered moving. It appears, however, that few have yet acted on this thought. A move within the greater Harrisburg area would probably allow existing employment to be maintained. For individuals who are single and presently occupy rental housing, the move might be relatively easy. For those who own property, however, or who have a spouse or children, both the financial and the psychological costs of changing residence are likely to be substantial. Even more extreme is the case of a move out of the Harrisburg area. In addition to all the above considerations, decisions would have to be made with respect to employment and career options, and there would also probably be more uncertainty with respect to some of the potential costs. A further consideration is that both plants are currently shut down and closely monitored. For some residents, the critical issue in the decision to move is the restart of Unit 1 as a nuclear plant, which is scheduled for December 1981.

It is not surprising that there was not an immediate exodus from the area. Similarly, the apparently normal in- and out-migration to date is not necessarily inconsistent with the fact that substantial numbers of residents may still be seriously considering leaving as a result of the accident. The extent of the continuing stimulus to move will be influenced by the events of the next several years. The actual decisions reached, the extent of public participation in the decisions, the clarity with which these decisions are communicated, and the public's confidence in the decision making bodies will affect the willingness of the area's residents to continue to live near TMI.

Potential effects on real estate values will be determined by similar considerations. The fact that there is a relatively large number of unconcerned buyers and only a small amount of property on the market in the vicinity of the plant may continue to make the impact on selling price imperceptible. It must also be noted, however, that there is a potential for a self-fulfilling prophecy such that expectations of effects are themselves responsible for their realization. This carries the implication that market conditions can change rapidly. Residents of the area have a vested interest in maintaining that there have been no adverse value effects, and their resolve has undoubtedly had much to do with the relative stability of the market. If this resolve is maintained, present market trends could continue, but if local attitudes or expectations

change, cumulative effects would be set in motion that could seriously impact local real estate values in a short period of time.

13.4 Potential Future Political/Institutional Effects

The necessity for emergency preparedness is obviously increased if one or both units at TMI are restarted. At the present time, many institutions that would require viable and comprehensive evacuation plans have already developed them. In a few cases, local municipalities do not have an effective means for quickly notifying residents (particularly rural residents) of the need to take cover or evacuate. However, Met-Ed has installed an additional 83 sirens at a cost of about \$1.3 million, which helped to improve the notification system. The residents' confidence in public officials was seriously eroded during the emergency, and one key to restoring that confidence is for the public to become convinced that adequate plans exist for assuring their safety.

For some, however, even a small risk of a second emergency is too large; these people are still committed to keeping both units closed permanently. Such persons have organized into antinuclear groups and are presently using legal procedures to stop the restarting. If they are successful and are assured that neither unit will ever again operate as a nuclear plant, some groups will lose members, and at least one group (PANE) may dissolve completely.

Current plans call for the restart of Unit 1 in December 1981 and it is the consensus of both pronuclear and antinuclear persons that there will be demonstrations in the area at that time. Given the stress experienced by many of these people during the emergency period, there is little doubt that feelings in the TMI area will run high as the restart date approaches. It is not surprising, therefore, that local law enforcement personnel are concerned about the implications of a restart ruling regarding Unit 1.

The second potential long-term institutional effect of the accident is reconsideration of growth policies in the area. A question has been raised in one municipality as to whether it should encourage growth within five miles of TMI, especially if one or both units restart. The decision of the municipalities and other units of government regarding whether or not to continue to promote growth near TMI, as has occurred during the last ten years, will have an important effect on the residents of the area.

13.5 Potential Future Effects On Individuals

Many of the effects mentioned in earlier sections of this chapter directly affect individuals. If the cost of power to the ratepayers eventually increases over and above what it would have without the accident, this will affect those ratepayers near TMI who are GPU customers. Furthermore, if the cost of electricity to GPU customers is substantially higher because of the accident, the area may lose jobs since many employers in the area are heavy users of electricity. On the other hand, those ratepayers near TMI who are not GPU customers may indirectly benefit from the accident for a period of time if their utility earns extra profit by selling replacement power to GPU.

Among those who are likely to be especially impacted by negative economic effects on the area are those individuals with substantial investments in the area. These would include not only local businessmen, but also large property owners, especially farmers. Because the plant's future is uncertain, these people's assets are likely to be less liquid. In the event that either unit is restarted as a nuclear plant, there is likely to be an adverse effect on the price of adjacent farm land, given the lack of both locational mobility and asset liquidity that is common to farm proprietors.

Clearly, there were people in the area who were seriously upset by the accident and their subsequent evacuation experience, and many of these people are currently concerned both about the lack of warning when the major releases occurred and about their children's health. People with these sentiments would feel compelled to move if either unit restarted as a nuclear plant; they would view it as irresponsible to subject either themselves or their children to any risk of additional radiation.

Because they are concerned about radiation and view the restart of Unit 1 as especially hazardous given the uncertain long-run condition of Unit 2, many of the people have adopted an antinuclear posture. Their wish to delay the restart and their argument for maximum caution in developing recovery plans for Unit 2 have caused antinuclear people to be labeled as obstructionists. However, they view this labeling as a form of "blaming the victim." Most wish to resolve issues associated with both units as quickly as possible without further risk to the residents of the area. At the same time, they realize that a safe cleanup of Unit 2 is going to take considerably longer than the 2-4 years indicated by the early estimates. New technology needs to be developed for some phases of the cleanup, regulatory agencies need to approve the plans, and a clear plan for

financing the cleanup needs to be formulated. At the current rate, local groups anticipate that the cleanup may take as long as ten years.

Another potential long-term effect is a change in attitudes among some who were affected very little during the emergency period. During construction, these people paid very little attention to TMI, and even during the accident they essentially went about their business. But continued contradictory news coverage of TMI has provoked a desire for "it to be over with." Discussion of TMI drags on, and it is likely to be in the news for several more years. These people are already exasperated by the interminability of the discussion and are coming to resent the fact that Unit 1 has not been restarted so that things can "get back to normal."

Finally, there is some potential risk to the health and safety of residents near TMI. It appears at present that the health effects from the accident itself are minimal. However, it is unclear at this time what the possible effects of various rehabilitation scenarios might be. For instance, there is current concern about the tritium remaining in the waste water after EPICORE-II cleans as much as it can. Although the water is currently being stored on site, this is not an effective long-term solution. There is also concern about the venting of noble gases, which some local residents view as a small risk to their health. Pregnant women appear especially concerned and there has been at least one unscheduled release since the accident.

The inescapable conclusion, and a discouraging one for residents of the area, is that the accident continues to have the potential to affect their lives. The individuals of the area around Three Mile Island recognize this and understandably resent it. Until that vulnerability is eliminated, and until more certainty surrounds the future of the facility, the accident will continue to be an unsettling influence on the lives of these people.

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- Traino, Mrs. J.;
Wife of Owner, Traino's Rug and Cleaning, Londonderry Township, Pennsylvania.
- Troebliger, Jim;
Non-Union Personnel, TMI, Dauphin County, Pennsylvania.
- Ulrick, Mary;
Barmaid, Colonial Inn, Dauphin County, Pennsylvania.
- Uscioff, Mr. and Mrs. George;
Manager-Owner, South Union Supply Company, Dauphin County, Pennsylvania.
- Vittore, D.;
Assistant Manager, Hamilton Bank, Dauphin County, Pennsylvania.
- Walsh, Ed;
Sociologist, Pennsylvania State University, State College, Pennsylvania.
- Waltermeyer, Rodney,
1st Ward Councilman, Middletown, Pennsylvania.
- Wauls, David L.;
Lebanon Valley Chamber of Commerce, Lebanon, Pennsylvania.
- Weaver, Elsie;
Resident, Londonderry Township, Pennsylvania.
- Weaver, William;
Firefighter, Union Hose Fire Company, Middletown, Pennsylvania.
- Wilcox, Betty and Charlie;
Residents, Londonderry Township, Pennsylvania.
- Willenbecker, Mark;
Firefighter, Liberty Fire Company, Middletown, Pennsylvania.
- Williams, Art;
Firefighter, Liberty Fire Company, Middletown, Pennsylvania.
- Wiltkowski, Mike;
Pennsylvania Department of Transportation, Dauphin County, Pennsylvania.

PERSONAL COMMUNICATIONS (Continued)

Wise, Paul;

President, Middletown Borough Council, Middletown, Pennsylvania.

Young, Bonnie;

Borough of Royalton Employee, Pennsylvania.

Young, Jack;

Assistant Manager, Acme Markets, Dauphin County, Pennsylvania.

Zeager, Ruby;

Resident, Londonderry Township, Pennsylvania.

Zearing, Herb;

State Office of Municipal Statistics, Dauphin County, Pennsylvania.

Zeckman, Richard;

On-site Training, TMI, Metropolitan Edison Company, Dauphin County, Pennsylvania.

Zeiters, Jim;

Planner, Tri-County Regional Planning Commission, Dauphin County, Pennsylvania.

Zuck, Lena;

Resident, Middletown, Pennsylvania.

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