

June 11, 1964

MEMORANDUM

TO : Files

FROM : R. H. Wilcox, Assistant to Executive Secretary,
ACRS

SUBJECT : DEL MEETING ON JERSEY CENTRAL NUCLEAR INSTRUMENTATION
HELD AT WETHERDA, MARYLAND ON MAY 12, 1964

The purpose of this meeting was to find out about and discuss the nuclear instrumentation to be used at the proposed Jersey Central Oyster Creek reactor. The ACRS was invited to attend, but on rather short notice. At the request of Mr. Rogers and Mr. Kewson, Dr. E. P. Epler was invited and did attend this meeting in the capacity of ACRS consultant.

Attendees

ACRS

E. P. Epler, Consultant
R. H. Wilcox, Staff

Division of Regulation

W. M. M. M.

Division of Reactor Licensing

R. S. Boyd
M. C. Gaskie
D. W. Korth
D. Sullivan
B. N. Grimes
B. E. Muller

Division of Compliance

L. Kornblith
H. R. Denton
R. Carlson

Jersey Central

D. E. Hetrick

General Electric

Mr. House
Mr. Lane
I. Peabody
W. Schulthis

Safety Standards

OFFICE	A. B. Holt	ACRS		
	C. E. Friswell			
REFERENCE		RHWILCOX:sls		
DATE		* part time 6/11/64		

FORM AEC-B16 (Rev. 9-58)

U. S. GOVERNMENT PRINTING OFFICE 16-62761-2

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Regulatory Staff

The first half hour of the meeting was devoted to an internal discussion of the problems by the staff and ACNS representatives.

Mr. Epler discussed work at Spert in which a period meter resulted in a faster trip than did level instrumentation.

Dr. Epler also expressed concern that failure of one clip lead might negate a scram. Mr. Frizzell did not think that the system would tolerate single failures. It was assumed that the Jersey Central instrumentation would be similar to that at Dresden. There was general agreement that bypassing by a single failure was unacceptable.

Mr. Frizzell indicated that the circuits were not tested as often as advertised. Dr. Epler urged more frequent testing, if single failure-negating circuits were accepted.

Mr. Boyd and Dr. Mann agreed that the purpose of the meeting was to ask "what" and "why" on the instrumentation, but not to reach a full and final judgement.

Jersey Central & General Electric

Mr. Gaske asked for a presentation on the safety system. Mr. Metrick indicated that this had been prepared; he then turned the meeting over to Mr. Peabody.

Mr. Peabody stated that a two-bus, relay-type system would be used. The basic criteria would call for a scram for any potentially unsafe condition; no scram for a spurious trip or instrument malfunction.

Circuit simplicity would be stressed; proven equipment used. Judicious duplication would be employed including fail-safe design features, i.e., failures to not prevent a shut-down or trip. Circuits are to be understandable and easy to maintain and test.

"On line" service is to be provided to satisfy the utility and be comparable to fossil-fueled plants. No single fault is to cause a scram.

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The GE rod drive system with pneumatic actuation of hydraulic drives was described. For Jersey, each drive will have its own scram and pilot valves. A-C current will supply the solenoids on the pilot valves; D-C will supply a backup valve. If both pilots fail to function, but the backup valve works, the rod will scram but at a reduced rate of speed (seconds). The backup valves are not fail-safe.

To date, GE has experienced only one pilot valve failure to drop out, that due to improper valve stem material.

There was some discussion of what would happen if rods were going in, but the reactor was on automatic recirculation flow control. GE's present approach is to control pressure with the initial pressure regulator.

The scram pilot valve was described. The most likely failure mode is for the valve to close which is safe.

Next, the Dresden relay approach was described. Two parallel 480 volt scram buses are used. Each safety chain is represented in each channel. Insofar as possible, sensors fail open. Automatic trips were not provided for calibration - this is an administrative function. There is no undervoltage trip.

There was discussion of why there is no scram on loss of turbine load. Tests show that the reactor is safe on the overpressure and the applicant hopes that breakers will close back in after a few cycles. Dresden has dumped full load once without a scram. The flux trip was stated to come fast in such an event anyhow.

The Jersey Central one-bus approach was next described. Mercury-wetted contact-type relays will be used; these have very high military reliability figures. There are four groups of pilot valves. Tripping of either half of the bus trips all solenoids, which will be of the D-C type. Parting of the contacts will take 4-5 msec (15 at most).

Picosimeters will contain no relays, but rather will use a solid state trip device rather than a vacuum tube bistable. The amplifiers are also solid-state. GE is considering a line which was also used at the University of Missouri reactor. Components would also be similar

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to those being installed at SM-1, although the safety circuit is quite different.

The annunciation scheme for Jersey is not yet fully worked out. GE recognizes that the advantage of duplication is lost if a circuit can fail.

The meeting recessed for lunch from 12:10 until 1:00.

Recirculation flow control is under study by GE-APED, and Mr. Peabody is a member of the Committee doing this studying. There will be a motor-generator set located outside of the containment and provided with a variable coupling. The generator output cables will penetrate the containment and provide power to the motor-driven recirculation pumps inside the drywell.

The primary control signal for the variable coupling has not been selected. Possible feedback signals are recirculation flow, steam flow, a limiting flux, or other.

To raise plant load, recirculation pumps will be speeded up; turbine admission valves will open subsequently on pressure increase. Present thinking is that a manual signal will be used for recirculation control. Load-following control is under study, however. Mr. Betrick eventually would hope that load would be determined by the system load dispatcher. The present thinking modifies what is stated in the hazards report, and thus alleviates concern expressed by Mr. Knuth for an incident involving rods driving in with recirculation flow control on automatic.

Dr. Epler questioned whether the operator won't increase recirculation flow to hold steady power. GE has not looked specifically into the flux peaking problems this might present, but because of intermixing of rod banks thinks that this might not be too great a problem. Dr. Epler stated that there is a precedent for requiring a sensor and limiter on rod misposition if this is harmful.

There will be manual isolation valves located near the pilot valves.

There was further discussion of the effect of mispositioning of rods, such as could result from a loose position indicator. GE believes that its position indicator design makes this incredible, but further analysis of this problem as an accident situation will be done.

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Mr. Gaske questioned whether flux trips would be set down at lower than full recirculation flow rates. This is not planned, except that the operator could switch to hi. 50% scale at say 40% flow. Flow control is not planned below 30-40%; steam separator action and other things must be studied at low flow rates. The recirculation flow dial may have a rate limit to control rate of reactivity insertion by this means.

Dr. Epler described his concept of what nuclear instrumentation is being proposed for Jersey Central. He would recommend that the two halves be physically separated such that no one failure could tie it up. GE indicated that the halves are physically divided.

Mr. Knuth questioned the capacity of the emergency diesel as related to the loads it must carry. He was concerned about control circuit failure which might tie all circuits into the bus which would then cause overload trip-out. This is not an integrated system, however.

There is no readout to show that a scram solenoid valve has operated correctly. Failure of an entire group of solenoids can be tolerated, however. Mr. Betrick stated that there will be alarms on the "X" relays.

The number of rods per backup valve is not yet firm. There will be one station D-C power supply (battery).

Frequency of testing was discussed, but it was generally agreed that this could be deferred until the operating stage.

Process instrument scrams will each be covered by four sensors and operate on 2/4 coincidence. The condenser vacuum switch is one exception; it will have only two sensors.

A better story on Log H and period protection was requested. High sensitivity picoammeters may be used; these would provide two decades of coverage below Log H. GE felt that the response to a fast period would be essentially equivalent; for a 5 second period each would trip in 3 seconds. At higher powers, the picoammeters were stated to be faster. Downscale trips on all but the lowest range are to be provided. Manual range switching will be used. There is an alarm on one picoammeter downscale. Three picoammeters downscale trips the channel; three on the other channel trips that one. Mr. Gaske indicated that Jersey Central would be asked to justify elimination of the period scram.

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Nuclear instruments will be on D-C (battery) power supply. Some process instruments, including water level, will be on A-C supply and will be on the bus powered by the diesel. Mr. Sullivan and Dr. Epler suggested that the diesel be started if the Jersey Central generator is lost. Afterheat removal must be maintained for hours; makeup water is added through the red drive pumps.

Bypassing of flux channels was discussed. A channel is apparently not tripped if only one is bypassed. Dr. Epler suggested an arrangement which would permit one and only one channel on each side to be bypassed.

Regulatory Staff

Dr. Epler expressed concern over the complexity of the bypasses, which are integral to the safety contacts. Mr. Frissell* commented that a brand new line of solid-state instruments would be used.

In a brief meeting with Dr. Epler and I, Dr. Mann proposed and it was generally agreed that the criteria looked OK, and there is reasonable assurance that the instrumentation will come out OK. Dr. Epler commented that it looked like a pretty good system and it could be done this way, but that it must be watched closely by the Regulatory Staff.

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* Frissell is leaving the AEC to go to work for the National Bureau of Standards.

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