TECHNICAL STAFF ANALYSIS REPORT

A 1.

ON

BEHAVIORAL EFFECTS

TO

PRESIDENT'S COMMISSION ON THE ACCIDENT AT THREE MILE ISLAND

ADVANCE COPY NOT FOR PUBLIC RELEASE BEFORE AMS, WEDNESDAY, OCTOBER 31, 1979

7911020224

REPORT OF THE TASK GROUP

ON

BEHAVIORAL EFFECTS

BY

Task Group:

Bruce P. Dohrenwend, Ph.D., (Task Group Head) Department of Psychiatry Columbia University

Barbara Snell Dohrenwend, Ph.D. School of Public Health Columbia University

Stanislav V. Kasl, Ph.D. Department of Epidemiology and Public Health Yale University

George J. Warheit, Ph.D. Departments of Psychiatry and Sociology University of Florida at Gainesville Collaborating Researchers:

Glen S. Bartlett, M.D., Ph.D. The Milton S. Hershey Medical Center The Pennsylvania State University

Rupert F. Chisholm, Ph.D. Graduate Program of Public Administration The Pennsylvania State University Capitol Campus

Raymond L. Goldsteen, M.A. School of Public Health Columbia University

Karen Goldsteen, B.A. Capitol Area Health Research, Inc.

John L. Martin B.A. Program in Personality and Social Psychology Graduate Center, City University of New York

This document is solely the work of the Commission staff and does not necessarily represent the views of the President's Commission or any member of the Commission.

This pre-publication copy is a final document and will be subject only to minor editorial changes in its published form.

Table of Contents

۰.

| | | Page |
|-------|--|------|
| Ι. | Introduction and Summary | 1 |
| II. | Overview of People, Places and Times | 8 |
| III. | Strategy of Data Analysis | 19 |
| IV. | Measures in Studies of the General Population and Mothers of Preschool Children | 20 |
| · v. | Results of Studies of the General Population Living Around TMI and of Mothers of Preschool Children | 22 |
| VI. | Measures in the Study of 7th, 9th and 11th Grade Students | 37 |
| VII. | Results of the Study of 7th, 9th and 11th Grade Students in the Lower Dauphin School District. | 39 |
| III. | Measures in the Study of the Workers | 45 |
| IX. | Results of the Study of the Workers | 46 |
| Χ. | Research on Mental Health | 53 |
| XI. | Appendix A: Description of Six Measures of Mental Health and Behavioral Effects Used in the Studies of the General Popu- lation, Mothers of Preschool Children, and Clients of Community Mental Health Centers. | 55 |
| XII. | Appendix B: Description of Three Measures of Mental Health and Behavioral Effects Used in the Study of the 7th, 9th and 11th Grade Pupils in Lower Dauphin School District. | 64 |
| XIII. | Appendix C: Description of Six Measures of Mental Health and Behavioral Effects Used in the Study of the Workers at TMI and Peach Bottom | 67 |
| XIV. | Appendix D: The Use of Telephone Surveys | 74 |
| XV. | Acknowledgements | 80 |
| XVI. | References | 81 |

List of Tables

• •

Page

| Table | 1. | Completed Sample Sizes and Completion Rates According to Time of Study, Place of Study, and Type of Respondent | 9 |
|-------|----|--|---|
| Table | 2. | Comparison of Workers Interviewed and Not Interviewed by the Cut Off Date of the Study in This Report | 1 |
| Table | 3. | Estimates of Proportions of Persons in the Population Living Around Three Mile Island Who Left the Area at the Time of the Accident | 4 |
| Table | 4. | Estimates of Proportions of General Population Sample and of Sample of Mothers of Preschool Children Living within 20 Miles of TMI Who Left on Each Day During | |
| in. | | the Accident | 2 |
| Table | 5. | Percents of Workers at TMI and at Peach Bottom Who Reported Periods of Extreme Upset Before and During | |
| | | the Accident and at Present | 7 |

List of Figures

| Figure | 1. | 20-Mile Radius of Three Mile Island: Counties and Townships |
|--------|----|---|
| Figure | 2. | 20-Mile Radius of Three Mile Island: Counties and Incorporated Places |
| Figure | 3. | Map of Lower Dauphin School District |
| Figure | 4. | Relation of Time of Interview to Level of Demoralization |
| Figure | 5. | Effect of Having a Preschool Child on Relation Between Distance of Home from TMI and Attitude Toward Continuing to Live in TMI Area |
| Figure | 6. | Change in Distrust of Authorities From April to August 1979 in General Population in Area of Three Mile Island |
| Figure | 7. | Level of Psychological Distress During the TMI Accident and Since the Accident for all Three Grades Combined 41 |
| Figure | 8. | Level of Psychological Distress During and Since the TMI Accident, for Those Who Stayed Compared With Those Who Left the Area |
| Figure | 9. | Percent of Telephones per Occupied Housing Until 1970 76 |

I. Introduction and Summary

The Charter for the President's Commission on the Accident at Three Mile Island states that, as part of its comprehensive study and investigation, it shall include "an evaluation of the actual and potential impact of the events on the public health and safety and on the health and safety of the workers" (Section 3 of the Charter).

1

The overall objective of the Task Group on Behavioral Effects is to examine effects on "the mental health of the public and the workers directly involved in the accident at TMI-2". Of particular interest are the behavioral response of the workers under stress during the accident, and the behavioral response of the population under stress during the accident. In examining effects on mental health, a distinction is to be made between short term and long term effects. Attention is also to be paid to the possible impact of the affected populations and workers of a variety of studies either under way or planned.

The Task Force on Behavioral Effects was created on Ju e 18th and met for the first time as a group on July 2-3. The accident at TMI is A place between March 28 and April 10. Fortunately, during or shortly after the accident, several researchers from colleges and universities near the TMI site began sample surveys of the approximately 744,000 people living within 20 miles of TMI. Most of these studies employed reliable measures of psychological effects with small but carefully drawn samples of the genera? population and/or high risk

groups such as mothers of preschool children within the general population. Each study represented the work of a single investigator or small team of investigators who were financing the undertakings mainly out of their own pockets or, occasionally, with the help of small sums from their college or university departments. These studies held out the best hope for identifying the immediate and short term behavioral effects of the accident on the general population and several important groups within it.

To be of use for purposes of the Commission, the studies being conducted by local researchers had to be suitably focused and expanded. The general strategy of the Task Force has been to locate studies of high vist groups in the general population and to seek control groups from whom comparable data could be collected. Each comparison was selected in such a way as to provide strong clues as to the mental health and behavioral effects between the time of the acccident in late March and early April and the time of last data collection in July and August. No systematic research had been begun, however, with regard to the behavioral effects and mental health of the nuclear workers, a group specifically mentioned in the charge to the Task Group as appropriate for study. We have been able to add a study of the workers. We have also been able to help expand data collection in previously begun studies of the general population and of mothers of preschool children, and to get the data processed for these studies and for a study of 7th, 9th and 11th grade students.

"Mental health" is a broad topic, and the data and time available for our analyses here made it possible to cover only narrow aspects of it. Fortunately, though narrow, these aspects.centering on measures of psychological distress, upset,

1232 052

and demoralization, are important and appropriate to what is known about the most characteristic responses to stress situations. Moreover, we have been able to construct reasonably reliable measures of several other important behavioral effects.

The report that we will summarize here and present in more detail in the following pages is based on surveys of about 2,500 persons from four different groups:

- The general population of male and female heads of households located within 20 miles of TMI.
- Mothers of preschool children from the same area and a similarly drawn control sample from Wilkes-Barre which is about 90 miles away.
- <u>Tecnagers</u> in the 7th, 9th and 11th grades from a school district within the 20 mile radius of TMI.
- 4. <u>Morkers</u> employed at TMI at the time of the accident and a control group

of workers from the Peach Bottom nuclear plant about 40 miles away. In addition, an interview study was conducted of a sample of clients at community mental health centers. These individuals, most of whom were suffering from chronic mental disorders, provided valuable criterion information that could be used to identify unusually high scores on a measure of demoralization.

The study of household heads in the general population consisted of surveys of three different samples ranging in size from 50 to 380. The first sample was drawn in April, directly following the accident; the second was drawn in Max: and the third and largest in July. The mothers of preschool children from the TMI area were first studied in a sampling in May and then in an additional sampling in July at the time that a control sample of Wilkes-Barre mothers with preschool children was added. The study of the teenagers

1232 053

was done in May, just before the Memorial Day weekend. And the last study, that of the workers, was begun in August.

The usual procedure in these studies was to draw strict probability samples of households and conduct structured half-hour length interviews by telephone. The April and May studies of household heads, however, were conducted by mail questionniares, and the study of the teenagers was conducted by questionnaires distributed in their classrooms.

A core of similar measures of mental health, attitudes, and behavior were used in each study except for the study of teenagers which was limited to specific measures of distress developed for that study. The areas covered by measures in the other three studies are:

- 1. Recall of immediate upset at the time of the accident.
- 2. Staying in or leaving the TMI area at the time of the accident.
- 3. Demoralization since the accident.
- 4. Perceived threat to physical health.
- 5. Attitude toward continuing to live in the TMI area.
- 6. Attitude toward nuclear power, including TMI.
- 7. Trust in authorities.

In addition, the study of the workers included measures of their concern about the future of their occupation and their perceptions of hostility from the wider community. The large majority of the measures used in all studies are scales composed of multiple items and demonstrating satisfactory incernal consistency reliabilities.

In all studies, the major measures of objective threat stemming from the accident were:

- 1. Living within versus outside the five mile radius of TMI.
- 2. Having preschool age children in one's family or not.

For the workers, an added measure of objective threat was whether they worked at TMI rather than Peach Bottom at the time of the accident. And for teenagers, we added whether their families left the area or not following the accident since this was a factor outside the control of the teenagers themselves.

In analyzing the results, we have conducted a series of regression analyses designed to assess the effect of each threat factor while holding other threat factors and relevant variables such as sex, age and educational level constant. All of the effects reported were found in these analyses to be statistically significant at the .05 level or better using one-tailed tests.

Demoralization was sharply elevated immediately after the accident but dissipated rapidly among most groups. We estimate that a substantial minority, about 10 percent of the household heads, showed severe demoralization immediately after the accident that was directly attributable to the accident itself. These 10 percent are an increase of about two thirds over the 15 percent or so who would ordinarily show such a high level of demoralization for a variety of reasons other than the accident. The most demoralized persons were household heads and teenagers living within five miles of TMI, and mothers and teenage siblings of preschool children. Teenagers who left the area temporarily were more distressed than those who did not. Levels of demoralization among workers at TMI were high in comparison to Peach Bottom workers and to males in the general population several months after the accident.

Although the <u>perceived threat to physical health</u> from the TMI accident was higher in the general population immediately after the accident than later on, by July most people were considerably reassured. Workers at both TMI and Peach Bottom also expressed a fairly low level of concern about the threat of their work situation to their physical health. However, workers at TMI were more uncertain about health effects than workers at Peach Bottom.

1232 055

Households heads living within 5 miles of TMI were more uncertain than those living outside. And mothers of preschool children felt more uncertain than mothers of preschool children in Wilkes Barre.

Feelings in the population within 20 miles of TMI about <u>continuing to live</u> <u>in the area</u> were mixed and uncertain. Relatively unfavorable attitudes, though still generally uncertain rather than negative, were expressed by people living within 5 miles of TMI and by mothers of preschool children. The only group with somewhat negative attitudes were those at risk on two counts, mothers of preschool children who live within five miles of TMI.

Attitudes toward nuclear power and reactivation of TMI 1 and 2 in the general population living within 20 miles of the plant showed uncertainty, with a leaning toward negative feelings. Mothers of preschool children expressed the most negative attitudes.

Among people living in the 20 mile area around TMI <u>distrust of federal</u> <u>and state authorities and the utilities</u> was high immediately after the accident. Although it was somewhat lower by May, as nearly as can be estimated, it continued to be higher than the average in the nation throughout the period of the study. Workers at both TMI and Peach Bottom, like the general population, expressed considerable distrust of federal and state authorities. They diverged from the general population, however, in expressing generally trusting attitudes toward the utilities.

Workers at both TMI and Peach Bottom expressed fairly low levels of <u>concern</u> <u>about the future of their occupation</u>. They also were similar in perceiving people in their communities as holding <u>less than positive attitudes toward them</u>. Since there was no evidence of a difference between TMI and Peach Bottom I these matters, neither of these findings contributes to our understanding of the basis for

the elevated level of demoralization among TMI workers that continued to be evident in August and through September when the study ended.

7

In brief, the TMI accident had a pronounced demoralizing effect on the general population of the TMI area, including its teenagers and mothers of preschool children. However, this effect proved transient in all groups studied except the workers, who continue to show relatively high levels of demoralization. Moreover, the groups in the general population and the workers, in their different ways, have continuing problems of trust that stem directly from the accident. For both the workers and general population, the mental health and behavioral effects are comprehensible in terms of the objective realities of the threats they faced.

II. Overview of People, Places and Times

Table 1 presents a summary description of the people and places studied and the times of the various data collection operations.

Table 1 about here

The samples of male and female household heads from the general population and the special samples of mothers of preschool children were drawn at different times following the accident, starting with a small sample from the general population in April. They were also selected in such a way that the effects of distance from Three Mile Island (TMI) could be analyzed. Within the TMI areas, the population within a 20-mile radius of TMI was sampled. This area is mapped in Figures 1 and (Warheit, 1979).
2 / The sample from the Wilkes-Barre area is about 90 miles away.

Figures 1 and 2 about here

Strict probability sampling procedures were used in the study of the general population to select households at random (April and May samples) or by place stratified random sampling from telephone directories (July-August sample). In Pennsylvania, a minimum of 90 percent of the population have telephones, so no marked bias should have been introduced by this procedure. (See Appendix D on in the telephone sample telephone interviewing.) Unfortunately,/there was no prior designation of whether the male or the female head of the household was to be interviewed, and females are over-represented in the resulting sample as a consequence.

The mothers of preschool children were also selected by strict probability sampling procedures. This time, however, the source was listings of birth announcements in the Harrisburg and Wilkes-Barre newspapers dating back to February, 1977 and continuing through June, 1979. The first sample from the TMI

1232 058

| Table 1. | Completed Sample Sizes and Completion Rates According to Time of Study, Place of Study, and Type of Respondent. | | | | | | | | |
|-------------------------|--|--|--|--|--|--|--|--|--|
| | (Percents in parentheses indicate completion rates for each sample; usually about half to two thirds of those not obtained were refusals, except among the nuclear workers where refusals constituted 40-45 percent of the total number of persons with whom interviews were not obtained) | | | | | | | | |
| Dates in 1979 | General Population: Male and Female Heads of Household within 20 mile radius of TMI | Mothers of Preschool Children sampled from birth announcements in Harrisburg newspapers | Mothers of Preschool Children samples from birth announcements in Wilkes-Barre newspapers | TMI Pe Workers | each Bottom Workers | 7th,9th,11th graders in Lower Dauphin | Clients of Community Mental Hea Centers | | |
| Prior to 3/28 | | No studies | in this period | | | | | | |
| 3/28 Accie Reopening | dent - 4/10 of schools | No studies | in this period | | | | | | |
| 4/10-4/30 | (.67)* | | | | - | - | | | |
| 5/1-5/31 | | 165 (.79)** | | | | 632 (.91) | | | |
| 6/1-6/30 | | | | | | | | | |
| 7/1-9/5 | 380 (.65) | 260 (.79)** | 328 (.66) | | | | 198 (Sample of convenience | | |
| 8/20-9/29 | | | | 305 ⁺ (.57) ⁺ | 258 ⁺⁺ (.53) ⁺⁺ | 1- | | | |
| • | | | | | | | | | |
| Overall | completion rate for Ap | ril and May combined. | land | | | | 53 | | |
| Overall + | completion rate for Ma | y, July and August com | and 10/10 in a coorda | 1 follow | up study of | subsample of | 000- | | |
| voes no resp | ondents (see p. 15). | iterviewed between 10/1 | and to/ to th a specia | TOTIOW- | up study of a | a subsample of | N | | |
| ++Does no | t include 30 workers in onderty (15.) | terviewed between 10/1 | and 10/10 in a specia | 1 follow- | up study of a | subsample of | non- 27 | | |



Figure 1 20-MILE RADIUS OF THREE MILE ISLAND: COUNTIES AND TOWNSHIPS

Figure 2

20-MILE RADIUS OF THREE MILE ISLAND: COUNTIES AND INCORPORATED PLACES



^{1232 061}

area was drawn in May, and interviewed by telephone. Later samples were similarly selected and interviewed during July and August in both the TMI and Wilkes-Barre areas.

The procedures for selecting respondents were different in the other studies. The study of teenagers involved pupils in the 7th, 9th and 11th grades of the Lower Dauphin School District. The location of this District and its schools is shown in Figure 3. All classrooms participated in the study,

Figure 3 about here

which was conducted just before the Memorial Day weekend.

Similarly, the aim was to interview all of the workers at TMI and at the Dermanent control plant, Peach Bottom, who were/employees at the time of the accident. As is shown in Table 1, however, this study was the last to go into the field; interviewing, again by telephone, began late in August and had to end for the most part by the end of September. As Table 1 shows, the response rates are lower in this study, reflecting the limited time the Task Force had to make a sustained effort to reach all workers who were not readily available and/or willing to cooperate in an interview.

Although the response rates are lower for the study of the workers, they are quite similar for the TMI facility and for the Peach Bottom control facility. As Table 2 shows, the workers interviewed at both facilities have quite similar

Table 2 about here

demographic characteristics except for variables on which one would expect them to differ -- distance of home from TMI and presence at plant at the time of the



Table 2

Comparison of Workers Interviewed and Not Interviewed by September 29, 1979

| Worker Characteristic | Site | | | | |
|------------------------------------|-----------------|---------------------|--------------------|---------------------|--|
| | Т | TMI | | Bottom | |
| | Interviewed (%) | Not Interviewed (%) | Interviewed (%) | Not Interviewed (%) | |
| Supervisory Status | | | | | |
| Supervisor | 35.0 | 25.9 | 39.5 | 16.3 | |
| Nonsupervisor | 65.0 | 74.1 | 60.5 | 83.7 | |
| College Graduate | 23.7 | Not obtained | 23.8 | Not obtained | |
| Sex | | | * | | |
| Male | 89.7 | 90.4 | 97.6 | 97.8 | |
| Female | 10.3 | 9.6 | 2.4 | 2.2 | |
| Married | 82.8 | Not obtained | 85.2 | Not obtained | |
| Age | | | | | |
| Less than 30 | 29.9 | 29.3 | 21.8 | 25.0 | |
| 30-39 | 50.3 | 46.8 | 46.7 | 46.0 | |
| 40-49 | 13.5 | 12.2 | 19.5 | 19.6 | |
| 50 or more | 6.3 | 11.7 | 12.1 | 9.4 | |
| Pre School Age Children | 29.2 | Not available | 33.7 | Not available | |
| Distance of home from T | MI | | | | |
| 5 miles or less | 35.6 | 50.0 | 0.4 | Not obtained | |
| Located at TMI at time of accident | 73.0 | Not obtained | 22.0 | Not obtained | |
| Total respondents* | (305) | (228) | (258) | (232) | |

* Bases for percents vary somewhat from totals shown because of missing data for some respondents for some variables.

14

accident. (Note that 22 percent of the Peach Bottom workers interviewed reported being at TMI during the accident. This is consistent with reports that some were called in to help in the crisis.) It is unlikely, therefore, that differences in mental health and behavioral effects between the two samples of workers interviewed can be explained by the problem of nonresponse.

There are, however, clear differences shown in Table 2 between those interviewed at either plant and those with whom interviews were not obtained by the cut-off date of September 29th. Supervisors, for example, were considerably more likely to be interviewed than other workers in both plants. To investigate the problem further, a separate study of nonrespondents was conducted from October 1 to October 10 after the field work on which this report is based was completed. Small, representative samples of workers at TMI and Peach Bottom who refused or were not interviewed for some other reason in the main study were approached again and asked for an interview. The results from interviews with 28 out of 50 former nonrespondents at TMI and 30 out of 75 former nonrespondents at Peach Bottom suggest that even if more time and money were available to raise the completion rates for the workers to between 70 and 80 percent, the main findings presented here would not be substantially altered.

The procedure for selecting the clients at community mental health centers was again different. Here, the Task Force focused on neither a whole population of patients nor a strict probability sample of such a population. Rather, the clients interviewed are a sample of convenience consisting for the most part of persons with chronic mental disorders who were available, willing and able to be interviewed by telephone (see Appendix D on telephone interviewing), or in person. They provide a criterion group whose responses indicate what scores indicate a high degree of demoralization.

1232:065

Household Heads in the General Population

The typical member of the large general population sample interviewed in July and August is female, married, and a high school graduate who has not gone on to finish a four year college. Less than 15% of this sample have not finished high school, and only slightly over this percent have finished four years of college or more. About a third live within five miles of TMI and 14% have preschool children.

This July-August sample was stratified in such a way as to over-represent lower educated households and households within a five mile radius of TMI. The smaller samples drawn in April and May were random samples and males were systematically alternated with females in the households selected. The result is that males and females are almost equally represented; the educational level is considerably higher as 49% of the April sample and 40% of the May sample are college graduates; and smaller proportions (16% in the April sample and 13% in the May sample) are living within five miles of TMI. Slightly older on the average than the July-August sample, these earlier samples of household heads have slightly smaller proportions with preschool children. In general, the April and May samples are highly similar to each other in demographic characteristics but show differences of the kinds indicated with the larger sample of household heads interviewed in July-August.

Mothers of Preschool Children

The samples of mothers of procchool children are, of course, much younger than the samples of household heads from the general population. Their main difference from the Wilkes-Barre mothers, similarly self-evident, is that they are roughly 80 miles nearer to TMI. The TMI mothers of preschool children have somewhat higher proportions of graduates of four year colleges than the Wilkes-Barre sample. There appears to be little difference in the demographic characteristics of the TMI mothers of preschool children interviewed in May and those interviewed in July-August.

Seventh, Ninth and Eleventh Grade Students

The sample of junior high and high school students ranges from 12 through 18 years of age. The sample of 632 students includes 27% seventh graders, 36% ninth graders and 37% eleventh graders. The sample is fairly well balanced for sex, with 56% females and 44% males responding to the classroom administered questionnaire. Over half of these students come from households in which the father has completed high school. About a third have fathers who have not completed high school, and about 20% have fathers who have had one or more years of college. About one third of the students live within five miles of the TMI plant, one half live between 6 and ten miles of the plant, while the remaining 20% live from 11 to 30 miles of the plant.

Workers

The survey of workers aimed to include all employees on the payroll of the Metropolitan Edison Company when the TMI incident began on March 28, 1979. This group includes all employees who were on permanent assignment at the Three Mile Island location when the accident occurred. The survey group does not include

Metropolitan Edison employees who were assigned temporarily to TMI during or following the accident. Contractor personnel also are not covered by the survey.

Permanent employees at the TMI plant fall into three categories: (1) Bargaining Unit employees; (2) Supervisory employees; (3) Non-exempt employees. Names of employees in these three categories were arranged in a combined alphabetical list and employees were contacted following a random number system designed to assure randomness in the order of initial contact attempts and equivalence of initial interviewer assignments.

Nuclear workers at the Peach Bottom Plant of Philadelphia Electric Company served as a comparison group. All employees permanently assigned to the Peach Bottom Plant comprised the study group. The same randomization procedure as that applied to the TMI employee list was used to determine the order of contact attempts with Peach Bottom workers, and equivalence of initial interviewer assignments.

As described earlier, and shown in Table 2, the demographic characteristics of the workers who were interviewed were similar. Note, however, that of the employees interviewed less than 10 percent were women, disproportionately at TMI. Since tests indicated that the exclusion of women did not change the results, they were included in all analyses.

18

III. Strategy of Data Analysis

The Task Force is concerned with assessing mental health and behavioral effects as they vary with the threat factors at the time of the accident at the end of March and during the course of the five months that followed. We do not have an ideal situation for doing so in that we have no pre-accident baseline on any of our measures of effect nor do we have perfectly matched control groups that were not exposed to the threat. Moreover, we do not have repeated post measures on the same respondents at various times during the months following the accident. Fortunately, however, we have been able to select meaningful comparison groups such as the Wilkes-Barre mothers of preschool children and the workers at Peach Bottom, places quite far away from TMI. And also fortunately, the investigations that we are relying on were conducted at different times since the accident so that we can begin to piece together which effects were immediate, which have begun to dissipate, and which have remained strong.

To conduct the statistical analyses, we have used a general linear model that allows us to assess the effect of one factor while holding the other relevant factors constant. Thus, for example, when we report an effect due to distance of a person's home from TMI we have controlled for having a preschool child in the family and various characteristics of the person such as age, sex, marital status, and level of education that might have been confounded with distance of the person's home from TMI. The particular procedure has variously been called dummy variable multiple regression analysis and non-orthogonal fixed effects analysis of variance.

All of the effects reported were found to be statistically significant at the .05 level or better using one tailed tests. Because of the large number of tests that were conducted and the lack of independence of the behaviors and

19

attitudes being studied, the true probability of type 1 errors, that is, falsely rejecting the null hypothesis, may be somewhat greater than .05.

IV. Measures in Studies of the General Population and Mothers of Preschool Children

The Main Measures of Threat

At 12:30 PM on Friday, March 30, Governor Thornburgh advised pregnant women and preschool age children to leave the area within five miles of TMI. He reaffirmed this advice at a press conference later that evening. No comparably authoritative definition of the chief targets of the threat was made before or after this message. Accordingly, the two major measures of threat that we have emphasized are:

1. Living within five miles of TMI.

Having one or more preschool children.

In so doing, we are not implying that Governor Thornburgh created a threatening situation; rather, we are suggesting that his statement narrowed and focused it.

Note that we accepted the respondent's report of the distance of his or her home from TMI. A survey conducted for the Nuclear Regulatory Commission (NRC) found that some people who lived more than 5 miles from TMI reported themselves as living within 5 miles (Flynn, 1979). If this error occurred in our survey it could inflate relations between distance from TMI and mental health effects if, in addition, those who were most upset and otherwise affected were also most likely to underestimate the distance of their home from TMI. We do not have the information that would enable us to check whether there were errors in our respondents' estimates of the distance of their homes from TMI. At the same time, a consistency that we will discuss later between the NRC results and ours concerning the proportion of people living within five miles of TMI who left the area argues against assuming gross misreporting by our respondents.

The Main Measures of Mental Health and Behavioral Effects

One of the most prominent behavioral effects was leaving the area. We have been able to develop other measures as well from the interview and questionnaire material gathered in the studies of the general population and mothers of preschool children:

- Recall of the personal "upsettingness" of the accident at the time it occurred.
- 2. Demoralization.
- 3. Perception of the threat to physical health.
- 4. Attitude toward continuing to live in the TMI area.
- 5. Attitude toward nuclear power in general and TMI in particular.
- 6. Attitude of trust or distrust toward authorities.

A full description of these scales is provided in Appendix A. This description includes the internal consistency reliabilities of the five, multiquestion scales for which they could be calculated in the various samples from the general population, the mothers of preschool children, and the clients of community mental health centers. All reliabilities are adequate for research purposes and some are more than adequate.

We have used the scores on the demoralization scale of clients of community mental health centers as an indicator of the points at which that scale indicates severe demoralization. Because of differences in the way men and women express their feelings, our procedure is to call scores above the mean for male mental health center clients an indication of severe demoralization in male respondents in general and scores above the mean for female clients an indication of severe demoralization in females in general.

V. <u>Results of Studies of the General Population Living Around</u> <u>TMI and of Mothers of Preschool Children</u>

How upset were people at the time of the TMI accident?

On the average people living in the 20 mile area around TMI rated the accident fairly high on an 11 point scale from least to most upsetting at the time. The midpoint on this scale is 5, and the average rating by these respondents was 7.4. As we would expect if people were indeed rating the extent to which they were upset at the time of the accident rather than their current level of upset about the accident, there was no change in this average between earlier and later interviews.

Women were found to be more upset than men, and people under 65 years of age were more upset than older people. However, all groups averaged above the midpoint on the scale.

Over and above these differences related to personal characteristics, people with a preschool child were more upset than others. Furthermore, mothers of preschool children who live in the area around TMI were more upset than mothers living at a greater distance, in Wilkes-Barre. In general, while people in the area found TMI a relatively upsetting event no matter what their circumstances, the most upset were those who could infer from advice given about evacuation and safety precautions that they were in danger on two counts, living relatively close to TMI and having a child in the vulnerable age range.

Who left the TMI area at the time of the accident?

On the basis of our study of the general population, we estimate that 52 percent of the people living within 20 miles of TMI left the area at the time of the accident, the majority of them on Friday, March 30th. As shown in Table 3,

Table 3 about here

the proportion who left differed between men and women, and by marital status, age and education.

Table 3 also shows that, over and above these differences related to personal characteristics, the decision to leave was influenced by the distance of the person's home from TMI. Although the basis for the estimation differs, our finding that 62 percent of those living within 5 miles of TMI left is consistent with the estimate in the study done for the NRC that 66 percent of households within a five mile radius of TMI contained at least one evacuee; the same study found that the proportion of households in which some members evacuated and others did not was small.

The decision to leave was influenced not only by distance of the person's home from TMI but also by whether there was a preschool child in the family, presumably as a consequence of Governor Thornburgh's advice on March 30th that preschool children should leave the area within 5 miles of TMI. Further evidence of the impact of this advice is shown in Table 4. Of those in the general

Table 4 about here

population who left, less than 5 percent left before March 30th and the majority, 59.5 percent, left on that day. Table 4 also shows that among the 72 percent in the sample of mothers of preschool children who left the TMI area, almost two thirds left on the 30th.

How demoralized were people in the TMI area?

Demoralization is a common distress response when people find themselves in a serious predicament and can see no way out (Frank, 1973). Sometimes, this level of distress can approach that shown by persons suffering from mental

1232 373

Table 3

Estimates of Proportions of Persons in the Population Living Around Three Mile Island Who Left the Area at the Time of the Accident

| ho Left |
|----------|
| 41 57 |
| 57 38 |
| 53 42 |
| 59 50 |
| |
| |
| 62 48 |
| 77 48 |
| |

Table 4

Estimates of Proportions of General Population Sample and of Sample of Mothers of Preschool Children Living within 20 Miles of TMI Who Left on Each Day During the Accident.

| Conserved Brandandian Count | |
|-------------------------------|--|
| (13% have preschool children) | Sample of Mothers of Preschool Children |
| 2.4 | 2.0 |
| 2.4 | 6.2 |
| 59.5 | 65.8 |
| 17.0 | 14.0 |
| 10.5 | 7.8 |
| 4.9 | 3.6 |
| 3,2 | 0.7 |
| 51.8 | 72.4 |
| 48,2 | 27.6 |
| | General Population Sample (13% have preschool children) 2.4 2.4 59.5 17.0 10.5 4.9 3.2 51.8 48.2 |

disorders (Dohrenwend, Dohrenwend, Gould, Link, Neugebauer and Wunsch-Hitzig, 1979). On our measures of demoralization the overall mean is 28.3 for clients of community mental health centers, most of whom were suffering from chronic mental disorders. For the female clients in our sample, the mean was about 30; for the males, about 25.

Figure 4 about here

Figure 4 shows that, on the average, demoralization in the community never reached the level of severity of the clients of the community mental health centers. It was, however, far higher on the average in the sample interviewed in April, closely following the accident, than in the samples interviewed in later months, as Figure 4 shows.

Moreover, 26% of those interviewed in April showed severe demoralization (scores above 30.46 for females and above 25.56 for males). These scores, let us emphasize, are like the scores of the more demoralized clients in our sample from mental health centers. In view of the stringency of this definition of what constitutes severe demoralization, the estimate should be regarded as conservative. In May and later months, in contrast to April, 15 percent or fewer in the general population scored above the means for our male and female mental health center clients. This difference between April and later months suggests that a substantial minority, perhaps 10 percent, experienced severe demoralization by the above definition at the time of and in the two or three weeks following the accident.

Combining interviews across the entire period of the study we find that the level of demoralization was higher among those living within five miles of TMI than among those living at a greater distance within the 20 mile area covered by the general population study. Almost a quarter, 22 percent, of those

26



living within 5 miles of TMI scored above the mental health center clients' mean, whereas only 15 percent of persons living at a greater distance had demoralization scores this high.

Consistent with findings of previous studies, we also found that men, and people who are currently married scored lower on the demoralization scale than women and those not currently married.

Was the TMI accident perceived as a threat to physical health?

Scores on our multiquestion measure of perceived threat to physical health from the TMI accident and radiation range from 1 to 3, with 2 the midpoint indicating uncertainty about the matter. For the general population sample interviewed in April, shortly after the accident, the mean was 1.85. This level of perceived threat declined fairly steadily over the time during which interviews were being done, to 1.68. While some uncertainty remained, people were becoming more reassured.

Men and women differed, women perceiving more threat to their health than men. People in different age groups also differed, the perception of threat generally declining with age. However, on the average both women and younger people scored below the uncertainty point on the scale.

Over and above sex and age differences, those living within five miles of TMI were less certain that their physical health was not affected by the accident than those living at a greater distance. This difference in opinions held by those living within five miles and those living further away was found both in the general population and among mothers of young children living in the area of TMI. Realistically, mothers living still further away, in Wilkes-Barre, felt even less threatened on this count than mothers living around TMI.

Attitude toward continuing to live in the TMI area.

In the general population the average score on a measure of whether the individual devalues the area as a result of the TMI accident and would like to move away was just on the side of the uncertainty point, favoring remaining in the area. Scores on this multiquestion scale range form 1 to 3 with an uncertainty point of 2, and the average score in the general population sample was 1.90.

Men and women differed, with women holding more unfavorable attitudes, though still on the average favorable toward continuing to live in the TMI area. The attitudes of people in different age groups also differed. The youngest people, in their 20's, were the least favorable, the oldest, those 75 or older, the most favorable, and in between there was a fairly regular increase in favorability with age. All but the youngest group, whose average was just above the uncertainty point, were favorable in general toward continuing to live in the TMI area.

People in the general population sample with a preschool child held more unfavorable attitudes toward continuing to live in the area than those without a child in this age range. Their average score was near the uncertainty point rather than favorable. Reflecting the effect of having a preschool child in the family found in the general population, the mothers of preschool children in the TMI area who were sampled separately also had an average score near the uncertainty point, at 2.03.

Within the sample of mothers, those who did not graduate from college had a less favorable attitude, with an average score of 2.10, than college graduates. whose attitude on the average was favorable. In addition, mothers living within 5 miles of TMI had a more unfavorable attitude than those living further from TMI.

The average score in the latter group was at the uncertainty point, but the average in the former groups was in the unfavorable range, at 2.37. In contrast with this difference, Figure 5 shows that distance from TMI had a negligible influence

Figure 5 about here

on attitudes toward living in the area in the general population sample. Thus, the only people whose attitudes toward continuing to live in the TMI area tended to be negative were those who could infer from advice given at the time of the accident about evacuation and safety precautions that they were in danger on two counts, living relatively close to TMI and having a child in the vulnerable age range.

.





1232 081
Attitude toward nuclear power including TMI.

In the general population living in the TMI area the average score on the multiquestion measures of attitude toward nuclear power and restarting of TMI 1 and 2 was in the unfavorable range. Scores on this scale range from 1 to 3, with 2 being the uncertainty point; the average score in the general population sample was 2.23. Although comparisons from surveys using somewhat different questions can be hazardous, the results of a national poll summarized by Mitchell (1979) suggest that on the issue of nuclear power, people in the TMI area do not differ from the rest of the country in being uncertain and divided. In the national poll taken in May, 38 percent reported that they had not made up their minds; 36 percent described themselves as supporters and 26 percent as opponents of nuclear power.

Women in the TMI area reported more negative attitudes on the average than men. Attitudes in the general population in the area also varied depending on whether the person had a preschool child, those with children in this age range having more negative attitudes on the average. Furthermore, in a sample of women with preschool children those who did not graduate from college had more negative attitudes than those who did. Among the relatively favorable groups, men, people without preschool children, and mothers of preschool children who had graduated from college, only men had an average score indicating a leaning toward favorable rather than unfavorable attitudes toward nuclear power.

Trust in authorities.

Individuals' responses to our scale of trust in authorities including federal and state officials and utility companies, covered the full range, from complete trust (score of 1) to total distrust (score of 3). For the sample strongly interviewed in April, the tendency, as Figure 6 shows, was to lean/toward

Figure 6 about here

distrust. This level of distrust appears to be higher than that found in national polls taken in April and early May (Mitchell, 1979). Although the questions on this topic in these polls were not identical to ours, on wost of them somewhere between about half and a substantial majority of respondents gave the trusting rather than the distrustful response.

As Figure 6 shows, the level of distrust in the TMI area declined after April, but the decline was very gradual. The tendency as of July and August was still fc opinions to lean, on the average, toward distrust. Insofar as these results can be compared with the responses to somewhat different questions asked on the national polls, distrust in the TMI area seems to have remained above the national level. Elevation of distrust in authorities among people in the TMI area is also suggested by the finding that mothers of preschool children interviewed in the TMI area and in Wilkes-Barre differed, with the TMI area mothers significantly higher on this measure.

Distrust was greater among women than among men. Comparing age groups, it was most elevated among people in their thirties, declining steadily with increasing age, but also lower among people under thirty. However, both sexes and all age groups scored, on the average, above the uncertainty point on the measure, indicating a tendency to distrust authorities.

1232 083





Main Conclusions from Studies of the General Population and of Mothers of Preschool Children.

The amount of immediate and, fortunately, short-lived demoralization produced by the accident among household heads in general and mothers of preschool children in particular in the TMI area should not be underestimated. The increase in demoralization at the time of, and in the month following the accident on March 28 was sharp.

We estimate that, as a direct effect of the accident, approximately 10 percent of the April general population sample experienced demoralization as severe as that reported by persons suffering from chronic mental disorders. Note that this is not to say that 10% of the sample became mentally ill as a result of the accident. Rather, their demoralization at the time was analogous to a sharp elevation in body temperature. Such an elevation is a clear sign that something is wrong. Persons with psychiatric disorders frequently show such elevations on measures of demoralization. So do psychiatrically normal people caught in situations of extreme stress.

Note that the decline over time in symptoms indicating demoralization is inconsistent with one explanation of elevation of symptoms among people in the TMI area; namely, that symptoms develop as a secondary effect of the filing of law suits claiming that people's health was damaged by the TMI accident. If this were so, symptoms should have remained high or even increased after April, when such suits began to be filed in connection with the TMI accident.

On the contrary, the reality of the objective stress situation in which people found themselves must be underlined. They were reacting to circumstances not of their own making that posed a clear and major threat to them so far as they could tell from the information available. This is evident in the higher

1232 385

levels of demoralization shown by persons living within five miles of TMI or having preschool children. They were told that their situation was more threatening by such a respected source of information as the Governor, who advised them to leave the area. Sharp elevation of demoralization in situations of severe objective threat and its rapid dissipation when the threat diminishes is consistent with most of the firm findings in reactions of previously normal persons to extreme situations such as combat during wartime and natural disasters (e.g., Dohrenwend and Dohrenwend, 1969; Dohrenwend, 1979).

While the unusually high levels of psychological demoralization apparently subsided after April, some of the other behavioral effects of the accident did not dissipate so rapidly. People have gradually become more reassured about the threat of <u>this</u> accident to their physical health. Distrust of authorities, however, while declining sharply after April has remained relatively constant from May on. And it is at a level that still shows that, on balance, there is more distrust than trust of government and utility companies so far as information about and policy towards the safety of nuclear energy are concerned.

1232 386

VI. Measures in the Study of 7th, 9th and 11th Grade Students

The Main Measures of Threat

Three main threat factors were identified as having potential for elevating psychological distress and physical symptoms. Two of these threat factors are the same as those identified in the previous samples:

1) Living within 5 miles of the power plant, and

2) Having one or more pre-school children in the household.

The third threat factor is whether or not they left the area during the accident. In the studies of the general population and mothers of preschool children, our approach was to examine the factors that influenced whether or not they left the area. However, in studying the effects of the accident on these adolescents, leaving or staying in the area was largely a matter over which they had little influence. Therefore, the act of leaving or staying in the area is taken here as an additional characteristic of the TMI incident for these young people. The question being posed is whether or not temporarily leaving their homes served to increase or decrease the amount of stress these young people experienced. Conceivably, it could go either way.

The Main Measures of Mental Health and Behavioral Effects

Towards the end of the questionnaire, students were asked to rate each of the following on a five point scale: 1) Worry, 2) Concern; 3) Disturbed; 4) Anxious. They made these ratings first for how they felt at the time of the accident and, on the next page, how they have felt since the accident. Thus, we have a self-perceived distress measure.

Students were also provided with a list of 10 physical symptoms such as sore throat, and sleep problems, and asked to check any symptoms they may have had during the time of the accident, March 28th through April 11th. We summed the number of these states to arrive at a symptom score for each student. A full description of these scales is provided in Appendix B. The first is a measure of psychological distress, the second a measure of psychosomatic distress.

38

VII. <u>Results of the Study of 7th, 9th and</u> <u>11th Grade Students in the Lower</u> Dauphin School District

The teenagers in the 7th, 9th and 11 h grades in Lower Dauphin were studied at the end of May, as Table 1 showed. No surveys were conducted with samples of these students either before or after that date. It is necessary, therefore, to rely more on the students' recall of their distress and symptoms at the time of the accident by contrast with how they have felt since the accident than in the studies of adults in the general population. Nor do we have contrast groups as in the study of mothers of preschool children and the workers. Focus, therefore, is solely on contrasts in threat associated with living within five miles of TMI or living further away, having preschool siblings or not, and being in a family that left the TMI area during the crisis by contrast with being in a family that stayed.

How much psychological distress did the students experience during the TMI accident?

On the scale combining reports of worry, concern, disturbance and anxiety, scores could range from 1 signifying psychological well-being to f dicating maximum psychological distress, with 3 the neutral midpoint. The students on the average reported a score of about 3.25 for the time of the accident. Moreover, a quarter of them scored 4 or more on this scale.

There was no difference between 7th, 9th or 11th graders in level of psychological distress during the accident. However, somewhat higher levels of distress were reported by students living within 5 miles of the power plant. An even higher level of distress is found when we look at students who have a

1232 389

not have a preschooler in the home, who average around 3.12.

We also found an increase in level of psychological distress for those students whose families left the area. They average around 3.50 in comparison to those who did not evacuate the area, whose average is around the neutral point, 3.00. We also found that females reported higher levels of concern in comparison to males, 3.50 and 2.75 respectively. Hence, during the accident, students in general tended to experience some psychological distress, and distress tended to be more pronounced for students in the more threatening circumstances.

How distressed have the students felt since TMI?

Students were also asked about their level of worry, concern, disturbance and anxiety since the TMI accident. This second measure of psychological distress has identical scale properties as the first, with a neutral point of 3 and range from 1 to 5.

Overall, the average level of distress since the accident is approximately 2. This value does not differ across the 3 grade levels. As can be seen in Figure 7, there was a sharp drop in the level of distress within 2 months of the

Figure 7 about here

occurrence of the accident for students in all 3 grades. The assurances which have come from authorities have apparently helped in reducing these teenagers' psychological distress over the accident.

However, there are two groups of students for whom this dissipation of distress is not quite so clear. When we compare the group of students who have

40



Figure 7. Level of psychological distress during the TMI accident and since the accident for all three grades combined.

41

a preschool sibling with those who do not, we find that their level of distress has not decreased to the student average of 2.00. Instead, they score just over 2.25. Similarly, we find that having left the area during the accident reduces the dissipation effect, such that, for those who left, their average concern since the accident is also at 2.25, compared with those who did not leave, whose average score is 1.75. It is interesting to note that those who stayed in a potentially hazardous area showed significantly lower levels of psychological distress both during the accident and in the two months following the accident, compared with those who left the area. See Figure 8.

Figure 8 about here

The sex difference noted earlier continued to emerge, with females scoring higher in levels of distress since TMI, compared with males.

Was distress accompanied by somatic symptoms?

The students were asked to report the occurrence of any of 10 symptoms commonly associated with stress in youngsters. An additional category of "other" was included in case they had experienced a somatic problem not included in the list of ten. They were asked to report the occurrence of these symptoms during the time from March 28 to April 9. We ply summed the number of symptoms checked to compute a scale score for each student. Thus, the scale values could range from 0 through 11. In fact, no student had a somatic symptom score above 8.

The average number of symptoms reported by the entire sample was 1. This small average value is characteristic for all group comparisons we made. Our correlations do indicate, however, that as psychological distress increases,

42



Reference time for report of psychological distress

Figure 8. Level of psychological distress during and since the TMI accident, for those who stayed compared with those who left the area.

so does the number of somatic symptoms experienced, but that high levels of . somatic symptomatology are relatively uncommon. We found small but significant increases in the number of symptoms reported by two of the groups at high risk. Students living within 5 miles of the TMI plant and students who left the area reported more symptoms, compared with those who live further away, and 'those who did not leave the area. Somatic symptoms are especially prevalent in females and in youngsters in the lower grades.

Main Conclusions from the Study of 7th, 9th and 11th Grade Students.

The youngsters appear to have reacted to the accident in ways remarkably similar to the adults. They were psychologically distressed by the accident at the TMI plant. Their distress was acute and diminished rapidly within 2 months of the accident. The groups who experienced the highest levels of distress were those with preschool siblings, those who live within 5 miles of the plant, and those whose families left the area. For those who have a preschool sibling, and those who left the area, the level of psychological distress had not dissipated to the neutral level after 2 months, as it had dissipated for the other groups. The point to be emphasized, as in the studies of adults, is that the reactions of distress were related to the realistic threat that the youngsters faced. These reactions tended to disappear as the threat receded in time.

44

VIII. Measures in the Study of the Workers

The Main Measures of Threat

The primary indicator of threat to the workers was the contrast between being employed at the site of the accident, TMI, as against being employed at Peach Bottom. Note was also taken of whether TMI workers reported being at TMI 2 during the accident between March 28th and April 11th. In addition, we included the two conditions outside of the work situation that had been included in all other studies: living within 5 miles of TMI, and having a preschool child.

The Main Measures of Mental Health and Behavioral Effects

The measures were designed to parallel those used in the studies of the general population living around TMI and the mothers of preschool children insofar as possible. Therefore they included a measure of upset at the time of the accident, as well as before and currently, the same measure of demoralization as used in other studies, a measure of perceived threat to physical health, and questions about trust in authorities.

In addition, two measures suited to the workers' situation were included:

- 1. Certainty about the future of their occupation
- 2. Perception of hostility from the community.

A full description of these scales is provided in Appendix C.

45

IX. Results of the Study of Nuclear Workers

How upset were the workers?

The workers were asked whether they had had any periods of extreme upset during three times: the 6 months before the accident, the crisis from March 28th through April 11th, and now. Before the accident there was no difference between workers at TMI and those at Peach Bottom. For the period of the accident, in contrast, a higher proportion of TMI than Peach Bottom workers reported being extremely upset. As shown in Table 5, however, this difference

Table 5 about here

between workers at the two sites had largely disappeared by the time they were interviewed.

How demoralized were the workers?

Demoralization is a common distress response when people find themselves in a serious predicament and can see no way out. On this measure the average score of TMI workers, 12.7, was higher than the average of 10.9 among Peach Bottom workers. By comparison, we found that the average score on this measure for men in the general population around TMI was 9.7 and that, after early elevation, demoralization appeared to be largely dissipated by July and August when most of the interviews were conducted in the general population. This comparison indicates that Peach Bottom workers may have been slightly demoralized but that TMI workers were clearly still more demoralized that men in the general population in late August and September when they were interviewed.

Table 5

Percents of Workers at TMI and at Peach Bottom Who Reported Periods of Extreme Upset Before and During the Accident and at Present

Time of periods of extreme upset

| Location of Plant | During the 6 months before 3/28/79 | Anytime during crisis (3/28-4/11/79) | At the present time |
|-------------------------|------------------------------------|--|---------------------|
| | | | |
| TMI | 10 | 28 | 16 |
| Peach Bottom | 11 | 17 | 13 |

There are also differences in level of demoralization between supervisors and nonsupervisors at TMI. The average level of demoralization of supervisors was 10.6, only slightly higher than the average of males in the general population in the area. Nonsupervisors were more demoralized than their supervisors at TMI, with an average score of 13.8. By contrast, the average score of nonsupervisors at Peach Bottom was a significantly lower 11.1.

Over and above the differences between supervisors and nonsupervisors, education, age, sex, and marital status influenced level of demoralization. Workers who are college graduates were less demoralized than those who had not graduated from college. In terms of age, workers under 40 were the most demoralized and those over 50 the least, with those in their 40's intermediate. Consistent with findings from other comparisons, women were more demoralized than men, and people not currently married more demoralized than the currently married.

Was the TMI accident perceived as a threat to physical health?

This scale was designed to indicate the extent to which the workers felt that their health was endangered by the TMI accident. Scores on this measure range from 1, indicating low concern, to 3, indicating high concern, with an uncertainty point of 2. Realistically, TMI workers reported more concern than Peach Bottom workers about work related threats to their health, and those who were at TMI during the accident reported more concern than those who were not. However, the means of workers at both TMI and Peach Bottom, 1.59 and 1.32 respectively, were below the uncertainty point, indicating that on the average the workers were not seriously concerned about their health. In this respect, they are like the general population, where scores on an indicator of concern

1232 398

about the accident as a threat to physical health were also in the low range.

Within this range between feeling safe and feeling uncertain nonsupervisors were more threatened than supervisors, and younger workers more threatened than older ones. However, even the most threatened group, workers under 30 at TMI, had an average score of 1.66, which is below the uncertainty level.

West the workers uncertain about the future of their occupation?

This measure was designed to assess the extent of the workers' insecurity about the future of their occupation as nuclear workers. A high level of insecurity might be one basis for demoralization. However, although workers at TMI felt less certain than workers at Peach Bottom about the future of their occupation, responses in both groups indicated that there is little feeling of insecurity on this count among the workers at either site. The scale ranges from 5, indicating most uncertain, to 1, indicating certainty about the future; the average score of Peach Bottom workers was 1.62 and the average of TMI workers was 2.19.

How hostile does the community seem to the workers?

This scale is designed to describe the extent to which the workers felt that the public was critical and unappreciative of their work. There is no evidence of a difference on this measure between workers at TMI and those at Peach Bottom, workers at both sites indicating that they perceived some hostility in the community. Specifically, the scale ranges from 1, indicating perception of greatest appreciation, to 10, indicating perception of greatest hostility, with a neutral point of 5.50. The average score of TMI workers was 6.60 and that of Peach Bottom workers 6.26. However, within both sites the extent to which

the community was perceived as hostile decreased with the increasing age of the worker.

Trust in authorities.

We attempted to construct a scale for the workers that would be comparable to the Trust of Authorities scale used for the studies of the general population and mothers of preschool children. The two questions in the workers' interview, about whether they felt information from state and federal officials was truthful, and about whether they thought their employer kept them fully informed about risks and unhealthful conditions of their job, were uncorrelated.

Responses to the question concerning state and federal officials suggest that the workers' attitude was similar to that found in the general population and among mothers of preschool children. Slightly less than half said they did not trust the information from state and federal officials, about a quarter were uncertain, and less than a third expressed trust.

On the other hand, when asked about whether their employers were keeping them fully informed about the risks involved in their job, the overwhelming majority of both TMI and Peach Bottom workers responded positively. Although this proportion was lower at TMI, 73 percent, than at Peach Bottom, where it was 85 percent, the sharpest contrast is between the trust expressed by most of the workers and the distrust expressed by the general population in relation to the utility companies.

The problem of nonresponse.

We mentioned earlier that we conducted a separate study of small subsamples of nonrespondents at TMI and Peach Bottom following completion of the main interview study reported above. These subsamples were drawn from the groups

50

of workers who previously refused or were otherwise not available for an interview. As we said then, the results of the study of nonresponse indicate that the main findings presented above would not be substantially changed if, with more time available, we had been able to improve the completion rates. For example, we found that prior nonrespondents who were interviewed in this special study did not have lower scores on our demoralization scale than those previously interviewed. If, contrary to our actual finding the previous nonrespondents had had lower scores, this could have called into question our conclusion that levels of demoralization had remained high among the workers by comparison with men in the general population.

A comparison of results obtained in interviews conducted before September 15th, results obtained in interviews between September 15th and September 30th, and results from the study of previous nonrespondents in October did reveal an interesting difference. There was a tendency in Peach Bottom, especially marked for supervisors, to score higher on demoralization in the more recent interviews. Whether this is simply a sampling fluctuation, or, instead, represents a real change going on at Peach Bottom is unclear from our data. To the extent that the difference represents a real change, the result suggests that the predicament of nuclear workers in general has begun to affect the supervisors at Peach Bottom.

Main Conclusions from the Study of the Workers.

One of the most important findings with regard to the workers is that two factors that affected the morale of other adults and teenagers in the TMI area did not show independent effects on the morale of the workers. These were living within five miles of TMI and having preschool children. Moreover, the

1232 101

workers did not show distrusting attitudes toward plant authorities. Clearly, they were not threatened in the same way as most groups in the general population. Yet, these workers at TMI, especially the large majority who are nonsupervisory, were showing higher levels of demoralization into September than their counterparts at Peach Bottom and than male household heads in general in the TMI area. Like Peach Bottom workers, TMI workers believed that less than positive attitudes are held toward them by people in the wider communities around them. This belief is not unrealistic if attitudes in communities around TMI are like those reported in a national poll conducted in April, when 55 percent of respondents blamed the accident on human error rather than on the government or the power industry (Mitchell, 1979).

The salient fact is, then, that the TMI workers' predicament has not been resolved. Their level of demoralization has not returned to normal following the accident as has been the case with our other samples of adults in the general population of the TMI area.

X. Research on Mental Health and

Behavioral Effects

One of the charges to this Task Force was to evaluate the possible impact on the affected populations and the workers of a variety of studies either under way or planned in the TMI area. This charge stemmed in part from the concern that the people being studied would come to feel that they were being used for psychological research. We have evidence that this was not the case with the samples of persons who participated in the studies on which we have relied. Questioning by the field supervisor of the interviewers involved in these studies about the reactions of those who participated failed to yield a single mention of such a response. Rather, the participants often expressed appreciation at being contacted for the interview and given a chance to express their feelings and attitudes.

The charge also asked that a distinction be made between short-term and long-term mental health and behavioral effects. Given the time frame for this research and the report to the President, it is obvious that we cannot evaluate how long some of the effects that have not dissipated will persist, nor what levels of upset, distress and demoralization could recur should another threat appear. Also given the brief time for this research it has not been possible to follow up our assessments of some aspects of the mental health and behavioral effects with more intensive study of the consequences to the groups and individuals at highest risk of upset, distress and demoralization. Moreover, we have not studied a number of groups -- the decision makers, for example, and persons who left the area as a result of the accident and have not returned.

1232 103

The present Report, then, has by necessity had limited goals and scope. There do remain important areas deserving further study, which touch on vital concerns regarding trust, vulnerability, and institutional capabilities for identifying and dealing with the psychological and behavioral consequences of situations such as that associated with the TMI-2 accident.

. .

President's Commission on the Accident at Three Mile Island

Task Force on Behavioral Effects

XI. APPENDIX A:

DESCRIPTION OF SIX MEASURES OF MENTAL HEALTH AND BEHAVIORAL EFFECTS USED IN THE STUDIES OF THE GENERAL POPULATION, MOTHERS OF PRESCHOOL CHILDREN, AND CLIENTS OF COMMUNITY MENTAL HEALTH CENTERS

RATING OF IMMEDIATE UPSET

How upsetting was the TMI incident? Please rate it on the O-10 scale. . O means least upsetting and 10 means most upsetting.

012345678910

Scoring Note: This item is scored just as the subject was asked to score it.

Reliability: Since this is a single item scale, we cannot check its internal consistency reliability. Nor were data collected on its test-retest reliability.

Interpretation: This scale is an attempt to measure the subjectively experienced immediate "upset" resulting from the accident. It is unfortunate that it consists of only one item. However, this item was preceded by the question: "In the last two years, have you experienced any major life changes?" Please put a check beside all of the following experiences which have occurred to you in the last two years." A list of 10 events including "Job change (what?), "Death in the Family (relationship to you, "Serious Illness (heart attack, etc.)." The individual was asked to rate the upsettingness of each of the events he or she experienced on the ten point scale later used to rate the upsettingness rating. This should markedly increase the validity of the TMI rating of upset. If so, it could provide a useful measure of immediate distress to contrast with the demoralization items that followed it in the questionnaire and that refer to longer term effects in the period since TMI and the time of the interview.

DEMORALIZATION

4.

- How often since TMI have you had times when you couldn't help wondering if anything was worthwhile any more? (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)
- Since TMI, how often have you felt that nothing turns out for you the way you want it to, would you say (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)
- Since TMI, how often have you felt completely helpless? (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)
- Since TMI, how often have you felt completely hopeless about everything, would you say (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)
- Since TMI, how often have you feared going crazy, losing your mind? (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)
- Since TMI, how often have you had attacks of sudden fear or panic? (4 very often; 3 fairly often; 2 sometimes: ¹ almost never; 0 never)
- Since TMI, how often have you feared something terrible would happen to you? (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)
- Since TMI, how often have you felt confused and had trouble thinking? (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)
- Since TMI, how often have you had trouble concentrating or keeping your mind on what you were doing? (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)
- Since TMI, how often have you been bothered by feelings of sadness or depression, feeling blue? (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)
- Since TMI, how often have you been in very low or low spirits? (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)
- Since TMI, how often have you felt like crying? (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)
- Since TMI, how often have you felt lonely? (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)
- Since TMI, how often have you had frightening dreams? (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)
- Since TMI, how often have you feared getting physically sick? (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)

- Since TMI, how often have you felt anxious? (4 very often; 3 fairly of cu; 2 sometimes; 1 almost never; 0 never)
- Since TMI, how often have you been bothered by feelings of restlessness? (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)
- 18. Since TMI, how often have you feared being left all alone or abandoned? (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)
- 19. Since TMI, how often have you been bothered by acid or sour stomach several times a week, would you say (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)
- 20. Think of a person who is the worrying type, a worrier. Is this person (4 very much like you; 3 much like you; 2 somewhat like you; 1 very little like you; 0 not all like you)
- Since TMI, how often has your appetite been poor? (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)
- 22. Since TMI, how often have you been bothered by cold sweats? (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)
- Since TMI, how often did your hands ever tremble enough to bother you, would you say (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)
- 24. Since TMI, how often have you had trouble with headaches or pains in the head? (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)
- 25. Since TMI, how often have you had trouble with constipation? (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)
- 26. Since TMI, how often have you felt you were bothered by all different kinds of ailments in different parts of your body? (4 very often; 3 fairly often; 2 sometimes; 1 almost never; 0 never)

Scoring Notes: All items are scored in the same direction on a five-point scale.

Internal consistency reliability: Above .90 in all samples.

Interpretation: These 26 items are a sample from a larger set of items that have been developed in the Social Psychiatry Research Unit, Department of Psychiatry, Columbia University, to measure demoralization (Dohrenwend, et al., in press-a; Dohrenwend et al., in press-b; Dohrenwend et al., unpublished). The 26 items correlate .98 with a composite scale formed from the larger set of demoralization scales.

"Demoralization" is the term used by Jerome Frank to describe the psychological symptoms and reactions a person is likely to develop "...when he finds that he cannot meet the demands placed on him by his environment, and cannot extricate himself from his predicament" (1973). Demoralization can coincide with

diagnosable psychiatric disorders but may also occur in the absence of such disorders. The various sources of the intractable predicaments include, for example, situations of extreme environmental stress such as combat or natural disasters; physical illnesses, especially those that are chronic; and crippling psychiatric symptoms of, for example, the kinds associated with severe psychotic episodes. Hence, an elevated score on a scale measuring demoralization is something like elevated physical temperature; it tells us that there is something wrong; it does not in and of itself tell us what is wrong.

PERCEIVED THREAT TO PHYSICAL HEALTH

- Are you satisfied that you are now safe and not contaminated by radiation from the TMI incident?
 - 1 yes 3 no 2 maybe 2 don't know
- Do you think your chances of getting cancer have changed because of the TMI incident?
 - 3 increased 1 decreased 1 remained the same 2 don't know
- 3. Since the TMI incident, has your health changed?
 - 1 much better 1 better 1 same 3 worse 3 much worse
- 4. Do you think your health will deteriorate in the future because of the TMI incident?
 - 3 yes 1 no 2 maybe 2 don't know
- Scoring Notes: All items are scored on a three-point scale with the highest scores assigned to perception of threat. Note that there is balanced keying of the items in this scale, so that for two items a positive response indicates the highest threat while in the other two a negative response indicates highest threat. Item scores were added and divided by 4 to obtain scale scores.
- Internal consistency reliability: From .66 to .69 in general population, TMI Mothers, and Wilks-Barre Mothers; .70 in clients of mental health centers.
- Interpretation: These 4 items represent an attempt to measure perceived threats to physical health from the TMI accident. The threats described come from radiation contamination, increased chances of cancer, and the actual or expected likelihood of unspecified deterioration.

ATTITUDE TOWARD CONTINUING TO LIVE IN THI AREA

- If you or your spouse were offered a job in another area containing no nuclear plants, assuming the pay and benefits to be comparable, would you want to take it?
 - 1 yes 3 no 2 maybe 2 don't know
- If you could, would you move to another house which was located farther away from a nuclear power plant?
 - 3 yes 1 no 2 maybe 2 don't know
- 3. Do you think the quality of life in this region has been permanently altered by the incident at TMI?
 - 3 yes 1 no 2 maybe 2 don't know
- Scoring Notes: All items are scored on a three-point scale with the highest scores assigned to desire to move. Item scores were added and divided by 3 to obtain scale scores.
- Internal consistency reliability: From .79 to .81 in General Population, TMI Mothers, and Wilkes-Barre Mothers; .83 in clients of Community Mental Health Centers.
- Interpretation: These 3 items represent an attempt to measure whether the individual devalues the area as a result of the accident and would prefer to leave it other things (e.g., economic considerations) equal.

ATTITUDE TOWARD NUCLEAR FOWER, INCLUDING TMI

- 1. Do you want to ban all nuclear powered, electric generating plants?
 - 3 yes 1 no 2 caybe 2 don't know

2. Are you in favor of Unit 1 at TMI restarting?

1 yes 3 no 2 maybe 2 don't know

3. Are you in favor of Unit 2 at TMI restarting?

1 yes 3 no 2 maybe 2 don't know

Scoring Notes: All items are scored on a three-point scale with the highest scores assigned to con attitudes. Note, however, that the first item unlike the other two is keyed negatively. Item scores were added and divided by 3 to obtain scale scores.

Internal consistency reliability: From .54 to .70 in General Population, TMI Mothers and Wilkes-Barre Mothers; .46 in clients of Community Mental Health Centers.

Interpretation: These three items are an attempt to measure whether attitudes are favorable or unfavorable toward nuclear power in general and towards the resumption of TMI as a nuclear power facility

TRUST IN AUTHORITIES

 Do you feel the information you were getting from state and federal officials during the TMI crisis was truthful?

1 yes 3 no 2 sometimes 2 don't know

2. Do you trust utility companies regarding the safety of nuclear energy?

1 yes 3 no 2 maybe 2 don't know

- 3. Do you think federal officials have been truthful regarding the radiation dangers of the TMI incident?
 - 1 yes 3 no 2 maybe 2 don't know
- 4. Do you trust the federal government regarding the safety of nuclear energy?
 - 1 yes 3 no 2 maybe 2 don't know

Scoring Notes: All items are scored on a three-point scale with the highest scores assigned to distrust. Item scores were added and divided by 3 to obtain scale scores.

- Internal consistency reliability: From .64 to .75 in General Population, TMI Mothers and Wilkes-Barre Mothers; .82 in clients of Community Mental Health Centers.
- Interpretation: This 4 item scale is an attempt to measure an attitude of distrust towards authorities responsible for the public health and safety with reference to the plants at TMI. The authorities referred to in the items are state and federal officials and the utility companies.

President's Commission on the Accident at Three Mile Island

Task Force on Behavioral Effects

XII.APPENDIX B

DESCRIPTION OF THREE MEASURES OF MENTAL HEALTH AND BEHAVIORAL EFFECTS USED IN THE STUDY OF THE 7th, 9th, AND 11th GRADE PUPILS IN LOWER DAUPHIN SCHOOL DISTRICT

Psychological Distress

 How did you feel when you were most concerned about the Three Mile Island incident? (Please put one check for each item).

| Worried | T | 2 | 3 | 4 | 5 | Not worried |
|-----------|----------|---|---|---|---|---------------|
| Concerned | T | 2 | 3 | 4 | 5 | Not concerned |
| Disturbed | Т | 2 | 3 | 4 | 5 | Undisturbed |
| Anxious | — | 2 | 3 | 4 | 5 | Calm |

 How do you feel now about the current situation at Three Mile Island? (Please put one check for each item.)

| Worried | 1 | 2 | 3 | 4 | 5 | Not worried |
|-----------|---|---|---|---|-----|---------------|
| Concerned | T | 2 | 3 | 4 | 5 | Not concerned |
| Disturbed | Т | 2 | 3 | 4 | -5- | . Undisturbed |
| Anxious | - | 2 | 3 | 4 | 5 | Calm |

Scoring note: The direction of scoring was reversed such that on both questions, for each of the four items, a high score, 5, indicated distress. (i.e. worried, concerned, disturbed, anxious), and a low score, 1, indicated the absence of distress. Item scores were added and divided by 4 to obtain scale scores.

Internal-Consistency

Reliability:

.84 for question 1. .86 for question 2.

These figures indicate a very high level of internal consistency reliability of both scales for the entire sample.

1232 115

Interpretation: These items were designed to assess the degree of emotional distress experienced by each respondent at two points in time. Each scale is based on self-reports. The first scale is based on recall, whereas the second scale is based on current state.

Psychosomatic Distress

 Did any of the following things happen to you during the time from March 28 to April 9? (Check all that happened.)

| Stomach Ache | Nightmares | | |
|------------------|------------------------|--|--|
| Sick to Stomach | Bed Wetting | | |
| Headache | Sleep problems | | |
| Sore throat | Loss of appetite | | |
| High temperature | Eating more than usual | | |
| Other | | | |

- Scoring Note: A check was assigned a 1, a blank assigned a zero. The score on this scale for each subject was simply the sum of the 11 possible symptoms. Scores could range from 0 to 11.
- Internal Consistency Reliability: .66 for the entire sample. This internal consistency coefficient was computed using the Kuder-Richardson formula 20, a special case of Cronbach's alpha, for dichotomous data. The level of reliability indicates an acceptable degree of consistency of responding for use as a scale.
- Interpretation: These are symptoms commonly experienced by youngsters under stress. Some of them such as bed wetting would be unusual among teenagers.

66

President's Commission on the Accident at Three Mile Island

Task Force on Behavioral Effects

XIII. APPENDIX C

DESCRIPTION OF SIX MEASURES OF MENTAL HEALTH AND BEHAVIORAL EFFECTS USED IN THE . STUDY OF THE WORKERS AT TMI AND PEACH BOTTOM
I am going to list some problems which people experience from time to time. Please teil me if any of them have bothered you at the times indicated.

| | During the 6 mos. before 3/28/79 | | Anytime during crisis (3/28-4/11/79) | | At the present time | |
|-----------------------------|--|----|--|----|---------------------------|----|
| | yes | no | yes | no | yes | no |
| Periods of extreme upset | 1 | 2 | 1 | 2 | 1 | 2 |

Scoring Note: Yes was scored 1 and negative response 0 for each period.

Reliability: No information. Each is treated as a single item index.

Interpretation: The middle item is as near as we could come to a measure for the workers that may be comparable to the ratings of upsettingness on a ten point scale that we used in analyses of the data from the general population and the mothers of preschool children.

DEMORALIZATION

This 26 item scale is identical to the one used in the studies of the general population and of mothers of preschool children. See Appendix A.

Reliability: The internal consistency reliability of this scale is .90 in TMI and .91 in Peach Bottom.

THREAT TO PHYSICAL HEALTH

| During the TMI i (3/28/79-4/11/79 job expose you t | ncident) did your o: | no problem at all | slight problem | sizeable problem | great problem | |
|--|--|---|--|--|-------------------------------------|--------|
| 1. Radiation? Yes No | | | | | | |
| 2. Risk of catch diseases? Yes No | ing | | | | | |
| 3. Even if your unhealthful c do you feel t TMI incident Yes No | employer kep onditions th hat your hea due to hazar | t you fully i at you may ha 1th was <u>endan</u> ds in the wor | nformed <u>/a</u> ve been ex gered more kplace? | bout any da posed to or than usual | ingers or your job/ during th | , e |
| 4. Are you satis from the TMI Yes Maybe Don't know No | fied that yo incident? | u are now <u>saf</u> | <u>e</u> and not | contaminate | ed by radia | tion |
| Scoring Notes: Q | uestion 1: N | o or No problem | em = 1 = 2 | t suchlas | | |
| Q | uestion 2: N S | o or No problem light problem = 3 | em = 1 , Sizeable | problem, o | or Great | |
| Q | uestion 3: N Y | o = 1 es = 3 | | | | |
| Q | uestion 4: Y M | es = 1 aybe or Don't | know = 2 | | | |
| I | tem scores w | ere added and | divided b | y 4 to obta | in scale so | cores. |
| Internal consist | ency reliabi | lity: .53 in | two sampl | es combined | : .48 in T | MI |
| and .54 in P | each Bottom | sample. | | | | |

Interpretation: This scale is intended to measure the extent to which the workers felt that their health was endangered by the TMI accident.

CERTAINTY ABOUT FUTURE OF OCCUPATION

I would now like to ask you how you see the <u>future of your occupation</u>. For each of the following questions, please indicate how certain/ uncertain you feel. Possible responses include:

| somewhat | a little | somewhat | fairly | very | |
|-----------|-----------|----------|---------|---------|--|
| uncertain | uncertain | certain | certain | certain | |
| 1 | 2 | 3 | 4 | 5 | |

- How certain are you about what your <u>future career</u> picture looks like? Are you ... (repeat response categories)?
- 2. How certain are you of the <u>opportunity for promotion</u> and advancement which will exist in the next few years? Are you ... (repeat response categories)?
- 3. How certain are you about whether your job skills will be of use and value five years from now? Are you ... (repeat response categories)?
- 4. How certain are you about what your <u>responsibilities</u> will be six months from now? Are you ... (repeat response categories)?

Scoring Notes: All items are scored on a scale from 1 to 5 as indicated. Item scores were reversed so that 5 indicated most uncertain. Item scores were added and divided by 4 to obtain scale scores.

- Internal consistency reliability: .65 in combined samples, .72 in TMI sample, and .36 in Peach Bottom. The low figure for Peach Bottom is probably due to the lack of variability in responses to these items in this sample, where the majority responded "very certain" to three of the four questions. This figure cannot therefore be interpreted as indicating that this scale is necessarily an unreliable measure in this sample.
- Interpretation: These questions were designed to assess the workers' feelings of security or insecurity about their occupation without an indication of the basis for their feelings

PERCEPTION OF HOSTILITY FROM COMMUNITY

- How do you think the performance of nuclear workers such as yourself was seen by people in the community during the TMI incident (3/28/79-4/11/79)? Please indicate on a scale of 1 to 10: 1 = made serious errors; 10 = performed very capably.
- To what degree do you feel this view was justified? Please indicate on a scale of 1 to 10: 1 = completely unjustified; 10 = completely justified.
- 3. How much do you feel the general public <u>appreciated</u> the work of nuclear workers such as you during the TMI incident (3/28/79-4/11/79)? Please indicate on a scale of 1 to 10: 1 = very little appreciation; 10 = very great appreciation.
- Scoring Notes: As noted, each item is scored on a scale from 1 to 10. Item scores were reversed so that the higher the score the greater the perception of hostility. They were added and divided by 3 to obtain scale scores.
- Internal consistency reliability: .71 in two samples combined; .72 in TMI and .69 in Peach Bottom.
- Interpretation: This scale was designed to describe the extent to which the workers felt that the public is critical and unappreciative of their work.

TRUST IN AUTHORITIES

- 1. Do you feel that the information you were getting from state and federal officials during the TMI incident was truthful?
- 2. During the TMI incident, (3/28/79 4/11/79), do you think your employer kept you <u>fully informed</u> about the dangers or unhealthful conditions that you may have been exposed to on your job?

<u>Scoring Notes</u>: Question 1: Yes = 1 Maybe or Don't know = 2 No = 3 Question 2: Yes = 1 No = 3

Reliability: There was no relation between these two items. Therefore, they were not combined to make a scale, but were analyed separately.

Interpretation: Each item is treated as a separate index with no interpretation beyond the working of each question.

President's Commission on the Accident at Three Mile Island

Task Force on Behavioral Effects

XIV. APPENDIX D

THE USE OF TELEPHONE SURVEYS

The Use of Telephone Surveys

Market researchers have reported the succesful use of telephone interviews to obtain data regarding a variety of subjects, e.g., the effectiveness of advertising campaigns, products being used in the home and so forth. By and large, however, social scientists have been skeptical of the telephone as a device for securing information from the population at large for a number of reasons. It has been argued that telephone surveys would provide a biased sample since not all persons have access to telephones in their homes. And, not all who have phones have them listed. It has been hypothesized further that respondents could not respond to complex questions over the telephone and/or they would not be willing to answer inquiries of a personal nature. The respondents have been viewed as more shy, cautious and unwilling to offer information over the telephone than in face-to-face situations. There is, however, a growing body of information that refutes this commonly held conception.

Bias due to underrepresentation.

Issues associated with underenumeration and other biases related to representativeness have been extensively studied by the Rand Corporation (Lucas and Adams, 1977). The results of this National Science Foundation supported study which was conducted in several Pennsylvania communities offer the following conclusions:

 Research shows that by 1976 saturation was so high that the exclusion of non-telephone households is no longer a liability for telephone survey sampling in most parts of the country (p. v). (See Figure 9 for data on counties surrounding TML.)



- Available techniques of random-digit and added-digit dialing are shown to provide representative samples of telephone households (p. v).
- 3. Estimates of population characteristics obtained by telephone or personal surveys in seven Pennsylvania cities were acceptable representations of the adult populations. This judgment was made after careful comparisons between census data, voter registrations and turnouts, and other available data (p. v).
- 4. Data from two Pennsylvania communities where comparative telephone and personal interviews were collected support the view that respondents are willing to provide detailed and complex information on a variety of personal topics over the telephone and that it is comparable to that obtained in person. In addition, telephone interviewing may lead to slight reductions in bias toward socially desirable and presumably less distorted answers, although the effects are fairly subtle (p. v).
- 5. Further comparative analysis of the personal and telephone interviews found a few differences which appeared to be associated with the complexity of the questions and the pacing of the interviews. The matters of complexity and fast pacing of the interviews appear to be more important issues than subject matter sensitivity (p. v).

The Rand Report concludes as follows: "Findings from the Pennsylvania surveys were consistent with a growing body of research which supports the conclusion that telephone surveys can provide representative samples of the general population and can obtain reliable answers on sensitive as well as factual subjects. The telephone survey does as well as the perso al survey for most purposes and has greater potential for quality and flexibility at lower cost" (pp. v, vi).

1232 127

Health related studies conducted by telephone.

A growing body of empirical research suggests that health related interviews conducted by telephone are as effective as those obtained in face-to-face settings. Josephson (1965) in a telephone interview which screened for visual difficulties (N=2000) concluded that little or no underreporting of problems occurred. This judgment was based on a follow-up in a face-to-face, personal situation. Hochstein (1967) compared data from two California health studies. One consisted of 977 mailed questionnaires, 518 telephone and 183 face-to-face interviews. The second consisted of 524 mailed questionnaires, 285 telephone and 137 face-to-face interviews. The findings showed few differences across all three methods in spite of the fact that the questionnaires/schedules included sensitive issues. The author concluded the data were virtually interchangeable among approaches on most substantive questions. In fact, on questions related to alcohol use, the women were slightly more likely to acknowledge drinking habits over the phone than by mailed questionnaire or face-to-face interviews.

Although not corroborated by face-to-face interviews, Mooney <u>et al.</u>(1968) successfully interviewed women over the telephone regarding menstrual cycles, pregnancies, illnesses and related subjects of a highly personal nature. And, the well-known longitudinal fertility studies of Freedman <u>et al</u>. successfully used telephone surveys in a number of instances (Coombs and Freedman, 1976).

Overall, there is a growing body of evidence which indicates that telephone interviews can provide as valid and reliable data as those obtained in personal face-to-face situations. In addition, the evidence indicates that the techniques (based on the Rand developed million random digits) used to select samples from

the general population for the report to the Commission, yield representative samples. We can, therefore, conclude that the use of telephone interviews to gather data for the studies of behavioral effects of the TMI accident gives them scientific value and utility.

The only possible major exception to this general conclusion involves the Arish who live in the area. They do not have telephones in their homes. But, they would nct, in all probability, provide information in a personal interview either.

XV. ACKNOWLEDGMENTS

There are many people whose efforts, taken together, were essential in making it possible for the Task Force and the collaborating researchers to do the work that has provided the basis for this report. These include Dr. Joseph Adelstein, Ms. Joanne M. Buhl, Mr. Shields Daltroff, Mr. Allen Danfield, Dr. Victor Fongemie, Mr. Joseph Gallagher, Dr. Wayne Guymon, Dr. Henry R. Hoerner, Ms. Janet Kelley, Mr. James Kimmey, Mr. Ralph A. Moyer, Jr., Mr. Vincent O'Reilly, Mr. Charles H. Pillard, Dr. Harold Proshansky, Mr. Robert R. Saylor, Dr. Patrick E. Shrout, Dr. Peter Campbell-Smith, Ms. Judy Vercher, and Mr. John F. Wilson. We gratefully acknowledge their contributions.

XVI. References

- Ad Hoc Population Dose Assessment Group. <u>Population Dose and Health Impact of</u> <u>the Accident at the Three Mile Island Nuclear Station</u>. (Preliminary Assessment for the Period March 28 through April 7, 1979). Food and Drug Administration Bureau of Radiological Health, Rockville, MD, Table 3-2.
- L. Coombs, R. Freedman, "Use of the telephone interview in a longitudinal fertility study." <u>Public Opinion Quarterly</u>, Vol. 28, Spring, 1964, 112-117. Bruce P. Dohrenwend, "Stressful Life Events and Psychopathology. Some Issues of Theory and Method," in J.F. Barrett, R.M. Rose and G.L. Klerman (Editors), Stress and Mental Disorder. New York: Raven Press, 1979, pp. 1-15.

Bruce P. Dohrenwend and Barbara Snell Dohrenwend. Social Status and Psychological Disorder: A Causal Inquiry. New York: Wiley, 1969.

- Bruce P. Dohrenwend, Barbara S. Dohrenwend, M.S. Gould, B. Link, R. Neugebauer, and R. Wunsch-Hitzig. <u>Mental Illness in the United States: Epidemiologic</u> Estimates of the Scope of the Problems. New York: Praeger, in press.
- Bruce P. Dohrenwend, L. Oksenberg, P.E. Shrout, B.S. Dohrenwend and D. Cook. What Brief Psychiatric Screening Scales Measure. In S. Sudman (Editor), <u>Proceedings of the Third Biennial Conference on Health Survey Research Methods</u>, Washington, D.C.: National Center for Health Statistics and National Center for Health Services Research.
- Bruce P. Dohrenwend, P.E. Shrout, G. Egri & F.S. Mendelsohn. What psychiatric screening scales measure in the general population: Part II: The components of demoralization by contrast with other dimensions of psychopathology. Unpublished manuscript.
- Cynthia Bullock Flynn, <u>Three Mile Island Telephone Survey:</u> <u>Preliminary Report</u> <u>on Procedures and Findings</u>, Mountain West Research, Inc., September, 1979. Jerome D. Frank, <u>Persuasion and Healing</u>. Baltimore: Johns Hopkins University Press, 1973. 1232–131

- J.R. Hochstein, "A critical comparison of three strategies of collecting data from households." <u>American Statistical Journal</u>, Vol. 62, September, 1967, 967-989.
- Eric Josephson, "Screening for visual impairment," <u>Public Health Reports</u>, Vol. 80, January 1965, 47-54.
- William Lucas and William Adams, "An Assessment of Telephone Survey Methods." October 1977, The Rand Corporation, Santa Monica, California.
- Robert C. Mitchell, "Public Opinion about Nuclear Power and the Accident at Three Mile Island," in D.L. Sills, C.P. Wolf and V.B. Shelanski (Editors), <u>Social Science Aspects of the Accident at Three Mile Island</u>, New York: Social Science Research Council, 1979.
- W.H. Mooney, B. Pollack and L. Corsa, "Use of telephone interviewing to study human reproduction." <u>Public Health Reports</u>, Vol. 83, December 1968, 1049-1060.
- George G. Warheit. "General Characteristics of Counties and Places Located within a 20-mile Radius of the Three Mile Island Nuclear Power Plant, Pennsylvania," Prepared for the President's Commission on the Accident at Three Mile Island, September, 1979 (Commission Document Control #9210004).