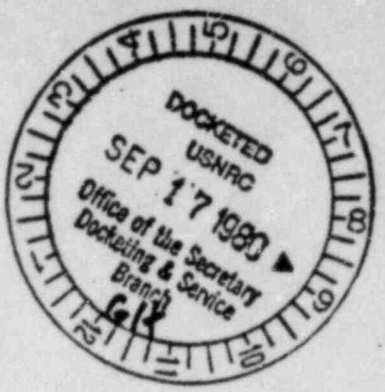

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

DIRECT TESTIMONY OF ROBERT D. POLLARD ON BEHALF OF THE UNION OF CONCERNED SCIENTISTS REGARDING UCS CONTENTION NO. 4

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September 15, 1980

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ROBERT D. POLLARD
QUALIFICATIONS

Mr. Pollard is presently employed as a nuclear safety expert with the Union of Concerned Scientists, a non-profit coalition of scientists, engineers and other professionals supported by over 80,000 public sponsors.

Mr. Pollard's formal education in nuclear design began in May, 1959, when he was selected to serve as an electronics technician in the nuclear power program of the U.S. Navy. After completing the required training, he became an instructor responsible for teaching naval personnel both the theoretical and practical aspects of operation, maintenance and repair for nuclear propulsion plants. From February, 1964 to April, 1965, he served as senior reactor operator, supervising the reactor control division of the U.S.S. Sargo, a nuclear-powered submarine.

After his honorable discharge in 1965, Mr. Pollard attended Syracuse University, where he received the degree of Bachelor of Science magna cum laude in Electrical Engineering in June, 1969.

In July, 1969, Mr. Pollard was hired by the Atomic Energy Commission (AEC), and continued as a technical expert with the AEC and its successor the United States Nuclear Regulatory Commission (NRC) until February, 1976. After joining the AEC, he studied advanced electrical and nuclear engineering at the Graduate School of the University of New Mexico in Albuquerque. He subsequently advanced to the positions of Reactor Engineer (Instrumentation) and Project Manager with AEC/NRC.

As a Reactor Engineer, Mr. Pollard was primarily responsible for performing detailed technical reviews analyzing and evaluating the adequacy of the design of reactor protection systems, control systems and emergency electrical power systems in proposed nuclear facilities. In September 1974, he was promoted to the position of Project Manager and became responsible for planning and coordinating all aspects of the design and safety reviews of applications for licenses to construct and operate several commercial nuclear power plants. He served as Project Manager for the review of a number of nuclear power plants including: Indian Point, Unit 3, Comanche Peak, Units 1 and 2, and Catawba, Units 1 and 2. While with NRC, Mr. Pollard also served on the standards group, participating in developing standards and safety guides, and as a member of IEEE Committees.

OUTLINE - DIRECT TESTIMONY ON UCS CONTENTION No. 4

While not requiring pressurizer heaters to conform with all safety-grade criteria, the Staff and Met. Ed. propose to connect the heaters to the onsite emergency power supply, in an apparent attempt to meet GDC 17. This testimony explains the proper application of the single failure criterion and demonstrates that connection of the heaters in the manner proposed compromises the emergency power supply by making it vulnerable to a single failure. The testimony also demonstrates that the proposal violates GDC 17. In addition, it relies to an inordinate degree on operator action. Finally, no showing has been made that the TMI-1 onsite emergency power supply is qualified to start and operate with the additional load. This poses undue risk to public health and safety.

UCS CONTENTION NO. 4

Rather than classifying the pressurizer heaters as safety-grade, the staff has proposed simply to add the pressurizer heaters to the onsite emergency power supplies. It has not been demonstrated that this will not degrade the capacity, capability and reliability of these power supplies in violation of GDC 17. Such a demonstration is required to assure protection of public health and safety.

In my testimony on UCS Contention 3, I discussed the reasons why the pressurizer heaters must be classified as safety grade and must, therefore, meet the Commission's General Design Criteria. I will now address the reasons why the use of non-safety grade heaters violates General Design Criterion 17 and degrades the capacity, capability and reliability of the onsite emergency power supplies.

General Design Criterion 17 requires that the onsite electric power supplies and the onsite electric distribution system "have sufficient independence, redundancy, and testability to perform their safety functions assuming a single failure." The design described in Section 2.1.1.3.1 of the Restart Report

violates this requirement because a single failure can result in loss of both onsite emergency power supplies. To explain this statement, it is necessary to first explain the requirements of the single failure criterion.

The single failure criterion requires that a safety system be capable of performing its safety function in the presence of any single detectable failure within that safety system (or its essential auxiliary supporting systems or another safety system) concurrent with all failures resulting from the single failure, all undetectable failures, and all failures that caused or were caused by the accident that requires operation of the safety system. Performing an evaluation to determine whether a system meets the single failure criterion involves the following steps:

1. Identify components that are not safety grade, e.g., not seismically and environmentally qualified in accordance with GDC-2 and 4, not physically and electrically separated as required by GDC-17 and 22, or not protected against fire as required by GDC-3.
2. Assume that each non-safety grade component fails if its failure adversely affects the safety system or assume it operates if its

operation adversely affects the safety system.

3. Assume that all failures which can cause or can be caused by the accident requiring the safety system to operate have occurred.
4. Assume that any other single failure has occurred and then determine whether the safety system being evaluated can still perform the required safety function.

Applying the single failure criterion to the TMI-1 onsite power supply considering the proposal to connect non-safety grade pressurizer heaters to that power system yields the following:

1. A safe shutdown earthquake occurs and causes a reactor shutdown and loss of offsite power. This requires use of the onsite electric power system and the pressurizer heaters to assure decay heat removal by natural circulation.
2. Because the heaters are not safety grade, it must be assumed that the heaters are damaged, for example, short circuited.
3. As called for by Met Ed's procedures, one group of damaged heaters is connected to one of the two redundant emergency power supplies and the

short circuit results in loss of that power supply.

4. The other redundant emergency power supply is also unavailable as the result of a single failure, such as the diesel generator failing to start.

5. The result is that the onsite power supply is unable to perform its safety function because both redundant divisions have been lost, one as the result of a single failure and the other as the result of the failure to require safety grade pressurizer heaters.

The foregoing is intended to illustrate only one example of how the use of non-safety grade pressurizer heaters can degrade the TMI-1 onsite emergency power system. Similar analyses can be done for other events such as a fire in or affecting the pressurizer heater circuits or a small steam or reactor coolant leak creating an environment which fails the heaters. The results of those analyses will be the same - loss of both redundant onsite power supplies. Of course, each event also results in loss of the pressurizer heaters as a means of maintaining the reactor coolant pressure necessary to establish natural circulation.

The only disagreement that I foresee from the Staff and Met Ed concerning the foregoing analysis is whether a fault, such as a short circuit in the pressurizer heaters or their circuitry, will result in loss of the emergency power supply.

The reason there may be disagreement is that the Staff and Met Ed may claim that the non-safety grade heaters will be isolated from the safety grade onsite power supplies in accordance with the provisions of Regulatory Guide 1.75, "Physical Independence of Electric Systems." Based on my experience participating as a professional member of the Staff in the development of Regulatory Guide 1.75 and serving as the NRC's representative on the nuclear industry committee that developed IEEE Standard 384, which is endorsed by Regulatory Guide 1.75, I conclude that such claims are without merit. In fact, statements contained in Met Ed's Restart Report and the Staff's TMI-1 Restart Evaluation refute any claim that the design complies with Regulatory Guide 1.75.

On page 2.1-5 of the Restart Report, Met Ed claims that "[t]he 480 volt circuit breaker is the isolation device between Class IE and non-Class IE portions of the design."* Met Ed

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* Emphasis added. The terms Class IE and non-Class IE are equivalent to safety grade and non-safety grade.

also attempts to describe how the use of an undervoltage relay to detect a fault and open the circuit breaker connecting the non-safety grade heaters to the safety grade power supply will remove any endangerment to the power supply caused by a fault in the pressurizer heater circuits. In addition, on page 2.1-5a of the Restart Report, Met Ed attempts to describe how the fault protection on the circuit breaker feeding power to pressurizer heaters "will be fully coordinated"* with the fault protection on the main circuit breaker supplying power to the safety grade bus. (The latter circuit breaker is not shown on Figure 2.1-4 of the Restart Report. If it were, there would be an incoming circuit breaker above bus 1P and another above bus 1S.) Thus, Met Ed's position is that protection of the emergency power supplies is achieved by the provision of a circuit breaker that would open to prevent loss of the onsite power supply in the event of a short circuit in the pressurizer heaters. The circuit breaker would be opened either directly by the fault current or indirectly by an undervoltage relay sensing an effect (i.e., undervoltage) of the fault current.

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* A circuit breaker generally includes a method of detecting high current through it that causes the breaker to trip open. These devices can be selected to adjust the magnitude of current and the time the high current persists needed to trip the breaker. The word "coordinated" means that when two (or more) circuit breakers are connected in series, the breaker closer to the load will open on a smaller current than the breaker closer to the power source.

In contrast, Regulatory Guide 1.75 states that: "Interrupting devices actuated only by fault current are not considered to be isolation devices..." (Regulatory Guide 1.75, Regulatory Position C.1., emphasis added.) The Regulatory Guide goes on to explain that "coordination" of circuit breakers was fully considered in developing the position. It also explains that for a circuit breaker to be considered an acceptable isolation device, it must be opened by " a signal other than one derived from the fault current or its effects...." (Regulatory Guide 1.75, Regulatory Position C.1, Basis). Thus, the inescapable conclusion is that the TMI-1 design does not comply with Regulatory Guide 1.75. Neither the "fully coordinated" breakers nor the undervoltage trip derived from the effects of fault current is an acceptable method of preventing a fault in the non-safety grade pressurizer heater circuits from causing a loss of the safety grade power supply.*

Met Ed's "Safety Evaluation" of the design is contained on page 2.1-7 of the Restart Report. Met Ed acknowledges, however reluctantly or tentatively, that a fault in the non-safety grade pressurizer heater circuits will cause the loss

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* The example of an acceptable trip signal given in Regulatory Guide 1.75 (an accident signal) is inapplicable in this instance. That signal is incapable of protecting the onsite power supply against a heater fault.

of the 480 volt ES system to which the heaters are connected. In the face of that correct statement, the only realistic way I can explain Met Ed's conclusion that the design is acceptable is to conclude that Met Ed either does not understand or chooses to ignore the requirements of the single failure criterion and the provisions of Regulatory Guide 1.75. I will now address the Staff's position, which reflects the same basic misapplication of the single failure criterion, and then explain the fallacy in both positions.

Although "Clarification" item 6* (Restart Evaluation, page C8-6) references Regulatory Guide 1.75, the Staff never discusses how these provisions are met or states a conclusion as to whether it has been complied with. My opinion is that, in view of the language of position #4** on page C8-3 (incorporated in the Commission's Order of August 9, 1979) and the reference to Regulatory Guide 1.75, compliance with Regulatory Guide 1.75 is mandated.

On page C8-7 of the Restart Evaluation, the Staff takes note of Met Ed's procedural "prohibition of energizing the two

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* Clarification item 6 states "The Class IE interfaces for main power and control power are to be protected by safety-grade circuit breakers."

** Position #4 states "Pressurizer heater motive and control power interfaces with the emergency buses shall be accomplished through devices that have been qualified in accordance with safety-grade requirements."

heater banks simultaneously." The Staff also states the following: "The concern with simultaneous energization of both heater banks is that the electrical separation of the heaters within the pressurizer and the heater cables leading to the pressurizer are not sufficient to assure the required independence of the two emergency power supplies." This statement is presumably based on the Staff's recognition that the TMI-1 design does not provide safety-grade isolation devices between the non-safety grade heaters and the safety grade onsite emergency power supply. If a safety-grade isolation device were provided, there would be no concern about energizing both groups simultaneously. Thus, the Staff recognizes that a fault in the heaters can cause the loss of the emergency power supply. Therefore, one must conclude that Regulatory Guide 1.75 is not met.

Furthermore, the Staff, either by misunderstanding or disregarding the requirements of the single failure criterion, apparently concludes that, if only one heater bank is connected to the emergency power supply, a heater failure and the resultant loss of only one emergency power supply will leave the redundant emergency power supply operable, thereby (in the Staff's view) meeting the single failure criterion. This is the same reasoning apparently adopted by Met Ed. Both err in not recognizing that:

1) the heater failure must be assumed at the outset because the heaters are not safety grade; 2) the power supply connected to the heaters must be assumed to be lost because the "isolation device" between the heaters and the power supply does not meet Regulatory Guide 1.75; and 3) the other onsite power supply must be assumed to be inoperable because of a single failure. Thus, the conclusion that the TMI-1 design does not meet the single failure requirement of GDC-17 is compelled.

Another reason why the connection of the pressurizer heaters to the onsite emergency power supply degrades that safety grade system is that operator action will be relied upon to connect the heaters to the emergency power supply and to disconnect other loads to prevent overloading the emergency power supply. Relying upon the operator to perform more actions needed to protect the public as a result of the TMI-2 accident, which was caused in part by incorrect operator action, is inconsistent with the lessons to be learned from that accident. Furthermore, if the objective is to provide "substantial additional protection to the public health and safety," then disconnecting other loads from and connecting the heaters to the emergency power supply should be done automatically as required by GDC-20. Relying on operator action is both unnecessary and unsafe. It poses the risk

of operator errors that could result in failure to establish natural circulation and/or in loss of the emergency power supply due to overload.

I will discuss one other way in which the TMI-1 design degrades the emergency power supply. Met Ed has not performed any qualification tests to demonstrate the reliability and capability of the TMI-1 onsite emergency power supplies to start and operate the loads added as a result of the lessons learned from the TMI-2 accident. Periodic tests are not a substitute for qualification tests. Proper qualification requires that a reliability goal be established and that tests then be performed to demonstrate that the reliability goal is met or exceeded.

Met Ed stated that the reliability of the onsite emergency power supply "has been demonstrated by monthly surveillances since TMI-1 began operation in 1974." (Answer to UCS Interrogatory 39). Met Ed also stated that: 1) the monthly tests were for the purpose of demonstrating both the reliability of starting the diesel generators and the reliability of carrying the required loads; 2) no specific reliability goal has been established; and 3) the reliability demonstrated by the monthly tests is not known quantitatively. (UCS Deposition of Ronald Stevens, et al, March 26, 1980, Tr 78-80). Considering

these statements and the fact that no monthly tests have been done on the modified design, no basis has been presented to support Met Ed's conclusion that the requirements of GDC-17 are met. Similarly, since the Staff has advanced no reliability goal nor proposed any qualification tests on the modified design, there is no basis for determining that the requirements of GDC-17 are met.

I conclude that, in the absence of adequate qualification testing, it has not been demonstrated "that the capacity, capability and reliability of the emergency power source (diesel generators) is not degraded as a result of implementing the capability to supply selected pressurizer heaters from ... the emergency power source when offsite power is not available." (NUREG-0578, page A-3). I also conclude that it has not been demonstrated that the requirements of GDC-17 are met and, therefore, TMI-1 should not be permitted to restart.

In summary, my testimony has shown that connection of the pressurizer heaters to onsite power supplies in the manner proposed compromises the emergency power supply by making it vulnerable to a single failure as defined by NRC practice. Met Ed's proposed method for "isolating" the emergency power supply from the non-safety grade pressurizer heater circuits is unacceptable; it does not meet GDC-17, Regulatory Guide

1.75 and Position #4 of the Commission's requirements for upgrading the heaters. In addition, Met Ed's proposal relies improperly on operator action. Finally, no showing has been made by either Met Ed or the Staff that the TMI-1 onsite emergency power supplies are qualified to start and operate the loads added as a result of the lessons learned from TMI-2, including pressurizer heaters. In my opinion, it is clear that the Commission's regulations have not been met and that TMI-1 cannot safely be operated under these circumstances.

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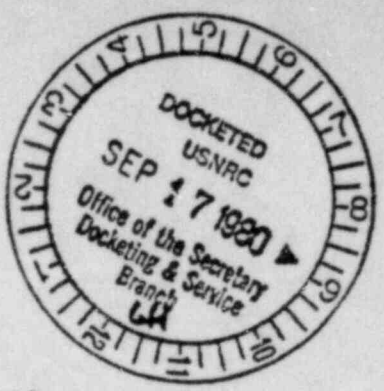

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CERTIFICATE OF SERVICE

I hereby certify that copies of the "Direct Testimony of Robert D. Pollard on Behalf of the Union of Concerned Scientists Regarding UCS Contention No. 4," have been mailed postage pre-paid this 15th day of September, 1980, to the following parties:

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