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NUCLEAR REGULATORY COMMISSION
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Docket No: 50-289

MEMORANDUM FOR: Thomas M. Novak, Assistant Director for Operating Reactors, DOL

FROM: Paul S. Check, Assistant Director for Plant Systems, DSI

SUBJECT: THREE MILE ISLAND UNIT 1 RISK REDUCTION

Plant Name:	Three Mile Island Unit 1
Docket No:	50-289
Licensing Stage:	Restart
Responsible Branch:	Operating Reactors Branch No. 4
Project Manager:	D. DiIanni
DSI Branch Involved:	Reactor Systems Branch

The enclosure to this memorandum discusses the reduction in risk associated with the suggested low power testing program at Three Mile Island Unit 1.

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Enclosure:
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ENCLOSURE

Reduction in Risk for Low Power Operation

Since the publication of the Reactor Safety Study (WASH-1400), the staff has continued its study of risk to the public from potential severe accidents at nuclear power plants. This effort has confirmed that the event scenarios dominating accident risks (e.g., small LOCAs/transients) are generally the same for different PWR desgins.

Risk is proportional to the probability of severe accidents (which lose the heat sink) and fission product inventory in the core. Thus, we have reexamined the dominant scenarios to estimate the reduction in the probability of the event due to the additional time available during low power operation for the reactor operators to restore heat sink by either "fixing" the important safety systems needed to mitigate the event or taking alternate courses of action. Similarly, we have estimated the reduced fission product inventory for operation of the TMI-1 core at 5% power for 6 months (assuming a 2-to-3-year shutdown prior to startup) and have, thereby, determined the reduction in potential public exposure via reduction in potential release magnitudes. From these factors we have estimated that the overall reduction in risk to the public should be a factor of 180 to 660 if TMI-1 is operated at 5% power for 6 months compared to continuous full-power operation.

Similar evaluations had previously been performed to estimate the reduction in risk for low power testing of two plants: Sequoyah, and Diablo Canyon. The low-power risk reduction for each of these plants was approximately the same (about 400 to 1500). The slightly greater risk reduction for the new plants than for TMI-1 is due mainly to the lower fission product inventory that results from lower fuel burnup. We have estimated that the previous operation of TMI-1 doubles the source term when compared with the new reactors. Other smaller factors which contributed to differences are (1) previous operation of TMI-1 ("burn-in" time which reduces risk compared to new plants) and (2) low volume steam generators at TMI-1 which slightly increase transient risks. The dominant events are (1) small break LOCAs with loss of ECCS, (2) transients with total loss of feedwater, and (3) failure of double check valves between the primary and RHR system which results in a LOCA (intersystem LOCA) outside of containment.

The time available before fuel failure following a LOCA is increased significantly (about 11 hours) because of the reduced initial power level. In addition, the coolant requirements for dissipating decay heat at 10 hours are only about 8 gpm which is within the capacity of the reciprocating charging pump used for the normal make-up systems. Because of the time avialable for the operators to correct malfunctions in the ECCS or initiate cooling with the normal charging system, we believe that the probability of a small LOCA resulting in excessive fuel damage and significant radiological release is reduced by at least a factor of 100 to 400 for operation at 5% power.

The risk reduction for the total loss of feedwater at 5% power is about a factor of 250 to 2500. As a result of this transient, it would take several hours to boil the steam generators dry and several more to boil the primary system to the beginning after uncovery. Other transients (steam line breaks steam generator tube rupture, rod ejection, and ATWS) were also examined. A similar reduction in risk was evident. Therefore, these transients did not become dominant.

Potential intersystem LOCAs have been reviewed with regard to operation at 5% power. Because of the low decay heat rate, only a small makeup flow rate is required to maintain core coverage. In addition, isolation of the lines by local operator action could terminate the event for most of the potential breaks. Therefore, we have estimated that the probability of this event resulting in excessive fuel damage is reduced by a factor of 100 to 200.

We have reviewed the fission products that are significant contributors to public health consequences. Those are Iodine, Cesium, Ruthenium, Strontium Tellurium, and Yttrium. The available inventory of these isotopes for a new reactor would be reduced significantly for operation at 5% power for six months compared to continuous full power operation. For TMI-1, significant amounts of Cesium, Strontium, and Ruthenium would still be present from previous operation and contribute to the source term.

The actual power history expected during the testing program would result in even less available fission product inventory. The peak power during this time period is only expected for a maximum of 10 to 20 days. This would result in a further risk reduction by a factor of about 2. It is therefore concluded that the public risk due to the proposed low power test program is less than public risk due to a full power long-term operation by a factor of about 350 to 1300.