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Nuclear Operations

August 17, 1990
NRC-90-0079

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

Reference: 1) Fermi 2
NRC Docket No. 50-341
NRC License No. NPF-43

2) Safety Evaluation Report,
NUREG-0798 For Enrico Fermi
Unit 2, From Office of Nuclear
Reactor Regulation - July 1981.

3) Detroit Edison Letter to NRC, NRC-89-0108,
"Proposed Technical Specification Change
(License Amendment) - Turbine Overspeed
Protection System (3/4.3.8)" dated
July 24, 1989

4) Detroit Edison Letter to NRC, EF2-53,907,
"Inservice Inspection Program",
dated June 30, 1981

Subject: Proposed Technical Specification Change
(License Amendment) - Turbine Overspeed
Protection System (3/4.3.8) Removal

Pursuant to 10CFR50.90, Detroit Edison Company hereby proposes to amend Operating License NPF-43 for the Fermi 2 plant by incorporating the enclosed change into the Plant Technical Specifications. This proposal requests removal of Technical Specification 3/4.3.8 "Turbine Overspeed Protection System" because the administrative controls imposed by this Technical Specification are unnecessary and require the plant to perform periodic power reductions for turbine valve testing. The basis for the subject Standard Technical Specification (TS) involves maintaining the turbine overspeed protection systems to reduce the hazards of turbine missiles. However, based on the orientation and location of Fermi 2 turbine and the structural design of the plant, Detroit Edison has concluded that any potentially generated turbine missile will not prevent the reactor from achieving and maintaining a safe shutdown condition. The supporting analyses for this conclusion have been previously reviewed and accepted by the NRC as indicated in Reference 2, Section 3.5.2.

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It was recognized that a potential turbine missile hazard was not the basis for Fermi 2 Overspeed Protection TS at the time of Fermi 2 licensing. Accordingly, the subject TS Bases discusses the reliability benefits of maintaining the turbine overspeed protection system and not the need to maintain the system to reduce the hazards of turbine missiles. Detroit Edison fully recognizes the benefit of performing turbine overspeed protection tests and inspections to ensure reliable operation of this station, however, we do not believe that rigid Technical Specification requirements are needed on this system. We are therefore requesting removal of the Turbine Overspeed Protection System TS.

Reference 4 committed to perform turbine valve inspections and cycling tests. Reference 2, Section 10.2.1, indicates that these inspections and tests are acceptable to the NRC staff and will be included in the Fermi 2 Technical Specifications. Please note, approval of this proposal will rescind the Reference 4 commitments.

Approval of this proposal will make the Reference 3 proposal unnecessary.

Detroit Edison has evaluated the proposed Technical Specification against the criteria of 10CFR50.92 and determined that no significant hazards consideration is involved. The Fermi 2 Onsite Review Organization has approved and the Nuclear Safety Review Group has reviewed the proposed Technical Specification and concurs with the enclosed determinations. In accordance with 10CFR50.91, Detroit Edison is providing a copy of this letter to the State of Michigan.

If you have any questions, please contact Mr. Gordon A. Nader at (313) 586-4513.

Sincerely,

Enclosure

cc: A. B. Davis
R. W. DeFayette
W. G. Rogers
J. F. Stang
Supervisor, Electric Operators, Michigan
Public Service Commission - J. R. Padgett

I, WILLIAM S. ORSER, do hereby affirm that the foregoing statements are based on facts and circumstances which are true and accurate to the best of my knowledge and belief.

William S. Orser

WILLIAM S. ORSER
Senior Vice President

On this 17th day of August, 1990, before me personally appeared William S. Orser, being first duly sworn and says that he executed the foregoing as his free act and deed.

Rosalie A. Armetta

Notary Public

ROSALIE A. ARMETTA
Notary Public, Monroe County, MI
My Commission Expires Jan. 11, 1992

INTRODUCTION

The Fermi 2 turbine generator, manufactured by the General Electric Company Turbine-Generator, Ltd. of Rugby, England, is a four-casing, tandem-compound, six-flow, 1800 rpm unit with 46 inch (nominal) last stage blades. An AC generator is connected to the turbine shaft. The turbine consists of one double flow high pressure element in tandem with three double flow low pressure elements. The turbine generator bearings are lubricated by a conventional pressurized oil system. The turbine generator uses an electro-hydraulic control (EHC) system that controls the speed, load, pressure, and flow for startup and planned operation, and trips the unit in off-normal situations. The EHC system operates the high pressure stop and control valves, bypass valves, low pressure stop and intercept valves, and other protective devices. Each valve is provided with an individual unitized actuator. The unitized actuators are self contained electro-hydraulic valve positioners that convert electrical control signals to valve position. Steam from the nuclear steam supply system enters the high pressure turbine through four 24-inch stop valves each of which are in series with a governing control valve. One stop valve and one control valve form a single assembly. After expanding through the high pressure turbine, the steam flows through the moisture separators and reheaters to the six intermediate stop valves each in series with an intercept valve into steam lines leading to the three low pressure turbines. Steam from each low pressure turbine is then exhausted into the main condenser. Moisture separation and reheating of the steam are provided between the high pressure and low pressure elements in two parallel shells, each of which contains combined moisture separator reheater assemblies. A moisture separator reheater assembly is located on each side of the turbine parallel to the turbine shaft.

The turbine generator is protected from excessive overspeed by two types of emergency overspeed trip protection systems, the mechanical overspeed trip systems and the electrical overspeed trip system. The overspeed protection systems are designed to prevent damage to the turbine and to equipment or structures from a turbine missile. (Analyses of the turbine missiles concluded that they are most likely to occur from an overspeed condition.)

The basis of the Standard Technical Specification 3/4.3.8 "Turbine Overspeed Protection System" involves maintaining the turbine overspeed protection system to reduce the hazards of turbine missiles. This function is discussed in Standard Review Plan Sections 3.5.1.3 and 10.2.3. However, based on the orientation and location of the Fermi 2 turbine and the structural design of the plant, Detroit Edison has concluded that any potentially generated turbine missile will not prevent the reactor from achieving and maintaining a safe shutdown condition. Please note that a turbine missile situation is highly dependent on the complete failure of all overspeed protection systems which is most improbable. Additionally, the Bases of TS

3/4.3.8 states in part: "Protection from turbine excessive overspeed is not required to protect safety-related components, equipment, or structures. However, it is included in order to improve overall plant reliability." Therefore, Detroit Edison does not believe that the administrative controls imposed by the subject TS are necessary because a turbine missile will not prevent the reactor from achieving and maintaining a safe shutdown condition.

EVALUATION

The removal of TS 3/4.3.8 from the Technical Specifications is based on the following items:

1) The turbine is protected from excessive overspeed by two types of emergency systems in addition to its normal speed control system.

2) Based on the orientation and location of Fermi 2 turbine and the structural design of the plant, any potentially generated turbine missile will not prevent the reactor from achieving and maintaining a safe shutdown condition.

3) Removing the subject TS would not require the plant to reduce power weekly to perform turbine valve testing associated with the overspeed protection systems. During transient operation (power increases and decreases) operational events are more likely to occur than operating at steady state conditions.

4) Recent inspection of a sample of the turbine steam supply valves and the operational test history of the overspeed protection instrumentation indicate that this system has always remained operable.

5) The manufacturer's recommendations on turbine overspeed protection system testing and inspections will be followed to ensure the reliability of the systems with consideration given to the operational constraints as a result of performing these tests and inspections.

Each of the above items will be addressed below.

Loss of electrical load or malfunction of the control system can cause the turbine to overspeed. The mechanical and electrical emergency overspeed protection systems operate to limit the maximum turbine speed under fault conditions. The mechanical overspeed trip function consists of two redundant systems using two separate spring-loaded eccentric rings mounted on the turbine shaft. When the turbine is accelerated to 110 to 111 percent overspeed, each ring strikes its respective trip level which in turn moves a limit switch. Operation of either limit switch will energize a system of protective relays that will trip the turbine.

The electrical overspeed system uses four separate and redundant channels of speed measurement. The four channels are fed through a network of comparative logic gates. This comparative logic system monitors the speed input signals and alerts the operator with an alarm if any one of the four inputs fails to match the others. Each channel energizes an overspeed trip relay (at 110% rated turbine speed) which has its output contacts arranged in two special two-out-of-four logic arrangements so that the operation of any two channels will trip the turbine. The two logic arrangements are arranged so that all six combinations of two channels are provided, although two combinations are duplicated. An output from either logic combination will trip the turbine. This design gives a high level of reliability with the minimum number of contacts. Spurious trips are avoided by this arrangement since each logic requires two channels to fail to the trip state before a turbine trip is initiated. Three channels must fail to their non-trip state before the system becomes completely inoperative. The system's AC power supply is redundant with automatic throwover to a backup AC supply.

Both types of overspeed protection systems trip the turbine by closing all high pressure and low pressure steam supply valves. Each high and low pressure steam line to the turbine has two valves in series such that a failure of one valve in each steam line would not necessarily cause a turbine to overspeed. Therefore, because of the redundancy and diversity of the two types of emergency overspeed protection systems the possibility of an overspeed condition occurring which could potentially generate a turbine missile is extremely remote.

An analysis performed in 1971 determined that the most likely source of a missile from the turbine generator is from wheel 8 of the low-pressure turbine. This analysis has indicated that other possible missiles from the high-pressure turbine or the generator rotor would not penetrate their respective outer casing. The potential missile from wheel 8 would be generated at an overspeed condition of 167 percent of rated turbine speed which is well above the overspeed protection systems' trip setpoint of approximately 110 percent.

As stated above, the only missile which could possibly do damage to essential equipment would be a missile emanating from the low-pressure section of the turbine (assuming the failure of all overspeed protection systems). This missile could break through the turbine casing in any radial direction. However, the direction of rotation of the turbine is such that the motion of the top half of the rotor carries it away from the reactor and auxiliary buildings. Furthermore, these buildings are not in direct radial alignment with the low-pressure sections of the turbine. Thus, the possibility of the missile taking a direct horizontal path toward the reactor and auxiliary building is remote. If, however, the missile were directed horizontally toward the reactor as a result of an internal or external

collision its emerging translational energy would be absorbed and the missile stopped by the concrete shielding which surrounds the turbine. This shielding would be only partially penetrated by the missile with the missile surrendering all of its kinetic energy.

Another path that the missile emanating from the low-pressure section of the turbine-generator could take is nearly vertically upwards through the roof of the turbine. It has been estimated that such a missile would lose very little energy penetrating the roof barrier. This missile would have to be deflected elastically or acted upon by wind forces to give it a trajectory which would allow it to fall directly atop the reactor or auxiliary building. To protect against nearly vertical missiles, all missile barriers in the auxiliary and reactor building have the required thickness to stop turbine generated missiles and also prevent the generation of secondary missiles due to concrete spalling and scabbing.

The Fuel Storage Pool is not protected by a missile barrier. However, the 1971 analysis calculated that the probability of a missile striking the fuel pool is less than once in every 10,000 years. Detroit Edison concludes from this analysis that no turbine missile will impact the fuel storage pool and thus no missile barrier is required.

The above mentioned turbine missile analysis was performed prior to the design and construction of the RHR Complex. A more recent turbine missile analysis was performed for the RHR Complex. This analysis concluded that a low trajectory missile (nearly horizontal) will be stopped by the turbine room's west wall. However, a vertically generated missile could perforate the RHR Complex's roof and cause equipment damage to one division. The RHR Complex houses two redundant safety-related divisions which are separated by a 4-ft thick wall (see UFSAR Figure 3.5-2). This 4-ft thick wall is more than adequate to prevent any spalling or scabbing of concrete on the other side (other division) of the wall and thus, will prevent any potential missile from impacting more than one division. Therefore, in the unlikely event of a turbine missile impacting the RHR Complex roof at least one full division of equipment housed in the RHR Complex will remain OPERABLE to achieve and maintain a safe shutdown condition of the reactor.

Please note that the turbine missile analyses mentioned above have been previously reviewed and accepted by the NRC as indicated in Reference 2, Section 3.5.2. Additionally, it was recognized that a potential turbine missile hazard was not the basis for Fermi 2 Overspeed Protection TS at the time of Fermi 2 licensing. Accordingly, the subject TS Bases discusses the reliability benefits of maintaining the turbine overspeed protection system and not the need to maintain the system to reduce the hazards of turbine missiles.

During the development of this proposal some inconsistencies were identified in support documentation which were the basis for the turbine, reactor and auxiliary building's turbine missile analysis and UFSAR statements. Some of these support documents were also the basis for Reference 2 conclusions. An evaluation of the inconsistencies and subsequent reanalysis of identified turbine missile barriers have determined that the conclusions and the factors of conservatisms as previously stated remain valid. However, some current UFSAR statements related to turbine missile protection are not accurate and are being changed, but these changes do not affect any conclusions previously made. In fact the same factor of conservatism or greater has been verified. All turbine missile barriers in the turbine, reactor and auxiliary buildings have more than the required thickness for missile protection.

Technical Specification (TS) 3/4.3.8 requires that a weekly surveillance requirement be performed by cycling all turbine high pressure stop and control valves and all turbine low pressure stop and intercept valves. In order to perform this surveillance requirement reactor power must be reduced to compensate for the reduction in steam flow to the turbine. This weekly reduction in reactor power is not desirable because of the capacity factor losses and the associated transient operation (frequent power increases and decreases) of the plant which makes it more susceptible to an operational event.

Recent inspections of some of the turbine's steam supply valves indicate that they are in good condition. During the first refueling outage two high pressure turbine steam supply valves were inspected. No problems were identified on these valves. Additionally, the bearings and glands from two low pressure turbine valves were dismantled for inspection and found to be in good condition. The TS required testing of the mechanical and electrical overspeed protection instrumentation has indicated that if a turbine overspeed condition had existed the turbine would have been tripped. At all times at least one mechanical system and enough channels of the electrical system were available to trip the turbine.

Detroit Edison intends to perform turbine overspeed protection system visual inspections and testing in accordance with the manufacturer's recommendations with consideration given to the operational constraints as a result of performing these inspections and tests. Detroit Edison fully recognizes the benefit of performing these inspections and tests to ensure reliable operation of this station. However, we do not believe that rigid Technical Specification requirements are needed on this system because as outlined above the postulated failure of this system and resultant proposed turbine missile will not prevent the reactor from achieving and maintaining a safe shutdown condition.

NO SIGNIFICANT HAZARDS CONSIDERATION

In accordance with 10CFR50.92, Detroit Edison has made a determination that the proposed amendment involves no significant hazards considerations. To make this determination, Detroit Edison must establish that operation in accordance with the proposed amendment would not: 1) involve a significant increase in the probability or consequences of an accident previously evaluated, or 2) create the possibility of a new or different kind of accident from any accident previously evaluated, or 3) involve a significant reduction in a margin of safety.

1) The proposed change does not involve a significant increase in the probability or consequences of an accide previously evaluated because the turbine overspeed protection system is not required to mitigate any design basis accident and the postulated failure of this system and resultant proposed turbine missile will not prevent the reactor from achieving and maintaining a safe shutdown condition. The basis for the subject system to be included in the Standard Technical Specifications is to reduce the hazards of turbine missiles. Turbine missiles from an overspeed condition at Fermi 2 are prevented by the two types of emergency overspeed trip systems (mechanical and electrical) which trip redundant high and low pressure steam valves to prevent an overspeed condition. Analysis has determined that because of the orientation and location of the Fermi 2 turbine and the structural design of the plant, the effects of the worst case turbine missile will not prevent the reactor from achieving and maintaining a safe shutdown condition. Additionally, the proposed change would allow for less frequent power reductions for turbine valve testing. During these power reductions and subsequent power increases operational events are more probable than operation at steady state conditions. Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated because the turbine overspeed protection system is not required to mitigate any design basis accidents and the postulated failure of this system and resultant proposed turbine missile will not prevent the reactor from achieving and maintaining a safe shutdown condition.

2) The proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated because the proposed change does not introduce a new mode of plant operation or involve a physical modification to the plant.

3) The proposed change does not involve a significant reduction in a margin of safety because, as outlined in item 1 above, the turbine overspeed protection system is not required to mitigate

any design basis accident and the postulated failure of this system and the resultant proposed turbine missile will not prevent the reactor from achieving and maintaining a safe shutdown condition. Additionally, the Bases of the subject TS states that the turbine overspeed protection systems are included in the Fermi 2 TSs in order to "improve overall plant reliability". Plant and public protection from turbine missiles are ensured by the structural design of the plant and the orientation and location of the turbine, and not explicitly by the turbine's overspeed protection systems.

Based on the above, Detroit Edison has determined that the proposed amendment does not involve a significant hazards consideration.

ENVIRONMENTAL IMPACT

Detroit Edison has reviewed the proposed Technical Specification changes against the criteria of 10CFR51.22 for environmental considerations. The proposed change does not involve a significant hazards consideration, nor significantly change the types or significantly increase the amounts of effluents that may be released offsite, nor significantly increase individual or cumulative occupational radiation exposures. Based on the foregoing, Detroit Edison concludes that the proposed Technical Specifications do meet the criteria given in 10CFR51.22(c)(9) for a categorical exclusion from the requirements for an Environmental Impact Statement.

CONCLUSION

Based on the evaluation above: 1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and 2) such activities will be conducted in compliance with the Commission's regulations and the proposed amendments will not be inimical to the common defense and security or to the health and safety of the public.

PROPOSED CHANGE