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R. C. DeYoung, Assistant Director for Pressurized Water Reactors, L

SAFETY EVALUATION REPORT: AUXILIARY AND POWER CONVERSION SYSTEMS

Plant Name: Indian Point Unit #3, Consolidated Edison Company of New York
Licensing Stage: OL
Docket No.: 50-286
Responsible Branch: PWR-1
Project Manager: Herschel Specter
Required Completion Date: May 11, 1973

The enclosed Safety Evaluation Report covers the areas of plant auxiliary and the power conversion system. Three areas of concern remain outstanding which will require a supplement to this report following receipt of information from the applicant. They are:

1. Fuel Handling System

We understand that the applicant plans to increase the fuel storage building overhead crane capacity, and that a larger, heavier fuel cask will necessitate a reevaluation of the sideways drop, and side tip drop accident into the fuel storage pool. The applicant will have to perform a structural check on the crane supports and possibly strengthen that structure. The structure and crane design should conform to seismic Category I design criteria.

2. Diesel Generator Cooling Water System

The applicant has indicated to us that he is performing a study of the service water system valving to the diesel general lube oil and jacket water heat exchangers. The purpose of the study is to give assurance that the cooling water will perform reliably over the long term operation following a passive failure in the system.

3. Main Steam Supply System

The applicant's analysis for the high energy line rupture problem was received on May 14, 1973. A review of this analysis must be performed prior to agreement as to the adequacy of the main steam supply system and auxiliary (emergency) feedwater system. In addition, the capacity

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sizing for the auxiliary feedwater pumps will require a reevaluation to more adequately meet the steam generator cooldown requirements.

Following an affirmative evaluation of these additional data, we will be prepared to provide a favorable safety evaluation to these items.

Robert L. Tedesco
Assistant Director for
Containment Safety
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Enclosure:
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9.0 Auxiliary Systems

9.1 Fuel Storage and Handling

This review covers the following sections: New Fuel Storage (9.1.1), Spent Fuel Storage (9.1.2), Spent Fuel Pool Cooling and Cleanup System (9.1.3) and the Fuel Handling System (9.1.4). It is estimated that approximately 95 percent of the required information has been presented. The deficient areas are:

(a) The sections on the New Fuel Storage (9.1.1) and the Spent Fuel Storage (9.1.2) should be expanded to include the assumptions used in the subcriticality calculations and the crane uplift forces to be withstood by the fuel storage racks.

(b) Provide the requirements for spent pool water cleanliness from fission and corrosion products and the time to locate and install the portable spent fuel cooling pump.

9.2 Water Systems

This review covers the following sections: Station Service Water System (9.2.1), Component Cooling Water System (9.2.2), Demineralized

Water Makeup System (9.2.3), Potable and Sanitary Water System (9.2.4), Ultimate Heat Sink (9.2.5) and the Condensate Storage Facilities (9.2.6). It is estimated that approximately 70 percent of the required information has been presented. The deficient areas are:

(a) Provide assurance that the service water system, component cooling water system and the safe shutdown impoundment dam are protected from tornado missiles.

(b) Provide a discussion of the methods that will be employed to prevent corrosion in the service water system, component cooling water system and the condensate storage facility.

(c) Discuss the consequences of single active failure in each power plant, postulated such that two component cooling water heat exchangers are disabled, leaving one heat exchanger for two reactors.

(d) Provide the seismic category of the safe shutdown impoundment and the test, inspection and instrumentation application criteria for the ultimate heat sink.

(e) Discuss the condensate storage facility's code design requirements and provide an analysis of the storage facility failure including the provisions for mitigating the environmental effects.

9.3 Process Auxiliaries

The contents of the Compressed Air Systems (9.3.1), Process Sampling System (9.3.2), Equipment and Floor Drainage System (9.3.3), Chemical, Volume Control, and Liquid Poison Systems (9.3.4), Boron Recycle System (9.3.5) and the Failed Fuel Detection System (9.3.6) reviewed under this section are essentially complete.

9.4 Air Conditioning, Heating, Cooling and Ventilation Systems

This review covers the following sections: Control Room (9.4.1), Auxiliary Building (9.4.2), Safeguards Building (9.4.3), Fuel Building (9.4.4), Turbine Building (9.4.5), Containment Ventilation System (9.4.6) and Miscellaneous Ventilation Systems (9.4.7). It is estimated that approximately 80 percent of the required information has been presented. The deficiencies are:

(a) Provide the location and the ability to withstand tornado forces and tornado missiles for the air conditioning-ventilation systems of the control room, auxiliary building, safeguards building, diesel generator compartments, electrical area and the uncontrolled access area.

(b) With regard to the control room air conditioning and ventilation system specify 100 percent capacity as the ability to maintain one or two control rooms at suitable and safe ambient conditions.

(c) Provide for the control room a discussion of the fire protection monitor's ability to detect smoke and isolate the ventilation system of the polluted area. Indicate the anticipated degradation of control room equipment if the design temperature levels are exceeded due to a fire inside or outside of the control room.

(d) Provide a detailed discussion of the radwaste area ventilation system including requirements for the monitoring of abnormal

radiation levels and the effects of the inability to maintain preferred air flow patterns.

(f) For the turbine building provide the requirements for monitoring abnormal radiation levels and the treatment of exhaust air.

9.5 Other Auxiliary Systems

This review covers the following sections: Fire Protection Systems (9.5.1), Communication Systems (9.5.2), Lighting Systems (9.5.3), Diesel Generator Fuel Oil Storage and Transfer System (9.5.4), Diesel Generator Cooling System (9.5.5), Diesel Generator Starting System (9.5.6) and Diesel Generator Lubrication System (9.5.7). It is estimated that approximately 95 percent of the required information has been presented. The deficient areas are:

(a) Provide a discussion of the requirements to assure that operation of the fire protection system would not produce unsafe conditions.

10.0 Steam and Power Conversion System

10.1 Summary Description

The contents of the Summary Description reviewed under this section are essentially complete.

10.2 Turbine-Generator

The discussion of the Turbine-Generator reviewed under this section is essentially 80 percent complete. Deficiencies are:

(a) Provide the performance requirements of the turbine generator under emergency conditions and a description of the use of extraction steam for feedwater heating.

(b) In Section 10.2.3.3 it was noted that due to low probability, turbine missiles are not considered as a design basis. To further support this discussion, provide the following information:

1. Describe how one can with confidence predict the probability of failure of 10^{-4} per unit year for present day nuclear turbines in the size range of 1150 MWe when 70,000 turbine years of operational experience on much

smaller units show that the probability of failure and ejection of a missile is 10^{-4} per unit year; i.e. discuss how the new problems that are created as a result of the growth in size (which affect the probability) have been accounted for, such as:

a. The electro-hydraulic turbine control and overspeed protection systems mentioned in #10.2.3 have become a necessity because of the decrease in the inertia to torque ratio. In this regard provide and compare the available data of malfunctions and failures of the mechanical and electro-hydraulic turbine control and overspeed protection systems expressed in malfunctions or failures per turbine operating year.

b. The new demands imposed on those manufacturing the turbine components due to higher working stresses, and other problems that must be dealt with in order to produce the larger low-pressure stage wheels and rotors.

2. Since the turbine missile is not considered a design basis indicate the assumed value of Psd in Section 10.2.3.2 i. e. relate the required missile barrier thickness to

adequately protect equipment (including the creation of secondary missiles) to the actual intervening barrier thickness. In this regard, assuming the mimimum energy absorbed by the turbine casing, indicate the sources and provide the experimental results to support the energy assumed absorbed by the turbine casing in the event of failure of a low pressure, last stage wheel when the turbine is rotating at various speeds between 110 to 180 percent of rated speed.

3. Explain the design considerations that lead to the decisions in the plant layout of arranging the two containments in line with the most probable trajectory of low pressure turbine missiles. Also indicate how much the probability of a critical strike would be reduced if the plane of the three low pressure cylinders last stage wheels did not intersect any critical target (equipment).

(c) Individually identify, all portions of the facility on a site plot plan that are essential in attaining and maintaining a safe shutdown which are not housed within barriers adequate to protect the equipment from the most energetic turbine missile. Describe how the valve of 10^{-8} for Pni was arrived at considering all

critical target areas and their associated probability of a strike Pms from all six low pressure cylinders.

(d) In tabular form, for each identified target on the plot plan indicate the range in the angles of the missile trajectory for which a critical strike was considered.

(e) Provide a plot of probability versus angle of missile trajectories measured from a plane normal to the turbine axis which was used in establishing the probability of a strike.

(f) Describe the turbine control and overspeed protection systems in sufficient detail to permit an evaluation of the degree of independence and redundancy of components and systems.

10.3 Main Steam Supply System

The contents of the main steam supply system reviewed under this section are essentially complete.

10.4 Other Features of the Steam and Power Conversion System

The review covers the following equipment: Condensers (10.4.1), Condensers Evacuation System (10.4.2) Turbine Gland Sealing System (10.4.3), Steam Dump System (10.4.4), Circulating Water System (10.4.5), Condensate Cleanup System (10.4.6), Condensate and Feedwater Systems (10.4.7), Steam Generator Blowdown System (10.4.8)

and Auxiliary Feedwater System (10.4.9). It is estimated that approximately 90 percent of the required information has been presented. Deficient areas are:

(a) The section on the condensers evacuation system should be expanded to include the capability to limit or control the loss of radioactivity to the environment.

(b) The environmental criteria of the steam dump system should be provided.

(c) Provide a description of the water quality and material selection used to prevent corrosion of the circulating water system.

(d) Provide the seismic classification of the condensate and feedwater systems and the supply of condensate available for emergency purposes.

(e) The steam generator blowdown system section should be expanded to include the seismic classification and a failure analysis of the system components.