UNION OF CONCERNED SCIENTISTS

1346 Connecticut Avenue, N.W.
Dupont Circle Building, Suite 1101
Washington, D.C. 20036

(202) 296-5600

Testimony of

ROBERT D. POLLARD and STEVEN C. SHOLLY

On Behalf of

THE UNION OF CONCERNED SCIENTISTS

Before the

SUBCOMMITTEE ON ENERGY AND THE ENVIRONMENT

COMMITTEE ON INSULAR AND INTERIOR AFFAIRS

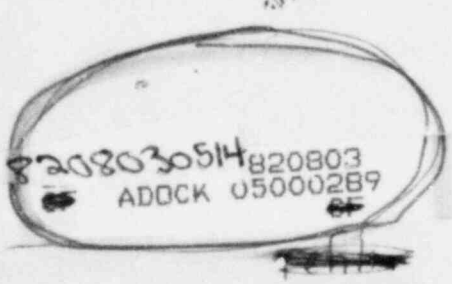
UNITED STATES HOUSE OF REPRESENTATIVES

CONGRESSMAN MORRIS K. UDALL, CHAIRMAN

March 29, 1982

Middletown, Pennsylvania

XA



Massachusetts Office: 1384 Massachusetts Avenue • Cambridge, MA 02238 • (617) 547-5552

Mr. Chairman, members of the Committee, and guests, thank you for the opportunity to testify on the important subject of the safety, or lack thereof, of the two nuclear power plants on Three Mile Island. You are to be commended for hearing directly the concerns of the people who face the risks posed by the Three Mile Island plants.

The Union of Concerned Scientists is an organization of scientists, engineers and other professionals supported financially by over 120,000 members of the public throughout the United States. In early 1980, Governor Richard Thornburgh asked UCS to conduct an independent study of the hazards posed by the presence of radioactive krypton gas in the TMI-2 containment and to evaluate alternative methods for removal of the gas. In addition, UCS was represented on a panel formed by the Environmental Protection Agency at the request of citizens in this area to review the NRC's environmental impact statement on the TMI-2 cleanup.

UCS is also an active participant in the NRC hearings concerning the possible restart of Three Mile Island Unit 1, on behalf of those of our sponsors who live in the area. Steven C. Sholly, a long-time resident of central Pennsylvania and a member of UCS's staff since early 1981, has also participated actively in the TMI-1 restart hearing as an individual.

UCS is continuing its evaluation of the adequacy of NRC's post-TMI requirements and their implementation. We hope to complete a book-length report on the NRC's response to the TMI accident in a few months. The book will trace the development of the TMI Action Plan, illustrate the extent to which NRC has implemented and enforced the "lessons learned" requirements, and present UCS's recommendations for action to ensure that those safety requirements do not become the "lessons lost."

Our testimony today addresses the safety status of Three Mile Island Units 1 and 2. While relying partially on some of the information obtained during our research for the forthcoming book, this testimony is based primarily on our participation in the NRC Licensing Board hearings on the restart of Unit 1 and our continued monitoring of the Unit 2 cleanup process. Given the time available today, we will not attempt to present detailed examples of a technical nature. Instead, we wish to bring to your and the public's attention the gamesmanship and, in some cases, misconduct that have precluded a reasoned decision-making process to determine whether TMI-1 should be permitted to restart.

RESTART OF TMI-1: IS IT SAFE?

UCS and Mr. Sholly have been the principal members of the public to raise design-related safety issues in the restart hearings. Other parties to the proceeding have raised important issues concerning the utility's management, operator training, and emergency planning. It is important to recall that, in ordering these hearings, the Commission stated that because of the accident at TMI-2, it "presently lacks the requisite reasonable assurance that the same Licensee's Three Mile Island Unit No. 1 facility, a nuclear power reactor of similar design, can be operated without endangering the health and safety of the public".[1] The Commission ordered TMI-1 to remain shut down until it determined whether the actions proposed to be taken at that unit were sufficient to provide adequate protection for the public health and safety.[2]

The Commission expected a Licensing Board decision within 335 days, i.e. in the fall of 1980. The Commission's estimate of the hearing's length was equally remarkable in its lack of accuracy -- 60 days. The hearing did not actually begin until October 1980, and some issues are still pending before the Licensing Board. Other issues are presently on appeal and the Commission has yet to render a decision on whether and under what conditions restart will be permitted.

This deviation from the Commission's original schedule was not caused by the use of dilatory tactics by the public intervenors. Instead, the delays were primarily the result of the NRC staff's inability to produce its safety evaluation report on the proposed restart of TMI-1 until June 1980 (supplements continued to be issued through early 1981)[3], the need to reopen the hearing after cheating occurred during the TMI-1 operator licensing exams, and the time necessary for the Licensing Board to review the lengthy evidentiary record and write a decision. Any "delay" attributable to the public's participation in the hearing was the result of the large number of valid, complex safety issues raised by the TMI-2 accident. It should be noted that but for the public's participation in the restart proceeding, many of these safety issues would not have been addressed.

In the meantime, the utility that showed the world how to destroy an operating nuclear power plant has earned the dubious distinction of demonstrating that it can also severely damage a plant that was already shut down. Investigations are underway to determine the extent of damage to the TMI-1 steam generators and the remainder of the reactor's primary cooling system, which was apparently caused by the introduction of sulfur into the system.

But for these "technical difficulties" (in NRC Chairman Palladino's euphemistic phrase), we believe that NRC would have already authorized restart. We are convinced, however, that such a decision could not have been based on a careful, complete, and objective review of the serious safety hazards at TMI-1. In UCS's view, restart of TMI-1 in the condition proposed by GPU and the NRC staff would subject the residents of this area to an undue risk to their health and safety.

UCS has described some of the inadequacies of the restart hearings in letters to Governor Thornburgh dated October 19, 1981, and January 26, 1982. We have to date received no response from the Governor, although on November 20, 1981, he urged the NRC to "conduct a careful and objective review" of the concerns raised by UCS and Representative Udall in an earlier letter.

Water Level Instrumentation: A Central Issue

One of the issues we addressed in our latest letter to Governor Thornburgh was the lack of instrumentation to measure the water level in the TMI-1 reactor vessel. Chairman Udall also addressed this issue in his letter to Governor Thornburgh dated July 23, 1981.

The subject of instrumentation to measure water level in the reactor vessel has been a major issue in the TMI-1 restart proceeding, as well as a prime area of concern for every other pressurized water reactor since the TMI-2 accident. The lack of such instrumentation in TMI-2 was the fundamental reason why the reactor operators took what was, in retrospect, exactly the wrong action by shutting off the emergency cooling system. The controversy that has

surrounded the need for such instrumentation is, in UCS's view, largely contrived. While opposition arguments have been couched in terms relating to safety, the real source of opposition stems from concerns about cost and schedule and a reluctance to admit that accidents involving multiple equipment and human failures can occur, as already demonstrated at TMI-2. An internal NRC staff memo addressing certain Advisory Committee on Reactor Safeguards (ACRS) concerns on this subject makes the following points:[3]

1) It should be remembered that the requirement for reactor water level instrumentation was suggested by most, if not all, of the organizations that reviewed this aspect of the TMI-2 accident, especially the ACRS which insisted upon the need to install water level instrumentation.

2) There is no general disagreement today on the utility of reactor water level instrumentation.

3) "The staff believes that the ACRS concerns primarily reflect the expressed views of applicants and licensees."

4) Opposition to water level instrumentation has given little cognizance to the fact that the intended purpose of this instrument is to provide in-depth protection against unpredictable accident scenarios involving multiple failures.

Remarkably, despite the strength of these conclusions, the NRC staff supports restart of TMI-1 without requiring such instrumentation to be installed.

Restricted Scope of the Restart Hearing

The Commission legalistically restricted the issues that could be raised in the restart hearings to those with a "direct nexus" to the accident at TMI-2. Whether an issue had an acceptable relationship to the accident depended to a large extent on who raised it. The NRC staff raised issues relating to the safety consequences of a loss of offsite electrical power, even though offsite power was not lost during the accident. UCS, on the other hand, was prohibited from raising the issue of inadequate hydrogen control systems, even though substantial hydrogen control problems arose during the TMI-2 accident. UCS was also prohibited from raising long-standing unresolved safety problems such as fire protection on the ground that no fires occurred during the accident. It is apparently NRC's position that these safety problems cannot be publicly examined until they happen to cause an accident.

Evidence relating to steam generator tube ruptures, offered by UCS, was also rejected by the Licensing Board on the similar ground that a tube rupture did not occur during the accident. (This is somewhat ironic considering the current condition of the TMI-1 steam generators.) After a steam generator tube rupture, the operator should immediately attempt to depressurize the reactor below the pressure at which the steam generator safety relief valves open. Because of the tube break, opening of these valves would result in discharging radioactive steam to the environment. The pressurizer relief valve (which stuck open during the TMI-2 accident) is used to depressurize the reactor in such a situation. By refusing to consider accidents involving rupture of a steam generator tube, the TMI-1 Licensing Board did not examine the role of the pressurizer relief valve in such accidents. The January 1982 accident at the Ginna plant in upstate New York and the NRC staff's evaluation of that accident[4] have since amply confirmed the importance of the pressurizer relief valve in protecting the public during a steam generator tube rupture accident.

In sum, by restricting the scope of the hearing, the NRC has effectively decided not to consider safety problems at Three Mile Island Unit 1 because they did not cause the Unit 2 accident and have not yet caused an accident in Unit 1.

Qualifications of NRC Witnesses

Another defect in the restart hearings was that the NRC staff witnesses were often ill-qualified on the relevant subjects and had little technical understanding of the sequence of events at TMI-2 and their safety implications. UCS has since discovered an internal NRC staff document indicating that NRC's own Director of Licensing shares this opinion. The memo, written and widely distributed to senior staff officials just four days before some NRC testimony was filed, admits that some NRC witnesses "appear not to be entirely knowledgeable and qualified."[5] This is one NRC statement with which UCS fully agrees. Unfortunately, the NRC failed to inform the Licensing Board that its witnesses were not knowledgeable and qualified.

In one instance, the staff witness did not attempt an in-depth analysis of the Unit 2 accident. Instead, the witness relied on a computer analysis purporting to show that the reactor fuel will be adequately cooled in a future accident. This computer analysis was based on the assumptions that the operator will not make a mistake such as shutting off emergency cooling, that delivery of emergency feedwater to the steam generators will not be lost, and that no substantial quantities of hydrogen will be formed.[6] Of course, all these are precisely what did occur during the TMI-2 accident.

Another staff witness admitted under oath that his testimony was not based on an evaluation of the TMI-2 accident and its implications, and that his testimony was the same as it would have been if the TMI-2 accident had never occurred.[7]

A third NRC witness had no prior substantive involvement in reviewing any safety system for any operating nuclear power reactor. When cross-examined on the testimony of other NRC staff witnesses that contradicted his testimony, this witness called that testimony "careless". In another instance, this staff witness had to consult with colleagues by telephone when he was "taken aback" by some of the wording of NRC's regulations.[8]

"Cooperation" Between the NRC Staff and the Licensee

The positions of the NRC staff and GPU (on both matters of substance and questions of law) were often virtually indistinguishable; one merely echoed the other. In part this resulted from close cooperation between the NRC staff and GPU.

This cooperation went so far that on March 13, 1981, the NRC staff called a meeting at GPU's request, during which the attorneys and technical staff of both NRC and GPU rehearsed GPU's cross-examination of the NRC staff witnesses who testified only five days later. The obvious purpose of this exercise was to ensure that both the NRC staff and GPU had their "stories straight" before appearing in front of the Licensing Board.

You may recall the description of the NRC licensing review process written by the NRC's Special Inquiry Group (the "Rogovin Report"), which concluded that as a result of "a substantial amount of informal consultation between the NRC staff and the applicant" before the issues reach the Licensing Board, the formal

hearings become a "ritualistic process, the result of which is effectively predetermined."[9] Apparently little at NRC has changed since that report was written.

The NRC staff and GPU also cooperated in attempts (often successful) to prevent information disputing their testimony from being entered into evidence. For example, the Board refused to admit the information provided to the NRC staff by GPU, and the NRC staff's own safety evaluation of that information, concerning the ability of safety equipment in TMI-1 to operate successfully under the temperature, pressure, radiation, and other conditions of an accident. In other instances, both the NRC staff and GPU opposed the introduction into evidence of their own documents on the specious ground that the intervenors had no witnesses to support the introduction of the documents. This tactic was frequently successful irrespective of the safety significance of the issues discussed in these documents.

Failure to Promptly Inform the Board and the Parties of New Information Relevant to the Hearing Issues

Many documents have recently come to our attention which show that NRC staff testimony on crucial safety issues was incomplete, misleading, or just plain wrong. The NRC staff, satisfied with "winning" the case, has not brought this information to the attention of the Licensing Board. Five examples stand out:

1) The formation of a steam bubble in the reactor or the primary cooling system which can interfere with cooling was litigated extensively. The evidence submitted was that for most small break loss of coolant accidents like the TMI-2 accident, a steam bubble will be formed and block natural circulation of the water. GPU and NRC staff witnesses assured the Board that this phenomenon was well understood and would cause no difficulty. However, long after this testimony was submitted and just a week before the Board's decision was issued, GPU provided the NRC staff with new information that was not brought to the attention of the Board and the other parties. The NRC staff had requested GPU to demonstrate "that controlled natural circulation cooldown from operating conditions to cold shutdown conditions, conducted in accordance with your [TMI-1] procedures, should not result in reactor vessel voiding." GPU's response was that cooldown of the plant will result in the formation of steam voids in the reactor vessel. Moreover, GPU also stated that due to the complexity of the problem, it is not possible with current computer models to predict either the occurrence or the behavior of such a steam bubble. GPU informed the NRC staff that it is "considering" the installation of additional instrumentation "so that the operator can anticipate void formation and respond accordingly," but GPU apparently does not intend to install these instruments before restart.[10]

2) The NRC staff also failed to notify the Board and parties of its conclusions regarding the "feed-and-bleed" and "boiler-condenser" cooling modes for the reactor. These core cooling schemes were heavily relied upon by the NRC staff, GPU, and the Board in concluding that TMI-1 is safe enough to restart. We have since discovered NRC staff documents noting that "there is a large uncertainty in the probability of successful cooling using feed-and-bleed,"[11] and that while core cooling in the boiler-condenser mode "might be possible . . . it seems unlikely."[12] This information is consistent with UCS's testimony in the hearing, but the NRC staff expressed no such reservations to the Board.

3) Another early concern of the NRC staff centered on those features of the TMI-1 design that would be used "to allow manual opening of the PORV [pilot-operated relief valve] during a feed-and-bleed mode of cooling."[13] The staff found the original design unacceptable, and GPU assured the NRC that it would modify the design. Despite this behind-the-scenes concern about the reliability of the PORV when used for feed-and-bleed cooling, both GPU and the NRC staff testified in the restart hearing that the PORV is not important to safety because it does not need to be used during feed-and-bleed cooling.

4) The TMI Action Plan (NUREG-0660) lists the safety improvements stemming from the TMI-2 accident that are required to be implemented at all nuclear power plants. The schedule in the TMI Action Plan heavily influenced the Licensing Board's determination on whether the safety improvements should be implemented prior to restart or could be delayed. However, an internal NRC document obtained by UCS in response to a FOIA request reveals that when the Commissioners approved the Action Plan in May 1980, the plan contained no safety rationale for the requirements and the NRC staff had no safety rationale to present.

This document shows that, six weeks after the Action Plan was approved by the Commissioners, the NRC Executive Director for Operations asked the NRC staff to develop a safety rationale for the Action Plan requirements. The specific information the Executive Director wanted was a discussion of "the basis for each requirement in terms of safety significance", "why the requirement or other action is needed", "why the particular approach was selected and other approaches were not", "why the requirement is sufficient in both scope and timing", and "the safety bases for deferring the possible safety improvement."[14] The Action Plan supposedly represents NRC's coherent, industry-wide response to the TMI accident. It is remarkable that only after the Action Plan was completed and approved did NRC's Executive Director turn his attention to such fundamental questions as the safety basis for each requirement and the reasons for not requiring certain safety measures.

UCS agrees that such information is necessary. However, neither the lack of a safety rationale for the Action Plan nor the eventual responses to the EDO's directive were ever brought to the attention of the Licensing Board and parties. Had the Board and parties known that the NRC staff was still developing a safety basis for the requirements and their implementation schedules, the Action Plan certainly would not have been accorded so much weight in the Board's decisions.

5) A final example, one which is presently requiring the Board to decide whether the hearing should be reopened, is the report of the Office of Inspection and Enforcement team which conducted the TMI-2 accident investigation.[15] This NRC team recommended a series of design-related modifications, a number of which were identical or similar to the positions advanced in the restart hearings by UCS and Mr. Sholly. The NRC staff did not produce this report during the discovery phase of the proceeding, despite interrogatories that called on NRC to identify any staff members who disagreed with the staff's formal position. As a result, the Board was unaware that some members of the NRC staff agreed with the design changes recommended by UCS and Mr. Sholly until after the hearing record was closed.

Alteration, Deletion, and Substitution of NRC Staff Testimony

In some ways most disturbing is an apparent pattern of altering, deleting or replacing the testimony of NRC staff witnesses who otherwise would have supported or (in some cases) agreed entirely with the independent technical analysis in UCS's testimony. This pattern is emerging from our current review of early versions of the staff's testimony that we recently obtained. In some instances the testimony was changed before being served; in other instances the testimony was not submitted at all because a different witness with different testimony was used instead.

For example, final testimony prepared by an NRC supervisor, including revisions suggested by the same NRC attorney who later introduced a different (and in UCS's view unqualified) witness, states that "[t]he term 'safety-grade components' which I use in this testimony should be considered synonymous with 'components important to safety'"[16] To anyone familiar with the extent to which this subject pervaded the restart hearing, it is clear that this testimony would have been exactly the same as UCS's testimony, and that it directly contradicts the testimony actually presented at the hearing by the NRC staff.

Another NRC staff witness prepared testimony concluding that TMI-1 meets General Design Criteria 34 and 35. These two NRC safety regulations impose safety requirements on the decay heat removal and emergency core cooling systems. Three weeks later, in a note to his supervisor listing "questions . . . for which I do not have ready answers", this same NRC witness wrote: "1. Does TMI-1 meet the staff's current interpretation of GDC 34? 2. Does TMI-1 meet the staff current interpretation of GDC 35?"[17] This episode points up the staff's apparent practice of picking witnesses who don't know enough to know what's true.

Quality of the Licensing Board's Decision

In some instances, the Licensing Board simply ignored major portions of UCS's testimony and wrote a decision that nowhere confronts that part of the evidentiary record. In other instances, the Board concluded that UCS prevailed, but nevertheless recommended restart without requiring prior implementation of the necessary safety measures.

For example, the Board concluded that UCS demonstrated that some of the safety equipment at TMI-1 does not meet NRC requirements intended to assure that the safety equipment will not fail during an accident.[18] Nevertheless, the Board recommended restart. This conclusion is not consistent with the NRC's duty to license only plants that meet its minimum safety requirements.

In another instance, the Board reached the following conclusion: "Given a hindsight look at the TMI-2 accident and at PORV performance, given the Staff's position which requires that the safety and relief valves function as expected during design transient and accident conditions, and given the words of GDC 14 [which imposes requirements intended to prevent loss of coolant accidents], one could easily reach the same conclusion as UCS that these valves must be classified as components important to safety and required to meet all safety-grade design criteria." Nevertheless, the Board elected not to require conformance with the applicable safety requirements, at least in part because "TMI-1 is a plant which has been fully operational for more than 4 years. It is not one which currently is evolving on the drawing board." The Board also concluded that the present design of TMI-1 "probably is not the same as if one

were to set out to design a new plant on the basis of present-day knowledge."[19] Here, the Board finally deferred to the Commission the decision whether the PORV should be required to meet current safety standards.

Who Protects the Public Now?

When Congress abolished the Atomic Energy Commission and replaced it with the Nuclear Regulatory Commission, it envisioned one specific job for the NRC -- to impartially, competently, and honestly carry out technical evaluations of the safety of nuclear power plants. Implicit in this delegation of authority to regulate an inherently dangerous technology is a public trust. The public has the right to expect that every person employed by the NRC will: "Put loyalty to the highest moral principles and to country above loyalty to persons, party, or Government department [and] Uphold the Constitution, laws, and legal regulations of the United States and of all governments therein and never be a party to their evasion."[21]

When, as in this case, the NRC's licensing process has been subverted by gamesmanship and misconduct, and the agency's mandate to protect the public health and safety has been shunted aside, the responsibility to remedy these defects reverts to the public's elected officials. UCS believes that the concerns expressed by residents of this area about the competence of GPU and the integrity of the NRC are well founded. Unless elected officials force the NRC to carry out its mandate to protect the health and safety of the public, we see little or no prospect that the "careful and objective review" that Governor Thornburgh seeks will ever be carried out.

THE TMI-2 CLEANUP: ITS PACE AND RISKS

Many citizens and elected officials have expressed strong concerns about the risks posed by Three Mile Island Unit 2 and the cleanup process, as well as the pace and source of funding for the cleanup. UCS believes that the cleanup must proceed at a deliberate pace. That pace should be constrained solely by the need to carefully plan each step in the process and to develop contingency plans to cope with possible difficulties that might arise. The pace should not be controlled by squabbles over who should pay for the cleanup. (While we agree that the pace of cleanup has been too slow, it should be noted that even with unlimited amounts of money and assuming that no major difficulties arise, the cleanup could not be completed for another four to five years in GPU's own estimate). We presently see no danger at TMI-2 that would justify hasty action. Indeed, a "fast-track" cleanup would be likely to increase the potential for harm to the public and the environment.

Those concerned about the current pace of the cleanup should recall that the TMI-2 cleanup has never been GPU's first priority. GPU's senior vice-president, Robert Arnold, told an NRC task force that the TMI-2 cleanup ranks fourth in priority behind maintaining a safe condition at TMI-2, preparing for restart at TMI-1, and refueling and restart of the Oyster Creek plant.[22] We are not aware of any subsequent statements that indicate that the TMI-2 cleanup has become GPU's top priority.

In UCS's view, the risks now posed by TMI-2 can only be ascribed to the uncertainty that springs from the unprecedented nature of the situation and the concerns about the competence of GPU. In this regard, we believe

Chairman Palladino's recent comments concerning this subject are a disservice to the residents of this area. Chairman Palladino apparently hopes to pressure the federal government into some form of direct or indirect assistance to GPU. He should have heeded Commissioner Gilinsky's counsel to limit his statements to a factual appraisal of the health and safety aspects of the cleanup process.

Specifically, Chairman Palladino's letter of March 22, 1982, to Senators McClure and Simpson appears to exaggerate the danger of a serious mishap at Unit 2. Every NRC document of which we are aware concludes that the likelihood of the TMI-2 reactor going critical is extremely low and, even in the unlikely event that occurs, the situation could be easily remedied without harm to the public. Similarly, Chairman Palladino's concern about fires and failures of equipment due to the environmental conditions in the plant are in marked contrast to the NRC's general lack of concern about fire protection and environmental qualification deficiencies in currently operating plants. However, if there are technical bases for these concerns (none have been given), then Chairman Palladino should concentrate on taking the actions necessary to mitigate those risks, rather than joining in the attempts to strike a balance among the competing equities of the licensee, the ratepayers, the affected states, and the federal government.

In sum, NRC appears to be overstating the risks at TMI-2 in order to influence the sources of cleanup funding and understating the risks of a TMI-1 restart for reasons also related to cleanup funding.

CONCLUSION

We have attempted to illustrate the actions of the NRC which justify the intervention of elected officials to assure that the decisions pertaining to restart of TMI-1 and the cleanup of TMI-2 will be based solely upon considerations of protecting the health and safety of the public. Each of the examples we have given have a solid factual basis, and there are many other examples which we have not discussed here. UCS will be happy to explain in any level of detail the safety issues that are relevant to the restart of TMI-1 and the cleanup of TMI-2.

However, one need not become involved in the technical details of any particular safety issue in order to determine whether the NRC is fulfilling its responsibilities in the manner in which the Congress intended. In this regard, we commend to you the attached editorial that appeared in the Harrisburg Patriot on December 16, 1981, for a succinct and, we believe, accurate assessment of the problems which are now your responsibility.

REFERENCES

1. Commision Order, July 2, 1979.
2. Commission Order and Notice of Hearing, August 9, 1979.
3. Memorandum for Chairman Palladino from William J. Dircks, Executive Director for Operations, "Staff Comments on the ACRS Report on St. Lucie Unit No. 2," December 23, 1981.
4. Memorandum for Roger Mattson, Director, Division of Systems Integration, from Themis P. Speis, Assistant Director for Reactor Safety, "Preliminary Evaluation of Operator Actions for Ginna SG Tube Rupture Event," January 28, 1982.
5. Memorandum for Harold R. Denton, Director, Office of Nuclear Reactor Regulation, and Howard K. Shapar, Executive Legal Director, from Darrell G. Eisenhut, Director, Division of Licensing, "TMI-1 Restart Status Report," September 11, 1980.
6. TMI-1 Restart Hearing Transcript. Testimony of Walton L. Jensen, Jr., Natural Circulation, ff. Tr. 4913; Tr, 4942, 4954, 4963-4968, 4977-4978, 5027-5028.
7. Id., Tr. 6630, Donald F. Sullivan.
8. Id., Tr. 8319, 8431, 8489-8492, 8523-8524, James H. Conran.
9. NUREG/CR-1250, "Three Mile Island: A Report to the Commissioners and to the Public," NRC Special Inquiry Group, Vol. II, p. 4, 11.
10. Letter to the NRC Office of Nuclear Reactor Regulation, Attn: John F. Stolz, from H. D. Hukill, Director, TMI-1, GPU, December 7, 1981.
11. SECY-81-513, "Plan for Early Resolution of Safety Issues," Enclosure 3, Appendix, p. 4, August 25, 1981.
12. NUREG-0557, "Evaluation of Long-Term Post-Accident Core Cooling of Three Mile Island Unit 2," p. 7-2, April/May 1979.
13. NRC Memorandum for H. Silver, TMI-1 Restart Project Manager, from R. Fitzpatrick, Power Systems/TMI Support Group, "TMI-1 - Manual Control of PORV," March 25, 1980.
14. Memorandum for Robert B. Minogue, Victor Stello, Harold R. Denton, and Robert J. Budnitz, from William J. Dircks, "Safety Rationale for Action Plan," July 11, 1980.
15. "Recommendations of TMI-2 IE Investigation Team (Operational Aspects)," September 1979.
16. Memorandum for James R. Tourtellotte, Assistant Chief Hearing Counsel, from Faust Rosa, Chief, Power Systems Branch, "Requested Material from TMI-1 Witness," August 13, 1980.
17. Note to T. Speis, Chief, Reactor Systems Branch, from W. Jensen, Reactor Systems Branch, "Status of TMI-1 Testimony," August 28, 1980.
18. Atomic Safety and Licensing Board, Partial Initial Decision, para. 1181, December 14, 1981.
19. Id., at para. 786.
20. Report of the President's Commission on the Accident at Three Mile Island, p. 20, October 1979.
21. Code of Ethics for Government Service (Incorporated in NRC Regulations at Annex A to 10 CFR Part 0, "Conduct of Employees").
22. "Evaluation of the Cleanup Activities at Three Mile Island," Report of a special task force formed by NRC's Acting Executive Director for Operations, p. IV-9, February 28, 1980.