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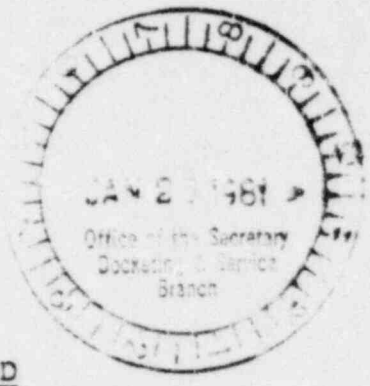

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
METROPOLITAN EDISON COMPANY	)	Docket No. 50-289 SP
	)	(Restart)
(Three Mile Island Nuclear Station, Unit No. 1)	)	
	)	

LICENSEE'S TESTIMONY OF

WILLIAM WEGNER

IN RESPONSE TO CLI-80-5, ISSUES 1, 2, 4, 5, 6, 7, 10 and 11, ANGRY CONTENTION NO. IV, SHOLLY CONTENTION NO. 14(a)-(e), AAMODT CONTENTION 2 AND CEA CONTENTION 10

(INDEPENDENT REVIEW BY BETA OF LICENSEE'S MANAGEMENT CAPABILITY AND TECHNICAL RESOURCES)

OUTLINE

The testimony of William Wegner, representing Basic Energy Technology Associates, Incorporated (BETA), summarizes the factual findings and conclusions reached by BETA after conducting an independent assessment of the management capability and technical resources of General Public Utilities/Metropolitan Edison Company to restart and operate TMI Unit 1.

The BETA assessment was conducted over a sixteen month period (October 1979 through January 1981), by using detailed one-on-one interviews with over 150 Licensee employees, reviewing onsite and offsite procedures detailing policy, requirements and organizational structure, reviewing a sample of all documents, and witnessing TMI-1 plant operations. BETA also worked with GPU on specific technical issues relating to TMI Unit 1.

After completing this extensive and thorough review process, BETA has concluded that the management capability and technical resources of GPU/Metropolitan Edison are sufficient to assure the safe restart and operation of TMI Unit 1. This overall conclusion is based upon specific factual findings reached on issues one, two four, five, six, seven, ten and eleven identified in the Commission's March 6, 1980 Order, CLI-80-5. The testimony is also responsive to ANGRY Contention No. IV, Sholly Contention No. 14(a) through (e), Aamodt Contention 2 and CEA Contention 13.

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My name is William Wegner. I represent Basic Energy Technology Associates, Incorporated. Our company has been employed by General Public Utilities/Metropolitan Edison to conduct an independent assessment of their management capability and technical resources as they relate to restart of the Three Mile Island Nuclear Generating Station Unit 1. The purpose of my testimony today is to present to you a summary of the findings of our assessment.

As background, Basic Energy Technology Associates, Incorporated, (BETA) is a company consisting of four associates. It was formed in October 1979. At that time, each of the associates had just recently retired from government service and had worked in headquarters positions in the Naval Reactors program for some twenty-five years. In my particular case, I served as the Deputy to the Director, Admiral Rickover, from 1964 until I retired in 1979.

More detailed information on the backgrounds of each of the BETA associates, including my education and professional qualifications, is attached to this testimony.

In early October, just after we began our company, I was contacted by Mr. Dieckamp of GPU requesting our assistance in work at the Three Mile Island nuclear plants. In November, Mr. Dieckamp specifically requested us to undertake an independent review and assessment of the management capability and technical resources of GPU as related to the TMI Unit 1 restart. At the time there were no definitive published criteria by the

NRC or other authorities by which to judge a utility's management capability and technical resources. We started by assembling the various reports issued by the President's Commission on Three Mile Island (Kemeny), the NRC and other groups investigating the accident which had addressed the issue. Each investigative group concluded that what was available and in place at Metropolitan Edison prior to March 28, 1979, was insufficient. However, none of the investigative reports outlined specifically what should exist at a utility in order to be acceptable. Because of this, we had to develop our own basis for the evaluation.

Since we developed our evaluation basis, the NRC and others have issued drafts of such criteria. In February 1980, the NRC distributed draft criteria which were later updated and redistributed in July and again in September 1980. In addition, NRC, in early 1980, contracted with Teknekron Research, Inc., to develop technical resources criteria. After we developed our bases, we were able to compare them with what NRC had produced and found no serious conflicts. If anything, our bases are probably more definitive in a number of areas.

It is important to understand this lack of specificity as regards management capability and technical resources, particularly as I discuss the results of our assessment. In assessing purely technical issues, while there may be disagreement with a given solution and the assumptions made in arriving at it, at least one is generally dealing with the laws of nature. In

management capability and technical resources, one is dealing with people, with organizational structure, with attitudes and with many other attributes, none of which conform to any given laws. How one utility may organize itself to handle a given situation may be entirely different from another, yet both may be equally effective. Where one person in a given organization may be capable of handling a certain range of responsibilities, another organization may require two people. The overall capability of an organization must be judged by looking at the entire picture, not just one isolated segment. This is what we attempted to do.

Admiral Rickover made this point when he testified before Congress on May 24, 1979, on the Three Mile Island accident. He said:

> "Over the years, many people have asked me how I run the Naval Reactors Program, so that they might find some benefit for their own work. I am always chagrined at the tendency of people to expect that I have a simple, easy gimmick that makes my program function. They are disappointed when they find out there is none. Any successful program functions as an integrated whole of many factors. Trying to select one aspect as the key one will not work. Each element depends on all the other elements.

"I cannot overemphasize the importance of this thought in your current deliberations. The problems you face cannot be solved by specifying compliance with one or two simple procedures. Reactor safety requires adherence to a total concept wherein all elements are recognized as important and each is constantly reinforced."

After establishing our guidelines for the assessment, we then determined just how deeply or broadly our review of management capability and technical resources would go. To do this, we defined management capability and technical resources as that overall capability of a utility to own, operate, and be fully responsible for one or more nuclear power plants in such a way as to protect the health and safety of the worker and the public. We decided to cover those elements within the management structure from the corporate level down to the supervisory level and that part of the technical structure wherein decisions are made which could affect the safe operation of the plant.

Our definition is not a narrow interpretation and our assessment was probably more extensive in scope than most would expect. The listing which follows represents the groups or areas we assessed:

1. Corporate headquarters
2. Both offsite and onsite organizations relating to:

a. Overall management

b. Operations

c. Engineering/Technical

d. Licensing

e. Quality Assurance

f. Nuclear Safety Assessment

g. Selection, training, and qualification

h. Radiological control

i. Emergency planning

j. Fiscal management

k. Personnel matters

l. Labor relations

m. Material management

n. Industrial safety

o. Security

p. Facilities management

q. Public relations

r. Radioactive waste management

s. Fire protection

t. Environment

u. Maintenance

v. Records control

w. Water chemistry

Each of these groups was reviewed to determine if it was sufficient in the following areas:

1. Detailed, written procedures

2. Clear lines of responsibility and authority

3. Qualified personnel, number and qualifications

4. Accountability for actions

Since GPU is a multiple reactor site corporation with a remote centralized headquarters organization, particular attention was given in the assessment to the working relationship between comparable offsite and onsite functions. We also attempted to assess the attitude of management in light of the strong comments by the Kemeny Commission in this regard.

In carrying out our assessment, we interviewed over 150 employees of GPU and its affiliated organizations. These interviews were usually conducted on a one-on-one basis and normally lasted no less than one hour each. Some lasted, in repeated sessions, as much as ten hours. Onsite and offsite procedures detailing policy, requirements and organizatonal structure were reviewed. A sampling of all documents was reviewed and operations were witnessed. The detailed assessment began in October 1979 and continued intermittently into January 1981.

In addition to the information obtained from the interview proces. BETA has worked with GPU on specific technical issues related to the TMI Unit 1 plant. This presented BETA with an opportunity to judge firsthand the technical and management capability of the GPU organization.

Since our assessment extended over such a long period of time and because after each visit we provided GPU/Met-Ed

management with our findings which were then acted on, we found it unproductive to provide written reports. Thus, our assessment can be characterized as a continuing process of auditing and upgrading. We consider this to be not only helpful but encouraging, because in many, if not all, of the areas reviewed, there is no point that is ever reached where situations are perfect--there is always room for improvement. Over the past year or so we have seen this continuing upgrading take place, and we would expect it to continue on into the future.

One reason contributing to the need to extend the assessment over such a long period of time was the changing nature of the GPU/Met-Ed organization and the realignment of responsibilities as the company moved to effect improvements it considered necessary. Thus, an assessment conducted in early 1980 would not have reflected the actual situation which now exists in early 1981. We have attempted to conduct our assessment on the basis of what actually existed at the time of the assessment rather than what GPU/Met-Ed indicated might exist at some future date. However, we did not ignore the plans and preparations which GPU was making in its effort to effect improvement. We feel that our latest assessment, which was completed in January 1981, reflects the organizational plan not only as it was proposed in September 1980, but as it probably will eventually settle out for the restart of Unit 1. For example, much of our review was performed during the time that the GPU Nuclear Group was functioning rather than the not

yet authorized GPU Nuclear Corporation. Insofar as effectiveness of operation, personnel assignments and responsibilities are concerned, there should be little difference.

As I previously pointed out, throughout the course of the assessment where we found things that, in our opinion, were wrong, weak or unclear, we brought them to the attention of GPU management. These issues were resolved or action has been undertaken to correct them. Thus, what we might have pointed out as a weakness based on what we saw in January or February of 1980, has since been corrected or is in the process of being corrected.

I will now give you a summary of our findings.

SUMMARY FINDINGS

In its Order CLI 80-5, dated March 6, 1980, to the Licensing Board, the NRC listed a number of specific issues which the Licensing Board was directed to examine relating to GPU/Met-Ed management capability and technical resources. I will use those questions, where appropriate, as a means to present to you the summary findings of our assessment.

Issue 1:

"Whether Metropolitan Edison's command and administrative structure, at both the plant and corporate levels, is appropriately organized to assure safe operation of Unit 1".

Finding:

Our assessment indicates that with the changes made, the command and administrative structure of GPU/Metropolitan

Edison is appropriately organized and, as such, can assure safe operation of Unit 1.

Since the company's reorganization and the creation of a single group totally responsible for its nuclear matters, GPU has established direct lines of authority and responsibility. Written procedures defining these responsibilities and functions are in place and are operating. People with experience and demonstrated ability have been put into these positions. Many of them are new hires.

During the time of our review we were able to witness at closehand the thinking and effort that went into the establishment of the GPU Nuclear Corporation. This close witnessing of the policy formation gave us an insight into what GPU management was attempting to achieve and how they approached the problem. To us it is clear that GPU management has every desire to put in place an organization which will concentrate its nuclear effort into a single, responsible group of people, thus correcting many of the weaknesses which existed prior to the accident. If they have erred in their effort, it will not be because of any reluctance to do the right thing or because they held back. I think that a comparison between the number of technical/professional people working on the plant prior to the accident with the number now assigned demonstrates a dramatic change in philosophy. While my figures may not be exact, they do show what has happened. In March 1979, there were 23 people assigned to the technical functions area for TMI

Unit 1. In December 1980 there were 97. In the nuclear assurance area, there were 33 persons assigned to TMI Unit 1 in March 1979, whereas there were 87 in September 1980 and 103 in December 1980. These numbers indicate a fourfold increase. These are people who are assigned specifically to TMI Unit 1 and are exclusive of pooled talent within the GPU Nuclear Corporation who might work on other plants but could be brought to bear on TMI Unit 1 problems should the need arise.

While it is too early to judge the long-term overall effectiveness of this type of arrangement, a number of observations can be made.

1. The establishment of a single organization, reporting to a high corporate level and responsible for all aspects of nuclear plant operation and support, is in agreement with many of the recommendations contained in post-TMI accident reports.

2. By combining the technical resources of the various GPU utilities, a larger pool of talent has been assembled which can be put at the disposal of the nuclear plants in order to resolve problems and to ensure a better flow of information between the plants.

3. By having a larger base of technical and management talent the GPU Nuclear organization is less reactive to personnel losses and can afford to move people to gain experience.

4. It can develop and use uniform policies between the plants on matters such as training, procurement and facilities.

5. Because of its combined size and consolidated technical strength it can provide GPU corporate management with a much more professional assessment of matters which might affect reactor safety.

6. All the key technical positions within the GPU Nuclear Corporation are filled by nuclear-experienced personnel and their functions are not diluted with nonnuclear matters.

7. The person at the site responsible for the operation of TMI-1 is a vice president of the GPU Nuclear Corporation and reports directly to the Office of the President of the corporation. He is not encumbered by organizational layers between himself and top management.

8. Those functions which need not be done at the site are performed offsite by personnel not reporting to the TMI-1 Unit Vice President. This provides the Unit Vice President with more time which he can devote to matters directly related to the operation of the plant.

9. For all practical purposes, TMI-1 and TMI-2 have been separated physically and organizationally. This is important in that a separate group of capable people have been assigned to TMI- 1, independent of TMI-2.

10. The new organization makes it very clear who is in overall charge of GPU nuclear matters.

In summary, it is our opinion that the new organization and the management of the GPU nuclear plants through this single, unified structure is probably the most effective way a

nuclear utility could be handled. It certainly follows, as closely as practicable, the concepts used by other successful high technology programs by embodying a strong centralized technical organization approach. This new organizational approach is in effect now. However, as previously indicated, additional time will be required for it to work smoothly and efficiently.

Issue 2:

"Whether the operations and technical staff of Unit 1 is qualified to operate Unit 1 safely (the adequacy of the facility's maintenance program should be among the matters considered by the Board)."

Finding:

This question embodies a large segment of our assessment and, for that reason, the answer must be broken down into smaller elements. In an overall sense, it is our opinion that the operations, maintenance, and technical staffs are qualified or will be qualified to operate Unit 1 safely. However, some amplification is necessary.

In the operations area, our assessment did not address the actual state of qualification of the licensed operators. For example, we did not interview licensed operators in order to make a judgment as to whether or not they had been properly trained. Others, including NRC, have done this or are scheduled to do it. Our assessment in the operations area centered on the capabilities of management and supervisory

personnel to determine if they possessed the requisite degree of technical knowledge and experience to establish and enforce proper operational methods and procedures. We also reviewed the paper systems used to control the operation of the plant which are in place or are planned to be in place for the restart.

Our review indicates that the Vice President--TMI Unit 1 has the proper background and experience necessary for the job. He has had a highly successful career in the nuclear Navy having held positions which included command of a nuclear ship and having been responsible for the training of hundreds of senior naval nuclear personnel. Based on my own personal knowledge, his standards for training and operating nuclear plants are exceptionally high. His overall effect on the TMI Unit 1 plant has already been dramatic even though insufficient time has passed for it to become evident in all areas.

The second, third and fourth level managers in the TMI Unit 1 operations area appear to have the necessary experience and qualification to perform their jobs. During the time of our review which spanned over a year we witnessed dramatic changes in the overall capability, interest and performance of this middle management group of people. They seem to have settled down with the new organization and they are becoming effective in handling their jobs. This was not the case a year ago.

At the time of our review in August 1980, we noted that the training programs for the licensed operators were in

the process of review and upgrading. New managers of TMI Unit 1 training had been hired and a complete review of the training program was being made. Our interviews of these new training managers indicate that they are aware of a number of weak areas in how training is conducted, the material presented, the examination process, etc. We were able to see and discuss their plans for correcting these areas and, if carried out in the time frame and manner indicated, they should be in a position to have sufficient numbers of qualified operators in time for restart of the plant.

During our initial review of the onsite and offsite technical support groups in the fall of 1979, we noted an apparent segregation between the onsite technical group with its operational concerns and the offsite group with its greater analytical and design knowledge. For example, technical procedures prepared at the site were not reviewed by the offsite engineering staff. In addition, the lines of communication between the two groups were such that operating experience was not consistently being fed back to the offsite engineering staff. The present organization corrects these problems and assures a close line of communication between the offsite and onsite technical groups. Additional analytical and design support for plant operation should be achieved by the presence onsite of a permanent staff of engineers who will report to the offsite Vice President, Technical Functions. GPU's management is also emphasizing in this reorganization the need for closer coordination between the offsite and onsite

staffs. As a result, the members of the offsite engineering staff will spend appreciable time at the site. In addition, the position of Vice President, Technical Functions has been given to a senior manager with extensive engineering experience associated with the operation of reactor plants. This operational background in the offsite engineering group combined with the onsite satellite staff and a closely coordinated onsite/offsite concurrence system should assure an effective overall technical support organization.

In addition to providing an effective organizational structure, it is necessary to have sufficient numbers of experienced personnel. The total technical support manpower available for all GPU operating nuclear plants has increased from a level of about 100 in March 1979, to a level of greater than 300 sometime during 1981. The experience and capabilities of the engineering staff are broad and we believe consistent with those necessary to support safe reactor operation. It remains to be seen if this level of experience and capability can be maintained as the staff expands. It also may be difficult for GPU to expand as rapidly as they propose. However, we judge that the current pool of inhouse engineering talent, approximately 250, not counting contracted engineering talent, is sufficient to assure that enough manpower will be available to meet TMI Unit 1 needs as well as to support Oyster Creek operations, TMI-2 cleanup, and the minimal effort required for Forked River and the decommissioned Saxton plant.

In stating Issue 2, above, to the Licensing Board, the Commission added parenthetically that the adequacy of the TMI-1 maintenance program should be among the matters considered by the Board. In a manner similar to that described above for assessing the operations area, BETA did not address the actual proven or demonstrated trade skills of the maintenance tradesmen. Rather, we undertook to assess the scheduling of work, assignment of personnel, organization of the department, and control of work, stressing the capabilities of management and supervisory personnel to determine if they possessed the required technical knowledge, experience, and insistence to enforce proper maintenance procedures and methods.

Several significant and constructive changes have been made since the accident which affect and improve the present maintenance capability and performance at Unit 1. Foremost is the assignment onsite of a full time Vice President responsible for TMI Unit 1. In his previous work, this particular assigned person, while new to GPU, has demonstrated his ability to set high standards and maintain control of work for which he is responsible. Also of significant importance is the capability of the new Manager-TMI Unit 1. Again this person is one of demonstrated performance in the industry, and he has clearly demonstrated in the Unit Manager position that he knows how to control the work to the requisite high standards. Prior to the accident at Unit 2, the Superintendent of Maintenance was responsible for all maintenance activities at both Units 1

and 2. Subsequently, and currently, he is assigned exclusively to Unit 1, reporting to the Unit Manager. The Superintendent of Maintenance now has assigned to him, just for Unit 1 work, a maintenance force approximately equal to that previously provided for all maintenance work on both Units 1 and 2. The organization below the Vice President--Unit 1, the Unit Manager, and the Maintenance Superintendent has been enlarged and that people of demonstrated competence have been assigned. The advantages accruing to this restructuring of the maintenance organization are a greater attention to detail, greater emphasis on the control of work, improved training, and an obvious upgrading in the quality and efficiency of work. The backlog of maintenance work including preventive maintenance is of manageable size and is being reduced.

One measure of the effectiveness of these new maintenance management controls is that one can now predict the performance of the Maintenance Department. Work is performed as scheduled. This is traditionally the sign of a well-trained maintenance group that is under control, well-supervised, performing work that has been adequately planned.

Another feature of the current maintenance program is that there is a preventive maintenance group, separate from the corrective maintenance group. About one-third of all Unit 1 maintenance personnel are assigned to this preventive maintenance effort. The group is well-supervised, adequately staffed, and the work is well-planned. A strong preventive maintenance program is a key to a reliable plant.

The assessment revealed a point of intrinsic value: a sense of pride and accomplishment in those responsible for the maintenance of the plant, creating a subtle and desirable difference in the way they approach their work and take care of the systems and equipment for which they are responsible. This is the thing that has changed during the period of this assessment. The plant is much cleaner, the work is under better control, plant maintenance status is known, problems are worked expeditiously.

To further enhance the quality and reliability of the maintenance program, there has been established at the corporate level, a Vice President, Maintenance and Construction. This Vice President is a person with a previously demonstrated outstanding capability to manage and direct large-scale maintenance and construction programs. Thus, for the first time, maintenance becomes a headquarters concern rather than a lesser included function assigned to the Unit Vice President to be accomplished only with plant staff. Under this new concept, the Unit Vice President can direct his principal efforts to the safe operation of the plant while accomplishing preventive maintenance and necessary repairs with the maintenance staff assigned to him. Major and specialized maintenance beyond the capacity or capability of the plant maintenance staff will be assigned to the Vice President, Maintenance and Construction, who will maintain a work force sufficient to ensure that all required maintenance work, as well as required modifications,

can be accomplished in the timely and quality manner necessary to support safe operation of the plant.

The concept of a corporate official with specific responsibility in the maintenance area is a new concept at GPU. BETA considers that the work is well-started, the planning is sound, good people will be selected for assignment to the work. Currently, the principal effort of the corporate Maintenance and Construction Division at Unit 1 is on construction--installing approved modifications in the plant. As the organization and staffing of the Division advances, its stated goal of supporting operation of the plant by taking responsibility for major maintenance work and all plant modification work should be fulfilled.

Issue 4:

"Whether the Unit 1 Health Physics program is appropriately organized and staffed with qualified individuals to ensure the safe operation of the facility."

Finding:

BETA considers GPU has organized and staffed the TMI-1 radiological controls organization with enough of the right kinds of personnel who have the necessary capability to achieve high standards of radiological control. The commitment to excellence in radiological controls is apparent in the management of GPU.

The radiological control organization for work associated with TMI Unit 1 has increased to about nine times

the size it had been prior to the accident at Unit 2. Seven of these current radiological control personnel have four-year college degrees compared to one previously. Personnel who perform maintenance work (decontamination, for example) are no longer in the radiological control organization so as to avoid the conflict within this organization between getting the work done and getting the best practicable radiological controls. A separate radiological engineering group has been organized within the radiological controls department to ensure radiological aspects of work are planned in advance. The attention to radiological controls at corporate management levels is evidenced by their assigning a corporate director of radiological controls at the vice president level. The TMI-1 manager of radiological controls reports directly to this vice president.

When BETA first went to Three Mile Island in October 1979, it was clear that top management was already firmly committed to high standards of radiological control. However, they were not aware of any particular radiological control problems associated with Unit 1, and they understood the NRC considered their performance in radiological controls at TMI-1 was about average compared to other nuclear power plants.

However, in our review in October 1979, we found that radiologial control personnel were frustrated over their inability to do what they felt should be done to improve radiological control. Some were very upset over the poor

radiological control situation and felt they were prevented from exercising good radiological control. A poorly organized radiological control group and poorly defined responsibilities contributed to the problems. Other radiological problems were identified during the October 1979 review, but these problems with attitude and organization overwhelmed all others.

Top management of GPU/Met-Ed moved immediately to improve radiological control. All or almost all of the recommendations made by BETA were undertaken. In some cases they went further. BETA has provided continuing help on radiological control on a frequent basis, with contacts as often as daily and with numerous trips to the plant. This testimony reflects the experience of one year of constant involvement with TMI-1 radiological control, not just one or two brief assessments of their management capability. The changes GPU/Met-Ed has made are summarized in the following paragraphs.

The radiological control organization for Unit 1 was split from Unit 2 so that attention to unusual radiological problems with recovery of Unit 2 would not detract from improving radiological control at Unit 1. The radiological organization was separated from the chemistry organization for a similar reason. A Manager of Radiological Controls was appointed initially directly under the TMI-1 Vice President, which was a higher reporting level than the radiological control organization had in the middle of 1979. A strong

manager was selected for this position, but he had no experience in directing radiological controls. However, past experience has shown that a strong manager can learn radiological controls and achieve the necessary program improvements far better than an experienced health physicist who is a weak manager. Nearly one year of further experience has shown this strategy to be correct.

GPU management perceived that the Manager of Radiological Controls would be better able to influence the plant management to achieve high standards of radiological control if he reported to a different vice president than the one who managed the plant. GPU therefore set up the Vice President, Radiological and Environmental Controls, reporting to the President of GPU Nuclear. This reorganization has further strengthened radiological control, and there are no signs that problems have been caused by separating the radiological control function from the maintenance and operational functions. Radiological control personnel in TMI-1 have retained the same office locations and continue to have close contact with daily work independent of the change in corporate reporting level.

A radiological engineering group was set up within the radiological control organization under an experienced health physics supervisor, and five radiological engineers were assigned to him. This increased by a factor of six the radiological engineering manpower on TMI-1. In addition to

getting more professionalism in radiological control, this has reduced the paperwork of radiological control technicians and allowed them to increase their time controlling the work. The radiological engineering group has revised 63 of the 66 basic radiological control procedures to make them more specific and to make them understandable, so that personnel can follow these procedures exactly as written. This engineering group follows the planning and performance of individual jobs to ensure they are performed with as little radiation exposure as reasonably achievable.

A measure of success of radiological engineering work, as well as of other radiological control work, has been the total manrem of radiation exposure, determined by adding the exposures of each individual worker over a fixed period of time or for a given job. The initial projection of 325 manrem for 1980 was reduced during the year and the total actual exposure was 201 manrem. A number of major radioactive jobs were performed in 1980. As one example, a steam generator was opened and inspected and one tube was plugged. The total exposure was 2 manrem, far below prior experience at other plants for similar work inside a radioactive steam generator.

A change apparent to all radiation workers has been the large increase in the number of radiological control technicians and their supervisors covering radioactive work. Associated with TMI-1 one year ago were 8 such personnel compared to 36 now. There is a radiological control foreman

onsite nearly all the time. These are all Met-Ed employees, not temporary contractor personnel.

Work shifts have been arranged in cycles so that one-sixth of the time radiological control technicians are in training. Qualifications have been strengthened by requiring three different examinations of each radiological control technician and foreman. First is a comprehensive written exam of approximately six hours. Short answers such as multiple choice are not permitted. Second is a practical examination covering work performance, including performance during a drill of an unusual situation. Third is an oral examination conducted by a board of three senior radiological control personnel to evaluate the ability of the technician or foreman to handle unusual situations. Requalification through all three examinations is required biannually. Any technician or foreman who fails to qualify is not allowed to work as a qualified technician.

Other organizational changes were also needed and accomplished. The radiological control organization had been responsible for performing some radioactive work, such as radioactive waste packaging and radioactive decontamination. This potential conflict between those responsible for ensuring proper radiological control and those personnel actually performing work was eliminated by removing these production functions from the radiological control organization. An administrative group of clerks was also added (there were none

previously assigned) to reduce the time spent by radiological control technicians and foremen away from the work they are controlling. Radiological support functions of dosimetry, instrument calibration, and respirator testing were consolidated for all workers at TMI. The TMI-2 radiological control organization has these support groups and provides services to TMI-1.

An important step in improving radiological control was for GPU/Met-Ed to obtain a person experienced in evaluating management and performance of a radiological controls program. This continuous assessment function is independent of the Unit 1 radiological control organization and is separate from the audits conducted by quality assurance personnel. The evaluator performing these assessments frequently discusses his findings with the Vice President TMI-1, the Manager of Radiological Controls, and other key managers. BETA has also been in close touch with these assessments.

The most visible improvement in radiological control has been in cleaning up the plant. The first sign to most workers that management was really serious about good radiological control was the immediate efforts to improve housekeeping, and to make sure these improvements continued. Coupled with this was a program to radioactively decontaminate every area practicable. Most of the contaminated areas in the Auxiliary Building have been decontaminated. Emphasis was placed on working clean, each worker picking up after himself, as well as

on eliminating the need for special anticontamination clothing in most areas of the plant. Every worker monitors himself thoroughly for radioactive contamination every time he leaves the contaminated area and radiological control personnel check this monitoring. Whenever contamination is detected on a person, a special investigation is made promptly, no matter how small the amount of radioactivity. The most useful measure of the success of this program to control surface contamination is that the highest radiation exposure to anyone from TMI-1 work in 1980 from radioactivity inside the body, has been less than 1 millirem. This is less than 1 percent of the radiation exposure a person receives from natural background in a year.

GPU has made other improvements by increasing the radiological control staff from about 9 before the accident to 78 in support of TMI-1 work at the end of 1980. The proof of success of this radiological control program does not have to wait until after the reactor returns to operation. The most challenging periods for radiological control are during shutdown when most radioactive work is performed. In 1980, a number of complex jobs were safely and successfully performed on radioactive systems in relatively high radiation areas.

In January 1981, BETA conducted an assessment of radiological controls at TMI Unit 1. Thirty-five key managers and supervisors most important in radiological work were interviewed individually for about one hour each and more detailed further sessions were conducted with five of these.

Seven foremen were also interviewed. Most of those interviewed were in maintenance and operations positions responsible for performing the work. All management personnel in the radiological control department were interviewed. Paying major attention to the management personnel outside the radiological control department is essential, since it is their workers who handle the radioactivity. In principle, a sufficiently aggressive radiological control department might be able to impose its will to achieve a radiological control program meeting the basic requirements. However, in practice high quality radiological control depends heavily on the management of those who perform the radioactive work.

Our latest assessment in January 1981 supports the conclusion that the TMI Unit 1 Health Physics program is appropriately organized and staffed with qualified individuals to assure the safe operation of the facility. Each of the management personnel was knowledgeable, interested, and actively involved in the radiological control program and without exception appeared fully capable of carrying out his part of the program to high standards. Major improvements have been completed and, as in any well-run program, GPU managers have identified further improvements they are making.

GPU/Met-Ed management is aiming toward higher standards of excellence in radiological controls than the requirements imposed by outside agencies. Achieving such performance is a never-ending challenge and requires constant

improvement. There is no way in such a program to require the utility to meet its own radiological performance objectives at a given date because the prime objective is to continue improving. There will always be methods to do radioactive work better and to control radiation and radioactivity better. BETA considers there should be no limitations on restart of TMI Unit 1 at this time because of the Health Physics Program.

Issue 5:

"Whether the Unit 1 Radiation Waste system is appropriately staffed with qualified individuals to ensure the safe operation of the facility."

Finding:

Considerable attention had been paid to radioactive waste before the accident. Nothing has been found to show any reduction in this attention or in the staffing. The Radioactive Waste Supervisor has been moved out of the radiological control organization into the operations group in which the operation of radioactive waste systems are also located. This change improves the control of radioactive waste because radiological control personnel review the radiological aspects of radioactive waste processing. The TMI Environmental Controls group is also planning to assess radioactive waste processing.

The staff available for radioactive waste processing under the Radioactive Waste Supervisor will be strengthened by adding an associate engineer. The three foremen have long

experience as supervisors, one as the only radioactive waste foreman for several years, and another as a radiological control foreman.

The facilities available have been improved by making modifications to the radioactive waste evaporator. Results are already available from work to reduce the generation of radioactive liquid waste. Leakage inside the plant from sources such as pump shaft seals has been reduced from about 1000 gallons per day to about 300 gallons per day. This reduces the amount of radioactive work associated with processing this waste through the evaporator.

An extensive program has been started to reduce the amounts of solid radioactive waste. One example of the results of this program is that the number of drums of radioactive solid waste packaged was reduced during several months at the end of 1980 from 17 per week to 3 drums per week. Radioactive solid waste is packaged for shipment by Unit 1, but before shipment, packages are double checked and triple checked by other GPU Nuclear organizations at TMI outside Unit 1.

This brief summary provides some of the background for BETA's conclusion that TMI-1 is appropriately staffed with personnel qualified to process radioactive waste safely.

Issue 6:

"Whether the relationship between Metropolitan Edison's corporate finance and technical departments is such as to prevent financial considerations from having an improper impact upon technical decisions."

Finding:

With the creation of the GPU Nuclear Corporation the likelihood of this situation developing is greatly reduced. Major policy/financial decisions are made by the GPU Nuclear Board of Directors which is composed of knowledgeable people, experienced in nuclear matters, who understand the importance of technical integrity. While corporate financial pressures may and do exist, particularly in the case of GPU/Met-Ed, our review indicates that if these pressures became so severe as to deny funds for proper and safe technical action at TMI-1, GPU Nuclear itself would not permit restart or continued operation of the plant. It is also apparent to us that with the restructuring and strengthening of the General Office Review Board (GORB), reaction from them would become evident if such a condition arose. At least through the time of our review, we could find no evidence that undue financial pressures were being applied in the technical areas of TMI-1 even though there was financial stress within GPU.

Issue 7:

"Whether Metropolitan Edison has made adequate provision for groups of qualified individuals to provide safety review of and operational advice regarding Unit 1."

Finding:

During our review of the GPU organization structure, we have observed several changes which have significantly improved the quality of operational advice and safety overview

that will be available to support TMI-1 operation. As presently structured we believe the GPU Nuclear Corporation will be able to provide the necessary advice and review.

One of the major factors leading to the conclusion that proper safety review and operating advice will be available for TMI-1 is the changes that have been made to the offsite technical support organization previously discussed. The increased size of the organization, its direct involvement in the preparation of procedures for plant operation, its greater participation in plant operation and testing, and the existence of an onsite technical group will, in our opinion, provide an effective source of technical expertise.

An additional change that we consider important is the redirection of the functions of the onsite safety review committee, the Plant Operations Review Committee (PORC). This group as we found in the fall of 1979, was more a part of the line organization than an independent safety overview group. In the process of doing their work, the PORC became involved in the detailed editing and rewriting of procedures sent to them for review. This evolved to the point where the members of the PORC, rather than being in a position to review a procedure from an overall safety standpoint, became, in effect, the authors of the procedure. They ended up doing the work that others were responsible for. This situation has changed. PORC is now rejecting inadequate submittals and requiring them to be redone so as to permit an adequate independent review.

Eventually it is planned that each group represented on the PORC will function as individuals responsible to approve a procedure in their area of cognizance. Further, a new group or committee is being formed called the Independent Onsite Safety Review Group (IOSRG). This group clearly will function as an independent review group in that none of the members are in line positions. Their charter is clear, and they should assure a broader and more continuous safety overview than has been available in the past.

In addition to this independent onsite safety review group, there continues to be the TMI-1 General Office Review Board (GORB). It will function as it has in the past reviewing matters of nuclear safety not only in detail but from the broadest of viewpoints. The membership of the TMI-1 GORB has been strengthened, there is a permanent chairman, and it meets periodically at the site. It appears to be addressing the proper issues. There also exists the newly formed Nuclear Safety Assessment Department, which by its charter, will have a responsibility to provide yet another independent review of matters which could affect nuclear safety.

What is most important in this area of safety review and operational advice is not so much organization, as it is an overall appreciation for and understanding of the necessity to have technically sound safety reviews by qualified people and the willingness to use them. For example, it is possible to have highly qualified people in the newly created position of

the Shift Technical Advisor. Yet, if the shift operations people do not understand and enthusiastically support the Shift Technical Advisor concept then its potential will not be realized. In our view we found at all levels at TMI Unit 1 full support for not only the Shift Technical Advisor concept, but also for all of the other added safety reviews. In some cases we found some uncertainty existing at the site as to how all of these different inputs would be effected in a timely manner, but, as with other situations, these are being resolved as the people become more familiar with their functioning. What we did find is an understanding on the part of the operators as well as management, of the need for independent safety review and advice.

Issue 10:

"Whether the actions of Metropolitan Edison's corporate or plant management (or any part or individual member thereof) in connection with the accident at Unit 2 reveal deficiencies in the corporate or plant management that must be corrected before Unit 1 can be operated safely."

Finding:

Clearly, and as appropriately pointed out in the post-accident investigation reports, there existed a number of deficiencies in the corporate and plant management at TMI prior to the accident at Unit 2. Many of these problems were not unique to TMI or GPU; also they had developed over many years as civilian nuclear power passed through its developmental

stages. Not only were these problems not unique to TMI, but in our opinion TMI probably was better than most of the other utilities in this regard.

Because of actions taken by NRC many of these industry-wide problems are being addressed and some have been resolved. However, it is still too early to expect that all of these deep-seated problems will have been corrected to the point where one could be fully satisfied; also, some of these problems, due to their nature, do not have obvious solutions. In our opinion, this describes the situation at GPU/Met-Ed. They have had to make more progress than others; they have had to face up to more of the problems than others for the obvious reason that they are the utility that had the accident and the spotlight is focused on them. This is not to say that GPU is correcting its problems only because of those reasons. However, the notoriety and public attention are certainly added incentives.

As previously stated, our review indicates that there are no deficiencies now existing in the corporate or plant management of GPU/Met-Ed which must be corrected before Unit 1 can be operated safely. It is important not only to understand what these findings mean, but what they do not mean. We did not attempt to determine, nor did we, that all of the management problems relating to the entire subject of designing, building and operating nuclear plants identified by the post-TMI accident investigations, have been satisfactorily resolved at

TMI Unit 1 or any other place. This will take much more time and action by GPU as well as groups or agencies external to GPU. It is our opinion that there are sufficient management and technical capabilities within GPU to permit restart of TMI Unit 1.

Issue 11:

"Whether Metropolitan Edison possesses sufficient in-house technical capability to ensure the simultaneous safe operation of Unit 1 and clean-up of Unit 2. If Metropolitan Edison possesses insufficient technical resources, the Board should examine arrangements, if any, which Metropolitan Edison has made with its vendor and architect-engineer to supply the necessary technical expertise."

Finding:

To answer this question, in the context it was asked, would have required us to have assessed the in-house technical capability assigned and being used in the clean-up operation of Unit 2. This we did not do. We are aware that GPU/Met-Ed uses a relatively large number of outside technical resources at Unit 2. Our assessment focused on the issue of the full-time availability of technical resources for safe operation of Unit 1. We are satisfied that, with the existing and planned organizational structure and assignment of personnel, there will be sufficient in-house and outside talent available and specifically assigned to TMI Unit 1 to permit its safe operation.

We were particularly interested in determining the method by which key in-house talent was distributed between Unit 1 and Unit 2, and the extent each of these personnel spent their time on Unit 1 vs. Unit 2. Because of the large number of rather difficult technical problems facing Unit 2, we expected to find that plant getting the majority of the time and talent of the key personnel--and that is what we initially found. The President of GPU Nuclear has his office located at the TMI site and while this is a plus, we found that he tended to be oriented toward Unit 2 problems. We also found that because the President was at the TMI site, the Executive Vice President was concentrating on the Oyster Creek plant. In the early stages of our review we found Unit 1 somewhat short of day-by-day attention from either of these top executives. Since that time, however, the President and the Executive Vice President have readjusted their time and efforts and, in our opinion, they are giving Unit 1 sufficient attention.

At the vice presidential level, it is our opinion that for the most part, the division of time devoted to the three GPU nuclear plants is appropriately balanced. It is also considered that the personnel assignments within the various divisions are such that, on one hand, there are people assigned to handle one plant only, and on the other hand, there are people who can act across all three plants where it is appropriate to do so. While there will undoubtedly be readjustments as time goes by and more experience is gained, the current

balance appears satisfactory. It will be the job of management to ensure that this balance is maintained once Unit 1 goes back into an operating mode.

This concludes the summary of our findings. In essence, we conclude that the management capability and technical resources of GPU/Metropolitan Edison are sufficient to assure the safe restart and operation of TMI Unit 1.

BACKGROUND OF THE FOUR ASSOCIATES OF BASIC ENERGY TECHNOLOGY ASSOCIATES, INC.

The four Associates of BETA retired from the Department of Energy's Naval Reactors program where they served as senior staff members for Admiral H. G. Rickover, Director, Division of Naval Reactors. In that capacity they were involved in the technical management of the design, construction, and operation of over 150 reactor plants, including the Shippingport Atomic Power Station currently operating with the Light Water Breeder Reactor.

The Associates of the Corporation are:

R. William Bass is a graduate of the United States Naval Academy and holds the degree of Naval Engineer from the Massachusetts Institute of Technology. He was a member of the Department of Energy's Naval Reactors program from 1956 through July 1979. In his position as Associate Director for Commissioned Submarines during the last thirteen years, he was responsible to the Director, Division of Naval Reactors for the maintenance and overhaul of the Navy's nuclear submarine propulsion plants. In that position his responsibilities included providing the support necessary to resolve operational problems on an immediate basis. With respect to the efforts associated with the overhaul, conversion, and refueling of over one hundred nuclear submarine propulsion plants, he had responsibility for scheduling, financial support, industrial capacity, technical direction, and qualification and training of workers. He was also responsible for coordinating the efforts of the fleet, two government laboratories, six naval shipyards, three private shipyards, and supporting tenders and submarine bases. Other experience in the Naval Reactors program includes assignment as the Naval Reactors shipyard representative for the construction of both nuclear-powered submarines and surface ships.

Robert S. Brodsky is a graduate of the Massachusetts Institute of Technology with a degree in Physics. He was a member of the Department of Energy's Naval Reactors program from 1953 through August 1979. For six years he held the position of Assistant Director for Reactor Safety and Computation. In that position he was responsible to the Director, Division of Naval Reactors for matters relating to the safety in design and operation of the Navy's shipboard nuclear propulsion plants, the Department of Energy's naval prototypes, and the Shippingport Atomic Power Plant. These responsibilities included the safety of design, core fabrication, operation, testing, maintenance, refueling, new and spent fuel shipping, and laboratory operations involving fissile materials. In carrying out these responsibilities he worked closely for many years with the Nuclear Regulatory Commission, the Advisory Committee on Reactor Safeguards, and other federal and state agencies.

Murray E. Miles is a graduate of Cornell University with a degree in Engineering Physics. He was a member of the Department of Energy's Naval Reactors program from 1955 through August 1979. For the last thirteen years he was Associate Director for Nuclear Technology. In this position he was responsible to the Director, Division of Naval Reactors for establishing and monitoring the radiological control procedures used during construction, operation, and maintenance of the Navy's nuclear propulsion plants, the Department of Energy's naval prototype plants, and the Shippingport Atomic Power Plant. While in this position he

developed the procedures and methods now followed in the naval program to control radioactive discharge and radiation exposure. His reports and methods have become world-wide standards. In addition, he was responsible for the design and technical developments associated with both primary and secondary water chemistry, reactor shielding, decontamination, environmental protection, and emergency planning.

William Wegner is a graduate of the United States Naval Academy and holds degrees of Naval Architecture and Marine Engineering from the Webb Institute of Naval Architecture. In addition, he holds a degree in Nuclear Engineering from the Massachusetts Institute of Technology. He was a member of the Department of Energy's Naval Reactors program from 1955 through August 1979. Since 1964 he held the position of Deputy Director of the Division of Naval Reactors. In that position he was responsible to the Director for all aspects of the Naval Nuclear Propulsion Program, including the design, construction, testing, and operation of the program's nuclear reactor plants. In addition to his overall broad responsibilities in these areas, he was specifically responsible for the development and operation of the Navy's selection, training, and qualification programs for nuclear power personnel. He was also specifically responsible for the foreign aspects of the naval nuclear propulsion program. In addition, he developed the Navy's senior officer training program which is directed towards assuring that all senior naval officers in major at-sea commands can adequately oversee engineering operations under their cognizance.

In addition to these specific duties, it should be noted that all of the Associates were involved in the selection and advanced qualification of the Navy's reactor engineering personnel. Additional responsibilities included the auditing of contractors' laboratories, shipyards, operating ships, prototypes, and the Shippingport Atomic Power Plant.