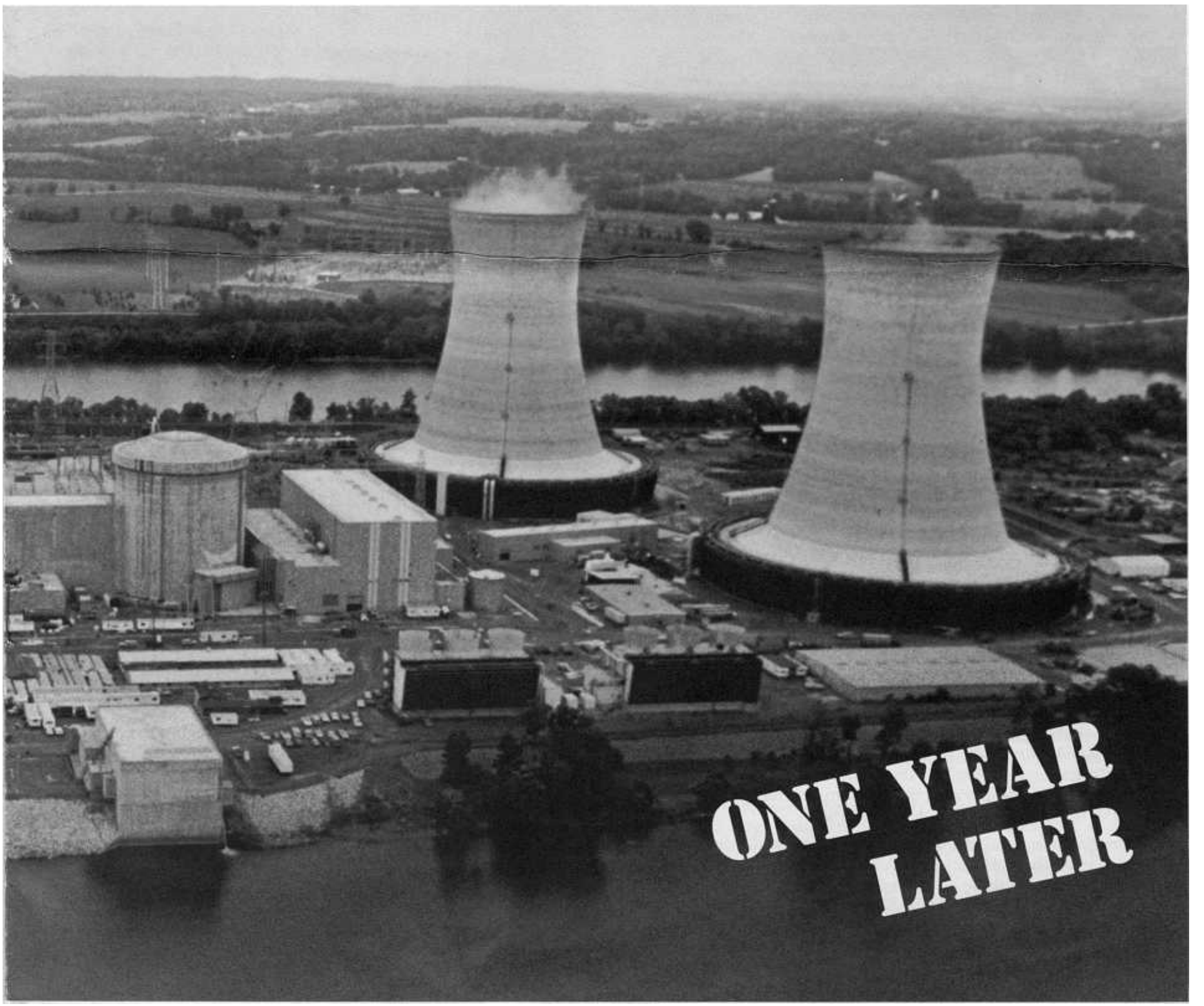
Three Mile Island



The Accident

TMI supervisors aril control roam operators confer in the Unit 2 control room during the accident.

The accident at Three Mile Island had a traumatic impact on the people in the vicinity of the plant, changed the course of General Public Utilities Corporation and its subsidiaries, and started a chain of events that deeply affected the commercial nuclear industry in the U. S. and throughout the world.

Several major investigations at the federal, state and local levels have focused on the TMI accident. Two of the most important *released* to date were those of the President's Commission On The Accident At Three Mile Island (the Kemeny Report) and of the Nuclear Regulatory Commission's Special Inquiry Group, headed by Mitchell Rogovin, a prominent Washington attorney. The conclusions of the two are similar in many major areas. And their conclusions support GPU's original position that the accident involved the entire industrial, technological and regulatory structure of nuclear power in the United States.

As the Kemeny Report says:

"While the major factor that turned the incident into a serious accident was inappropriate operator action, many factors contributed to the actions of the operators... These shortcomings are attributable to the utility, to the suppliers of equipment and to the federal commission [Nuclear Regulatory Commission] that regulates nuclear power."

WHAT HAPPENED

The accident began about four in the morning on March 28, 1979. What happened, in brief, is this: There was a failure in the system

that cools the nuclear materials (uranium) in the core of the reactor, and the nuclear fuel became very hot. Part of the uranium fuel may have gotten close to the melting point, indeed a small part of it may have melted. Significant amounts of the hollow zirconium rods containing the uranium fuel pellets reacted with steam, producing a large volume of hydrogen in the reactor system. Radioactivity from the reactor leaked into the water of the unit's primary cooling system and thence into the Reactor Building. A small fraction leaked into the environment.

But accidents of this magnitude are seldom that simple. As the Kemeny Report found, the TMI accident was the "result of a series of human, institutional, and mechanical failures." The most important of these mechanical failures was related to a single valve, usually referred to as the PORV (power-operated relief valve) on the pressurizer, which helps control the pressure within the reactor system.

Continuing with Kemeny's analysis: "The PORV should have closed 13 seconds into the accident ... it did not. A light on the control room panel indicated that the electric power that opened the PORV had gone off, leading the operators to assume the valve had shut down." The PORV was stuck open for the next two hours and 22 minutes, and needed coolant water escaped through it. During that time coolant water in the system dropped by at least one-third.

Kemeny concludes: "Had the valve closed as it was designed to do, or if the control room operators had realized that the valve was stuck open and had closed a backup valve to stem the flow of coolant water, or if they had simply left on the plant's high pressure injection pumps, the accident at Three Mile Island would have remained little more than a minor inconvenience for Met-Ed."

Concerned over the effect on safety of too much water, and not realizing that the PORV had failed, the control room operators had turned off the high pressure water injection system.

Members of the President's Commission tour Unit 2 Control Room as part of their TM! accident investigation. On the left is Dr. John G. Kemeny, president of Dartmouth College and chairman of the commission.

OPERATOR ACTIONS

One must look behind the operators' actions to determine why these errors occurred.

Accepted procedures and training conditioned the reactions of the operators. There had been a fundamental failure to anticipate this potential problem by the entire industry, including GPU's reactor supplier, the Nuclear Regulatory Commission, and our own people. From the start, training throughout the industry to handle accidents in which water is lost from a reactor system assumed that the water would be lost through relatively large, easily detectable breaks. This is not what happened at Three Mile Island. The water loss was through a small source-the stuck-open valve-and was as damaging as it was because it was continuous, long-lasting and of a kind not anticipated in the training of Met-Ed's operators.

The Rogovin Report describes the accident as one for which the TMI operators had never been trained and which was not described in their written emergency procedures. And, as the Rogovin Report points out: "These problems were not unique to Metropolitan Edison. Although it is true that Met-Ed's training program was, in some respects, deficient, it appears that Met-Ed afforded its operators training that, taken as a whole, was typical of the industry and in certain respects, was above average. The shift crew on duty when the accident began were all products of the nuclear Navy training program and each had at least 5 years

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"... it appears that Met-Ed-afforded its operators training that, taken as a whole, was typical of the industry and in certain respects, was above average."

Rogovin Report

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of Navy experience. Prior to the accident, all of them had completed training courses which met NRC requirements, had passed NRC exams, and had received simulator training totalling 5 to 9 weeks each. Three had received 1 week's training at Penn State University's research reactor. Their combined average NRC licensing exam test scores were above the national average. The inadequate training that plays a role in this accident must be attributed to not one utility but rather to the industry as a whole and to the NRC."

SIMILAR ACCIDENTS UNREPORTED

In this case, one of the most important training inadequacies was in anticipating the results of a malfunctioning PORV. All information and training materials from the manufacturer, from the Nuclear Regulatory Commission and from other utilities indicated that a stuck-open PORV could be detected by a simultaneous decrease of both pressure and water level in the pressurizer. Instead, during the accident, there was an increase in the water level while the pressure was decreasing.

A number of incidents and analyses in the past several years indicated the industry's information on this matter was wrong, but the results were not passed on to us. For example, both the Kemeny and the Rogovin reports describe a similar PORV related accident at a nuclear plant near Toledo, Ohio (the Davis-Besse plant) of the same type as TMI-2.

While that accident was contained before it became serious, information about its causes and containment were not transmitted to GPU-neither by the company which made the equipment for both plants nor by the NRC.

Independent analyses before the accident by the manufacturer, by staff members of the Nuclear Regulatory Commission and by an engineer at another utility all had indicated that previous information had been faulty. However, word of these reports did not reach the company until March 29, 1979-the day following the accident.

THE "BUBBLE"

The hydrogen bubble was a source of concern for many people at the time of the accident, and still raises questions in the minds of some.

In the days following the accident, some NRC officials began to fear that a large bubble of hydrogen left in the reactor system by the accident might possibly explode. TMI personnel and authorities outside the company disagreed that such a possibility existed. (The disagreement centered on whether there was or was not oxygen inside the reactor core along with the hydrogen. If there were oxygen, and of a sufficient amount, an explosion could be triggered.) Several NRC spokespersons made public statements warning of such a potential explosion. As time went on, however, it became increasingly clear that there was no oxygen present.

As soon as there was agreement that no oxygen was present, those involved made the facts public, but the word pricking the hydrogen bubble's explosiveness never got as much circulation as the previous reports of the bubble's dangerousness. As Kemeny says, "That it [the fear of the bubble's exploding] was a groundless fear, an unfortunate error, never penetrated the public consciousness."

Meanwhile, through the days while the bubble controversy heated up and cooled off, those running TMI-2 made steady progress in reducing the bubble. In a few days it was gone. Rogovin quotes an NRC official as saying: "The hydrogen bubble did not miraculously disappear, it was systematically eliminated by Met-Ed operators."

"That it [the fear of the bubble's exploding] was a groundless fear, an unfortunate error, never penetrated the public consciousness."

Kemeny Report

MELTDOWN DANGER EVALUATED

While the small amounts of radiation released were disturbing to the public, concern was at least as strong about the situation deteriorating to a much more serious accident-that of a meltdown of the reactor fuel. While some analyses indicate TMI-2 was not close to a significant fuel meltdown, others, such as the Rogovin group, felt otherwise. Because of this, they analyzed what the consequences of a meltdown would have been.

Speaking of the possibility of a meltdown of the reactor's fuel core, the Rogovin Report calculations project that at one point, a substantial portion of the fuel in the core was within 30 to 60 minutes of a possible meltdown.

However, Rogovin concludes that even with a core meltdown, "the most likely probability is that the reactor building would have survived in this accident scenario, and the vast majority of the radioactive material released from the fuel would have been retained within the building, not released to the surrounding environment."

The Rogovin group concludes that in the accident one of nuclear power's major safety concepts, its defense-in-depth safety design, which calls for multiple safety backups, "...worked to protect the public health and safety. In spite of multiple equipment malfunctions, human failures and the creation of conditions in the reactor and auxiliary buildings that were never contemplated in the design of the plant's safety systems, the utility and its engineering support staff were able to bring the system to a stable condition without release of radioactive materials to the atmosphere that could have resulted in significant health effects to those living near the plant."

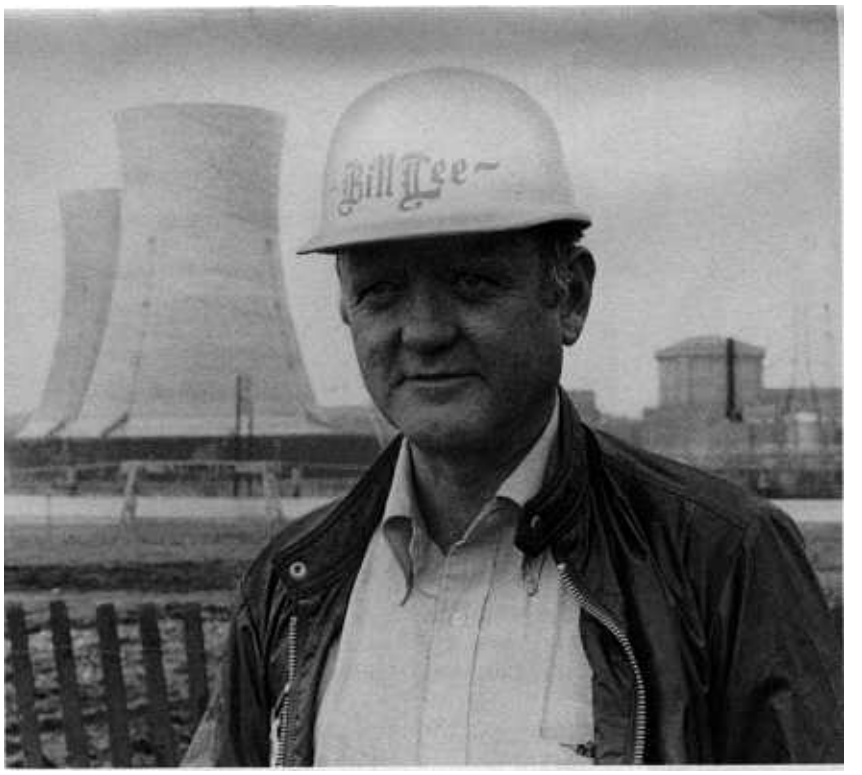
ACCIDENT MANAGEMENT EVALUATED

After the accident was over, GPU's management of it was subjected to close scrutiny. Among those doing so were executives of other companies in the nuclear industry, themselves familiar with all aspects of nuclear power generation.

One with particularly wide personal knowledge of the situation later testified before the Pennsylvania Public Utility Commission concerning the company's management capabilities during the accident. He was William S. Lee, president and chief operating officer of Duke Power Company, a North Carolina company which is a major operator of nuclear power plants. He had spent considerable time at TMI assisting in containment of the accident, a period in which he was able to closely observe TMI's people in action under crisis conditions.

Lee told the Pennsylvania Commission: "The actual conduct of the activities in containing the accident ... was under the direction of the GPU management ... It was a most challenging technical and organizational task. It was accomplished with great skill and steadfast purpose under conditions that were difficult and trying. Everyone involved, and particularly the GPU team, worked extremely long hours, seven days a week. Senior GPU personnel provided judgment, leadership, coordination and an ability to interface with the great number of individuals and organizations that were involved in this extraordinary undertaking.

"The formation of the Industry Advisory Group was just one example both of the foresightedness of the GPU team and of the *respect* they enjoy throughout the industry."



William S. Lee, president and chief operating officer of Duke Power Company.

The Industry Advisory Group, usually referred to as the "think tank" at the accident site, was a major part of what the Rogovin Report was to characterize as "a massive response" to help control the accident. The report states: "Over a thousand people, from reactor operators and health physics technicians to top executives from every corner of the industry, dropped their everyday work and went to the TMI site. Thousands more were active in performing supporting analyses and experiments, and in procuring and dispatching needed supplies."

Public Impact

A DIFFERENT KIND OF ACCIDENT

The TMI accident was different from most accidents in one major respect-the lengthy time involved in its occurrence and resolution. For example, when a plane crashes, the event is over in a few minutes. The consequences to plane, passengers and crash site are known within hours. The damages are examined and cleaned up soon after.

The TMI accident, on the other hand, developed over a period of days and will require years for cleanup. The element of suspense was added, and the suspense was increased by the fact that what was happening was unanticipated, invisible to the public, and not fully understood.

Theodore Gross, provost of the Capitol Campus of Pennsylvania State University, would later tell the Kemeny commission: "Never before have people been asked to live with such ambiguity. The TMI accident-an accident we cannot see or taste or smell-is an accident that is invisible. I think the fact that it is invisible creates a sense of uncertainty and fright on the part of people that may well go beyond the reality of the accident itself."

President Jimmy Carter entering Unit 2 Control Room on his tour during the accident. Pennsylvania Governor Dick Thornburgh is behind hint. On the right, a TMI technician indicates the way.

NO ONE HARMED

Now that there has been time for all to thoroughly study and thoughtfully consider the accident, it is clear that the most important aspect of the accident was that no one was physically harmed, or is likely to suffer future ill effects.

> *"The accident ... did not result in radioactive release levels that posed any threat to public health..."*
>
> *Rogovin Report*

This was affirmed by the Kemeny Report, which states: "...The radiation doses were so low that we conclude that the overall health effects will be minimal. There will either be no case of cancer or the number of cases will be so small that it never will be possible to detect them. The same conclusion applies to the other possible health effects."

The Rogovin Report concurs, stating: "The accident at Three Mile Island did not result in radioactive release levels that posed any threat to public health, even in the long run."

However, Rogovin also feels that many in the public do not realize this and places the blame on "a failure to convey credible information" to the public. Specifically, this report states: "...The fact that there will be no adverse radiation health effects, or very minimal effects, from the Three Mile Island accident has not been clearly understood by the public. It is clear to us that the public misconception about the risks associated with the actual releases measured during the accident, as well as about the risks associated with nuclear plants generally, has been due to a failure to convey credible information regarding the actual risks in an understandable manner to the public."

PUBLIC TRAUMA

But although no one was physically hurt by the accident, or is likely to be, some people in the TMI area, as the Kemeny Report makes clear, were badly shaken by the accident.

Kemeny says: "The major health effect of the accident appears to have been on the mental health of the people living in the region of Three Mile Island and of the workers at TMI. There was immediate, short-lived mental distress..." The report cites adults living within five miles of TMI or with preschool children, and teenagers living within five miles of TMI, or with preschool brothers or sisters, or whose families left the area during the accident, as two groups who were especially subject to this mental distress.

PUBLIC INFORMATION

Some of this stress was no doubt caused by the manner in which accident information reached the public.

There was confusion in the way this was done by all involved-Met-Ed, the NRC and the media. This confusion was due to the development of the accident over a period of several days, due to the multiplicity of information sources that sometimes conflicted, and due to the technical nature of the accident that frequently baffled the ability of media representatives to absorb it or the ability of company representatives to explain it.

The problem of accurately communicating the course of the accident was also complicated by the unprecedented media turnout. Our company was not prepared to handle the public information aspects of an accident of this magnitude and interest.

..there no systematic attempt at a cover up by the sources of information [about the accident]."

Kemeny Report

The Rogovin Report's introduction discusses the turnout and its implication: "The threat of a nuclear disaster to a power plant on the very doorstep of the northeastern megalopolis, in the teeth of recent energy-environmental arguments over nuclear power generation, almost guaranteed a heavy news coverage under any circumstances. Add a hit movie about a plot to conceal a pending nuclear disaster, with Jane Fonda as a reporter out to uncover the plot, and the result is a media stampede. By the third day of the accident, an estimated 400 reporters jockeyed for leads and angles at the TMI site, many if not most of them meanwhile trying desperately to cut through the jargon and acronyms of the industry for a simple understanding of what was going on and what might happen-and where everybody would run if it did. It was not always enlightened journalism, but there was lots of it..."

There have also been charges that some groups involved tried to deliberately cover up the severity of the accident, or attempted to withhold critical information. Both the Kemeny and Rogovin groups investigated these charges, and both concluded that neither Met-Ed, GPU or others willfully withheld or distorted the information about the progress of the accident.

The Kemeny Report found that while many problems arose in reporting the accident to the public, "there was no systematic attempt at a cover up by the sources of information." The Rogovin study concurred, finding that "the evidence failed to establish that Met-Ed management or other personnel willfully withheld information..."

IMPROVING THE PUBLIC INFORMATION EFFORTS

GPU and Met-Ed recognize the public's right to know in the fullest detail what happens at TMI and, in particular, the details of the plans now under way to safely restore it to useful service. Indeed, public understanding is basic to success of the plans.

To this end, public affairs, community contact and news media relations have been greatly broadened since the accident. One move was to establish a team of knowledgeable public affairs representatives to meet with and be of service to municipalities, mayors, supervisors, commissioners, and other town and county officials. These representatives attend municipal meetings to discuss problems and answer questions. Should there again be an emergency at TMI, the public affairs representatives will be part of a team responsible for contacting municipal and county officials to keep them promptly informed, firsthand, of information *about* the emergency as *it is* being released to the public through the media.

The company is also establishing a system to keep key state and national officials advised of activities at TMI. This system can also serve as an informational conduit in the event of a future emergency.

a television news crew confer National anal local news coverage was intense for several days following the accident.

COMMUNITY LEADERS

Particular attention has been paid to keeping community leaders advised of the status and plans of TMI. Almost daily, groups of such leaders, ranging from eight to 40 people, are welcomed to the TMI Observation Center for briefings and are taken to the plant site to tour the recovery operations. There have been days when as many as five briefings and tours have been conducted. The scheduling of briefings and tours results either from personal invitations by the public affairs representatives or from specific requests by the public.

Interest has been so great that the staff at the Observation Center is being enlarged to accommodate schedules for briefings and tours mornings, afternoons and evenings every day.

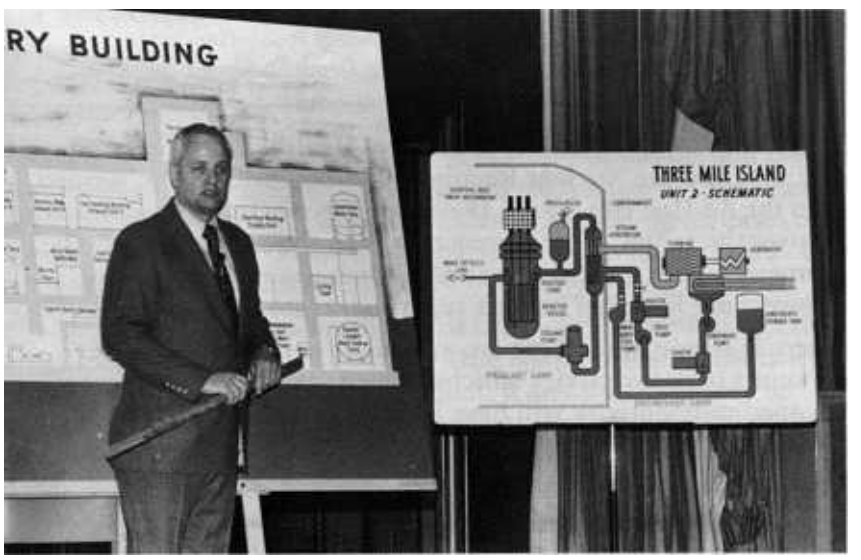
Visitors on the TMI Observation Centers deck looking across at the station on July 7, opening day for the center following the accident.

6,000 VISITORS A MONTH

More than 47,000 people visited the TMI Observation Center between July 7, 1979, when it reopened following the accident, and February 29, 1980. That is an average of about 6,000 people a month, compared to a pre-accident monthly average of about 1,400. The TMI Observation Center has become a tourist attraction.

Visitors to the center not only can see a film and exhibits, but have the opportunity to discuss nuclear matters with company representatives and ask questions of them. The center's observation deck gives a good view of the Three Mile Island facilities.

The Observation Center also serves as a clearing house for requests for information from students and other researchers.



Robert C. Arnold, head of the TMI restart and recovery effort, participating in one of the briefing sessions held periodically in the TMI area to bring public and press up-to-date on plant cleanup. This briefing was at The Forum in the Pennsylvania *Department of Education in Harrisburg.*

PUBLIC BRIEFINGS

Public briefings of a broader scope are frequently held in Harrisburg or other places in the TMI area. At these briefings representatives of the Pennsylvania Department of Environmental Resources join top TMI plant officials and others to keep the public up-to-date on the status of TMI Station and its current programs. Graphics are used to clarify explanations and audience questions are answered. The briefings are generally held every three or four weeks.

Wide use is being made in the community relations program of "Community Report" booklets. These consist of an expanding series of third-person presentations or verbatim testimony explaining the accident, various aspects of the current TMI programs, and other topics of public concern.

Advertising, paid for by the stockholders, also has been used since the accident to explain various matters, such as radiation, concerning public health, welfare and safety.

MEDIA RELATIONS

Another step in the "public right to know" program has been establishment of a new media relations group at the TMI site. This group, on the scene, is available at all times to answer media questions, issue statements on current developments, and conduct media briefings and media plant tours in connection with important developments at TMI.

A TMI spokesman answers journalists' questions during one of the press information days held periodically at TMI since the accident.

EMERGENCY COMMUNICATIONS

Also of utmost importance, GPU and Met-Ed have developed and are implementing a detailed emergency communications program for activation in the event of any future accident. The new program takes into account the communications lessons learned from the TMI-2 accident and is designed to avoid the communications problems encountered at that time.

ECONOMIC IMPACT

Concern has been expressed about the economic impact of the accident on the area around Three Mile Island. In its work, Pennsylvania Governor Dick Thornburgh's Commission on Three Mile Island addressed this concern. The commission finds, "The event [TMI-2 accident] caused disruptions to area business during the first few weeks, but evidence suggests that these effects were largely dissipated during the following six months."

A second report, done for the NRC by consultants from outside the commission, comes to a similar conclusion concerning continuing effects on the area's economy from the accident. "By September 1979, six months after the accident, there was no evidence of continuing negative effects on the economic base of the area surrounding TMI," the report finds.

Radiation And TMI

Two TMI radiation protection technicians check wind speed and direction during the accident. Measurements such as these helped determine the amount of radiation released.

SOURCES OF AVERAGE EAST COAST AMERICAN'S ANNUAL INTAKE OF RADIATION

SOURCE	MILLIREMS
Natural	
Sky	85
Housing	34
Food	25
Ground	II
Air	5
Total Natural Sources	110
Man-Made	
Medical and Dental	41
Weapons Fallout	4
Total Man-Made Sources	45
Total All Sources	155

"Nuclear Radiation and Health" by Roger E. Linnemarnn, M.D.; "The Environmental Impact of Electrical Power Generation: Nuclear and Fossil" by Pennsylvania Department of Education

Each of us is constantly exposed to radiation. Most of this radiation occurs naturally in the environment. It reaches us from such sources as the sky, materials in the houses we live in, some of the foods we eat. It is estimated the average person on the East Coast absorbs about 155 millirems of radiation a year. (A millirem is a standard measure of radiation.) The table above right lists the sources of this radiation.

Nuclear energy also produces radiation. Virtually all of this radioactivity is kept within the nuclear plant and humans do not come into contact with it. However, during the TMI accident, small amounts of radioactivity escaped into the atmosphere. There was great public concern about this radioactivity at the time of the accident and there has been since.

TMI ACCIDENT RELEASES

The amount of radioactivity which escaped and its probable effect on the people in the TMI area have been two of the most thoroughly studied aspects of the TMI accident. Following the accident, experts from three federal agencies (the Environmental Protection Agency; the Department of Health, Education and Welfare; and the Nuclear Regulatory Commission) were formed into the Ad Hoc Population Dose Assessment Group specifically to answer the radiation questions raised by the accident. Both the Kemeny and Rogovin staffs studied the questions and their answers are included in their reports.

There is strong agreement among the three reports on the amounts of radioactivity which escaped and on the fact that the escaped radioactivity will have little, if any, effect over the years on the health of the people in the TMI area.

The Ad Hoc Group found that "the average dose to an individual in this population [living within 50 miles of TMI] is 1.5 millirems." The group concludes: "The maximum dose that an individual located off-site in a populated area might receive is less than 100 millirems."

The Rogovin Report says the releases "resulted in an average dose of 1.4 millirems to the approximately two million people in the site area." The report goes on to say, "The 1.4 millirem dose may be compared to differences in annual doses in background radiation from living in a brick versus a frame house, an additional 14 millirems/year; as living in the high altitude of Denver rather than in Harrisburg, an additional 80 millirems/year."

As for the maximum possible dose to an individual, Rogovin says, "To calculate this figure, we assumed that an individual had been standing on the cast bank of the Susquehanna, across the river from the plant, near the North Gate to the site (the direction in

which the maximum exposure was most likely to occur), 24 hours a day for six days, with no clothes on, and in the open. Our calculations estimated that such a person would have received a dose below 100 millirems."

As part of TM I's continuing program for checking radiation, two radiation protection technicians check for radioactivity in the Susquehanna River in Middletown, Pa. Air in the TMI area is also checked for radioactivity regularly by TMI technicians.

The Kemeny Report finds: "The maximum estimated radiation dose received by any one individual in the off-site general population ... during the accident was 70 millirems."

EXAMINING FUTURE IMPACT

In regard to the effects of the radiation released on the people in the TMI area over the long run, there is also substantial agreement among the three reports.

The first of them to be issued, that of the Ad Hoc Population Dose Assessment Group, finds: "The projected total number of excess health effects [from the radiation released], including all cases of cancer (fatal and non-fatal) and genetic ill health to all future generations, is approximately two."

The Rogovin Report makes the point this way: "The effects on the population in the vicinity of Three Mile Island from radioactive releases measured during the accident, if any, will certainly be nonmeasurable and nondetectable...The effect of this total dose, averaged over the population in the site area, will be to produce between none and one additional fatal cancer, and between none and one and a half total (fatal and non-fatal) cancers, over the lifetime of the population." Under normal circumstances this population can expect to have an estimated 350,000 cancers over its lifetime.

The Kemeny Report concludes: "On the basis of present scientific knowledge, the radiation doses received by the general population as a result of exposure to the radioactivity released during the accident were so small that there will be no detectable additional cases of cancer, developmental abnormalities, or genetic ill-health as a consequence of the accident at TMI."

More recently, in February 1980, the Pennsylvania Department of Health announced there had been an increase in the number of cases of infant hyperthyroidism in three Pennsylvania counties since the TMI accident. Infant hyperthyroidism can lead to mental retardation if not properly treated by drugs. Following the announcement there was public apprehension that the increase in the disease was due to radiation from the TMI accident. (One of the possible causes of the disease is radioactive iodine.) However, Department of Health officials and other experts believe there is no connection between these cases and the TMI accident.

"The department feels there is primarily no relationship between the two," said Dr. Donald Reid, executive deputy secretary for planning of the Department of Health.

"The effects on the population in the vicinity of Three Mile Island from radioactive releases measured during the accident, if any, will certainly be nonmeasurable and nondetectable . . . ."

Rogovin Report

Dr. Victor Bond of the Brookhaven National Laboratories, advisor to the Kemeny Commission on medical matters, said, after the Department of Health announcement that there could not possibly be a connection between the accident and the increase in the disease, because the amount of iodine radiation released during the accident was too low to produce such results.

Met-Ed has promised full cooperation with the continuing investigation of the increase in the disease which the Pennsylvania Department of Health is conducting.

RADIATION MEASUREMENTS ADEQUATE

One reason for the certainty with which the investigative groups were able to estimate radiation dosages was the large number of radiation measuring devices and measurements available during the time of the accident. Because of the public's concern over the reliability of these estimates, the Rogovin group specifically examined the adequacy of the monitoring and reached the following conclusions:

"We studied the monitoring efforts by Met-Ed, the NRC and others in response to the accident to determine whether it was possible or likely that the average, or maximum probable, dose was underestimated because of inadequacies in monitoring. We found that, although the monitoring efforts could have been better and monitoring capabilities should be improved, the monitoring of releases during the accident was adequate to insure that the estimates of dose to the population are adequate."

In response to this and other recommendations, we have further improved our monitoring capabilities, both in the equipment and in the number of measurements and measuring devices used.

Radiation protection technician Beverly Della Loggia and Robert C. Arnold show the media a method of checking for airborne radioactivity. This check was made March 10 this year before the first time since the accident that humans entered the airlock leading to the Unit 2 Reactor Building. The contents of the airlock were cleared into the atmosphere through the vents next to Della Loggia and Arnold. The two made the test while the airlock was being cleared for the entry on March 13.

Changes in the Organization

GPU Chairrnan William C. Kuhns, left, and President Herman Dieckainp before the Pennsylvania Public Utilities Commission in January, when they discussed plans to /arm GPU Nuclear Corporation and to combine the managements of Metropolitan Edison Company and Pennsylvania *Electric Company.*

General Public Utilities is undertaking major reorganizational moves which will improve the management of its nuclear operations. In January, the company announced plans to form a GPU Nuclear Corporation that will have total responsibility for the restoration and safe operation of TMI and for the safe and efficient operation of GPU's other nuclear unit, the Oyster Creek plant in New Jersey. At the same time, the company also announced plans to combine the managements of its two Pennsylvania utilities, Met-Ed and Penelec. Both moves will require regulatory approval.

UNIFYING NUCLEAR CONTROL

Even before the TMI accident, the company's planning contemplated GPU Nuclear. A step in this direction was taken last June by formation of the TMI Generation Group, which brought together about 275 Met-Ed and GPU Service Corporation nuclear and technical people who had TMI as their primary responsibility.

GPU Nuclear will be responsible for the restoration and safe operation of the two units at TMI and the safe and efficient operation of Oyster Creek nuclear station in New Jersey. It also will have responsibility for the design, construction and operation of any future nuclear plants in the GPU System. Ownership of the nuclear units will remain with the GPU operating companies.

This move to unify and expand the System's nuclear capability, reflecting recommendations of the President's Commission on TMI and several other investigations, will provide for safer and more reliable generation of electricity with nuclear energy. The flow of vital technical and operational information between nuclear stations, both within and outside the GPU System, will be stimulated. Formation of this separate nuclear company should help attract the best personnel from the entire nuclear industry.

Robert C. Arnold, currently head of the TMI recovery operation, will be president of GPU Nuclear Corporation. GPU Nuclear's executive vice president will be Philip Clark, who joins us after 25 years in a senior position with the Navy nuclear program. (The Navy nuclear program is a leading training ground of those in the nuclear power industry.) GPU's president, Herman Dieckamp, will assume the additional responsibilities of chairman and chief executive officer for GPU Nuclear Corporation. Staffing of other top positions with highly experienced nuclear experts is well under way.

GPU Nuclear Corporation, with headquarters in Parsippany, N. J., will be responsible for the operation and maintenance of about $1.8 billion in nuclear facilities. It will have an initial complement of about 1,100 people, of whom 300 have technical professional degrees. The composite nuclear experience of the professional staff alone is about 3,500 work years.

In our opinion, the formation of GPU Nuclear is one of the most important changes we can make. Rogovin pointed out that the key to future improvements in nuclear safety is not only one of hardware, but even more importantly, one of personnel and of management. We are convinced that GPU Nuclear is the surest way to improve nuclear safety in all three of these areas.

As the Rogovin Report concludes: "There have obviously been substantial changes in GPU and Met-Ed."

INDUSTRY WIDE SAFETY EFFORTS

GPU and GPU Nuclear are not alone in working to improve the safety of nuclear energy production.

Almost from the date of the TMI accident, there have been industry-wide efforts to make sure that the lessons learned at TMI-2 are applied to make all nuclear plants safer. These activities have led to formation of an industry group, known as the Nuclear Safety Analysis Center (NSAC) that will investigate and apply technical lessons learned at TMI.

The electric utility industry also has formed the Institute of Nuclear Power Operation (INPO), with an annual budget of $11 million, to establish benchmarks for excellence in the operation of nuclear power plants. It will conduct audits to verify compliance with its standards and will analyze and share reactor operating experience with utilities owning nuclear stations.

The nuclear power industry has also established a mutual insurance organization to help cover the costs of replacement power resulting from any future nuclear accidents. This coverage will be available to those utilities that meet the safety standards established by the NRC, NSAC, and INPO.

We believe these activities are doing much to improve the safety of all U. S. nuclear plants, including ours. We have participated fully in all three of these important efforts from their beginnings and will continue to do so.

COMBINING PENNSYLVANIA MANAGEMENT STRENGTHS

Combining the managements of GPU's two Pennsylvania operating companies will enhance the System's ability to provide reliable service to customers at reasonable cost. It will do this by bringing together the complementary strengths and resources of the Pennsylvania companies.

The combined management will focus on the ongoing improvement of customer and community relations, and on expanding our conservation and load management programs. These are designed to minimize customer charges by reducing the need for expensive new generating facilities and assuring the efficient use of existing facilities.

The organization will be headed by William A. Verrochi, current president of Penelec, and will be headquartered in Reading, Pa., where Met-Ed currently is based. However, Johnstown, Pa., Penelec headquarters, will continue to be a key management location, particularly for customer and community relations and the management of the System's coal-fueled generating plants in western Pennsylvania.

The combined operation will be managed by a single set of officers, but will not be a formal merger. The objectives of achieving improved management efficiency, economies of scale, and uniform policies for better service to our Pennsylvania customers do not necessitate a formal merger. None of the outstanding securities of either company will be affected.

TMI-1 Restart

The restoring of the entire TMI station to service involves two simultaneous tasks-the return of TMI-1 to service, and the cleanup and recovery of TMI-2. These tasks are inter-related, but quite different in magnitude and are on different timetables.

TMI-1 was undamaged by the accident. It was shutdown at the time for routine refueling and maintenance. It was scheduled to go back on-line the day of the accident, but has remained idle-first because available manpower at TMI station was committed to containment of the Unit 2 accident, and later by order of the NRC, pending completion of a lengthy hearing schedule and implementation of improvements to enhance its safe operation. It is hoped that TMI-1 will be back in service by the end of 1980, but delay in securing the necessary government approvals may prevent this.

Safety is the first order of business in everything that's being done in both Unit 1 and Unit 2. GPU is unequivocally committed to further improve the safe operation of its nuclear generating plants to a point where they meet the most stringent safety standards as defined by the Kemeny and Rogovin studies and new standards of the NRC. Indeed, GPU is working on its own to go beyond the safety recommendations called for by these groups to make certain that the lessons of TMI-2 are translated into improved equipment specifications, operating procedures and operator training.

BASIC STEPS AT TMI-1

The various steps GPU is taking to increase safety of operation are tied most immediately to preparations for the restart of TMI-1 Unit 2. Meanwhile, improvements being implemented at TMI-1 also are being instituted at the company's Oyster Creek, N. J. nuclear plant.

An essential step that must be taken before restarting TMI-1 is to isolate all of its functions from TMI-2. Certain facilities before the accident were shared, such as the Fuel Handling Building and radiation waste treatment processes. These and other common facilities are being severed so each unit will be independent and there will be no possibility of the cleanup of Unit 2 affecting operations at Unit 1.

Storage and shipment of waste materials from the cleanup of Unit 2 also are being isolated from Unit 1.

As part of the retraining of Unit I personnel, a control room supervisor, left, checks a control room operator's actions in a simulated accident situation.

UNIT 1 **MODIFICATIONS**

The specific safety oriented areas, in addition to the isolation of Units 1 and 2, being addressed in preparing Unit 1 for return to service include retraining and re-examination of operators, review and revision of operating procedures, development of improved plans for handling emergencies, equipment and system modifications, radiation management, and overall management of the TMI-1 operation.

These changes have been and are being undertaken to accomplish three safety related goals: (1) to reduce the probability of an accident occurring at Unit 1; (2) to reduce the effect that any accident may have in the unlikely event that it does occur; and (3) to improve the ability of TMI and GPU personnel to fully handle any accident which may arise with the least possible impact on the public or the plant's employees.

Electricians check circuits beneath the Unit I control room. As *part of the Unit I restart program, all electric circuits in the unit are being checked to ensure safety* and readiness *for return to service.*

To date, the TMI-1 restart team has identified more than 330 separate items it has done or is planning to do to improve the safety and operating capability of TMI-1. The most important of these include:

- All control room operators are undergoing retraining, with special emphasis on the areas of natural circulation, small break loss of coolant accidents, and other types of accidents with similarities to the TMI-2 accident.
- Significantly expanded use of the computerized simulators in training reenact not only the conditions of the TMI-2 event, but also other potential accident situations involving single and multiple malfunctions.
- NRC has been asked to recertify through intensive examinations all operators at the TMI facility, both Units 1 and 2.
- *Control room facilities have been redesigned to provide faster, more accurate and more easily understood information to the operators on the plant status under all conditions, including those of a severe accident.
- Improved instrumentation will depict more reliably the situation of key safety functions, including such items as the PORV and temperature readings within the nuclear core.
- Extensive physical modifications include improved systems for assuring reactor cooling and immediate shutdown of the reactor in the event of a wider range of potential malfunctions.
- A graduate engineer familiar with nuclear plant theory and operations will be in the control room at all times after restart to provide support and additional diagnostic capability.
- Written emergency and operating procedures are being redefined to eliminate ambiguity, to provide for accurate transfer of operating information from shift to shift, and to clearly specify the duties of individual operators on any given shift.
- A proposed emergency plan, with special emphasis on accurately communicating information to the public and government representatives as quickly as possible, has been developed and is being discussed with the NRC.
- Special emergency operations centers, having direct communications to the plant control room, will be set up for federal, state and local officials, and these and other key points will be stocked with additional emergency equipment, such as respirators and radiation detectors.
- The probability and effects of potential radiation releases during an accident will be significantly reduced through the addition of improved filtration systems and more rapid and complete isolation of the Reactor Building during an accident.
- Provision is being made for equipment and maintenance which may be necessary following an accident, such as- where feasible-remote maintenance of potentially contaminated facilities.

RESTART TIMETABLE

Our original schedule called for completion of TMI-1 safety modifications by the end of 1979, but the length of the NRC restart proceedings makes the reactivation of TMI-1 unlikely before the end of 1980, at the earliest. Because of this, some of the modifications will not be completed until later- this year. However, TMI-1 will be ready for return to service when permitted by the NRC.

This is the background on the NRC restart hearing. In June 1979, three months after the TMI-2 accident, Met-Ed advised NRC of the steps it proposed to improve TMI-1 's safety prior to restart. In July 1979, the NRC ordered the restart hearing.

The NRC has appointed a three-person Atomic Safety and Licensing Board (ASLB) to act for them. Such boards are used by the NRC to determine the facts of a situation and make recommendations as to what should be done. Board members are chosen from scientists and other professionals experienced in nuclear matters.

The ASLB acting in the TMI-1 restart proceedings has held two meetings in preparation for the start of its hearing, now scheduled to begin in mid-summer 1980. Many different organizations and individuals will be represented at the hearing.

In addition to Met-Ed and the NRC technical staff, a number of interested citizens and groups will express their views. Government organizations will also participate, including the Commonwealth of Pennsylvania, the Pennsylvania Public Utilities Commission, the Pennsylvania Consumer Advocate, and Dauphin County, where TMI is located.

It's expected the ASLB hearing will last several weeks at least. After the hearing is finished, it could be several months before the board reaches a decision. Their judgment will then be reviewed by the NRC commissioners, who will have the final say on the restart of TMI-1.

GPU and Met-Ed agree that TMI-1 should not be restarted until NRC is assured of the unit's safety. However, the company believes the proceedings are being delayed unnecessarily and has urged the commission to expedite them. Because these urgings have not been successful, there is an unnecessary burden on all the customers of the GPU System. Return of TMI- I to service will reduce the cost of replacement power by over $160 million per year, or about $14 million per month.

TMI-2 Recovery

Shortly after the accident, GPU engaged a leading engineering firm in the nuclear industry, the Bechtel Power Corporation to help identify the technology for decontaminating and restoring the TMI-2 reactor to service. The study led to these basic conclusions:

- The technology for decontamination is well known and has been previously demonstrated. It can be accomplished safely.
- The job will take until at least 1983-barring legal, political or regulatory delays.
- The restoration costs will be about $400 million, of which some $300 million will be covered by private property damage insurance.

TMI-2's RECOVERY SINCE THE ACCIDENT

TMI-2 is now in a state known as cold shutdown, as it has been since a month after the accident. Significant progress has been made since then in its cleanup. A large portion of the surface contamination has been removed from the Auxiliary and Fuel Handling Buildings, which function as service facilities for operation of the reactor. The Fuel Handling Building has been restored to normal human access.

Some 430,000 gallons of contaminated water in the Auxiliary Building are being decontaminated by a system developed specifically for this job known as EPICOR II. As of early March, EPICOR II has processed about 150,000 gallons of contaminated water. The processing is expected to be completed during the last half of 1980.

The technology for decontamination is well known and has been previously demonstrated.

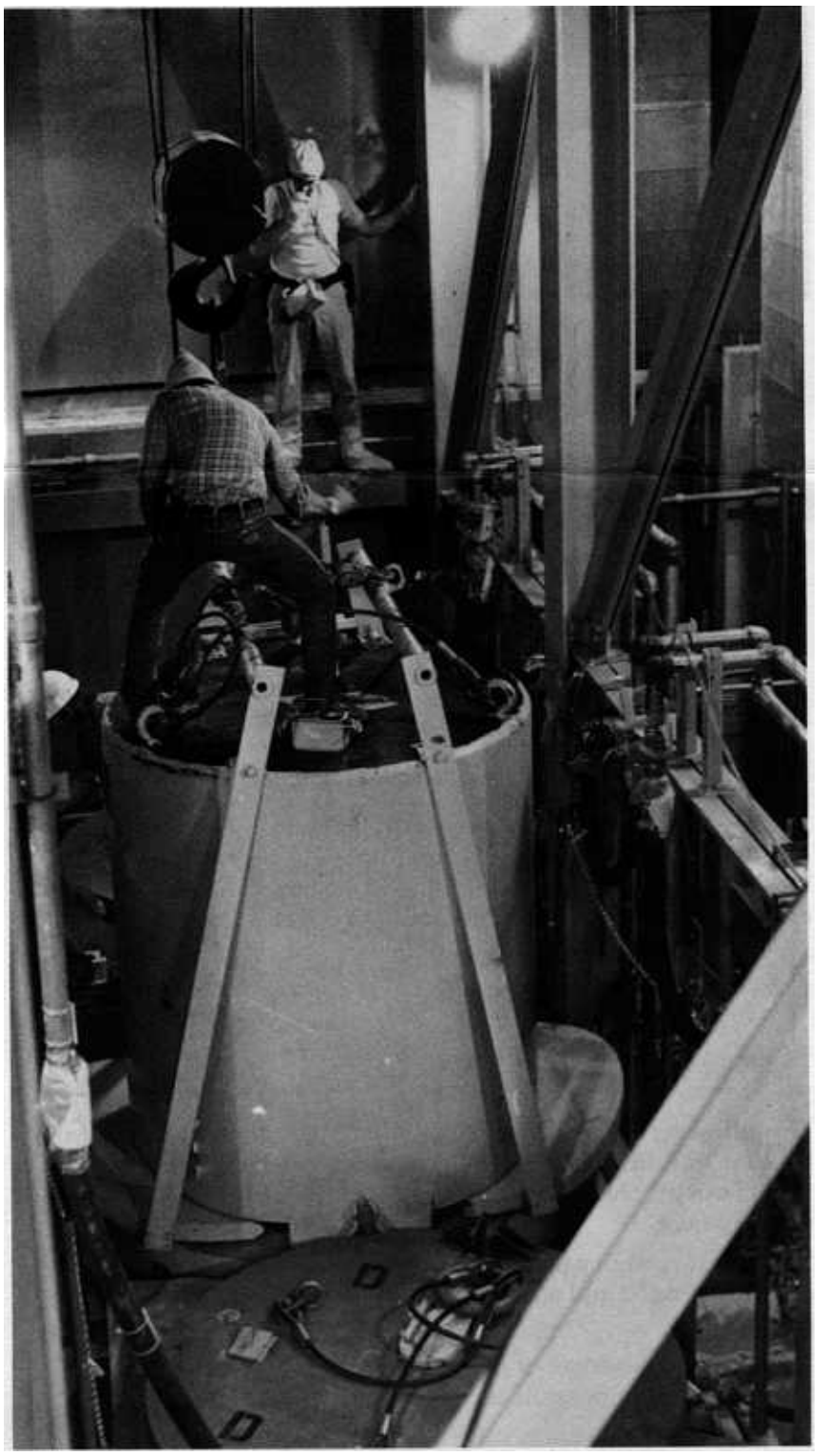
The processed water is being stored in tanks on TMI, while several methods for its disposal are being studied. The final decision will be subject to environmental review.

A different system for treating the more heavily contaminated water-some 700,000 gallons--in the TMI-2 Reactor Building is being developed. It is expected that development of this process will be completed in the second half of 1980, but will be subject to NRC approval before it can be placed in operation.

HUMAN **ENTRY PLANNED**

The Reactor Building has not yet been entered, though air and water samples have been obtained from inside the building by remote control, and in March TMI personnel entered the previously sealed airlock which leads to the Reactor Building. The air and water samples indicate that contamination of both air and water in the building is less than was anticipated.

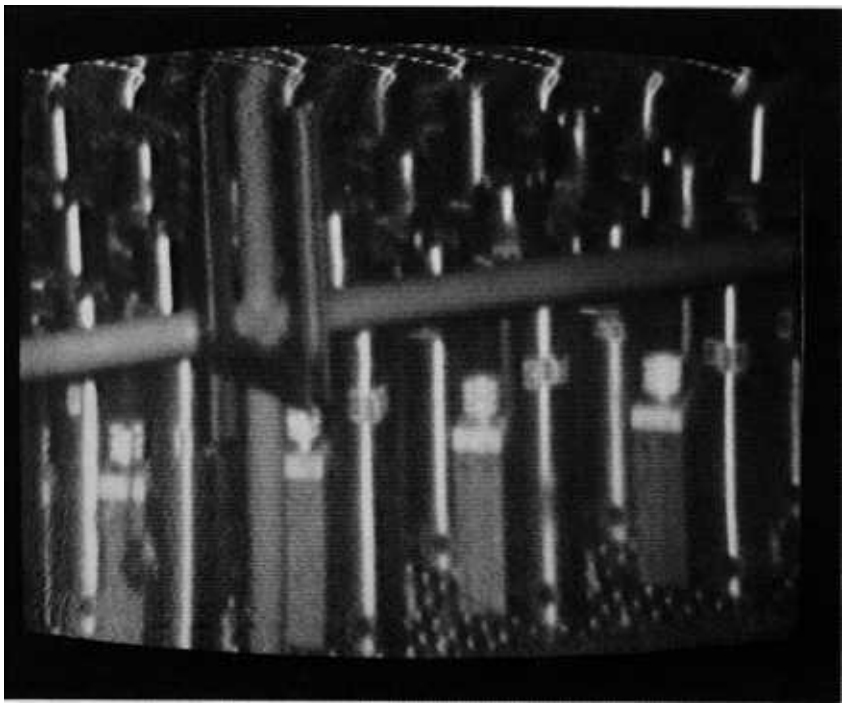
In addition, late last year a TV camera was inserted into the



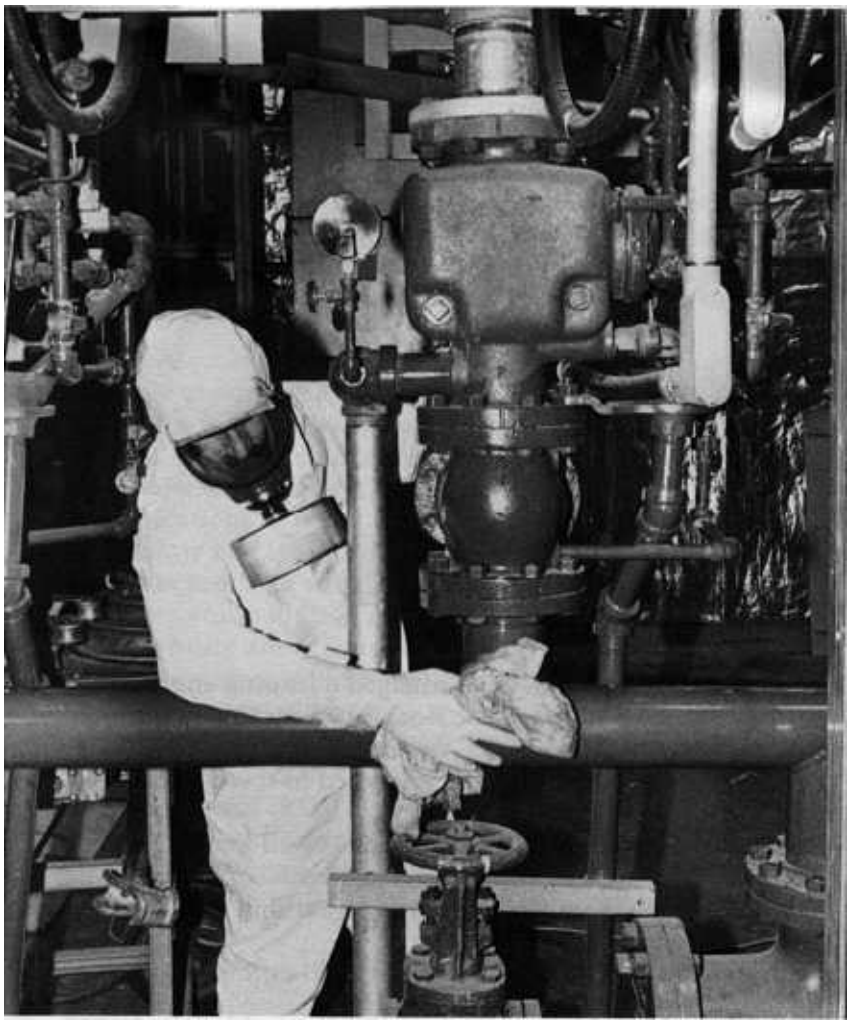
A change of filters in EPICOR II, a system for cleaning contaminated water. The man in the foreground is on a specially designed carrier. When a filter is changed it is drawn up into the carrier and then moved to a special storage area on the island.

Reactor Building. The pictures did not show any major structural damage, but there does appear to be precipitation inside the building, probably caused by the interaction of warm air at the bottom of the building and cold air at its top.

The technicians entered the airlock in March and conducted a series of tests which included checking for surface contamination in the airlock and for radiation around the door leading from the airlock into the Reactor Building.



A shot by the robot TV camera inserted into the Unit 2 Reactor Building last year. This picture, part of the first look inside the building since the accident, shows the mechanisms that control the amount of nuclear activity in the reactor when it is operating.



Part of the Unit 2 cleanup. A TMI worker wipes surface contamination off piping in the unit's Auxiliary Building.

It will be desirable before human entry of the Reactor Building to dispose of radioactive krypton gas in the structure. Several methods of doing this are being studied. Believed the most feasible, and the one posing the least danger to public health and safety, is the controlled release of the gas from the building into the atmosphere. Releases would be at harmless levels. The process would take from one to three months because it would only be done during weather conditions that maximize atmospheric dispersion. An application has been filed with the NRC for approval of this procedure.

FUTURE RECOVERY STEPS

As the recovery continues after initial human entry, the Reactor Building will be partially decontaminated by remote control. This will be done mainly by repeated flushings with water and detergents. They should be completed by mid-1981.

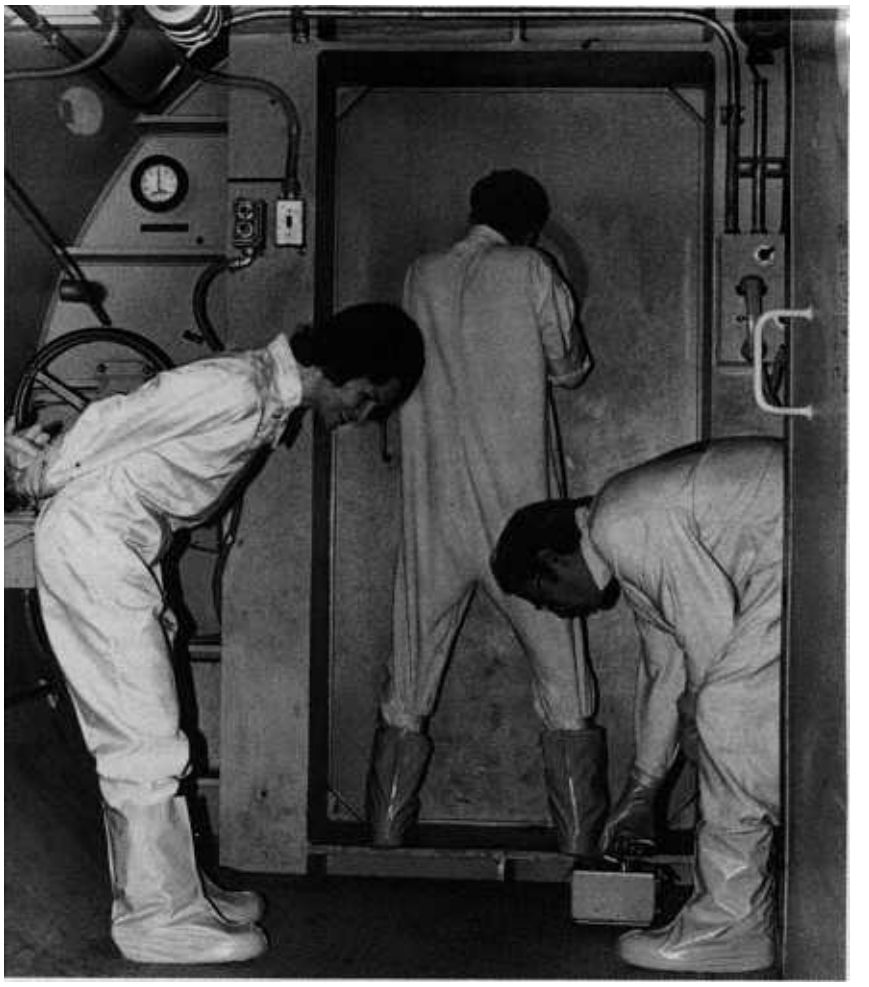
We recognize the need, first and foremost, f 'Or safe cleanup, recovery and operation of our TMI nuclear plants. We are pledged to this end ...

The following year will see completion of decontamination of the Reactor Building by "hands-on" methods (such as scrubbing by workers in protective clothing) and removal of the fuel from the reactor's core.

In the next recovery phase, the reactor cooling system will be decontaminated and a determination made of the degree of damage.

Repair or replacement of damaged equipment and systems will follow, and make possible the start-up.

This recovery program is subject to what is found upon human reentry of the Reactor Building and the company's ability to finance the program, as well as on public and governmental acceptance of the various steps of the plan and of the final restarting of TMI station.



Another recovery step. Three technicians in the airlock to the Unit 2 Reactor Building March 13 this year, when the airlock was entered for the first time since the accident. The man-woman radiation protection team in the foreground is checking for surface contamination. The technician in the background peers through a porthole into the Reactor Building itself to check the situation inside the building.

In Conclusion

We recognize the severity of the TMI accident. We recognize the need, first and foremost, for safe cleanup, recovery and operation of our TMI nuclear plants. We are pledged to this end through the programs we have described.

We further recognize the need for close regulatory scrutiny of each step on the road to recovery. We have cooperated to the very best of our ability with state and federal agencies, and will continue to do so, in the investigations of the accident, in revealing in the fullest detail possible the restart and recovery plans, and in presenting all the technical evidence available for evaluation. This evidence points to the completion of the cleanup as being a significant benefit to the health and safety of the public.

Obstacles that could delay, or indeed block, fulfillment of the plans include inadequate rates to cover the cost of replacement power or otherwise maintain the financial viability of the GPU System, and regulatory and legal delays of the timetable for restarting and recovery.

The GPU System is taking every step to demonstrate that it is fully capable of doing the job, and that regulatory procedures are more than adequate to assure that the public's rights are protected.

In all of these activities safety, of course, is the No. 1 consideration. We believe, however, that the commitment to safety can only be fulfilled if there are no unnecessary delays, potentially jeopardizing public and employee safety, in the cleanup and restoration of the TMI Station to service.

Finally, we recognize that keeping the public informed is a continuing obligation. The public has a right to know the details of our plans and progress toward recovery. The major steps being taken to meet this commitment are described in the preceding pages. It is our hope that this information will provide our readers with better knowledge and understanding of what we are doing.

March 28, 1980

General Public Utilities Corporation 100 Interpace Parkway Parsippany, New Jersey 07054