Background Information

UPDATE

Three Mile Island Cleanup

May 1982

GPU GENERAL PUBLIC UTILITIES CORPORATION

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Note:

The following questions and answers are intended to provide readers with a very basic understanding of the Three Mile Island (TMI) cleanup, based on its current (May 1982) status. Additional information on any specific aspect of the cleanup can be obtained by contacting the General Public Utilities representative from whom you received this report, or by writing directly to either GPU Nuclear Communications, C/O Three Mile Island Nuclear Station, P. O. Box 480, Middletown, Pa. 17057, or to GPU Service Corporation - Communications Department, 100 Interpace Parkway, Parsippany, NJ 07054.

General Public Utilities Corporation
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Some Key Questions Surrounding the Cleanup At Three Mile Island

Q. What is meant by "the cleanup at Three Mile Island?"

A. The cleanup at TMI basically involves removal of radioactive fission products dispersed during the March 1979 accident that contaminated parts of the TMI Unit 2 containment and auxiliary buildings.

Those radioactive materials include gases, contaminated water in the containment building basement and in the reactor cooling system and radioactive particles causing surface contamination. Most gases - primarily krypton gas - were vented from the containment building during the summer of 1980 with negligible impact to the public. The water in the auxiliary building and most of the water in the containment building basement has been processed and is being stored on the island. Follow-on decontamination can be compared to a hands-on "dusting"or "scrubbing-down" of all exposed surfaces, during which all radioactive particles must be removed and stored.

Cleanup will also include removal of the Unit 2 reactor fuel core, thought to be severely damaged during early stages of the accident, as well as disposition of the fuel core and the other radioactive wastes produced in the course of the cleanup.

Thus, the cleanup program has as its main objectives:

- maintaining the reactor in a safe condition;
- collecting and disposing of the radioactive fission products resultant from the accident;
- decontaminating plant facilities; and,
- disassembling the reactor, removing and disposing of the damaged fuel core.

Q. Is the cleanup really necessary?

A. Absolutely. Failure to clean-up the plant would, in effect, turn TMI into a long-term nuclear waste disposal facility. The reactor building was not designed for this purpose and could eventually leak radioactivity to the environment if it were left as-is for an extended period of time.

The facility contains sources of radiation that are hazardous to workers and potentially hazardous to members of the public who live near TMI. It is, therefore, in the best public interest to complete the cleanup safely and expeditiously in order to protect the public health and safety, as well as minimize public anxiety over potential future accidental releases of radioactivity.

Q. How far has the cleanup progressed since the accident?

A. Thus far, major cleanup milestones achieved include:

the venting in the summer of 1980 of 43,000 curies of krypton 85 gas from the reactor building;

the processing of some 500,000 gallons of contaminated water from the Unit 2 auxiliary building;

decontamination of the Unit 2 fuel handling building;

decontamination of most of the Unit 2 auxiliary building surfaces affected by the accident;

a number of exploratory manned entries into the Unit 2 containment building to conduct damage assessments, equipment maintenance and radiation surveys and to explore the most efficient ways of decontaminating affected areas; and,

the processing of some 600,000 gallons of accident-generated radioactive water from the basement of the Unit 2 containment building, essentially completed in March of 1982. (The processed water is being stored in

two 500,000 gallon tanks built especially for that purpose until a decision on its ultimate disposal.)

Although significant, these accomplishments can be viewed as preparatory steps leading to the main "hands-on" cleanup effort.

Q. What major steps remain for the cleanup to be accomplished?

A. The job ahead can be viewed in four stages: processing and storing another 100,000 gallons of radioactive water from the reactor cooling system; removing damaged fuel and the reactor core itself from the Unit 2 reactor vessel and eventually from the TMI site; and decontaminating the remainder of the building interior. During each stage of this process, radioactive wastes will be generated in the cleanup and will require removal from Three Mile Island for disposal.

In April, 1982 an agreement in principle was signed by GPU and the U.S. Dept. of Energy (DOE) that will facilitate the removal of the damaged Unit 2 reactor core from the TMI site once it is removed from the reactor vessel. The agreement provides a framework under which the DOE will acquire the core and take it to federal facilities for research and development purposes.

Q. How long will the cleanup take?

A. The current GPU schedule shows full removal of the damaged Unit 2 reactor core occurring in August of 1985, with final decontamination of the Unit 2 containment building extending into 1986.

Two factors have a direct impact on the pace of the cleanup; the availability of necessary funding and the speed of regulatory approvals necessary to proceed with the various steps involved in the cleanup.

Any extension of the cleanup schedule will increase the cost of the cleanup and the potential

for accidental releases of radioactivity to the environment.

Q. How much will the cleanup cost?

A. Actual expenditures to-date and current projections provide for decontamination, including fuel removal, to be completed in 1986, at a cost of $750 million in 1980 dollars ($1.034 billion when adjusted for inflation of 10% per annum). Restoration of the unit (including replacement of the nuclear fuel core) is expected to take an additional two years, at a cost of $260 million in current dollars ($430 million when adjusted for inflation of 10% per annum). The estimated amounts do not include the cost of modifications to meet post-accident regulatory requirements (estimated at $80 million) or the cost of ordinary operation and maintenance of TMI-2 (estimated at $170 million) expected to be incurred during this period.

The above estimates are subject to major uncertainties, the most important of which is the schedule. The schedule is affected by: (a) the regulatory environment, (b) the full scope of the challenges in decontaminating the reactor, (c) the effect of government regulations on the issue of waste disposal and (d) the condition of major components. Any extension of the cleanup schedule resultant from these factors will increase the cost.

GPU had $300 million in property damage insurance, the maximum available at the time of the accident, to cover part of the estimated $1.034 billion cleanup program. To-date, the Company has spent over two-thirds of the $300 million of insurance proceeds available. At the current level of effort the remaining insurance is expected to last until early 1983, at which time other funding sources must be available to cover the remaining cleanup costs.

Q. Why does the cleanup take so long and cost so much?

A. While the proven technology exists to accomplish the cleanup safely, the task is unprece-

dented in its magnitude. Literally thousands of skilled workers are involved in the effort.

Costs associated with the cleanup are also greatly impacted by inflation, and the program might be accomplished for something less if it could proceed on a more expeditious schedule. However, regulatory and financial constraints have been extending the cleanup schedule. For example, cash flow requirements for the cleanup to proceed on schedule (based on the current estimate) average about $125 million per year. The cleanup is currently being conducted at a scaled-down level of $60 million per year and could be restricted even further if funding is not in place to continue the cleanup.

There are several major contributing factors to the $1.034 billion six-year cleanup estimate. Primarily, it's a highly labor-intensive process which requires huge capital costs to adapt and apply existing technology.

For example, the first and simplest major task in the cleanup was the removal of krypton gas. Regulatory approval of the venting procedures was secured and krypton gas was diluted then safely released. But decontaminating the radioactive water presented a much greater "dollar-per-hour" cost. Extensive - and expensive - new "state-of-the-art" equipment had to be built, installed and tested. The Submerged Demineralizer System (SDS) used to process the containment building water is a prime example. However, the third contaminant - the radioactive solid materials - is clearly the most expensive phase of the cleanup program.

Safe removal and disposal of a very severely damaged core has never before been tackled. Assumptions on the physical damage to the core range from a bed of rubble in one portion to complete, but possibly weakened, fuel rods in other regions. Again, the equipment and techniques for handling this broad spectrum of possibilities must be designed, constructed and tested.

The core removal operation, as indeed all cleanup operations at the site, must be done with the maximum attention to both public and

worker safety. Procedures and equipment to insure this vital objective for the cleanup workers and the surrounding communities are costly. Therefore, short cuts that might reduce costs in other industrial operations are **simply not acceptable here.**

Safety considerations also apply to the massive task of collecting and disposing of the radioactive solid particles on the walls, floors and equipment of the containment building.

Once the relatively loose and soluble material is removed from these surfaces by "gross decontamination" techniques, such as high-pressure hosing, the work is a long, tedious, "hands-on," mopping and scrubbing operation involving hundreds of thousands of square feet of surface. The ultimate magnitude of this job will depend on how deeply imbedded and difficult to remove the particle contamination is. In some cases, grinding and sand blasting may be required.

In addition, surface decontamination hinders worker productivity by the simple fact that people are working in a radioactive environment, which demands restrictive personnel equipment, and limited space. Some measure of the cost of working under these difficult conditions can be gained when you consider that to date about 600 manhours of working time inside containment (49 entries) has been accumulated at a cost approaching $10 million for these initial steps.

Moreover, the dollar cost expended per curie of radioactivity removed goes up markedly with each succeeding operation designed to further lower that radioactivity level. For example, the first gross wash-down of a contaminated surface may remove half of the curie activity on that surface. To remove half of the remaining activity may take many, many times the manhour and dollar expenditures of that initial removal step, and so on until the desired radioactivity cleanup level is reached. There is no doubt that the pace of the cleanup to date has been slower than it would have been if there had been sufficient funds available to proceed at the optimum work level. As with any major project these days, the inflationary impact is heavy. Longer schedules

mean higher costs. It is estimated that every year of delay adds about $100 million to the total cleanup program cost from the effect of inf lation alone.

Q. Who should pay the cleanup costs?

A. The burden of the cleanup costs should be spread beyond GPU stockholders and ratepayers. Stated quite simply, if the benefits of the lessons learned extend beyond these groups, so, too, should the burdens.

The conclusions of both the President's Commission on the Accident at Three Mile Island (the Kemeny Report) and the Nuclear Regulatory Commission's Special Inquiry Group (the Rogovin Report) are that the accident involved the entire industrial, technological and regulatory structure of nuclear power in the United States. Thus, potential contributors to the cleanup include not just GPU, its customers and shareholders, but the federal and state governments, and the electric utility industry as well.

The accident at Three Mile Island is a national problem that deserves a national response.

In addition to the national lessons of safety provided by the accident at TMI, delays in cleanup have already shaken investor confidence in the utility industry nationwide - resulting in higher borrowing costs being passed on to electric utility customers across the country. As long as the cleanup remains unfinanced, this `risk premium" will remain.

Finally, if adequate insurance had been available to GPU at the time of the TMI accident to cover the full cleanup, the costs would have essentially been shared by all utilities paying premiums for such insurance. Just as cost-sharing would have been the appropriate response then, it is equally appropriate now.

The Edison Electric Institute and the NRC are currently developing a program and rules to establish adequate on-site insurance to assure

that such a funding impasse will not occur in the event of future accidents at nuclear power plants.

Q. What would happen if GPU went bankrupt before the cleanup could be accomplished?

A. The NRC has the authority under existing law to act to ensure that public health and safety are protected should the utility be unable to complete the cleanup.

The NRC staff has conducted a study of the **Potential Impact of License Default on Cleanup of TMI-2** (NUREG-0689) which identifies several different organizations which might possibly continue the cleanup. The report notes that the potential negative impact of bankruptcy on TMI cleanup (possible delays, increased costs and uncertainty over who would assume responsibility for the cleanup) leads to the conclusion that other alternatives should be examined to reduce the potential of bankruptcy or to independently ensure cleanup funds.

Q. What alternatives exist for sharing the cleanup costs?

A. Federal assistance in the form of direct grants or loan guarantees, a retroactive federally-sponsored nuclear property insurance program funded by nuclear utilities, a federal assessment of utilities to provide a cleanup fund, voluntary contributions from other utilities, indirect tax assistance, rate relief, research and development funding and health and safety grants, or a combination of some or all of the above are possible sources of funds to aid in financing the TMI-2 cleanup.

On September 10, 1981, the Edison Electric Institute (EEI) Board of Directors recommended that the electric utility industry invest $192 million for the TMI cleanup. The EEI is a trade association representing the nation's privately-owned electric utilities.

The EEI Board recommendation was consistent with a comprehensive TMI cleanup cost-sharing plan proposed by Pennsylvania Governor Dick Thornburgh in July, 1981.

Essentially, the so-called "Thornburgh plan" calls for a 50/50 split of the uninsured cleanup costs between national and local sources that include GPU, the electric utility industry, remaining insurance proceeds, the federal government and the state governments of Pennsylvania and New Jersey.

While all the components of such a cost-sharing of the cleanup are not, at this juncture, in-place, federal legislation has been introduced that would provide for the utility industry participation in the cleanup, and several other cost-sharing proposals have been offered and are being examined by various congressional committees.

Q. What if these cost-sharing proposals fail?

A. Doing nothing is simply not an option. The public interest in health and safety requires that TMI be cleaned up. The only question is how to accomplish that in the most fair and equitable way. A cost-sharing approach meets that requirement in the most practical and equitable manner. While a stalemate has existed over how the remaining cleanup effort is to be funded, a difficult consensus on sharing those costs has now been developed. If, for some reason, each element of this consensus cannot be approved as part of a comprehensive funding program and cleanup expenses exceed insurance proceeds, the only alternatives would be for the cleanup to be halted or for the federal government to assume a much greater and direct role. Such a drastic remedy should not be required except as a last resort.

Meanwhile, the cleanup at TMI remains paramount.

Without a timely and effective solution, TMI will continue to pose a potential health and safety hazard.

Q. Why can't the proceeds from lawsuits GPU has initiated against the NRC and the reactor manufacturer (Babcock & Wilcox) be used to pay for the cleanup?

A. Since the timeframes for both litigations are lengthy and indeterminate and their final outcome is uncertain, it is imprudent to count on any proceeds from them being available to help pay for the cleanup, at least in the near future. In the meantime, it is essential that the cleanup continue.

Depending on the ultimate outcome, portions of the proceeds from these litigations could be used to offset other contributions made toward the cleanup.

Q. What are the sources of radiation that continue to pose a potential threat to public health and safety?

A. The primary sources are water contaminated by radioactive materials during the accident and the damaged nuclear fuel core. Other sources include contamination on walls, floors and equipment surfaces in the reactor containment building. Similar contamination of surfaces in the auxiliary building and fuel handling building has been essentially cleaned at this time.

Additionally, the disposition of radioactive wastes and the damaged fuel core must be accomplished. Although the reactor has been safely maintained in a "cold shutdown" state since April 1979, the NRC staff believes a remote possibility exists that the fuel could accidently begin a chain reaction again. Such a reaction could release radioactive materials to the reactor building and, over a long period of time, possibly even to the outside environment. Removing the fuel to storage is therefore a major objective of the cleanup.

Q. Can the cleanup be partially accomplished?

A. The NRC in preparing the Programmatic Environmental Impact Statement (PEIS) on the TMI cleanup (NUREG-0683) examined two partial cleanup alternatives; one involved removing the damaged fuel from the reactor and the second involved doing nothing except to maintain the reactor safely shut down.

NRC believes both partial cleanup alternatives would require that TMI be used as a permanent waste repository. According to the NRC staff, this is neither compatible with current national policies or NRC regulatory guidelines for radioactive waste disposal.

Q. Can the cleanup be put off until later?

A. The cleanup should be done without further delay to eliminate the potential health hazards to workers and the public and to minimize public anxiety associated with the radioactive wastes.

As noted, regulatory and budgetary constraints have already delayed and scaled-down the level of effort to about $60 million per year. At that level the remaining insurance proceeds will only last until early 1983. Adequate funding could raise the level of effort to a more effective $125-150 million per year and expedite the cleanup period.

Q. Why can't the facility just be sealed up or entombed?

A. Sealing the facility would amount to establishing a permanent radioactive waste storage site in the middle of the Susquehanna River. Even if the building were sealed, the possibility exists that radioactive water from the plant might eventually leak to groundwater and subsequently to the river. Moreover, entombing the facility would still require substantial decontamination of the reactor building so that workers could fix the reactor core to prevent the fuel from

undergoing a chain reaction again, or to remove the fuel. In either case most of the cleanup effort would still be required.

Q. What about restoring the damaged reactor?

A. The estimated $1 billion cost of cleanup **does not** include any follow-on restoration of TMI-2.

It is much too early to be able to determine if it is economically or politically feasible to restore TMI-2 to service as a nuclear unit. Studies conducted for GPU by Gilbert Associates have shown that conversion of TMI-2 to a fossil-fired generating station is not economically feasible. Those findings, coupled with environmental, supply and regulatory problems attendant to a coal or gas-fired facility at the TMI-2 site, make the conversion option undesirable at the present time.

Q. Who is to manage the cleanup effort?

A. The actual cleanup activities are presently managed by GPU Nuclear Corporation, formed by General Public Utilities to manage and operate GPU's nuclear facilities, including TMI. Formation of GPU Nuclear was a concerted effort by GPU to strengthen the management and operations of its nuclear facilities that was under consideration even before the TMI-2 accident and is in keeping with the recommendations of the President's Commission on the Accident at Three Mile Island (the Kemeny Commission.)

The Nuclear Regulatory Commission (NRC) has overall responsibility for regulatory oversight of cleanup activities. The Environmental Protection Agency (EPA) has oversight responsibility for radiological monitoring activities around TMI, while the U.S. Dept. of Energy (DOE) will, through an agreement with GPU, remove and dispose of the damaged TMI-2 fuel core.

Q. Will cleanup activities at TMI Unit 2 have any impact on the undamaged Unit 1 ?

A. Since the two units are physically separate, cleanup activities need not affect Unit 1.

TMI Units 1 and 2 were originally designed as independent nuclear generating plants which shared certain support services. Since the accident at Unit 2, the two units have been almost completely separated from each other. This has been done to further assure safe operation of Unit 1 while the cleanup of Unit 2 proceeds.

Since the accident, TMI Unit 1 has remained shutdown pending the outcome of a series of public hearings ordered by the NRC before an Atomic Safety and Licensing Board, even though other Babcock & Wilcox units of similar design around the country have been allowed to restart while "TMI lessons-learned" modifications are underway.

Subsequently, repairs were found to be necessary to some of the tubes in the Unit 1 steam generator and resolution of the so-called "stress issue" associated with the unit's return to service caused further delays in restart of TMI-1.

At this writing, resolve of the stress issue is still pending before a U.S. Court of Appeals. Meanwhile, in April (1982) GPU Nuclear announced plans for repairing the steam generator tubes by late summer or early fall. This would permit the return of Unit 1 to service before the end of 1982, reducing costly reliance on oil and coal-fired replacement power.