

THREE MILE ISLAND IMPLICATIONS FOR GOVERNMENT POLICY

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INTRODUCTION

On March 28, 1979, the worst commercial nuclear accident in the United States occurred at Three Mile Island (TMI) (Kuhns 1979). The plant is located on the Susquehanna River at Middletown, Pennsylvania near Harrisburg. Within a 15 mile radius of the plant is a population of 375,000 people.

Thirty nine percent or 144,000 people in the 15 mile radius of TMI voluntarily evacuated. Main reasons given were the perceived danger, confusion, and the fear of forced evacuation (Flynn 1979). An analysis of these events will be used to identify the implications for government policy concerning evacuation of the population in and around a nuclear power plant.

CHRONOLOGICAL ORDER OF EVENTS

In order to place our implications for governmental policy in proper context, we will first present a chronology of events from the time the accident was discovered until the time that Harold Denton, the chief Nuclear Regulatory Commission (NRC) spokesman, left TMI. This time period is generally, considered to be the "crisis" period, as shown in Figure 1. This chronology demonstrates that uncertainty and ambiguity prevailed. Further and that emergency preparedness including evacuation planning action was less than satisfactory during the "crisis" period.

IMPLICATIONS FOR GOVERNMENT POLICY

The first implication of the TMI experience relates to the sites of nuclear power plants. TMI was situated close to a densely populated area. If there is a need for nuclear generated power, and that power can be generated with minimal risks to the health and welfare of the surrounding population "the newer power plants must be sited in locations remote from concentration of population" (Kemeny 1979). This is based on the premise that even with the construction of a "safe" plant, there is the possibility of another accident like TMI. Therefore, remote sites with less people at risk are pre-

ferrable to sites in densely populated areas where many people will be at risk. Construction in more remote areas would also allow for evacuations of fewer people and thus not create the problems associated with density. This should not be construed as a recommendation to construct power plants in rural areas. The key concern is first to construct a "safe" plant.

The second implication is that emergency preparedness must become a top priority for all the institutions involved in the operation and regulation of nuclear power plants. It must be recognized that the potential for evacuation might occur, and therefore, emergency plans must be ready for immediate action. The disbelief in the possibility of the occurrence of an accident of a magnitude like TMI led many parties to relax and not consider emergency preparedness as a realistic need.

Two important lessons were learned. 1) There is a need for centralized authority in a crisis situation like TMI. Power must be centralized immediately in one competent person. In the TMI case, the delay in declaring a general emergency, and the designation of Harold Denton as person-in-charge, resulted in confusing and conflicting leadership. The public did not know whom to listen to or whose recommendation to follow. In such an ambiguous situation, it was not surprising that families living in the area of the plant who were younger, better educated, and had children were most likely to evacuate in this ambiguous situation. See Table 1. 2) Strong governmental intervention must ensue and emergency powers must be assumed. It cannot be expected that all people will voluntarily comply with the various stages of an evacuation. In this emergency, it is recognized that civil law is superseded, and that extraordinary powers are needed to safeguard the health and welfare of the residents surrounding a nuclear power plant. For example, the ability to "draft" use of school buses for evacuation purposes and to utilize necessary building facilities and agencies is assumed.

Elements of emergency preparedness

FIGURE 1: CHRONOLOGY OF EVENTS AT THREE MILE ISLAND

Date: 3-8-79 4:00 AM Accident initiated. 6:55 AM Site emergency declared.
 7:24 AM Pennsylvania Emergency Management Agency (PEMA) notifies Governor.
 8:40 AM First team of 5 inspectors leave NRC Region 1 for site.
 9:00 AM NRC notified President Carter & Environmental Protection Agency.
 9:01 AM Associated Press releases bulletin advising a general emergency declared at TMI, but that no radiation was released.
 10:30 AM NRC press release confirms incident; release of primary water to containment; no offsite radioactivity.
 1:15 PM Herbein, of Metropolitan Edison reports "no significant levels of radiation; reactor being cooled in accordance with design; no danger of core meltdown."
 4:30 PM Lt Governor news conference: Situation more complex than state led to believe. No danger to public health. Metropolitan Edison gave misleading information. Radiation has been released.
 10:00 PM Lt Governor's news conference: High radiation levels on site; no critical levels off site.
 Date: 3-29-79 5:15 PM Governor's press conference: No cause for alarm. No danger to public health. No reason to disrupt daily routines. Situation appears under control, but important to remain alert and informed.
 Date: 3-30-79 8:01 AM Helicopter measures dose rate of 1200 mr/h over Unit 2 auxiliary blg vent stack.
 8:42 AM Plant informed Bureau of Radiological Protection and Governor of radiation release.
 9:00 AM Wire service story about radiation release.
 9:55 AM NRC informed Governor that evacuation is unnecessary, but advisable for persons in 5 miles downwind of plant to stay indoors.
 10:25 AM Governor on local radio station WHP advises people within 10 miles of plant to stay indoors with doors & windows closed.
 10:47 AM President Carter orders H Denton to site to take charge.
 12:30 PM Governor's news conference: no reason to panic but pregnant women and school children within 5 miles of plant should evacuate.
 4:00 PM UPI quotes Thompson of NRC saying there is a possibility of core meltdown
 10:00 PM Governor & Denton news conference: Advisory still in effect. No explosion in the reactor vessel. Possibility core meltdown very remote.
 Date: 3-31-79 12:00 M Denton press conference: Crisis not over. NRC still examining hydrogen bubble data. Does not think bubble is a problem.
 2:45 PM Commissioner Hendrie press conference: Reactor stable; fuel cooling. Possible precautionary evacuation during hydrogen problem handled.
 5:00 PM Governor's news conference: Advisory still in effect. No need for full evacuation. No threat to public health.
 11:00 PM Governor & Denton news conference: No possibility of hydrogen explosion in reactor vessel in near term.
 Date: 4-1-79 1:00 PM President Carter visits site.
 2:00 PM Denton press conference: Advisory still in effect.
 Date: 4-2-79 11:15 AM Denton news conference: Bubble size decreasing.
 Date: 4-3-79 2:40 PM Denton news conference: Situation stable. Hydrogen no longer threat
 Date: 4-4 to 4-6: Minor problems remain. Cooling continues.
 Date: 4-9-79 Governor lifts advisory. All schools in a 5 mile radius reopen.

should include the following: 1) existence of local evacuation plans which are a matter of public record; 2) explication of the role of the NRC; 3) the coordination and interaction between the NRC, Federal, State and Local Gov-

ernment Agencies as well as the public utility; and 4) the education of the public about nuclear power plants and the effects of radiation (NRC 1980). There is also need to conduct drills, including siren tests and mock evacua-

tions, to make sure that all elements of the plans are working smoothly.

An emergency evacuation, especially if it occurs during school or work hours, will result in the separation of members of the family unit. The fact that entire families with children were more likely to evacuate during TMI indicates that the forced separation of an emergency evacuation will not be easy to implement. Therefore, special training for the National Guard or State Police will be needed to help them handle these potentially difficult family

It should also be recognized that the decision to evacuate a particular geographical area will have an impact on the adjacent areas. The Governor's advisory evacuation probably impacted on people living in the next five mile radius. It is difficult to ascertain the exact extent of this impact. Therefore, the rationale for selecting the area to be evacuated must be clearly delineated and communicated. This should delimit the impact on adjacent geographical zones.

Another lesson learned from the TMI experience is that emergency preparedness planning should take into account the communication problems for so-called hidden groups like the Amish, the deaf, and people for whom English is not the primary language. The use of cars with loud speakers, captioned T.V. messages and multi-language communications are only some examples of spreading the message to these and other groups.

Furthermore, the fact that the elderly were unlikely to voluntarily evacuate suggests that they may be unwilling or unable to evacuate even if ordered. Special training for appropriate law enforcement officials will be needed if they are to recognize the special needs of the elderly.

The location of TMI in a mixed urban - rural area drew attention to other than direct human needs. Some persons engaged in agriculture were reluctant to abandon their farm animals. Realism requires that emergency evacuation planning consider the impact of farm animals on individual's decisions to evacuate or not. Animals as well as people may need to be evacuated.

A final implication (Starr and Pearman 1981) is that the person-in-charge and the organizations that the individual represents must be be-

TABLE 1: EVACUEE & NON-EVACUEE TRAITS

Factors	Moved		Chi ²	p
	Out	Home		
In present home under 5 years	25	24	0.0	NS
Area resident under 10 years	10	8	0.4	NS
Proximity to TMI under 10 miles	86	57	19.9	.001
Full families	43	15	19.8	.001
Aged under 50				
Female	73	44	15.3	.001
Male	61	34	11.4	.001
College educated				
Female	71	70	0.0	NS
Male	59	32	11.4	.01

Source: Starr & Pearman, 1980.

lievable and must have earned the public trust. The fact that NRC and the utility company that operated TMI have been viewed by some parts of the public as being in collusion did not help to evoke trust in these officials (Bowden 1980). If the responsible parties do not have this public trust, further chaos will ensue.

In sum, if it is necessary to evacuate a densely populated area safely, immediate action coupled with forceful governmental intervention is necessary. More important, the relevant government agencies must earn the public's trust before a crisis occurs.

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lower incomes than younger citizens, they are at a moderate disadvantage when it comes to obtaining insurance; the model demonstrates a positive effect of income on insurance. Older Americans do have quite high rates of insurance coverage.

We can trace another effect of age on the death rate through the income variable. Because age has a negative effect on income, and income a negative effect on the death rate, we see that to some extent the higher death rates of older Americans are due to their impoverished circumstances. Given the close size of this indirect effect (.105) to the one implied above (age-health insurance-crude death rate: -.125), it is probable that the death rates of older Americans could be reduced by alleviating their penury as much as by making sure they have adequate health insurance. As predicted, there is a positive net effect of the proportion non-white in an area on the death rate; the more non-whites there are, the higher is the death rate. The path coefficient is .29. As predicted, race has a strong negative effect on income. The path coefficient is -.63. Thus the non-white death rate must be higher than the white death rate in part because of the negative direct effect of income on death rates, and because low income people are less likely to have health insurance coverage.

The most surprising relationship in the model involves the effect of race on insurance. Non-whites, when contrasted to whites of the same age and similar income, are much more likely to have health insurance coverage. In an attempt to understand this relationship, the path coefficient was recalculated, employing another health insurance variable; this variable measured the proportion of a census area's population with health insurance of any kind, except for Medicaid. This reduced the path coefficient from the .65 depicted in Figure 2 to .30. What this indicates is that, for whatever reasons, non-whites are more likely to be covered in part because they are more likely than whites to have Medicaid. The implication is that the health of whites could be improved by locating those whites eligible for, but not taking advantage of, Medicaid. Nevertheless, even after this adjustment in the health insurance variable was made, it seemed that certain whites were less likely than non-whites to have health insurance. There is no obvious explanation for this.

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