RELATED CORRESPONDENCE

LIC 9/15/80

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

LICENSEE'S TESTIMONY OF WILLIAM F. ITSCHNER, RICHARD BARLEY, JAMES MOORE AND CHARLES PELLETIER IN RESPONSE TO THE LEWIS CONTENTION AND ANGRY CONTENTION NO. V(D)

(FILTERS)

OUTLINE

The purposes and objectives of this testimony are to respond to the Lewis Contention and ANGRY Contention V(D), which assert the need for improvements to the auxiliary building filters and for the installation in effluent pathways of systems for the rapid filtration of large volumes of contaminated gases and fluids. The testimony shows that: the quantity of radioactive gases required to be transported outside the TMI-1 reactor building for processing by the waste gas disposal system will be reduced from that experienced at TMI-2; the leakage of radioactive gases is minimized; and the charcoal in the filters is maintained in a condition which ensures that iodine removal efficiency will be maximized in gaseous effluent pathways. The testimony also concludes that the TMI-2 accident has not demonstrated a need for unspecified additional filtration systems.

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INTRODUCTION

This testimony, by Mr. William F. Itschner, GPU Senior Mechanical Engineer; Mr. Richard Barley, GPU Lead Mechanical Engineer; Mr. James Moore, GPU Mechanical Components Manager, and Dr. Charles Pelletier, Assistant Vice President and Manager, Science Applications, Inc., is addressed to the following contentions:

LEWIS CONTENTION

> Filters: There are new filters on the auxiliary building of TMI#2. There are no similar structures on the auxiliary building of TMI#1. Further, preheaters must be placed on the filters of the auxiliary building because they got wet during the accident on 3/28/79 in TMI#2. To mitigate a similar accident in TMI#1, preheaters on the filters in the auxiliary building of TMI#1 are necessary. There are many design errors in the filter system and design of same. I am presenting the above as examples of a larger problem.

ANGRY CONTENTION NO. V(D)

> The NRC Order fails to require as conditions for restart the following modifications in the design of the TMI-1 reactor without which there can be no reasonable assurance that TMI-1 can be operated without endangering the public health and safety:
>
> (D) Installation in effluent pathways of systems for the rapid filtration of large volumes of contaminated gases and fluids.

RESPONSE TO LEWIS CONTENTION

BY WITNESS MOORE

This contention addresses gaseous radioactive materials located outside the reactor building. Since these radioactive materials are actually produced in the reactor fuel, they would have escaped from the fuel, penetrated the fuel cladding and have been transported through the containment building via one of the plant auxiliary systems, such as the makeup and purification system. At this point, the material is principally contained by the closed auxiliary systems, and thus the design concern for the filtration systems is the limited release of radioactive materials from these systems.

All of the methods employed to control the release of radioactive material are based on the fact that if radioactive material is s ored, natural radioactive decay will reduce the level of radioactivity. In TMI-1, the primary method of controlling gaseous radioactive material is to collect the gas in the waste gas disposal system (WGDS) where it is compressed and stored in tanks. When the radioactivity has decayed to an acceptable level, the gas is released at a controlled rate, as allowed by the plant technical specifications, through High Efficiency Particulate Absorbers (HEPA) and charcoal filters to the station vent. The HEPA filters retain radioactive particulate matter, while the charcoal filters retain radioactive iodine. Essentially all of the radioactive particulates and iodine are retained on the HEPA and charcoal filters where they decay and are eventually dipsosed of when the filters are replaced. Thus, the radioactive gases released will consist of the long-lived radioactive noble gases which did not decay during the storage period.

The TMI-1 auxiliary and fuel handling building ventilation system is designed to control the release of any radioactive gases which may escape from the closed auxiliary systems. These ventilation systems collect air and gases from the various cubicles and areas of the buildings and process them through HEPA and charcoal filters prior to release to the station vent.

In TMI-2, the waste gas disposal system also collected and compressed radioactive gases, and stored them in the waste gas decay tanks. During the first week of the TMI-2 accident, a significant source of gas outside of the reactor building was in the makeup tank which removed gases from the reactor coolant. In the process of transferring this gas from the makeup tank to the waste gas disposal system and compressing it for storage, leaks in pipe flanges and a compressor released some gas to the auxiliary building atmosphere. It was collected by the auxiliary and fuel handling building ventilation systems, processed through HEPA and charcoal filters to remove radioactive particulates and iodine, and then released.

The TMI-2 radioactive gaseous releases and the effectiveness of the charcoal filters following the TMI-2 accident will be discussed below by Dr. Pelletier. The action being taken to assure the effectiveness of the TMI-1 charcoal filters will be described by Mr. Itschner; and the action being taken to minimize the amount of gas which could escape from the auxiliary systems will be described by Mr. Barley.

In addition to these actions, TMI-1 will be modified prior to restart to permit the venting of radioactive gases from the reactor coolant system directly to the reactor building atmosphere for storage and decay in the event of an accident. This reduces the need to transport large quantities of radioactive gases outside the reactor building via the makeup tank for processing by the waste gas disposal system. Thus, the TMI-1 systems outside containment should not provide a significant release path if exposed to the same conditions as experienced at TMI-2.

BY WITNESS PELLETIER:

In responding to both of these contentions, it is important first to put into the perspective the actual offsite radiological consequences of the TMI-2 accident. The liquid releases during the accident were insignificant. In total, about .4 curies of radioactive liquid iodine were released.(8) This amount is less than liquid releases technical specification limits for normal operation.

The gaseous releases amounted to be about 17 curies of iodine and 10 million curies of short lived noble gases (pre purge).(8) These releases, as explained below, would have been significantly reduced had the TMI-2 accident occurred on the as-modified TMI-1. Even so, however, the radiological consequences to the hypothetically most exposed individual from all accident related sources amounted to 76 millirems(8) which is a small fraction of Part 100 guidelines and is less than one-year exposure to background radiation (90 mrem/year).

Early in the TMI-2 accident, it appeared that the charcoal adsorbers in the auxiliary and fuel handling building ventilation exhaust systems were not removing as much I-131 as they should have been. Indeed, laboratory tests showed that the efficiency of auxiliary building charcoal for removing methyl iodide was only 56% to 69.5%.(1) Also, there were uncertainties concerning the source of the I-131 in ventilation air. For these reasons, it was decided to install additional iodine adsorbers.

Subsequent analyses show that the charcoal adsorbers in the auxiliary and fuel handling building exhaust removed approximately 90% of the I-131 to which they were exposed. This estimate is based on the ratio of I-131 measured in the station vent during the first two weeks of the accident and that measured on a sampling of the charcoal after it was replaced starting on April 12, 1980. This higher retention efficiency compared to the previous laboratory tests is due to the following factors. One is that laboratory tests were carried out at 95% relative humidity. The relative humidity to which the charcoal was exposed during the first weeks after the accident was less than 95%. An estimate of 30% has been given.(1) It has been shown that the higher the relative humidity, the lower the efficiency for retaining methyl iodide.(4,5) The other factor is that laboratory tests are carried out using 100% methyl iodide. This form of iodine is the most penetrating form known. Measurements at TMI-2 showed that from 10% to 30% of the I-131 in air was in the organic form.(2) The rest was in forms which are retained with higher efficiencies.(7)

Nonetheless, the low retention efficiencies for methyl iodide measured for the initial charcoal loading at TMI-2 indicate that the performance of the charcoal had degraded during its first year of operation.(1,3) To insure that the charcoal at TMI-1 retains an efficiency of at least 90% for all forms of I-131, a surveillance program will be carried out. This program is discussed below by Mr. Itschner.

With regard to employing heaters to reduce moisture in the influent air, tests have shown that maintaining the relative humidity at 50% to 70% can extend the effective life of charcoal adsorbers.(4,6) Therefore, heaters to lower the relative humidity may be worthwhile. However, this is a question of economics, not safety. Finally, I know of no evidence which suggests that the charcoal "got wet" during the accident at TMI-2. As noted above, the charcoal appeared to have only been exposed to air with an average humidity of 30%.

BY WITNESS ITSCHNER:

As noted above, during the TMI-2 accident the auxiliary and fuel handling building filter systems removed most of the radioactive iodine that was released to the auxiliary and fuel handling building atmosphere.

One and one half months following the accident Licensee completed construction of supplemental HEPA and charcoal filters on the roof of the TMI-2 auxiliary building that were in series with the auxiliary and fuel handling building ventilation systems and filters. These supplemental filters provided iodine and particulate filtering of the auxiliary and fuel handling building ventilation systems effluent.

The supplemental filters were installed to provide additional capability for radioactive iodine removal during reactor stabilization and plant cleanup because the installed system filters were thought to be degraded as described above by Dr. Pelletier.

In order to prevent degradation of the TMI-1 filter systems, improved testing and maintenance requirements have been adopted for the filters that serve both the auxiliary and fuel handling building ventilation systems and the TMI-1 WGDS. These requirements increase the frequency of routine testing and require non-routine testing following events such as fires or painting which may reduce the filter performance in an accelerated fashion. These requirements were incorporated in the TMI-1 Technical Specifications.

Supplemental filters like those installed on TMI-2 are not needed on TMI-1 because action being taken ensures that the currently installed filters will have sufficient capacity to perform their intended function.

BY WITNESS BARLEY:

As explained above, a significant release pathway of short lived radioactive noble gases was leakage in the Unit 2 WGDS to the auxiliary building atmosphere which bypassed the waste gas decay tanks. To avoid leakage in the Unit 1 WGDS, a leak reduction program for systems outside containment has been implemented as described in Section 2.1.1.8 of the Restart Report. This program will significantly reduce the liquid and airborne radioactive containment levels outside the containment. The TMI-1 waste gas disposal system is included in the leak reduction program (see Item 5 of Table 2.1.-4, Restart Report.)

Further, as discussed in Licensee's testimony on containment isolation in Response to Sholly Contention No. 1, and Section 2.1.1.5 of the Restart Report, containment isolation modifications are being made which will reduce the transfer of radioactive contamination from the reactor building. This will assist in lowering the potential levels of airborne contamination outside containment and also reduce the demand on the gaseous and liquid radwaste systems.

BY WITNESSES ITSCHNER, BARLEY, MOORE AND PELLETIER:

In summary, the modification and design provisions described above ensure that:

(1) The quantity of radioactive gases required to be transported outside the reactor building for processing by the WGDS at TMI-1 will be reduced from that experienced at TMI-2;

(2) The leakage of radioactive gases is minimized, thus ensuring that radioactive gases are decayed prior to release; and

(3) Charcoal is maintained in a condition which ensures that iodine removal efficiency will be maximized in gaseous effluent pathways.

References

(1) "Analysis of the Adsorbers and Adsorbents from Three Mile Island Unit No. 2," NUCON 6 MTG611/04, May 25, 1979.

(2) "I 131 Studies at TMI Unit 2," J.E. Cline, et al., EPRI NP-1389, April 1980.

(3) "Technical Staff Analysis Report on Iodine Filter performance to President's Commission on the Accident at Three Mile Island," Bland, William M., October 1979.

(4) "Effects of Weathering on Impregnated Charcoal Performance," V. R. Deitz, NUREG/CR-0025, March 1978.

(5) "Effects of Weathering on Impregnated Charcoal Performance," V. R. Deitz, NRL Memorandum Reports 4006, NUREG/CR-0771, May 10, 1979.

(6) "Testing Iodized Activated Carbon Filters With Non-Radioactive Methyl Iodide," V. R. Deitz and J. B. Romans, Naval Research Laboratory Memorandum Report 4240, May 30, 1980.

(7) "Long-Term Performance of Charcoal Absorbers Removing Radioiodine in Ventilation Exhaust Air," C. A. Pelletier, et al., EPRI NP-534, July, 1978.

(8) "Assessment of Offsite Radiation Doses from the Three Mile Island Unit 2 Accident," TDR-TMI-116, Revision 0, July 31, 1979.

RESPONSE TO ANGRY CONTENTION NO. V(D)

BY WITNESS MOORE

As discussed in Licensee's testimony above, the TMI-2 accident demonstrated a need to ensure that gaseous systems are appropriately maintained in an operable condition. The Licensee has taken action to assure charcoal and filtration units are properly maintained and that gaseous radwaste systems are intact. Further, the containment structure is designed to hold fission products released from the primary system in the event of accidents.

It is concluded that the TMI-2 accident has not demonstrated a need for unspecified "installation in effluent pathways of systems for the rapid filtration of large volumes of contaminated gases and fluids." Rather, the TMI-2 experience has demonstrated that gases and liquids (fluids) can be maintained in containment and storage facilities until such time as processing can proceed. (See Licensee's testimony of E. Fuhrer and R. McGoey on the Physical Separation of TMI Units 1 and 2.)

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Education: B.S., Mechanical Engineering, Newark College of Engineering, 1958.

Experience: Senior Mechanical Engineer, GPU Service Corporation, 1974 to present. Responsible for criteria preparation and evaluation, technical review of engineering design, project assistance, field liaison and consultation for the following generating station systems and components: HVAC, fire protection, waste treatment, heavy material handling and maintenance access.

Project Manager, E.R. Squibb & Company, 1973 to 1974. Responsible for mechanical engineering aspects of construction projects dealing with steam generation, chilled water, cooling towers, water treatment and process cooling.

Facilities Engineer, FMC Corporation, 1966 to 1973. Directed efforts of architects, engineers and contractors in the planning for and construction of a chemical research and development center.

Project Engineer, Ortho Pharmaceutical Corporation, 1959 to 1966. Responsible for the engineering facets of various production projects, including comfort and environmental air conditioning systems; material handling; dust collection and exhaust systems; distilled and pyrogen-free water systems; steam and gas sterilization facilities; biological production and sterile packaging facilities; and, boiler water and cooling water treatment programs.

Chief Operating Engineer, United States Rubber Company (now Uniroyal), 1953 to 1959. Responsible for the management, operation and maintenance of a steam power plant and allied equipment.

<u>Professional Affiliations</u>:

Member, ASME Committee on Nuclear Air and Gas Treatment and ASME Executive Committee on Nuclear Air and Gas Treatment.

Past Member, ASME Committee on Cranes for Nuclear Power Plants.

Licensed Stationary Engineer, State of New Jersey.

RICHARD BARLEY

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Education: B.S., Chemistry, Pennsylvania State University, 1969. U.S. Naval Nuclear Power School and Prototype Training 1969-1970. Graduate courses in reactor plant engineering.

Experience: Lead Mechanical Engineer, TMI-1, Metropolitan Edison Company, 1976 to present. Responsible for the support of plant operations and maintenance activities relating to mechanical systems and components including review of safety related operating test and maintenance procedures. Member of Plant Operations Review Committee.

Engineer, TMI-1 Operations Department, Metropolitan Edison Company, 1974 to 1976. Duties included providing technical support and engineering assistance to the Supervisor of Operations.

U.S. Navy, 1970 to 1974, Naval Officer aboard operating nuclear fleet ballistic missile submarine. Positions held include Main Propulsion Assistant; Damage Control Assistant; Reactor Controls Division Officer. Throughout this period, duties included direct supervision of nuclear power plant operations and maintenance.

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Education: B.S., Marine Engineering, State University of New York Maritime College, 1956.
Completed all requirements except thesis for M.S., Nuclear Science and Engineering, Catholic University of America, 1968.

Experience: Mechanical Components Engineering, Manager, GPU Service Corporation, 1978 to present. Responsible for areas relating to mechanical components, water chemistry systems, HVAC and fire protection.

Mechanical Systems Engineering Manager, GPU Service Corporation, 1971 to 1978. Responsible for areas relating to mechanical systems and structural design of power plants.

Senior Project Engineer, GPU Service Corporation, 1968 to 1971. Technical cognizance over the design of power plant fluid systems, including establishment of design criteria, design review and coordination and evaluation.

Senior Engineer, Allis-Chalmers, Atomic Energy Division, 1964 to 1968. Responsible for supervising fluid system modifications and installation of a redundant reactor core spray system at the LaCrosse Boiling Water Reactor Project; served as fluid systems consultant for the Pathfinder Atomic Power Plant Project.

Lead Engineer, Allis-Chalmers Atomic Energy Division, 1964 to 1966. Responsible for coordinating work on the LaCrosse fluid systems; performed heat transfer, fluid flow, stress and safety analysis designs for LaCrosse fluid systems.

Various engineering positions, Allis-Chalmers Atomic Energy Division, 1960-1964. Performed design engineering work for the Pathfinder reactor and turbine plant systems; responsible for design of feedwater temperature control system which maintained a constant temperature at all plant loads.

U.S. Navy, 1957 to 1958. Served as Damage Control Assistant and Engineering Officer aboard the USS Lester.

Allis-Chalmers Graduate Training Course, 1956 and 1959-1960. Received on the job training in the Hydraulic Turbine, Steam Turbine, Centrifugal Pump and Nuclear Power Departments.

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Business Address: Science Applications, Inc.
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Education: B.C.E., Sanitary Engineering, Rensselaer Polytechnic Institute, 1956. M.S., Radiation Biology, University of Rochester, 1957. Ph.D., Environmental Health, University of Michigan, 1966.

Experience: Division Manager, 1973 to 1978 and Operations Manager, 1978 to present, Science Applications, Inc. Manages the activities of a group providing technical research, services and consultation to the nuclear industry and government. Activities include studies of iodine behavior, charcoal testing, occupational radiation exposure reduction, leak detection methods for condensers and steam generators and effluent measurements.

Chief, Environmental Inspection Branch, Directorate of Regulatory Operations, U.S. Atomic Energy Commission, 1971 to 1973. Planned, organized and directed work of branch responsible for the development of AEC-Regulatory effluent and environmental inspection programs involving both radiological and non-radiological considerations.

Chief, Environmental Branch (Idaho Operations Office), U.S. Atomic Energy Commission, 1967 to 1971. Directed the activities of a branch involved in environmental monitoring and research and the National Reactor Testing Station (NRTS). Activities included routine monitoring of atmosphere and lithosphere at the NRTS; research on deposition of airborne materials on natural surfaces; doses from clouds of gamma emitting radionuclides and movement of radionuclides in soil. Directed independent environmental monitoring programs around several AEC licensed nuclear facilities in the U.S. for the AEC's Division of Compliance. Planned and directed emergency response activities for accidents at the NRTS involving releases to the environment.

Instructor and Assistant Professor, University of Michigan, 1960 to 1966. Taught and performed research mainly in area of environmental behavior of radioactivity. Developed and executed environmental survey for the Enrico Fermi Power Plant and Ford Research Reactor. Health Physics consultant to industry.

Radiation Control Engineer, Bethlehem Steel Company, 1958 to 1960. Developed company-wide programs for personnel monitoring and testing of sealed sources. Performed Health Physics surveys of industrial and medical x-ray units and radiography sources.

Health Physics Consultant, ASTRA, Inc., 1957 to 1958.

Honors and Professional Affiliations:

Certified by American Board of Health Physics, 1966.

Health Physics Society; President-elect, Delaware Valley Chapter, 1958 to 1959; Education and Training Committee, 1967 to 1970 (Chairman, 1970); Secretary, Eastern Idaho Chapter, 1968; Chairman, 5th Mid-year Symposium, 1970; Symposia Committee, 1972.

Appointed to the American Board of Health Physics, January 1971 (5 year term).

Member, ANS 18.1 working group for standards development on Effluent Sources at LWRs, 1974 to present.

Honorary Societies: Sigma Xi; Delta Omega; American Men and Women of Science; Who's Who in Ecology; Who's Who in Technology Today.

Publications:

"Environmental Surveys for Nuclear Facilities," Nucleonics, January, 1959.

"Maximum Permissible Weight Concentrations for Enriched Uranium," Nucleonics, October 1958.

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"The Sensitivity of Environmental Surveys to Atmospheric Releases from Nuclear Facilities," Ph.D. Thesis, University of Michigan, 1966.

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"Potential Benefits of Reducing Occupational Radiation Exposure," AIF/NESP-010, May 1978, with P. G. Voilleque.

"Long-Term Performance of Charcoal Absorbers Removing Radioiodine in Ventilation Exhaust Air," EPRI NP-534, July 1978, with others.

"Surface Effects in the Transport of Airborne Radioiodine at Light Water Nuclear Power Plants," EPRI NP-876, September 1978, with R. N. Hemphill.

"Location of Condenser Leaks at Steam Power Plants," EPRI NP-912, October 1978, with others.

"Evaluation of Radioiodine Measurements at Pilgrim Nuclear Power Plant," NUREG/CR-0395, October 1978, with others.

"131I studies at TMI Unit 2," EPRI, NP-1389, April 1980, with others.