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THRU: V. A. Moore, Chief, Electrical Systems Branch, DRS

SCHEMATIC DIAGRAM REVIEW, INDIAN POINT NUCLEAR GENERATING UNIT NO. 3; DOCKET NO. 50-286

We met with the applicant and his contractors on May 18 and 19 to review the following schematic diagrams:

1. Offsite Power
2. Onsite AC Power
3. Reactor Trip
4. Safety Injection
5. Containment Spray
6. Containment Isolation
7. Steamline Isolation
8. Emergency Feedwater
9. Cable Separation
10. Diesel Fuel Oil Transfer

In attendance were:

WNES	CON ED
R. M. Harper	R. P. Remshaw
H. F. Clark	R. H. Koppe
M. H. Judkis	J. J. Grob
O. M. Hange	P. Szabados
R. F. Devine	W. C. Dumper
J. L. Grover	R. A. Saya
H. N. Skow	
G. W. Dillon	

UE & C	AEC
W. P. Robinson	C. Hale, DRL
J. G. Kritikson	E. Howard, CO:I
D. H. Rhoads	D. Sullivan, DRS

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We completed our review of the schematics with the exception of those for the Emergency Feedwater system (see paragraph 8) and the Diesel Fuel Oil Transfer system (see paragraph 10), and several unavailable schematics for portions of the Containment Isolation and Steamline Isolation systems.

Summary of Outstanding Items

1. It appears that an excessive use of swing buses in the d.c. system creates unnecessary common failure modes. A staff position on this matter remains to be formulated.

2. Both trains of engineered safety feature logic can be concurrently defeated by test switches. A single annunciator indicates a test condition (one or both trains).

3. The design basis for the Emergency Feedwater system in terms of protection system requirements has not been determined. Our review of the schematics has been postponed pending this determination. The matter has been referred to DRL for resolution.

4. A few schematics of the Containment Isolation, Steamline Isolation and Diesel Fuel Oil Transfer systems remain to be reviewed.

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1. Offsite Power

Power is brought to the Buchanan substation via two rights of way; overhead 138 kv lines carried on a single set of four-circuit towers, and a single underground 138 kv line from across the river. From Buchanan to Unit 3 there are two lines, one overhead (138 kv) and one underground (13.8 kv) which supply power to the emergency buses.

Generator trip, in the event of turbine trip, is accomplished by redundant breaker and trip coils.

We observed no areas where a single failure could deprive the station of all offsite power. The design appears to be acceptable.

2. Onsite A.C. Power

Onsite a.c. power is furnished by three diesel generators rated at 1750 kw continuous. They are arranged in a split-bus configuration.

Since diesel generator logic is two-out-of-three and there are two station batteries, it is necessary for at least one of the d.c. control power buses for one of the a.c. trains to "swing" between the redundant d.c. sources. Con Ed has elected to swing all three control power buses.

Our review indicates that, in the event of loss of offsite power from the 138 kv sources, a fast transfer is made to the 13.8 kv source. Supply breaker opening is delayed for about 25 cycles. The momentary voltage loss will start the diesels. If no power is available after 25 cycles, the supply breakers are opened, and the diesel generator breakers will close onto their respective buses at the proper frequency and voltage values.

We uncovered no single failure modes which would prevent more than one diesel-generator from operating. There is a concern, however, that the swinging of d.c. control buses at all three a.c. trains creates an unnecessary vulnerability to common mode failures. We expressed this concern to the applicant. The matter remains unresolved.

Apart from this one area, and, excluding considerations of diesel generator ratings which have not yet been reviewed, we believe the design of the onsite power system is acceptable.

3. Reactor Trip

The design of the reactor trip system is virtually identical to those of recently approved Westinghouse plants. No deficiencies were observed, and we believe the design is acceptable.

4. Safety Injection

The Safety Injection System is similar in design to those of other Westinghouse plants except for a somewhat improved on-line testing capability. In the other designs it is possible to functionally test the initiating logic circuits only as far as the "Master" relays. Subsequent on-line testing consists of only continuity checks with an ohmmeter. In the Indian Point 3 design a test switch in each train blocks the output from the master to the slave relays such that the master relay can be actuated on-line. Further, the operation of the master relay contact can be monitored by a test light in series with the contact and the slave relay coils. The additional voltage drop through the light limits the slave relay coil current such that the relays do not actuate; this scheme permits a continuity check of the master relay contact and the slave relay coils.

Further downstream testing can, as before, be accomplished only during shutdown.

There are two logic trains, A and B, which respectively control one of two redundant devices where two are involved. For "two-out-of-three" devices, two are respectively controlled as before with the third controlled by both trains. This does not involve swing buses; the common devices are controlled by parallel-connected contacts from both trains. There is, however, some small, but acceptable, loss of circuit independence.

Our review uncovered a serious deficiency which the applicant agreed to correct; both trains of all engineered safety features can be concurrently defeated by the test switches. A single annunciator window is provided to indicate train bypass. At the meeting, the applicant proposed to incorporate an interlock to prevent placing more than one logic train in the test mode. We will review the modified circuit when it becomes available.

Our review also included several redundant valve actuation circuits which were found to be acceptable.

Apart from the one deficiency discussed above the Safety Injection system appears to be acceptable.

5. Containment Spray

The initiating system is similar in design to the Safety Injection initiating system; there are two redundant logic trains with the same kind of testing circuit. The same bypassing problem exists here.

Our review included several redundant valve initiating circuits.

Apart from the bypassing problem common to all ESF in this plant, we believe the design of this system is acceptable.

6. Containment Isolation

The initiating logic is redundant and testable on-line similar to the other ESF initiating circuits.

We selected three pairs of valve circuits for review, only one of which was available. The pair which we were able to review, sump pump isolation, was satisfactory. The remaining circuits, containment purge isolation and containment pressure relief isolation will be reviewed at a later date.

Assuming satisfactory resolution of the outstanding items, we believe the design of the containment isolation system is acceptable.

7. Steamline Isolation

The design is similar to those recently approved on Westinghouse plants with the exception of the new on-line test circuitry.

As before, each isolation valve is controlled by two solenoids (1/2 logic), one assigned to each initiating logic train. The circuits for the solenoids were not available, and will be reviewed at a later date.

Assuming satisfactory resolution of this outstanding item, we believe the design of this system is acceptable.

8. Emergency Feedwater

The circuits were not reviewed pending a determination whether or not this system is an engineered safety feature covered by IEEE-279.

This matter has been referred to DRL for resolution.

9. Cable Separation

The principal topic of discussion was the physical separation of redundant cables in the two cable tunnels. We had previously been informed by the applicant that redundant cables were located in the same tunnel and we had implied that they should be in separate tunnels.

At this meeting the applicant stated that, because of the 2/3 and 3/5 logic systems at the plant it would be necessary to have three tunnels to achieve the additional separation we had asked them to consider.

Since a third tunnel is out of the question, the adequacy of the design must be judged on the physical independence of the four sets of cable trays (two per tunnel). We were informed that the horizontal separation (aisle space) is about four feet. Vertical separation is not as critical since a vertical set of trays is assigned to only one channel. All power cables are asbestos covered and have three-phase breaker protection.

Non-safety feature cables may be assigned to any tray, but tray-hopping is not permitted by their criteria.

No conclusions or decisions were reached at the meeting, and this matter remains under evaluation by the Electrical Systems Branch.

10. Diesel Fuel Oil Transfer

Each diesel has its own day tank. Each day tank can receive fuel from any one of the storage tanks via two redundant piping systems.

A sequencer selects one storage tank at a time in response to level information. Our discussions indicated that a single failure could disable the automatic transfer capability of the system by disabling the sequencer. Since each day tank contains 55 minutes of fuel, we will judge the design in terms of manual capability given the loss of automatic transfer capability 55 minutes subsequent to a LOCA. The applicant will inform us of the time available to the operator under these conditions to perform the manual function. Assuming adequate time is available, we will review the schematic diagrams to determine if any single failure could disable both the manual and automatic functions.

This matter remains outstanding.

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