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HW-71917 REV 1

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H.B. Spencer

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A. K. Hardin, Supervisor
Process Standards

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By Authority of D.S. Lewis

CG-PR-2 3-4-94

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IRRADIATION PROCESSING DEPARTMENT

February 16, 1962

PANELLIT GAUGE REQUIREMENTS - K REACTORS

There is a need for mandatory Panellit gauge requirements which will ensure a reactor scram upon loss of a process pump.

With a process pump shaft break, a bulk outlet temperature surge will result and if the bulk outlet temperature exceeds the saturation temperature at atmospheric conditions, damage to the crossover line, elbow into the downcomer, and the downcomer may occur.

Presently, there is no requirement which will ensure a Panellit trip upon pump shaft break. Although such a trip might occur now, the uncertainty will be greatly diminished by establishing mandatory requirements. Table 1 shows bulk temperature increases assuming a reactor scram would not occur upon pump shaft break. Reactor power levels were computed assuming a 5°C inlet water temperature and a 95°C bulk outlet temperature. The hydraulic supply and demand curves, used to determine reactor flows, were supplied by the process engineers.

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A. K. Hardin

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February 16, 1962

As shown in Table 1, the temperature surges at B, C, D, DR, F, and H reactors would be relatively small. Gauge setting requirements are not justified at these reactors. The temperature surge of 6.0°C at the K reactors is of sufficient magnitude to warrant a process standard requiring Panellit gauge settings which will ensure a reactor scram when a process pump shaft break occurs. For the pre-set trip point set at 25, a Panellit gauge must normally read 42 to ensure a reactor scram. With a little conservatism, the process standard should require a maximum Panellit reading of 40. The requirement need only apply when the bulk outlet temperature is above 93.5°C . At least three Panellit gauges located in the central zone should be required to read 40 or less, and the tube flows associated with these gauges should be in the range of 60-70 gpm.

A temperature surge above the top-of-downcomer saturation temperature could result in complete replacement of the downcomer. Construction costs for such an incident would be upwards from \$280,000 and the reactor downtime would be from 30-45 days. Although these figures are for an extreme case, the possibility of such an event occurring still exists. The potential for such effluent piping damage can be reduced by having mandatory Panellit gauge requirements. The cost for such requirements are negligible.

C. F. Poor

Process Analysis
RESEARCH AND ENGINEERING

CF Poor:mrf

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TABLE 1REACTOR SHAFT BREAK EFFECTS

<u>Reactor</u>	<u>No. of Pumps</u>	<u>Reactor Flow</u> gpm	<u>Power Level</u> MW	<u>Bulk Outlet</u> °C	<u>Bulk Temperature Surge</u> °C
B	8	88400	2096	95	3.9
	7	84700	2096	98.9	
C	9	98500	2312	95	1.9
	8	95500	2312	96.9	
D	8	85700	2032	95	2.9
	7	83000	2032	97.9	
DR	8	86800	2058	95	3.8
	7	83250	2058	98.8	
F	8	89100	2113	95	3.0
	7	86200	2113	98	
H	8	85000	2016	95	2.5
	7	82700	2016	97.5	
K*	6 modified	201500	47786	95	6.0
	5 modified	189000	47786	101.0	

* The 190-K process water pumps in each K area are to be modified on a one-at-a-time basis between January 1, 1962, and July 1, 1962.

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