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AN ASSESSMENT OF THE GPU NUCLEAR CORPORATION ORGANIZATION AND SENIOR MANAGEMENT AND ITS COMPETENCE TO OPERATE TMI-1

BY

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19 NOVEMBER 1983

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PREFACE

By letter of September 2, 1983, Mr. William G. Kuhns, Chairman, General Public Utilities, requested me to assess the GPU Nuclear Corporation, including the soundness of the organization and its senior management, in anticipation of the operation of the undamaged nuclear plant at Three Mile Island (TMI-1). He assured me of complete and open access to all GPU personnel, facilities, and information, as well as freedom to use whatever other resources, personnel, or sources of information I might wish.

I am often asked how I ran the Naval Reactors Program, sometimes by people hoping to find methods for use in their own work. Frequently there seems to be an expectation that I could tell them about some simple, easy procedure which made the Naval program function. Unfortunately there is none. Any successful program functions as an integrated whole of many factors. Trying to select one as the key will not work. Each element depends on all the other elements.

This is something that can be learned only through personally experiencing operating responsibility and making hard decisions. A lack of operating experience in people responsible to evaluate the competence of organizations leads too often to focusing on trivial details or on vague generalizations. Attaining competence and reliability in a nuclear operation is difficult, but recognizing them is not. In fact, with experience in operation, it is possible to lay down certain principles which are essential to safety, and are observable and verifiable.

Mr. Kuhn's request offered me the opportunity to apply the successful principles on which the Naval program was based to an evaluation of GPU Nuclear's competence to operate TMI-1. Although commercial nuclear plants and Naval nuclear plants differ in many ways, they do not differ in the underlying principles which make for safe operation. These apply equally to both. It is my hope that, by performing this assessment, those principles will become more widely understood and practiced. Since nuclear power is clearly here to stay, such attitudes and principles must, in my opinion, become industry's standard. I therefore accepted Mr. Kuhn's invitation.

Fortunately, I was able to enlist the support of three of my early associates from the Navy program: James M. Dunford, Jack C. Grigg, and Robert V. Laney. These people spent many years assisting me in developing, building, and operating nuclear power for the Navy. They are well-versed in the principles which guided that work and are practiced in discerning where these principles are being used or ignored. They assisted me throughout this assessment.

We made two early decisions affecting the scope of the assessment:

First, we would focus on the competence of the present GPU Nuclear organization and the people who are now responsible to manage it, rather than on managers who are now absent.

Second, we would focus on the management of GPU Nuclear's operational reactor at Three Mile Island and, to a lesser extent, Oyster Creek, but exclude the TMI-2 salvage operation.

We were aided in our assessments by several recent evaluations of GPU Nuclear. These include two detailed assessments by the staff of the Nuclear Regulatory Commission, two by the Institute of Nuclear Power Operations, and one by the Atomic Safety and Licensing Board. Although different in scope, these focused on specific organizational features and management practices.

While noting that these assessments all reach conclusions which are favorable to GPU Nuclear, our assessment is based on our own direct observations. However, because these previous reviews all focus on traditional management functions, our assessment is directed much more toward management's fundamental understanding and practice of underlying principles of operation.

I have mentioned the principles of operation which I used in building the Naval Reactor Program. I emphasize that these are principles, not procedures or practices. Procedures or practices must be changed as circumstances change. Principles are constant and can be applied now and in the future. If a management is imbued with these principles and accustomed to using them, it will adapt to change. The principles are defined in the body of the assessment report, Section II-E; they are stated here in the form of management objectives:

1. Require Rising Standards of Adequacy.
2. Be Technically Self-Sufficient.
3. Face Facts.
4. Respect Even Small Amounts of Radiation.
5. Require Relentless Training.
6. Require Adherence to the Concept of Total Responsbility.
7. Develop the Capacity to Learn from Experience.

These principles express attitudes and beliefs. They acknowledge the complex technology. They recognize that safe nuclear operation requires painstaking care. They declare that a nuclear management must be responsible—all the time. Although easily stated and readily defined, these principles are exceedingly demanding of a management which chooses to adopt and follow them. If management has chosen such a course, it will lead to a competent and dependable operation.

It is extremely important that senior management become technically informed and be personally familiar with conditions at the operating plant. They should visit the plants frequently, at irregular hours, inspect selected portions, and leave a written record of what they observed and how long they remained. These would be surprise inspections for which people could not prepare ahead of time. In this way, the pressure will be to maintain the plant in excellent condition at all times.

I believe that our criteria, and the principles on which they are based, measure more than the structural or technical adequacy of an organization. If used knowledgeably, they can expose a management's motivation to act responsibly, which we call integrity. A lack of integrity would be incompatible with conformance to these criteria.

Based on the assessment of the GPU Nuclear Corporation, including the soundness of its organization and senior management as reported herein, I conclude that the Corporation has the management competence and integrity to safely operate TMI-1.

H. G. RICKOVER

November 19, 1983

I. SUMMARY

A. Scope. This is an assessment of the GPU Nuclear Corporation, including the soundness of its organization and senior management, in anticipation of the operation of TMI-1. The focus is expressly on the present management and its qualifications to operate nuclear plants. The methods and criteria used in the evaluation were selected for that purpose.

The assessment team is aware of a number of questions currently being reviewed by the NRC which, in varying degrees, are perceived as bearing on "fitness to operate." These questions relate to events which took place several years ago or to recent events related to the conduct of salvage operations at TMI-2. We address neither of these. The early events are excluded from the evaluation because the competence of the present management could not credibly be measured by events which took place under a previous management so thoroughly different. The TMI-2 operation is excluded because it is, in a technical sense, a very different kind of activity than power plant operation.

The assessment thus concentrates on the fitness of the present management of the GPU Nuclear Corporation and its TMI-1 and Oyster Creek Stations. The information obtained from these sources is used, together with criteria described below, to assess management's qualifications to operate TMI-1.

B. Method. The existence of several recent and valuable evaluations by the Nuclear Regulatory Commission, the Institute of Nuclear Power Operations, and the Atomic Safety and Licensing Board, uniformly structured around traditional management functions, argued strongly that this assessment should not follow the same pattern. We intend to provide a fresh perspective on the meaning of "fitness to operate" and a different approach to measuring it. This is an appraisal of management's understanding and application of tested "principles of operation" which are fundamental to all nuclear power activities. These principles and the measurement criteria derived from them are described in Section II-E of this report.

The assessment was conducted by reviewing numerous documents describing the management structure and its current performance; by inspecting TMI-1 and Oyster Creek Stations and related training facilities; by interviewing a representative sample of managers; and by applying the principles of operation and related criteria to the information thus obtained.

The assessment team was given full access to people, facilities, and records of its choice, and its questions were answered promptly and frankly.

The documents reviewed (Appendix A) were selected to give the team an understanding of differing points of view about management competence; to use previous assessments as a means of directing our own inquiries toward management areas which had previously been questioned by others; and to review enough examples of management's written policies and procedures to form a basis for assessing its operating standards.

The list of managers interviewed (Appendix B) in this assessment includes most of the senior managers at corporate headquarters and a representative sample of managers at the TMI-1 and Oyster Creek Stations, including the Vice Presidents/Site Managers, and many of their principal subordinates and support function managers located at the stations. We interviewed individuals five levels below the Corporate President, four levels below the Station Manager, and at various levels in between. In total, 49 managers were interviewed.

The assessment team members, all having extensive experience in conducting similar interviews, directed their questions toward the following specific objectives:

> To learn, within the range of the respondent's direct observation and field of expertise, the conditions and management attitudes as they were in 1979.
>
> To learn the respondent's observations as to present conditions and management attitudes, within the range of his personal observation and expertise.
>
> To obtain the respondent's assessment of the differences between 1979 and the present, his explanation of the reasons for these differences, and to test his credibility.
>
> To assess each individual's qualifications for the responsibilities of his job.

C. Criteria of Competence. While the physical aspects of commercial nuclear power stations differ substantially from Navy nuclear propulsion plants, the same underlying precepts must govern the operation of both. It is important that these precepts be clearly understood. The criteria used to assess the competence of the GPU Nuclear Corporation to operate TMI-1 are:

1. Require Rising Standards of Adequacy.
2. Be Technically Self-Sufficient.
3. Face Facts.
4. Respect Even Small Amounts of Radiation.
5. Require Relentless Training.
6. Require Adherence to the Concept of Total Responsbility.
7. Develop the Capacity to Learn from Experience.

We believe that these criteria are qualitatively different from and in some respects superior to functional criteria customarily used to evaluate a management's performance. They go beyond questions of the adequacy of organizational structure and the number and quality of staff. The criteria described below address management's basic attitudes toward safe operation, explore their underlying motivation, and examine the force of the example given to the rest of the organization. In addition to testing present fitness to operate, these criteria can also tell us something about how a management is likely to respond to future events.

D. Conclusion and Recommendations.

1. Conclusions. Based on the assessment of the GPU Nuclear Corporation and its organization and senior management as reported herein, the team concludes that GPU Nuclear Corporation has the management competence and integrity to safely operate the TMI-1 plant.

2. Recommendations. In the course of the investigation, several items were observed which, if adopted, would enhance the operation of the TMI-1 plant. While they are not considered necessary prior to restart, the team recommends they be adopted.

   a. GPU Nuclear should devise a plan to upgrade the operation and support of the TMI-1 and Oyster Creek plants, to achieve a ranking in the top one-sixth of all commercial nuclear plants in the Institute of Nuclear Power Operations (INPO) evaluations. Milestones should be set in each area and progress measured against these milestones.

   b. GPU and GPU Nuclear senior management should become technically informed and personally familiar with conditions at the operating plant. They should visit the plants frequently, at irregular hours, inspect selected portions, and leave a written record of what they observed and how long they remained.

   c. Some personnel in the TMI-1 Training Department responsible for training licensed operators are not yet qualified Senior Reactor Operators. We recommend that these personnel complete qualification procedures on TMI-1 as soon as possible.

   d. GPU Nuclear should continue to reduce its dependence on the use of consultants. The organization should become self-sufficient to the point where use of such personnel would be necessary only in special circumstances where development of in-house capability could not be justified.

e. The general announcing system for the TMI plant distracts personnel in the control room. The system should be modified to significantly reduce these broadcasts to the control room. This will prevent distraction of operators from their primary duties. Also, too many people are in the control room. Only those essential to the operation of the plant should be there. Instructions to this effect should be posted and complied with.

II. METHODS AND CRITERIA

A. Scope. This is an assessment of the GPU Nuclear Corporation, including the soundness of its organization and senior management, in anticipation of the operation of TMI-1. The focus is expressly on the present management and its qualifications to operate nuclear plants. The methods and criteria used in the evaluation were selected for that purpose.

The assessment team is aware of a number of questions currently being reviewed by the NRC which, in varying degrees, are perceived as bearing on "fitness to operate." These questions relate to events which took place several years ago or to recent events related to the conduct of salvage operations at TMI-2. We address neither of these.

The early events are excluded from the evaluation because the competence of the present management could not credibly be measured by events which took place under a previous management so thoroughly different. The nature and extent of the differences are reported in Section III of this report.

The TMI-2 operation is excluded because it is, in a technical sense, a very different kind of activity than power plant operation and because it is being conducted through a prime contract arrangement having no counterpart in GPU Nuclear's nuclear station operations.

The assessment thus concentrates on the fitness of the management of the GPU Nuclear Corporation and its TMI-1 and Oyster Creek Stations. The information obtained from these sources is used, together with criteria described below, to assess management's qualifications to operate TMI-1.

B. Method. Among the documents the team reviewed are several which evaluate various aspects of the comapny's current organization and performance. These include detailed assessments by the NRC staff and Institute of Nuclear Power Operations in 1982 and 1983, as well as an Atomic Safety and Licensing Board evaluation of August 1981. Although these differ in method and style, they are similar in their focus on the key functional elements: management and administration; operations; technical support; training; maintenance; radiological control; and quality assurance. Obviously, an assessment of management's performance in each of these areas gives, in the aggregate, a basis for evaluating management's overall competence.

The existence of these recent evaluations, uniformly structured around traditional management functions, argued strongly that this assessment should not follow the same pattern. We intend, instead, to provide a fresh perspective on the meaning of "fitness to operate" and a different approach to measuring it. This is an appraisal of management's understanding and application of tested "principles of operation" which are fundamental to all nuclear power activities. These principles and the measurement criteria derived from them are described in Section II-E.

The assessment was conducted by reviewing numerous documents describing the management structure and its current performance; by inspecting TMI-1 and Oyster Creek Stations and related training facilities; by interviewing a representative sample of managers; and by applying the principles of operation and related criteria to the information thus obtained.

The assessment team was given full access to people, facilities, and records of its choice, and its questions were answered promptly and frankly.

Document reviews, personnel interviews, and criteria of competence are described in the following Sections C, D, and E.

C. Document Review. The documents reviewed are listed in Appendix A to this report. They were selected to meet several needs: namely, to give the team an understanding of differing points of view about management competence; to use previous assessments as a means of directing our own inquiries toward management areas which had previously been questioned by others; and to review enough examples of management's written policies and procedures to form a basis for assessing its operating standards. This is not meant to be an exhaustive list of relevant documents, yet we believe it fairly represents the much larger body of available material and is sufficient for the purpose of this assessment.

D. Interviews. The managers interviewed in this assessment are listed in Appendix B. The list includes most of the senior managers at corporate headquarters and a representative sample of managers at the TMI-1 and Oyster Creek Stations, including the Vice Presidents/Site Managers, and many of their principal subordinates and support function managers located at the stations. We interviewed individuals five levels below the Corporate President, four levels below the Station Manager, and at various levels in between. In total, 49 managers were interviewed.

Interviews were conducted in private, with two or three team members questioning one manager. The assessment team members, all having extensive experience in conducting similar interviews, directed their questions toward the following specific objectives:

> To learn, within the range of the respondent's direct observation and field of expertise, the conditions and management attitudes as they were in 1979. Those interviewed who were hired after the accident were asked to describe conditions and attitudes which existed at the time of their arrival.
>
> To learn the respondent's observations as to present conditions and management attitudes, within the range of his personal observation and expertise.

To obtain the respondent's assessment of the differences between 1979 and the present, his explanation of the reasons for these differences, and to test his credibiity.

To assess each individual's qualifications for the responsibilities of his job.

E. Criteria of Management Competence. The criteria of competence used in this assessment are based on the successful operating principles which guided the development and safe performance of the Nuclear Navy during its formative years. We believe that these principles are valid now as they were then.

While the physical aspects of commercial nuclear power stations differ substantially from Navy nuclear propulsion plants, the same underlying precepts must govern the operation of both. It is important that these precepts be clearly understood. The following paragraphs identify and describe the criteria used to assess the competence of the GPU Nuclear Corporation to operate TMI-1 and to show how they relate to underlying operating principles.

We believe that these criteria are qualitatively different from, and in some respects superior to, functional criteria customarily used to evaluate management's performance. They go beyond questions of the adequacy of organizational structure and the number and quality of staff. The criteria described below address management's basic attitudes toward safe operation, explore their underlying motivation, and examine the force of the example given to the rest of the organization. In addition to testing present fitness to operate, these criteria can also tell us something about how management is likely to respond to future events.

The criteria are briefly described in the following paragraphs:

(1) Rising Standard of Adequacy. Excellence in operating nuclear power plants cannot be achieved merely by meeting a set of minimum standards. Excellence is achieved by raising standards and goals when lower thresholds of competence have been reached. It is necessary, of course, to define minimum requirements, particularly when evaluating eligibility for an operating license. However, the competence of nuclear operations management must be measured not only by success in reaching prescribed minimums but by its determination and success in exceeding them.

(2) Technical Self-Sufficiency. Nuclear power is a technology whose complexity far exceeds that of other common methods of generating electricity. Commercial nuclear power is less than 25 years old and is still evolving and changing. It is essential that decision-making managers not only have extensive technical training themselves, but that they also

have expert analytical and engineering resources readily available within their own organization. It is insufficient to rely solely, or even primarily, on outside contractors or consultants for technical support, a practice which is commonly used. A nuclear utility must have its own broad-based technical staff capable of all but the most specialized services.

Based on this operating principle, the team assessed the strength, diversity, and adequacy of GPU Nuclear's in-house technical resources in support of plant operation.

(3) Facing Facts. A problem cannot be solved until it is transmitted to and acknowledged at the organizational level where it can be properly addressed. Unfortunately, there is a disposition common to all operating organizatons to minimize the potential consequences of problems, especially when blame may attach to the reporter or when the solution may require higher level assistance. Facing up to difficulties, regularly informing higher levels of management of them, and determining and correcting their root causes involve attitudes and practices which are essential to operating competence.

GPU Nuclear's policies and practices on these matters were examined.

(4) Respect for Radiation. It is incumbent on nuclear plant operators to minimize personnel radiation exposure by all reasonable means. A constant concern for the undesirable biological consequences of even small amounts of radiation and an insistence on reducing them are characteristics of a competent nuclear management. Since exposure levels allowed by regulations are seldom approached in practice, management's intent and ability to accomplish the purposes of the "As Low As Reasonably Attainable" (ALARA) program can be tested by examining its Radiological Control Program and the measures which it has adopted to minimize exposures.

GPU Nuclear's Radiological Control Program was examined for examples of innovative steps being taken to reduce exposure and to observe the importance which management attaches to its ALARA commitment.

(5) The Importance of Training. The selection and training of operators is at least as important as any other element of safe reactor operation. It is vital that the mental abilities, qualities of judgment, and level of training be commensurate with the responsibility involved in operating a nuclear station. A management's attitude toward excellence in operation and its understanding of how to achieve excellence are both revealed in the quality of training provided.

GPU Nuclear's training program was closely examined and evaluated.

(6) Concept of Total Responsibility. Operating nuclear plants safely requires adherence to a total concept wherein all elements are recognized as important and each is constantly reinforced. Training, equipment maintenance, technical support, radiological control, and quality control are essential elements, but safety is achieved through integrating them effectively in operating decisions. Management's understanding of this principle at the corporate and plant levels is a valid measure of competence. The organizational structure gives some indication of management's awareness, but is less important than understanding and applying the principle.

GPU Nuclear Managers were interviewed to determine their understanding of the relationship between support functions and the conduct of plant operations, to observe the effectiveness with which they are being integrated, and to test for the concept of total responsibility.

(7) Capacity to Learn from Experience. Since we are dealing with persons and machines which cannot be made perfect, it is important to recognize that mistakes will be made. We must do our best to design machines having tolerance for mistakes and to continue to improve them through experience. This process of evolutionary improvement, the basis for much of our most useful technology, depends on a capacity to acknowledge mistakes and to determine and correct their underlying causes, whatever the cost. An inability or unwillingness to learn from experience is intolerable in nuclear operations.

The GPU Nuclear management was assessed with respect to its policies and practices in identifying operational problems, searching out their root causes, and applying the lessons learned.

III. ASSESSMENT

A. Introduction. This section contains an assessment of the competence of GPU Nuclear Corporation's management in terms of the basic operating principles previously defined. Under each criterion, we provide a comparison between management attitudes and operating conditions which prevailed in the 1979 period and those of today. The former conditions are derived from the personal observations of managers interviewed. Present conditions are based on the assessment team's own observations, on their reading of relevant documents, and on responses to questions in interviews.

In addition to comparing conditions in 1979 and 1983, we trace the differences, where appropriate, to specific changes in management attitudes and policies. This process leads to an appraisal of the competence of the present management, and assesses the extent of its understanding and application of these proven operating principles.

B. Assessment Against Criteria. For the reader's convenience, each assessment is given the same number as the corresponding criterion in Section II-E.

(1) Rising Standard of Adequacy. As stated earlier, excellence in operating nuclear power plants cannot be achieved merely by meeting a set of minimum standards. A technology having inherent public risk, a technology which is still new and still evolving, must be built upon rising standards of excellence which substantially exceed those used for licensing purposes. The degree to which a management understands and applies this principle is one measure of its competence and reliability.

We found evidence from our interviews that the prevailing attitudes and policies at the time of the accident can best be described as, "Operate in accordance with the conditions of the license and applicable regulations." We found no evidence that, at that time, regulatory requirements were considered to be goals to be exceeded, or that management had a policy which deliberately encouraged the use of standards exceeding those mandated by regulation.

Individual managers whom we interviewed referred to numerous conditions existing in 1979 which they now consider to have been deficient, at least by today's standards. Such deficiencies were identified, for example, in training programs, in-house technical competence, preventive and corrective maintenance programs, safety assessment, quality assurance scope, and numbers of operators available for shift duty. We did not investigate nor do we suggest that the TMI-1 practices in 1979 were necessarily different from the industry norms of the time. Our interest here is to examine the management's present attitudes and policies with respect to standards of adequacy, to compare them with the 1979 time period, and to identify any changes which have occurred and the reasons for them.

We note that, in June 1980, a policy directive to all TMI managers carried the following message:

> "We will, of course, also meet applicable regulations, etc., but that is not automatically sufficient. I look to each of you to continually ask yourself 'What is the right thing to do,' <u>not</u> just 'what do the regulations or license require.'...Understanding and applying the principle that first and foremost we must satisfy our own standards is a vital and part of carrying out our responsibilities."

Our interviews with corporate managers reinforce the vitality of the above-quoted policy. GPU Nuclear managers today are expected and encouraged to do more than merely meet regulatory requirements. They are expected to achieve levels of performance which meet their own professional standards of excellence, and which equal or exceed the best practice in the industry. Such a policy, provided it is confirmed in deeds, marks a radical departure from the past. The assessment team looked for objective evidence.

The evidence which we found abundantly confirms that this policy reflects the intent of management. The policy is widely understood and followed at those levels in middle management where interpretative decisions and budget requests originate. We found that operating managers and service managers alike function and plan ahead with confidence that corporate resources will be made available to them to improve their levels of performance beyond that required. Specific cases will be found throughout this report showing that GPU Nuclear has established and continues to develop safety and reliability practices which lie beyond regulatory requirements. A few brief examples of such practices are listed here:

- Training — Present training exceeds regulatory requirements in breadth, depth, and diversity of personnel trained. (See Section III-B(5), below)

- In-House Technical Competence — Present in-house technical resources, both at corporate and plant levels, show an extraordinary depth of talent dedicated to the support of operations. [See Section III-B(2), below)

- Maintenance — Formal preventive and corrective maintenance programs have been established and are growing in strength.

- Safety Assessment — GPU Nuclear has established an independent safety assurance function at the corporate level; has independent on-site safety review groups; carries out a formal safety review of all documents or changes to them which affect operation; and in addition, maintains General Office Review Boards, containing some outside members, to advise the Chief Operating Officer and the Corporate Board of Directors on safety matters affecting each station.

- Quality Assurance Scope — GPU Nuclear is an industry leader in recognizing the need to broaden the definition of matters relating to safety and in implementing that broadened definition in their Operational Quality Assurance Plan. GPU Nuclear has recently become the first utility which has qualified and been authorized by the National Board of Boiler and Pressure Vessel Inspectors to use the "R" and "NR" stamps in performing repairs.

- Number of Operators Available for Shift — GPU Nuclear plans to provide six full shifts of operators in order to assure that one shift will always be available for training. This goal is expected to be met prior to plant start-up.

As noted above, the assessment team observed many other examples in addition to these. Some of the others will be found in following Sections III-B(2) to III-B(7).

The assessment team finds that the present GPU Nuclear Corporation's management understands the operating principle of Rising Standards of Adequacy and is applying it effectively. As a result, there are numerous areas of activity where GPU Nuclear's standards now significantly exceed those required by regulation.

(2) Technical Competence. Decision-making managers must not only have extensive technical training themselves, but must also have expert analytical and engineering resources readily available to them in their own organization.

Prior to March 1979, the TMI-1 plant had a small in-plant engineering staff of 18 to support operations and maintenance. In addition, there were 16 engineers at Metropolitan Edison headquarters with competence in design engineering, radiation safety, and environmental engineering. Additional engineering support could be obtained, if called for, from GPU Service Corporation, Parsippany, New Jersey; Babcock and Wilcox, Lynchburg, Virginia; and Gilbert Associates, Reading, Pennsylvania, the TMI-1 architect/engineer. However, these three organizations had no personnel solely dedicated to the support of TMI-1, and hence could not be utilized as readily as in-house staff.

In contrast with the 1979 situation, TMI-1 now has a Plant Engineering Staff of 27 reporting to the Station Manager; an on-site Technical Functions staff of 40 professionals, reporting to the Technical Functions Vice-President at corporate headquarters; and a headquarters technical support staff of 65 professionals dedicated to TMI-1. These numbers, totaling 172, do not include other engineering professionals in the corporate Nuclear Assurance, Radiological Control, and Maintenance and Construction Departments, nor do they take account of the remainder of the corporate Technical Functions Staff, about 200 professionals, who are supporting TMI-2 and Oyster Creek, but could, under special circumstances, assist TMI-1.

It is quite evident that, on the basis of numbers alone, GPU Nuclear has committed an extraordinary range of technical resources to TMI-1.

The team reviewed the experience and training of the management personnel at the operating stations and headquarters in order to assess their technical competence. Personnel interviewed included the Vice President, TMI-1; Vice President, Oyster Creek; Operations and Maintenance Directors; Plant Engineering Directors; Manager, Plant Operations; etc., as well as senior managers at headquarters. The general level of education, training, and experience in the pertinent nuclear disciplines was considered adequate. It was notable that more than half of the total managers, professionals, and licensed operators assigned to TMI-1 have been hired into GPU Nuclear since March 1979.

A major steam generator repair has recently been completed by TMI-1. This work involved virtually all in-plant personnel, was technically complex and difficult, and was skillfully carried out in the presence of high radiation levels. Its successful completion demonstrates the organization's maturity and operational competence in this kind of evolution.

The Technical Functions organization at corporate headquarters has been almost totally put in place since the accident. The organization includes Engineering Services, Licensing and Regulatory Affairs, Engineering and Design, Systems Engineering, Engineering Projects, and Start-Up and Test. The team particularly noted that GPU Nuclear now has both plant analysis and control and safety analysis capabilities in the Systems Engineering Section. The Technical Functions Division has the necesssary mix of engineering and plant design talent to perform conceptual designs of most plant modifications. Additionally, Technical Functions now provides on-shift Technical Advisors in the plant at all times.

Finally, TMI-1 will have a full six shifts of qualifed operators, permitting one week in seven to be devoted to operator training for maintaining the required level of competence.

The assessment team concluded that GPU Nuclear managers have appropriate and adequate levels of technical training, and that in-house technical resources are clearly ample in diversity and depth to support the operation of TMI-1.

(3) Facing Facts. Facing up to difficulties, regularly informing higher levels of management of problems and determining and correcting their root causes involve attitudes and practices which are essential to operating competence. Unfortunately, there is a disposition in all operating organizations to minimize the potential consequences of problems and to try to solve them with the limited resources available at the level where they are first recognized. The practice of forcing problems up to higher levels where greater resources can be applied must be assiduously fostered by top-level managers.

The formation and structure of the GPU Nuclear Corporation provides one of the most important indications that the present management intends to keep itself informed of operating problems. The purpose in forming GPU Nuclear, as stated in GPU's organization manual, is to "provide a full-time dedicated management for the single purpose of safe and effective operation of all nuclear facilities in the system."

The organization is so structured that Technical Functions; Radiological and Environmental Controls; and Nuclear Assurance, including Training and Quality Assurance, report directly to the President of GPU Nuclear, and each has personnel at the operating sites to provide independent reviews of the quality of the operations. The site-based units support operations; and, as the assessment team points out elsewhere in this report, a strong team spirit exists at the sites. At the same time, from the viewpoint of exposing problems, it is clear that the existence of the independent reporting channels described above can give corporate management substantially greater insight into plant operations than they would have if all such functions reported directly to the Station Manager as they did in 1979.

The increased visibility which this arrangement gives corporate management is accentuated by another new practice which is now is use. The GPU Nuclear President requires biweekly Significant Event Reports from the Vice President/Station Manager, as well as from each support division Vice President (Technical, Maintenance and Construction, Radiological Control, Quality Assurance, and Nuclear Assurance). These reports are typically five to ten pages in length, and expressly point out problems. Thus he and his immediate staff see not one but several views of the conditions at the station, each presenting a different perspective.

In fact, the assessment team observed at all levels of management a dedicaton to the policy of full problem disclosure, investigation, and remedy. The following examples show how this policy is being implemented:

- Administrative Procedure No. 1029 at TMI-1 (No. 105 at Oyster Creek) sets down standards of operating conduct, emphasizing safety. It requires that all significant off-normal incidents be reported in writing and analyzed for cause. Such incidents are reviewed with personnel from all shifts, are included in future operator training programs, and are sent for review by the Independent On-Site Safety Review Group.

- In-plant management at TMI-1 holds daily planning meetings, involving on-site service managers, which are devoted to bringing problems to the surface for solution.

- Senior station managers, including service managers, make night-shift plant tours to assist in identifying problems at an early stage.

- The Quality Control Department has a procedure by which problems which are unresolved after a predetermined period of time are escalated progressively to higher management levels until resolved.

- GPU Nuclear has an Ombudsman to whom any employee can bring any problem or perceived problem. Complete anonymity is assured, and the employee is provided a written reply to his question or concern.

The assessment team tested the flow of information to various levels of management by questioning personnel on specific occurrences and problems. We found that such information is being widely distributed and that problems are appropriately escalated and additional resources applied as needed.

The present GPU Nuclear Management has generated an atmosphere of openness which is conducive to facing facts and resolving problems.

(4) Respect for Radiation. One criterion for judging the quality of management of a nuclear plant in the degree to which radiation control (Rad Con) is given prominence in organizational level, in staffing, and in the demand for high standards of performance in this area. This attitude of

management is not always found because radiation problems are new even to experienced managers in non-nuclear plants and are generally underrated. Radiation sources are elusive and the effects of poor radiation control are not easy to see. There is a tendency to look on the control requirements as overdone and, in any case, to be within the capability of the normal work force to carry out.

Effective radiation control means that a technically well-conceived program must be in place with trained Rad Con technicians assigned and strict adherence to procedures enforced. These will not be present without strong management support and involvement through goal-setting, progress reports, and first-hand observations of operations.

A comparison of Rad Con at Three Mile Island—before the accident and today—shows the same story as has been observed in several other areas of plant operation: namely, a significant upgrading has occurred. This change in Rad Con is due in no little part to the determination on the part of top management of the Utility to elevate the status of Rad Con in the organization and to demand that this function meet the highest standard it was reasonable to set. A GPU Nuclear Vice President with previous experience in Rad Con was appointed, goals were set, support for added personnel and facilities was given, and top-level monitoring of progress was instituted.

Our study of Rad Con at TMI-1 showed that many steps have been taken to upgrade the program there and at Oyster Creek. The goals have been set and the decisions on facilities and staff have been made on the basis of getting the best, not just meeting the minimums. Taken as a whole, the actions described in the following paragraphs are evidence of top management's awareness of the importance of radiological control and of its determination to give full support to the program for its control.

- Personnel. The TMI-1 Radiological Control organization in 1979 was small in size—about ten technicians assigned to TMI-1—and reported to the Manager of Administration of the site, certainly a modest level of visibility for this important function.

  Today, the Manager, Radiological Controls, at TMI-1 reports directly to the GPU Nuclear Vice President, Radiological and Environmental Controls, and has a group of 47 supervisors, engineers, and technicians assigned to TMI-1.

- Training and formal qualification of Rad Con technicians is managed by the Rad Con Department at TMI-1. Training in fundamentals is provided by the Training Department, but Rad Con monitors its content and effectiveness. Specific Rad Con training and qualification is performed on-site.

One significant improvement which has been achieved at TMI-1 is that formal qualification of Rad Con technicians has been accepted by the craft union and appears in the union contract job descriptions. These descriptions call for written examinations and periodic training, and allow reassignment out of the Rad Con Department for failure to progress. This important agreement on the part of the union could only have been obtained where strong management support for Rad Con was present.

- Radiological Assessment is performed at TMI-1 by an experienced senior radiological control professional who reports directly to the Vice President and Director of Radiological Controls. The assessor has the assignment to monitor every phase of work at the site and to make his Rad Con reports directly to the Vice President. He has the authority to stop work which is unsafe or is not following procedures. The fact that it is rarely necessary for the assessor to formally exercise this authority to stop work is indicative of the respect with which he is regarded by the operations and maintenance people of TMI-1. Thus, this assessor represents another effective tool of management in support of Rad Con.

- Radiological Engineering groups have been established at TMI and at corporate headquarters to address technical problem areas in Radiological Safety. Their review of work packages at the site helps to ensure that proper consideration of radiological concerns is given before the work starts. This arrangement is much better than the alternative which is often used, wherein the radiological monitoring supervisory personnel take on these reviews as an added function.

- Radiological Deficiency Reports (RDRs) are now a part of the Rad Con system at TMI. Patterned after the Quality Assurance Deficiency Reporting system, which is one of the accepted parts of quality assurance, the RDRs can be issued by anyone who is in a position to observe violations of radiological control procedures or who wishes to make suggestions for improvements in this area.

The procedure for handling the RDR requires that it be reviewed, evaluated, acted upon when indicated, and tracked through the entire process until final resolution. The originator is always informed of the actions taken on his report.

The evidence of recent RDRs, received on the average of over ten per month, suggests that they are a particularly effective tool for increasing the awareness of all personnel at TMI-1 on the nature and importance of radiological controls.

• A Radiological Awareness Committee has been formed at TMI-1, consisting of senior management representatives of all TMI-1 divisions. They meet monthly to discuss problems and seek ways to improve the understanding of radiological controls at all levels.

The general employee does not have an appreciation of the problems of radiation and tends to think of the radiological control provisions as unnecessarily elaborate and meticulous. For that reason the system is not always wholeheartedly supported. The Committee's efforts have paid off in gaining greater support, as measured by reductions in the generation of radioactive waste and making more effective use of containments to restrict the spread of radioactivity during maintenance.

• Personnel Exposure Control has been upgraded by several procedures or systems that represent some of the more advanced ideas or techniques in Rad Con.

(a) Any skin contamination detected is immediately evaluated and corrected. Records are kept and critiques held to discover root causes of the contamination and actions needed to correct them.

(b) The radiation dosimetry program uses the latest state of the art equipment. This permits separate readings of beta and gamma radiation. These readings are entered into the company computer directly at the locations where dosimeters are read. Thus, the records are up-to-date for each day of work for every employee.

(c) There is real-time radiation monitoring of the environmental radiation sensors permanently installed at 16 locations within a five-mile radius of TMI. The readings are fed to a computer which produces reports and alarms if elevated readings are detected. The state and county offices are also on this same automatic system.

The radiation control system in effect at Three Mile Island is a well-directed and effective approach to this important area. Management commitment to the goal of excellence is quite evident in the organizational position of Rad Con within the company structure, and in the choice of managers to carry out the program. These managers have set future goals for continuing improvement over the current highly acceptable record.

(5) The Importance of Training. After the technical design of the plant itself, the most important element in assuring reliable and safe operation of a nuclear power plant is the training of the crew who will operate the plant. A key indicator of management's understanding of safe nuclear plant operation is the degree to which high-level attention is given to training. Despite evidence from the Naval Nuclear Program as to its importance, this procedure had apparently not been widely accepted by the commercial nuclear power industry at the time of the TMI accident.

In the history of the Naval Nuclear Program, training was one of the early actions, even before many of the basic technical decisions had been made in the development and construction of the plant. This emphasis on early and thorough training of the crews of the nuclear submarines and surface ships made it possible to assign a fully-trained crew to operate the plant during every phase of construction and testing, including sea trials. Theretofore, the custom in shipbuilding had been to perform the tests and sea trial with a civilian trial crew. The naval crew took over after the trials, but lacked the valuable familiarity with the plant that operation in the testing period would have given them.

In 1979, before the TMI accident, training placed heavy reliance on the fact that considerable numbers of the operating and maintenance crews were former members of the Naval Nuclear Program. The basic training which those people had received in the Navy was useful in shortening the time needed to qualify them as commercial plant operators. In the many investigations which have been made into the training aspects of the TMI accident, it has been brought out that TMI training tended to concentrate on the narrow objective of getting the operators successfully through the NRC operator examination. If the NRC exam failed to cover all the elements of plant theory, safe operation, and casualty procedures, as applicable to the commercial plants, the training program might well miss them also.

At the time of the accident, there was only a small commitment of physical resources and operator time to training. Furthermore, the place of training in the organization was not high: the seven-person training organization reported to the Superintendent of Three Mile Island, competing for his attention with all of the problems of operating a site with 219 employees, one commercially operating nuclear power plant, and one plant in the final stages of start-up testing. Evidence of the secondary position which training occupied can be found in the training attendance records at the time. Operational considerations prevented as much as 50% of the scheduled attendance at training lectures; those not attending were assigned take-home packages for self-study.

In the commercial nuclear power industry's analysis of the lessons of TMI, training has been identified as one of the key items needing greater management attention. The charter of the Institute of Nuclear Plant Operation (INPO) reflects this emphasis.

GPU Nuclear's upgrading of the corporate and TMI training program is quite dramatic. It reflects an unreserved determination by GPU management to create a training program second to none in the nuclear industry. The following paragraphs, which are only examples, illustrate the fundamental character of some of the improvements which have been made.

- Organization. With the organization of all nuclear activities of GPU into one company—the GPU Nuclear Corporation—direct responsibility for all nuclear plant training was assigned to the corporate level. The Corporate Director of Training reports to the Vice-President, Nuclear Assurance, a position now filled by the person who was directly responsible for organizing the upgraded training program at TMI. This position of high visibility for training meets the requirement that top management must be involved in and take responsibility for the proper training of nuclear plant personnel. Further, GPU Nuclear management has taken a positive position in favor of improved training facilities and personnel, and requiring the training organization to be accountable for its performance.

- Facilities. A large new training building has been built at TMI with space for 16 classrooms, maintenance training labs, library, staff offices, and modern training aids, particularly in electronic and audio-visual equipment. Further training in maintenance and radiation control is done within the plant itself and in laboratory trailers adjacent to the plant.

- Staff. The training staff, which was only seven in number in 1979, has been expanded to 55, with further increases to 62 planned when the two nuclear simulators are installed at TMI. For operator training, licensed and unlicensed, the staff numbers 15. The remaining personnel are involved in the several other types of training which have been added to make this a complete training facility, such as maintenance, Rad Con, water chemistry, and general employee training.

  Not only has the the number of training staff been increased, but also the quality of the instructors has been given critical attention. Considerable effort has gone into obtaining experienced instructors with background experience in the TMI plants or in other plants of a similar type. At present, four instructors in reactor operator training are licensed by NRC, two as

Senior Reactor Operators (SRO) and two as Reactor Operators (RO). An Instructor Development Program is also in place. One objective is to have five operator instructors licensed as SROs on TMI-1, with completion expected in early 1984. A continuing program is in effect to ensure that the instructors advance in instructional skills and knowledge of their area of specialization.

Similar expansions of staff, an upgraded program, and extensive new facilities were observed at Oyster Creek.

- Operator Training. One of the significant actions taken to enhance operator training by TMI management is the organization of operations personnel into six shifts. This permits training to be given to every operator for one full week in seven, a plan which substantially exceeds NRC training minimums. This is unusual in the industry, and is a good demonstration of the commitment of GPU Nuclear's management to become one of the best in training.

There are other refreshing elements of management involvement in training, such as emphasis on manager-level training in nuclear theory, in the details of plant design, and in operation and maintenance. Managers also participate in the briefing of many of the cyclic training periods for each crew, and have become involved in simulator training at Babcock & Wilcox, Lynchburg, Virginia.

- Entry level training. TMI-1 management is changing its previous emphasis on the hiring of Naval Nuclear experienced personnel to fill vacancies in the operator ranks. They have found that both availability and retention of ex-Navy personnel is not promising in the long run. The competition for them is becoming ever greater as the presently programmed commercial nuclear plants come on line in the next five years. The program which has been started at TMI takes promising entry level operating people directly from high school. They will require two years to become auxiliary (non-licensed) operators and more years to qualify as control-room operators. Once the program is in place, and with careful guidance, it will give stability to that group for many years.

- Simulator training. The program to install two simulators in the training facility at TMI is well underway. Basic Principles Simulators will be delivered in early 1984 to both TMI-1 and Oyster Creek; preparations at each site for using it in training are on schedule. This simulator does not duplicate the physical layout of the plant, but demonstrates its dynamics of operation; students can readily see the effects of changes which they can make at the control board, and become intimately familiar with the principal plant variables, and the relationships between them.

The Replica Simulator for TMI-1, due to be in place at the end of 1984, is a physical duplication of the plant operating console and is controlled by sophisticated computer programs that will faithfully model the fundamentals of plant operations. It will duplicate a very wide variety of transient conditions with accurate representation of what the plant itself will do under the plant conditions and operator actions which are chosen. At the outset, the Replica Simulator will be able to model some 200 plant failure sequences, with the possibility of expanding, through additional programming, to 500 failure sequences.

Two of the most important and significant changes which have been made by General Public Utilities to upgrade the TMI-1 nuclear plant operations have been the formation of GPU Nuclear Corporation, with its centralized mode of management, and the upgraded training program which has been in place there. The management change is, indeed, part of the reason that such a large step increase in training could be made.

The management of the training activity at the TMI-1 plant fully meets the requirement that top managers be directly involved with the training activities in observing classes, setting high standards, providing resources, and monitoring the progress of the program to assure its continued performance and improvement.

(6) Concept of Total Responsibility. Operating nuclear plants safely requires adherence to a total concept wherein all functional elements which support operations are recognized as important and each is constantly reinforced. Even after each support function—technical, training, quality assurance, radiological control, maintenance, etc.—is adequately staffed and trained, they must be effectively integrated if they are to support sound operating decisions.

As pointed out elsewhere in this report, we found that a number of these support functions are believed by present managers to have been inadequately performed at the time of the accident. Beyond these individual inadequacies, we note also that the organization which existed in 1979 made it difficult for support functions to assist operations even if they had been adequate in themselves.

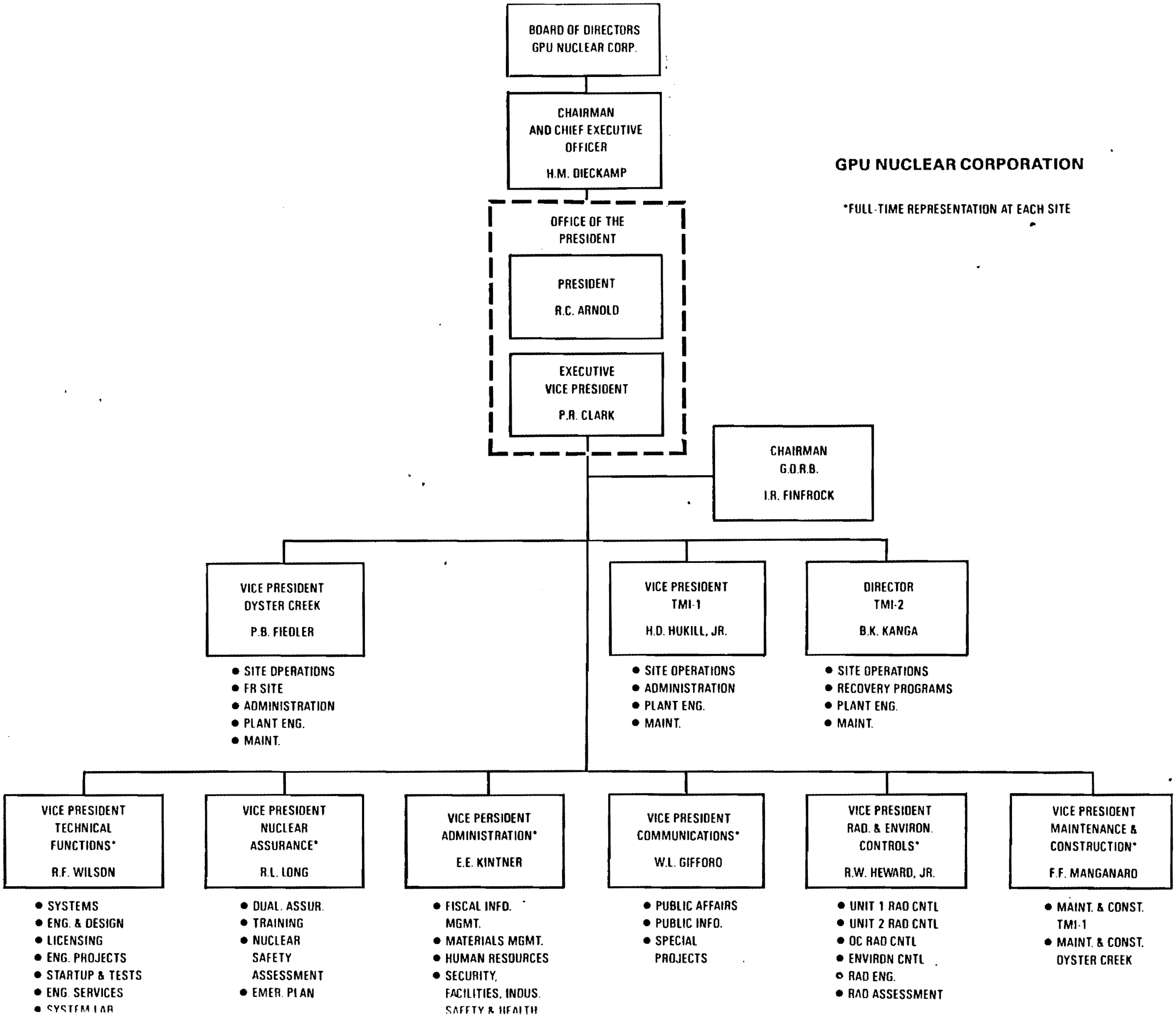
Some of the support required by operations, particularly technical support, was located outside the operating company, partly in GPU Service Corporation and partly in subcontractors, making effective integration all but impossible. In addition, most of the off-site line managers had responsibility for both fossil and nuclear generation and hence were unable to give undivided attention to managing and integrating all of the functions affecting their nuclear plants. Only the Station Manager had undivided responsibility, but he did not have and could not readily call upon all of the required supporting resources.

The inadequacies of the organizational structure existing in 1979 were beginning to be recognized before the accident. Following the accident, GPU took steps to create a single purpose, self-sufficient nuclear operating organization which embodies the concept of total responsibility and has the potential to achieve it. Unlike the 1979 organization, in which three organizational levels separated the off-site President of the operating company from the TMI-1 on-site Superintendent, the present GPU Nuclear organization has the individual responsible to operate TMI-1 reporting directly to the off-site President. The latter has a full range of supporting staffs and only nuclear responsibilities. A current organization chart is shown on the following page.

The concept of total responsibility and the capability to achieve integrated decision-making are enhanced by having all necessary supporting resources available within the GPU Nuclear Corporation, where they report either to the on-site Vice President TMI-1, or to his immediate superior. The support services which report to that immediate superior have on-site units to assure that each service is conveniently accessible at the scene of operation and that it participates effectively in reaching integrated operating decisions.

We believe that the present GPU Nuclear organizational structure is soundly conceived to attain integrated decision-making. The importance which management attaches to the support functions is demonstrated by placing them directly under the President, with Vice-Presidential status. The central importance of Operations and the support which it must have is maintained by assigning an individual of Vice-President level to manage the site and by giving him on-site access to all necessary support.

The views expressed above are evident merely from a careful review of GPU Nuclear organization charts, but charts do not explain how organizations operate in practice. Through intensive interviews, the assessment team looked for objective evidence that the potential for integrated decision-making is actually being realized. We were interested to know whether the on-site units representing corporate level support groups recognize that their sole purpose is to support safe operations. We asked whether the on-site units bring the help of specialized corporate personnel to the site


GPU NUCLEAR CORPORATION
*FULL-TIME REPRESENTATION AT EACH SITE
BOARD OF DIRECTORS GPU NUCLEAR CORP.
CHAIRMAN AND CHIEF EXECUTIVE OFFICER
H.M. DIECKAMP
OFFICE OF THE PRESIDENT
PRESIDENT
R.C. ARNOLD
EXECUTIVE VICE PRESIDENT
P.R. CLARK
CHAIRMAN G.O.R.B.
I.R. FINFROCK
VICE PRESIDENT OYSTER CREEK
P.B. FIEDLER
● SITE OPERATIONS
● FR SITE
● ADMINISTRATION
● PLANT ENG.
● MAINT.
VICE PRESIDENT TMI-1
H.D. HUKILL, JR.
● SITE OPERATIONS
● ADMINISTRATION
● PLANT ENG.
● MAINT.
DIRECTOR TMI-2
B.K. KANGA
● SITE OPERATIONS
● RECOVERY PROGRAMS
● PLANT ENG.
● MAINT.
VICE PRESIDENT TECHNICAL FUNCTIONS*
R.F. WILSON
● SYSTEMS
● ENG. & DESIGN
● LICENSING
● ENG. PROJECTS
● STARTUP & TESTS
● ENG. SERVICES
● SYSTEM LAB
VICE PRESIDENT NUCLEAR ASSURANCE*
R.L. LONG
● QUAL. ASSUR.
● TRAINING
● NUCLEAR SAFETY ASSESSMENT
● EMER. PLAN
VICE PERSIDENT ADMINISTRATION*
E.E. KINTNER
● FISCAL INFO. MGMT.
● MATERIALS MGMT.
● HUMAN RESOURCES
● SECURITY, FACILITIES, INDUS. SAFETY & HEALTH
VICE PRESIDENT COMMUNICATIONS*
W.L. GIFFORD
● PUBLIC AFFAIRS
● PUBLIC INFO.
● SPECIAL PROJECTS
VICE PRESIDENT RAD. & ENVIRON. CONTROLS*
R.W. HEWARD, JR.
● UNIT 1 RAD CNTL
● UNIT 2 RAD CNTL
● OC RAD CNTL
● ENVIRON CNTL
● RAD ENG.
● RAD ASSESSMENT
VICE PRESIDENT MAINTENANCE & CONSTRUCTION*
F.F. MANGANARO
● MAINT. & CONST. TMI-1
● MAINT. & CONST. OYSTER CREEK

and involve them constructively in assisting Operations. We inquired whether the on-site groups are a team, working together to achieve safe operation, or whether they tend to be bureaucratic and self-centered.

From interviews at both stations, we learned that safe operations is recognized to be the central and dominant objective and that doing what must be done to achieve it is more important than who does it or who gets credit. There is a strong sense of "team" at both sites. Numerous examples, a few of which are noted here, show that this is an operative concept:

- At both TMI-1 and Oyster Creek, there is an established practice by which support service managers (quality assurance, radiological control, maintenance, training, etc.) make regular plant tours on the night shifts to see how their procedures are being carried out and to show their interest in operating problems. Written reports are made to the Site Manager.

- TMI-1 has a practice by which senior site managers, including support managers, regularly attend shift turnover meetings. This demonstrates the total responsibility concept.

- We noted that Operations Managers, including the Vice-President, conduct briefings of shift crews during each cyclic training.

- Team attitudes at the operating sites are so strongly developed that Operations Managers derive support from the service groups, while being free of the burden of their administration. This allows Operations Managers to concentrate on operations.

- It was evident to the assessment team that the Concept of Total Responsibility found at the plant sites is reflected also in corporate headquarters. By receiving information from site operations and on-site service units, corporate managers are tightly knit into operating affairs and are enabled to make informed, integrated operating policies and decisions.

The assessment team concludes that the present GPU Nuclear organization, in contrast with the organization in use in 1979, reflects an understanding of the concept of total responsibility and integrated decision-making. We observed that these concepts are practiced at both the station and corporate levels.

(7) Capacity to Learn from Experience. Since we are dealing with people and machines which cannot be made perfect, it is important to recognize that mistakes will be made. We must design machines having tolerance for mistakes, and we must improve them through experience. A capacity to acknowledge mistakes and to search out and correct their underlying causes is essential to nuclear operations.

The assessment team explored two interrelated areas of activity in order to assess GPU Nuclear's capacity to learn from experience. First, we inquired whether management has policies requiring that they be informed regularly of problems discovered at lower levels. Are there clear, accepted methods for reporting problems upward? Are they regularly used, and do individuals perceive a management which not only insists on knowing, but also acts on that knowledge?

Second, we inquired whether management's record of responses to past problems reveals an inclination to apply superficial remedies or whether the record shows diligence in determining and correcting root causes. For this second area, the assessment team examined the actual responses which the company had made to the management lessons of the TMI-2 accident. We used for this test several of the principal management lessons and recommendations found in the Kemeny and Rogovin reports. Our purpose was to note whether the recommendations had been responded to at all, and more importantly, whether the responses were thoroughgoing remedies designed to deal with the root causes of the problems defined.

With respect to the first area, management has instituted a number of practices since the accident whose purpose is to assure that significant problems are identified and reported upward to the required management level for solution. Some of these are described in the following paragraphs:

- Each Station Vice President and each Support Division Vice President sends a personal, bi-weekly Significant Events Report to the President, GPU Nuclear, with copies to the GPU Chairman and the GPU President. These reports are five to ten pages, succinctly written, and emphasize problems.

- Each Station has an established plant procedure for handling unusual operating incidents or findings. These procedures include specific requirements to prepare written reports, investigate causes, review the incident with personnel from all shifts, and incorporate lessons learned in the Operator Training Program. Each such report is also sent for review to the Independent Onsite Safety Review Group.

• Each Station is assigned a Safety Review Manager with a broad charter and full access to monitor safety practices. This manager reports to the Nuclear Safety Assurance Department at corporate headquarters.

• Each Station is assigned a Radiological Assessor with responsibility to observe and monitor radiological control practices. He reports to the Vice-President, Radiological Control, at corporate headquarters.

• TMI-1 has assigned an independent quality assurance engineer on shift to monitor TMI-1 operations and to report his observations outside the operations chain, to the Quality Assurance Manager.

• Finally, with respect to management policies concerning upward reporting of problems, we find that the following quoted passage is instructive. It is taken from an Administrative Procedure titled Conduct of Operations. At TMI-1 the procedure number is 1029, and at Oyster Creek the procedure number is 106. In both cases the same language appears, instructing Shift Supervisors regarding their responsibility to report a potential threat to public safety. The passage follows:

"An essential element of protection of public health and safety is timely notification of State, local, NRC and Company officials in the event of an accident. There should be no reluctance on your part to initiate the notifications called for by the Emergency Plan if conditions indicate a potential threat to public health or safety even if more evaluation is necessary to confirm the existence of such a threat."

The instruction goes on to state certain governing principles:

" • Promptly report all facts and other information concerning plant conditions and the potential threat to the public.

" • Be thoroughly and totally candid, and do not withhold any information.

" • Answer any questions to the best of your ability, whether or not they appear to you to be pertinent to the situation at hand.

" • Make every reasonable effort to convey information so that the recipients have an understanding of the significance of the report including the degree of uncertainty that may exist as to plant conditions and the prospect for further degradation in the situation."

From these examples of current practices and from discussions of upward reporting attitudes during interviews, the assessment team is convinced that GPU Nuclear has established the importance of candid problem-reporting and has effective practices in use which do it.

We turn now to the second area of exploration to ask what kind of actions are taken once a problem is identified, and particularly whether the remedies are thoroughly responsive to the full scope of the problem. This is intended to assess whether, in practice, GPU Nuclear displays a capacity to learn from experience. In the following paragraphs we use examples of some of the principal management-related lessons and recommendations drawn from the Kemeny and Rogovin Reports:

> "Therefore, the industry must also set and police its own standards of excellence to ensure the effective management and safe operation of nuclear power plants." (Kemeny, page 68, para. B.1)

> "...many utilities apparently regarded bare compliance with NRC minimum regulations as more than adequate for safety." (Rogovin, page 90)

The assessment team addressed management's attitude toward exceeding minimum standards in Section III-B(1), titled "Rising Standards of Adequacy." We found that GPU Nuclear consistently sets and polices its own standards of performance, and that in many cases these exceed regulatory requirements.

> "There must be a systematic gathering, review, and analysis of operating experience at all nuclear power plants coupled with an industry-wide international communications network to facilitate the speedy flow of this information to affected parties." (Kemeny, page 68, para B.1.b)

The Institute of Nuclear Power Operations has established two industry-wide information collecting and dissemination systems for operating experience. One is called Significant Event Evaluation and Information Network (SOER). Both TMI-1 and Oyster creek are participating effectively in this program. The other program, designed to collect equipment reliability information, is called Nuclear Plant Reliability Data System (NPRDS). Neither TMI-1 nor Oyster Creek is yet fully operational for routine interactive data entry and use, although both advised the assessment team that they expect to reach that goal with the next few months.

> "We recommend that each nuclear power plant company have a separate safety group that reports to high-level management." (Kemeny, Page 68, para. 3.2)

GPU Nuclear Corporation has established a Nuclear Safety Assurance Department and staff at corporate headquarters, reporting to a Vice President. At each station there is an Independent On-Site Safety Review Group, reporting to Nuclear Assurance at headquarters, and a separate Plant Review Group, reporting on-site, responsible to supervise formal safety reviews of technical specification, operating procedure, or design changes, on behalf of the Station Manager.

In addition, there are high-level General Office Review Boards for each station, having outside as well as inside members, with responsibility to overview, assess, and report to the Chief Operating Officer and the Board of Directors on significant matters affecting safety.

> "...there must be a single accountable organization with the requisite expertise to take responsibility for the integrated management of the design, construction, operation, and emergency response functions, and the organizational entities that carry them out." (Kemeny, pages 68 and 69, para. B.3)

> "We have found an industry in which the expertise and responsibility for safety is fragmented among many parties..." (Rogovin, page 90)

The assessment team has discussed the present "single accountable organization" under the preceding section III-B(6), titled "Concept of Total Responsibility," and has contrasted that organization (GPU Nuclear) with conditions prevailing in 1979. In constructing this present organization, GPU Nuclear has taken full account of the lessons of experience. The organization includes units at headquarters and at each station responsible for operations, technical functions, nuclear safety assurance, radiological controls, maintenance and construction, training, and quality assurance. Managers, technical and professional personnel, and licensed operators now assigned to TMI-1 number 442 persons; at the time of the accident, the corresponding number was 127.

> "The kinds of changes needed...include...new programs for improved operator training...and...that qualified engineer supervisors...will be a part of...every reactor operating shift." (Rogovin, page 90)

> "Each utility should have ready access to a control room simulator. Operators and supervisors should be required

to train regularly on the simulator." (Kemeny, page 71, para 3.d)

GPU Nuclear's response to these lessons and recommendations are:

New, well-equipped, contiguous training centers have been constructed at both TMI-1 and Oyster Creek. Basic Principles Simulators are on order for each station, a Replica (control room) Simulator is on order for TMI-1, and a Replica Simulator is in budget plans for Oyster Creek.

Shift Technical Advisors, each a degreed engineer, are assigned to each operating shift.

The assessment team believes that GPU Nuclear practices effective upward problem reporting. The management has demonstrated the capacity to learn from past experience and continues to learn from experience. The assessment team found abundant evidence that this vital operating principle is understood and practiced at all levels.

IV. Conclusions and Recommendations.

A. Conclusion. Based on the assessment of the GPU Nuclear Corporation organization and its senior management as reported herein, the team concludes that GPU Nuclear Corporation has the management competence and integrity to safely operate the TMI-1 plant.

B. Recommendations. In the course of the investigation, several items were observed which, if adopted, would enhance the operation of the TMI-1 plant. While they are not considered necessary prior to restart, the team recommends they be adopted.

1. GPU Nuclear should devise a plan to upgrade the operation and support of the TMI-1 and Oyster Creek plants, to achieve a ranking in the top one-sixth of all commercial nuclear plants in the Institute of Nuclear Power Operations (INPO) evaluations. Milestones should be set in each area and progress measured against these milestones.

2. GPU and GPU Nuclear senior management should become technically informed and personally familiar with conditions at the operating plant. They should visit the plants frequently, at irregular hours, inspect selected portions, and leave a written record of what they observed and how long they remained.

3. Some personnel in the TMI-1 Training Department responsible for training licensed operators are not yet qualified Senior Reactor Operators. We recommend that these personnel complete qualification procedures as soon as possible.

4. GPU Nuclear should continue to reduce its dependence on the use of consultants. The organization should become self-sufficient to the point where use of such personnel would be necessary only in special circumstances where development of in-house capability could not be justified.

5. The general announcing system for the TMI plant distracts personnel in the control room. The system should be modified to significantly reduce these broadcasts to the control room. This will prevent distraction of operators from their primary duties. Also, too many people are in the control room. Only those essential to the operation of the plant should be there. Instructions to this effect should be posted and complied with.

APPENDIX A

DOCUMENTS REVIEWED

1. Organizational Plan, GPU Nuclear Corporation.

2. Biographies of all senior officials of the GPU Nuclear Corporation.

3. Letter from Mr. H. M. Dieckamp, dated September 12, 1980, initiating the GPU Nuclear Corporation.

4. Results of Faegre & Benson Investigation of Hartman Allegations, dated September 17, 1980.

5. Testimony of Mr. R. C. Arnold before the Atomic Safety and Licensing Board (ASLB) in December 1980.

6. GPU Accident Task Force, Final Summary Report, dated December 15, 1980.

7. Metropolitan Edison memo, "Off Shift Tours by Senior Management," dated January 20, 1981.

8. ASLB Partial Initial Decision (Procedural Background and Management Issues), dated August 27, 1981.

9. ASLB Report of the Special Master, dated April 28, 1982.

10. ASLB Partial Initial Decision, dated July 27, 1982.

11. GPU Nuclear's Operational Quality Assurance Plan for TMI-1 and Oyster Creek, dated September 1, 1982.

12. Memorandum on Management Escalation Program for Quality Assurance Deficiencies, dated October 4, 1982, signed by H. Hukill and B. K. Kanga.

13. Report of the Nuclear Regulatory Commission (NRC) Systematic Assessment of Licensee Performance (SALP) of TMI Unit 1, dated November 22, 1982.

14. GPU Annual Report for 1982.

15. TMI Fact Book, dated February 7, 1983.

16. Basic Energy Technology Associates (BETA) Report on GPU Nuclear, dated February 28, 1983.

17. Institute of Nuclear Power Operations (INPO) Evaluation of Oyster Creek Nuclear Generating Station, dated March 1983.

18. Affidavit by R. Parks, March 1983.

19. Rohrer, Hibler, and Replogle, Inc. (RHR) Consultation with GPU Nuclear Management, dated March 15, 1983.

20. GPU Nuclear Corporation Audit Report S-TMI-83-02, Safety Review Program, dated March 21, 1983.

21. News Release on R. Parks (by Government Accountability Project [GAP]), dated March 22, 1983.

22. GPU Nuclear Corporation Audit Report S-TMI-83-03, TMI-1 Drawing Control, dated March 22, 1983.

23. Memo responses to Audit S-TMI-83-03, dated April 13, 1983.

24. Prepared Statement of R. Parks, dated April 22, 1983.

25. Letter to Secretary of Labor from Thomas Devine, GAP, re: Parks, dated April 22, 1983.

26. Griebe-Lowe Report on King Allegations, dated April 25, 1983.

27. Those portions of the Statements of GPU Nuclear Corporation before the Subcommittee on Energy and the Environment of the Committee on Interior and Insular Affairs, U.S. House of Representatives, Washington DC, made April 26, 1983, discussing the status and actions required for TMI Unit 1 restart.

28. Congressional Testimony of Lawrence P. King, dated April 26, 1983.

29. Prepared Statement by L. P. King, dated April 26, 1983.

30. Report of Joint NRC Headquarters/Regional Inspection of TMI-1, No. 50-289/83-10, made April 20-28, 1983, to evaluate the effectiveness of GPU actoins to ensure adherence to procedures at TMI Unit 1.

31. "Nuclear Personnel Training After TMI-2: The GPU Nuclear Response," by R. L. Long, et al., dated May 1983.

32. Evaluation by the INPO of TMI Unit 1, made May 9-16, 1983.

33. RHR Clarifying Letter to GPU Nuclear, dated May 13, 1983.

34. BETA Clarifying Letter to GPU Nuclear, dated May 13, 1983.

35. GPU Response to Griebe-Lowe Report, dated June 8, 1983.

36. TMI-1 General Office Review Board (GORB) Restart Review Subcommittee Final Report, dated June 10, 1983.

37. H. M. Dieckamp letter to NRC Chairman N. J. Palladino, dated June 10, 1983.

38. Memorandum from NRC Commissioner V. Gilinsky for the Parties in the Three Mile Island Unit 1 Proceeding, dated June 22, 1983.

39. NRC Memorandum on Licensee's Obligation to Report the BETA and RHR reports, dated June 22, 1983.

40. TMIA Interim Comments on Babcock & Wilcox Trial Record, dated July 1, 1983.

41. Memo responses to Findings 2, 4, and 12 of Audit Report S-TMI-83-02, dated July 12, 1983.

42. Memorandum concerning Technical Function Safety Reviewers, dated July 13, 1983.

43. H. M. Dieckamp response to letters from Sen. J. Heinz (Pennsylvania) and Rep. Goodling concerning Restart of TMI-1, dated July 13, 1983.

44. TMI-1 Restart Readiness Prerequisite Listing, Rev. 3, dated July 21, 1983.

45. GPU Nuclear Response to BETA recommendations, dated July 26, 1983.

46. GPU's response to Commissioner V. Gilinsky's memorandum, dated August 4, 1983.

47. Interim Report, GORB OTSG Subcommittee, dated August 16, 1983.

48. GPU Nuclear Corporation Audit Report S-TMI-83-07, Corrective Action Program, dated August 16, 1983.

49. Interim Report concerning OTSG Repair, dated August 18, 1983.

50. Monthly report of Quality Assurance Manager to Vice-President/ Director of TMI-1, dated September 1983.

51. TMI-1 Steam Generator Repair Safety Evaluation Report, NUREG-1019, dated September 1, 1983.

52. NRC Interim Report of TMI-2 Allegations regarding Safety Related Modifications and Quality Assurance Procedures, dated September 1, 1983.

53. NRC Report of Investigation regarding Parks Allegations, TMI-2, dated September 7, 1983.

54. TMI-1 Administrative Procedure No. 1029, Rev. 11, Conduct of Operations, dated September 15, 1983.

55. GPU Nuclear Response to TMIA Interim Report, dated September 22, 1983.

56. Letter from Edwin H. Stier to R. C. Arnold, re: Parks, King, Gischel, dated September 23, 1983.

57. GPU v. Babcock & Wilcox Lawsuit Review and Its Effect on TMI-1, NUREG 1020 (draft), dated September 28, 1983.

58. Memorandum from Commissioner V. Gilinsky to the Commissioners concerning the Future of Three Mile Island Unit 1, dated September 28, 1983.

59. NUREG 1020, Public Version, GPU v. Babcock & Wilcox, dated October 1983.

60. TMI Quality Assurance Organization Chart, Rev. 2, dated October 3, 1983.

61. NRC Memorandum on Its Review of GPU v. Babcock & Wilcox Lawsuit, dated October 3, 1983.

62. Licensee's Response to Commission Order of October 7, 1983, with 11 attachments.

63. NRC Order to Stay Hearing on Hartman, dated October 7, 1983.

64. NRC Notice to the Parties concerning time to complete review of issues that might affect decision to restart TMI-1, dated October 7, 1983.

65. GPU's Response to NUREG 1020 (by H. M. Dieckamp), dated October 14, 1983.

66. GPU Nuclear's TMI 1983 Annual Quality Assurance Assessment, dated October 17, 1983.

67. Organization Chart, TMI Training, dated October 17, 1983.

68. TMI-1 Plant Status Report for period October 15-28, 1983, H. Hukill to R. C. Arnold/P. R. Clark, dated November 1, 1983.

69. Memo, Licensed Instructors for TMI-1 Operator Training, dated November 1, 1983.

70. "Quality Assurance Verification of Important to Safety Plant Activities," J. C. Fornicola, B. E. Ballard, presented at Tenth National Conference, ASQC.

71. "Important to Safety and the Graded Approach," B. E. Ballard and N. C. Kazanas (undated).

72. GPU Nuclear Radiological and Environmental Controls Organization Plan (undated).

73. Position Descriptions: Radiological Engineering Manager, Radiological Engineer, and Radiological Assessor.

74. Estimated Resources (Personnel) Applied to TMI-1 as of 3/79, dated October 21, 1983.

75. GPU Nuclear Corporation Organizaton Chart showing Resources (Personnel) Applied to TMI-1, as of June 27, 1983.

76. Oyster Creek Operating Procedures
    No. 105—Conduct of Maintenance, Jan. 7, 1983
    No. 106—Conduct of Operations, June 16, 1983
    No. 106.4—Conduct of Radwaste Operations, Feb. 16, 1983
    No. 106.5—Plant Status Control, Feb. 16, 1983
    No. 106.6—Conduct of Chemistry Operations, June 1, 1983
    No. 107—Procedure Control, Apr. 14, 1983
    No. 108—Equipment Control, Jan. 7, 1983
    No. 108.1—Radwaste, Off Gas and Boiler House Equipment Control, Jan. 27, 1983
    No. 124—Plant Modification Control, Oct. 18, 1983

77. INPO Memorandum Report, Visit to Oyster Creek Nuclear Generating Station, dated October 26, 1983.

78. GPU Nuclear Status Report for Oyster Creek INPO Evaluation, Memo signed by P. B. Fiedler, dated October 25, 1983.

79. Organization Chart, Oyster Creek Quality Assurance Unit.

80. Organization Chart, Oyster Creek Training Department.

81. Organization Table, Oyster Creek Division, GPU Nuclear.

82. INPO Follow-Up on INPO Programs, CEO Workshop, dated September 1983.

83. GPU Nuclear "R" and "NR" Certification by the National Board of Boiler and Pressure Vessel Inspectors, dated April 5, 1983.

84. Corporate In-Service Inspection (ISI) Program Draft, dated October 24, 1983.

85. Corporate Weld Program and GPU Nuclear Welding Manual, dated February 1983.

86. TMI Administrative Procedure 1042, Control of Welding, dated March 3, 1983.

APPENDIX B

PERSONS INTERVIEWED

GPU NUCLEAR MANAGEMENT

R. C. Arnold
President and Chief Operating Officer (GPU Nuclear)

T. G. Broughton
Director, Systems Engineering

P. R. Clark
Executive Vice President

H. M. Dieckamp
Chairman and Chief Executive Officer (GPU Nuclear)

R. W. Heward
Vice-President/Director, Radiological & Environmental Controls

N. C. Kazanas
Director, Quality Assurance

R. W. Keaten
Director, Engineering Projects

E. E. Kintner
Vice-President/Director, Administration

W. G. Kuhns
Chairman and Chief Executive Officer (GPU)

R. L. Long
Vice-President/Director, Nuclear Assurance

F. F. Manganaro
Vice-President/Director, Maintenance & Construction

R. N. Whitesel
Vice-Chairman, General Office Review Boards, and Manager, Nuclear Safety Assurance Department

R. F. Wilson
Vice-President/Director, Technical Functions

TMI-1 MANAGEMENT

B. E. Ballard
Manager, Quality Assurance

E. J. Brown
Administrative Support, Training

R. Campbell
Reactor Operator

J. J. Colitz
Plant Engineering Director

R. F. Fenti
Quality Control Manager

R. R. Harper
Corrective Maintenance Manager

H. D. Hukill
Vice-President, TMI-1

C. A. Irizarry
Simulator Development and Training

G. A. Kuehn
Manager, Radiological Controls

B. P. Leonard
Operator Training Manager

M. A. Nelson
Plant Review Group Chairman

S. L. Newton
Manager, Plant Training

L. G. Noll
Shift Supervisor

V. P. Orlandi
Lead I&C Engineer

M. J. Ross
Manager, Plant Operations

O. J. Shalikashvili
Deputy Manager, Plant Training

R. P. Shaw
Radiological Engineering Manager

D. M. Shovlin
Manager, Plant Maintenance

D. Smith
Senior Reactor Operator

M. G. Snyder
Preventive Maintenance Manager

R. J. Toole
Manager, Operations and Maintenance

R. W. Zechman
Technician Training Manager

W. H. Zewe
Radwaste Operations Manager

OYSTER CREEK MANAGEMENT

Frank Ciganik
Group Shift Supervisor

P. B. Fiedler
Vice-President, Oyster Creek

David Gaines
Manager Plant Training

Edward Growney
Safety Review Manager

Thomas Lonsdale
Control Room Operator

J. P. Maloney
Manager Plant Material

Ray Markowski
Manager Site Audit

Robert McKeon
Manager Plant Operations

William Popov
Manager of Maintenance and Construction

Clark Tracy
Quality Assurance Manager

Douglas Turner
Manager Radiological Control

W. J. Smith
Plant Engineering Director

J. L. Sullivan, Jr.
Plant Operations Director

APPENDIX C

ASSESSMENT TEAM MEMBERS

James M. Dunford

Consultant. Pioneer in Navy nuclear propulsion program from 1946 to 1965. Participated in USS Nautilus and USS Seawolf design and Nautilus prototype construction at Arco, Idaho. Six years Deputy Assistant Director Naval Reactors, Atomic Energy Commission, responsible under the Assistant Director for all training matters in the Naval nuclear program. Member of Advisory Board for Oak Ridge School of Reactor Technology. Recording Secretary for Atomic Energy Commission's Reactor Safeguards Committee, Dr. E. Teller, Chairman. Two years Special Assistant to Atomic Energy Commissioner Thomas E. Murray for commercial nuclear power matters; Vice-President of New York Shipbuilding Company, responsible for building and testing three submarines and a cruiser for the U.S. Navy. Professor of Mechanical Engineering (Nuclear Power), University of Pennsylvania. Technical Director, Naval Air Engineering Center, Philadelphia, Pennsylvania.

B.S., U.S. Naval Academy, 1939; S.M., Naval Construction and Engineering, Massachusetts Institute of Technology, 1944; Graduate, Oak Ridge Training School, 1947.

Jack C. Grigg

Graduated Texas Tech University with B.S. in Electrical Engineering, 1941. Employed Westinghouse Electric Corporation in design of electric equipment, 1941-42. Employed in Electrical Branch, Navy Bureau of Ships, under supervision of then Commander H. G. Rickover, in design of electric control equipment for ships, 1942-52. Employed as Director, Nuclear Control and Instrumentation Division, Bureau of Ships, and Chief, Nuclear Controls and Instrumentation Branch, Naval Reactors Division, U.S. Atomic Energy Commission, responsible for all aspects of instrumentation and control for nuclear propulsion plants for Navy ships and the Shippingport Atomic Power Station, 1952-78. During this period, participated in the interviews of hundreds of Navy officers being selected to enter the nuclear propulsion program; headed teams of Naval Reactors personnel conducting examinations of ships engineering personnel; acted as principal assistant to Admiral Rickover in conducting initial sea trials of nuclear ships. Self-employed as Consulting Engineer, 1979 to date. Participated in design reviews of overall plant control of the Clinch River Liquid Metal Fast Breeder Reactor Plant. Participated in review of and made recommendations for the correction of scram circuit breaker problems in the Salem Nuclear Power Station.

Robert V. Laney

Consultant, Energy Project Management; former Deputy Director, Argonne National Laboratory; Vice-President and General Manager, Quincy Shipyard Division, General Dynamics; Atomic Energy Commission and Bureau of Ships Technical Representative at Westinghouse Bettis Atomic Power Laboratory; Project Manager, Naval Reactors Program, Atomic Energy Commission and Bureau of Ships. Ch. Engineering Review Team, Washington State Public Power Supply System; Member Commonwealth Edison Ad Hoc Advisory Committees on Three Mile Island; Consultant, Design Verification, Houston Lighting and Power Company; Ch. Technical Audit Associates Design and Construction Audit Team, WPPSS WNP-2. Consultant Battelle Northwest Laboratories; Department of Energy; Argonne National Laboratory.

B.S., U.S. Naval Academy; M.S., Massachusetts Institute of Technology; M.B.A., University of Chicago.