DEC 1 0 1979

TERA

Mary Ruff
1118 Willow Street
Norristown, PA 19401

Dear Mary,

Your communication earlier this year concerning the Three Mile Island incident is appreciated. It was forwarded to me for reply. We regret that because of a significant increase in agency work load so much time has passed and that perhaps my reply is not in time to meet your needs.

We received many letters from your science class at the Rittenhouse Middle School at Norristown, Pennsylvania, asking questions about the accident at the Three Mile Island Nuclear Station, Unit 2, and the subsequent releases of radioactive materials. Since many of the letters contained similar questions and since you are probably interested in the answers to all of the questions, a copy of all of the questions and answers has been provided as the enclosure to this letter. I might add that many of the questions have been paraphrased and/or combined with other questions. NRC appreciates your views on nuclear power and we hope that you will take the time to learn more about radiation and nuclear power plants.

Sincerely,

/s/

Harold R. Denton, Director
Office of Nuclear Reactor Regulation

Enclosure:
As Stated

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OFFICE	ANL/TMI	TMI task force	TMI task force	D/TMI-2		
SURNAME	B. Jaroslow	W. Oliu	S. Miner	R. Vollmer		
DATE	10/xx/79	12/5/79	12/5/79	12/5/79		

Distribution:

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ENCLOSURE

Q.1 How did the radiation leak through the four-foot thick walls? Why don't you make the walls thicker? Why was radioactive "steam" allowed to leak?

A. The steam produced in the Pressurized Water Nuclear Power Plants, such as TMI-2, comes from the steam generator and unless there were leaks in the steam generator tubing, the steam produced would have essentially no radioactivity associated with it. The steam released from TMI-2 steam relief valves, therefore, had essentially no radioactivity associated with it.

Most of the radiation that was released to the environment came from contaminated liquid which reached the auxiliary building from various sources. Little radioactivity was released directly to the environment from the reactor building. The contaminated water had radioactive gases (like iodine, xenon and krypton) dissolved in it. Some of the radioactive gases came out of solution when the contaminated water was in the auxiliary building and leaked to the environment from the auxiliary building.

The function of the concrete walls of the containment is to shield (protect) people on site from direct radiation from radioactivity inside the containment. At TMI the direct radiation (shine) from inside the containment contributed essentially nothing to the dose received by the offsite population. So you see that increasing the thickness of the containment wall would not reduce the amount of radiation that actually escaped from the site.

Q.2 Why did it take almost four hours for the plant to notify the Nuclear Regulatory Commission (NRC)?

A. Although the accident sequence began just after 4:00 a.m., damage to the reactor core of Unit 2 (TMI-2) did not occur for some time, and it was not until after 6:30 a.m. that the operators of the plant recognized that damage to the reactor's core had occurred. At 6:56 a.m. the plant operators declared a Site Emergency and, 8 minutes later, called the Region I office of the U.S. Nuclear Regulatory Commission (NRC), which is located near Philadelphia, Pennsylvania. The call was taken by an answering service because the Region I office had not yet opened for the business day. The answering service employee then called the home of the Region I Duty Officer and was told that the officer had just left in his car for work. At 7:38 a.m., the Duty Officer, having arrived at work, called the Three Mile Island plant and was notified of the accident. He was also told that the operators of the plant had signalled a General Emergency. At 7:45 a.m., after talking to the plant operators, the Duty Officer contacted NRC Headquarters near Washington, D.C., and reported the TMI-2 accident.

According to the record, the TMI plant operators called the NRC Region I office some 8 minutes after they were first aware of the seriousness of the TMI accident.

Q.3 Is the river going to get polluted, will the water be safe to drink?

A. With regard to your concern about the release of contaminated water, except for releases of liquid containing only low or nondetectable levels of radioactivity to the Susquehanna River, such releases are not currently permitted Before such releases take place, the impact will be evaluated by the NRC and the evaluation will be made available to the public. By this course of action, we will assure that a thorough assessment is completed prior to release of the contaminated liquids and that the health and safety of the offsite population will be protected.

As a result of releases containing only low or nondetectable levels of radioactivity, the levels of radioactivity in the Susquehanna are indistinguishable from existing background levels at public water supply intakes from the river. These levels have been confirmed by independent measurements made by the NRC, the Environmental Protection Agency, and the Commonwealth of Pennsylvania.

Q.4 How will the release of radioactivity affect our food?

A. The preliminary findings of the radioactive materials released are contained in the interagency task force report, "Population Dose and Health Impact of the Accident at the Three Mile Island Nuclear Station" (NUREG-0558). The radioactive materials that were released were primarily radioactive gases. The radioactivity was almost entirely from xenon, which is a

chemically inactive gas. As the gases leaked out, the winds diluted them. To determine if food grown in the area will be contaminated, the Department of Energy measured the amounts of radioactivity present in the samples of soil, water, air, and vegetation.

Based on these samples and other information, it was concluded that the principal isotopes in the escaped gases were xenon-133 and xenon-135. Although radioactive iodine was found in samples of some milk, the concentration was less than 1% of the concentration permitted by NRC regulations. Other food samples were tested by the U.S. Food and Drug Administration and none of the 377 food samples tested contained reactor-produced radioactivity.

Q.5 Did the accident occur by a mistake or an atomic reactor operator who they said turned off a cooling system too soon? Why aren't there more backups? Who is to blame for this accident?

A. The events that led to the accident at Three Mile Island are very complex. Investigation shows that several things combined to make the Three Mile Island accident occur. They resulted from (1) aspects of the plant's design, (2) the actions of the plant staff following the start of the accident, and (3) malfunctions of equipment. Without any one of the three, the accident would not have been as severe. The NRC is still evaluating changes in equipment and operator training that will be required to prevent a repetition of the Three Mile Island accident or other accidents.

Q.6 How long will the plants be closed? Where will the people go for jobs? When will people be able to go back into the containment?

A. Unlike some manufacturing plants and assembly lines, it takes relatively few people to run a nuclear power plant; it may take as few as 10 people per shift to control and monitor a nuclear reactor. Other people are required to perform maintenance and routine tests. Normally, 200 people work at a two-unit nuclear plant like the Three Mile Island Nuclear Station. In the coming months, it will take more people than normally work there to clean up Unit 2 and prepare it for decommissioning or for further operation.

The owners of Three Mile Island have not yet submitted to the NRC a proposal for recovery of Unit 2, although they are conducting feasibility studies. We anticipate that a considerable length of time will pass before any proposals or decisions are made regarding Unit 2's recovery.

A.7 What will happen to the people who live around the plant? Will there be more cancer there 20 years from now?

A. A team of investigators from the Nuclear Regulatory Commission, the Environmental Protection Agency, and the Department of Health, Education and Welfare calculated the doses to the people living within 50 miles of the Three Mile Island site and estimated the number of new cancers that would result from the exposure to the radioactivity that leaked out of

the plant. The team reported their work in a report entitled, "Population Dose and Health Impact of the Accident at the Three Mile Island Nuclear Station" (NUREG-0558). They concluded that the offsite collective dose associated with radioactive material released from March 28, 1979, to April 7, 1979, represents minimal risks (that is, very small number of additional health effects to the offsite population).

Q.8 How many more nuclear plants are being planned or built?

A. There are now 70 units with operating licenses, 91 units under construction, and 25 units where an application has been made for a construction permit. These plants will have a combined electrical capacity of 180,000 megawatts.

Q.9 What future safety precautions will be taken so that this won't happen again? Are we going to have more protection at the Limerick Nuclear Generating Station?

A. We have taken a number of actions with respect to all nuclear power plants as a result of the Three Mile Island incident. Specifically, full-time inspectors have been assigned to each operating plant utilizing Babcock and Wilcox pressurized water reactors like those at Three Mile Island. In addition, all such plants were shut down and the licensees of each plant were instructed to provide us with additional information about their facilities in light of the Three Mile incident. After review

of the information provided, orders were issued to the licensees that required them to make immediate plant modifications, to provide additional operator training, and to revise certain operating procedures. Additional long-term actions were ordered to further upgrade certain plant systems and operator training and procedures. All of these plants, except of course the Three Mile Island plant, have complied with the orders and have been permitted to resume operation.

In addition, licensees of all operating plants utilizing pressurized water reactors have been instructed to take specific actions with regard to the status of certain equipment, plant procedures, operator actions, and facility designs. Licensees of all operating plants, including those utilizing boiling water reactors, have been instructed to provide us with additional information with regard to their facilities in light of the Three Mile Island incident.

We are currently reviewing the information provided. As soon as our review is complete, orders for modifications, as appropriate, will be issued to provide additional protection to the health and safety of the public.

As a result of TMI-2, in addition to the actions outlined above, studies were initiated in the areas of emergency preparedness, operator licensing reassessment, loss of feedwater event, small-break loss-of-coolant accidents, and lessons learned from the incident. In a number of areas, work has

progressed to the point where additional license requirements have been recommended. A number of these recommendations have been approved and efforts have begun to implement them.

In addition, as you are aware, President Carter appointed a Presidential Commission to conduct a comprehensive study of the TMI accident. The commission issued its report at the end of October. We are currently reviewing the reports to determine which of their recommendations should be implemented.

Q.10 What was the radiation level outside the plant?

A. The very small dose of radiation that was received by people in the area came from radioactive gases that escaped from the auxiliary building. The average dose of radioactivity received by the population within 50 miles of TMI was approximately 4 millirems. The maximum exposure to any individual was less than 100 millirems, which is less than the yearly dose each person receives as a result of natural background radiation. Doses at these levels result in less than one health effect over the lifetime of all people in this area. Natural background radiation received by people in the Harrisburg, Pennsylvania, area is approximately 125 millirems per year. To put these doses into perspective, it should be noted that a traveler flying round trip in a jet from New York to Los Angeles receives 5 millirems of cosmic rays.

Q.11 Why did it take so long for the plant workers to detect abnormal levels?

A. The radioactive elements (fission products) that give off radiation are normally trapped in the zircaloy tubes (called cladding) which contain the fuel pellets. If the cladding ruptures, the fission products escape into the reactor's cooling water. If there is a leak from the reactor cooling system to the containment, a radiation alarm will be produced. In the Three Mile Island Unit 2, an open valve allowed the reactor coolant to escape into the containment. As described in the Presidential Commission Report, low-level radiation was detected within the containment building in the 2 hours after the turbine trip, and increased markedly thereafter. Thus, it took a couple hours after the beginning of the accident before high radioactivity levels were detected.

Q.12 Was there any immediate help available?

A. After the owners of the plant notified us, we sent people to the site. Help also came from other organizations, such as the Department of Energy, the Department of Defense, the Commonwealth of Pennsylvania, the Babcock and Wilcox Company, and other utilities who own nuclear power plants.

Q.13 Why did the backup cooling system burst?

A. The backup cooling system for the steam generators, the auxiliary feedwater system, did not burst. The system started up but some closed valves prevented the cooling water from reaching the steam generators.

Q.14 Will fish or other wildlife be killed?

A. Fish and other wildlife did not die as a result of exposure to the radioactive materials that escaped during the accident.

Q.15 Was the plant contaminated?

A. Yes. Several of the buildings at the plant are contaminated by radioactive materials.

Q.16 What will happen to the radioactive iodine?

A. The radioactive iodine that was released from the plant was primarily iodine-131. This isotope decays to nonradioactive elements by giving off beta radiation. The time it takes for one-half of the radioactive atoms to decay away is called a half-life. The half-life for iodine-131 is 8 days. By this time, the small amount of iodine-131 released has largely decayed and therefore no longer exists as radioactivity in the environment.

Q.17 When will they be able to use the building again?

A. In order for Met Ed to use the containminent building for Unit 2, the water and gases presently there must be removed, then the insides of the building must be decontaminated (or cleaned up). These procedures will take at least one year to perform.