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February 18, 1986

Mr. Ron Maines
Operator Licensing Branch
Division of Human Factors Technology
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Ron:

I am, of course, concerned and dismayed by the letter of complaint that you received from Toledo Edison's Davis Besse regarding the theory section (SRO section 5) that was administered to their candidates on the last written examination given on November 19, 1985. I have reviewed section 5 of that examination, and I feel adamant that it was appropriate. In fact, I consider this type of a theory section to be prototypic. I would welcome the opportunity to defend any or all of the questions contained in that section.

Sincerely,

J. C. Huenefeld
Power Generation Engineering

Concurrence Leo J. Defferding
Program Manager

/c

xc: B Boger
J McMillen

Points Available

5.0 THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS (25.0)

QUESTION 5.01

a. Define shutdown margin. Include any assumptions about axial power shaping rod or control rod positioning. (2.0)

b. During a plant heatup in accordance with the Plant Startup Procedure, PP 1102.02, the reactor must be shutdown by ≥1% Δk/k. If Group 1 rods are withdrawn, does their worth count as part of that 1% Δk/k? (1.0)

QUESTION 5.02

While drawing a bubble in the pressurizer, the vapor space is vented to the quench tank. Describe how conditions in the quench tank can be used for determining when a steam bubble exists in the pressurizer. (2.0)

QUESTION 5.03

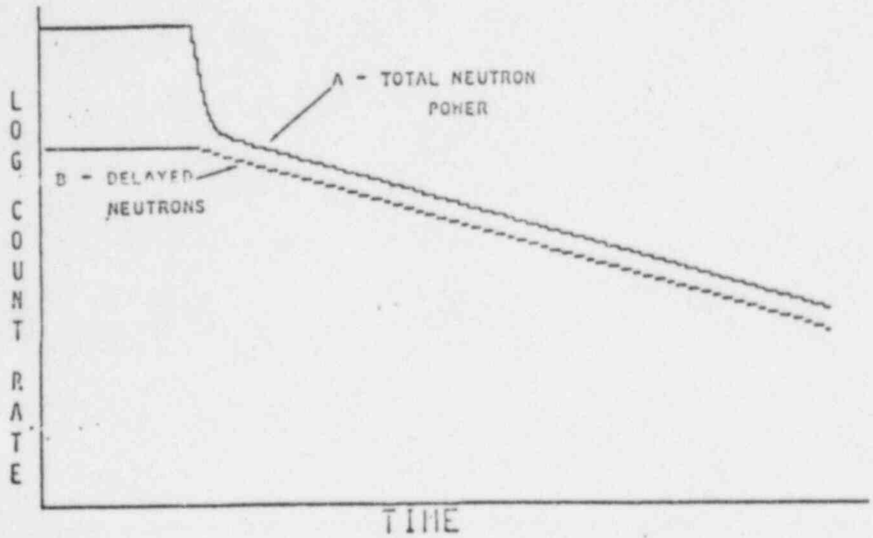
During a reactor plant startup with three reactor coolant pumps running, will Quadrant Power Tilt (QPT) be more limiting at low power or high power? Explain. (2.0)

-Section 5 Continued on Next Page-

Points
Available

QUESTION 5.04

Curve "A" on the trace below is a logarithmic plot of total neutron power versus time after a reactor trip. Curve "B" is a plot of the neutron power due to delayed neutrons alone versus time for the same trip. Explain why total neutron power (i.e., curve A) does not drop all the way down to the delayed neutron level (i.e., to curve B). (2.0)



QUESTION 5.05

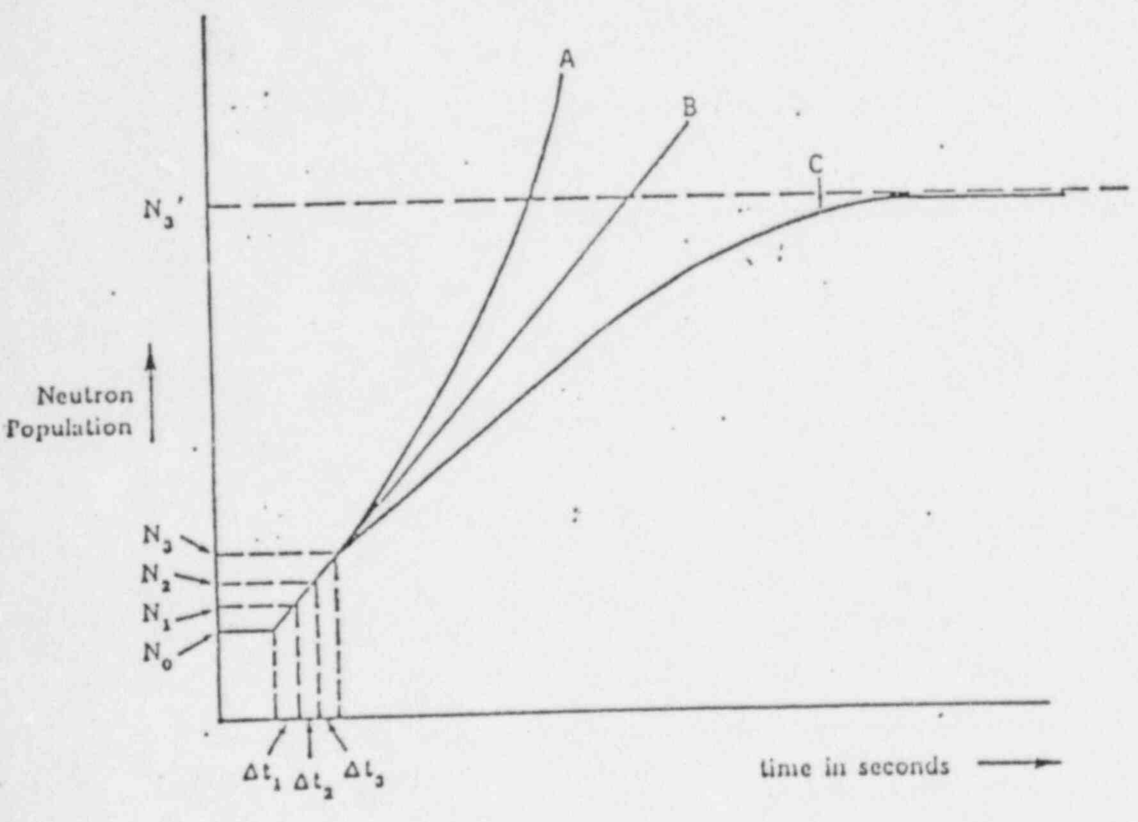
The reactor is critical at 10^{-8} amps. A stable 1 DPM startup rate is achieved. If rods are inserted continuously until startup rate drops to zero, and then the rod insertion is immediately stopped, will the reactor be critical, supercritical, or sub-critical? Explain. (2.0)

-Section 5 Continued on Next Page-

Points
Available

QUESTION 5.06

The figure below shows neutron population response to reactivity insertion. Label each of the three (3) curves as supercritical, exactly critical, or subcritical. (Assume below the point of feed-back effects.) (1.0)



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Points
Available

QUESTION 5.07

Given a large vented tank 30 ft. in diameter and 60 ft. high with a centrifugal pump taking a suction from its base. The pump is located at a vertical elevation corresponding to the bottom of the tank. The tank is entirely full of water and is maintained at 60°F by heaters. Assume the vent becomes totally clogged while the pump is in operation. Atmospheric pressure is 14.7 psia. Answer the following questions:

a. What is the maximum differential pressure that could occur between the inside and outside of the tank? Explain. (1.5)

b. Explain why the pump may begin to cavitate at a higher tank level than with the vent open. (1.0)

QUESTION 5.08

When conducting a rapid plant shutdown at 25 MW per minute (Abnormal Procedure AB 1203.07), why is the operator required to add boric acid to the makeup tank as unit load decreases? (2.0)

QUESTION 5.09

Assume that the condenser is not available and the operator is manually controlling steam generator pressure at 995 psig using the atmospheric vent valves. Estimate how many gallons of water would be required to cooldown the RCS from 582°F to 546°F. Show assumptions. (2.0)

a. 350 gallons

b. 3500 gallons

c. 35,000 gallons

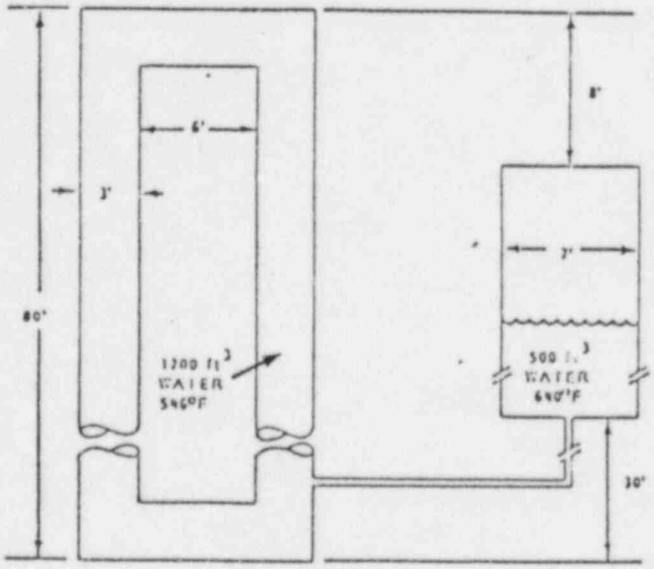
d. 73,000 gallons

-Section 5 Continued on Next Page-

Points
Available

QUESTION 5.10

Consider the system shown below (an 80 ft high loop of 3 ft diameter steel pipe and a pressurizer). Initially the pressurizer is saturated at 640°F and the loop is subcooled at 546°F. Assume that the entire system, including the pressurizer is allowed cooldown. The thermal contraction of the entire system due to this cooldown is 600 ft^3. Will the pressurizer be empty? Explain. (1.5)



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Points
Available

QUESTION 5.11

The reactor is at 100% FP equilibrium xenon conditions when a reactor trip occurs. Three (3) hours later the reactor is restarted.

a. When at 10^{-8} amps, which direction will rods have to go to hold power constant? Explain. (1.0)

b. Sketch the xenon concentration through to equilibrium assuming the reactor is raised to 92% power within 1 hour (4 hours after the trip). (1.5)

QUESTION 5.12

When borating from a lower to a higher boron concentration, why will the final boron concentration value always be 3 to 4% lower than anticipated? (1.0)

QUESTION 5.13

Why are SFRCS tripped and AFW actuated immediately following a loss of NNI X DC power, rather than waiting for the plant transient to initiate an SFRCS actuation? (1.5)

-End Section 5-

JMM 12/19/85

POWER PLANT EXAMINATION RESULTS SUMMARY

FACILITY	Davis Besse 1
DATE OF WRITTEN	November 19, 1985
DATE OF ORALS	November 20-21, 1985
DATE OF SIMULATOR	
EXAMINERS	J.C. Huenefeld / B.F. Gore
TYPE OF EXAM	(COLD) (HOT) — HOT circled

Overall Results	Total No.	Passed No.	Passed %	Failed No.	Failed %
Senior Operator	8	4	50	4	50
Reactor Operator	1	0	0	1	100

1. Reactor Operator
2. Senior Reactor Operator Instant
3. Senior Reactor Operator Upgrade
4. Reactor Operator Retake
5. Senior Reactor Operator Retake
6. Instructor Certification
7. Senior Reactor Operator Fuel Handling

NAME	DOCKET NO.	TYPE CODE	1	2	3	4	TOTAL	5	6	7	8	TOTAL	RO W	RO O	RO S	SRO W	SRO O	SRO S
Michael G. Parker	55-30880	1	79.1	77.2	92.6	75.2	81.07						P JCH	(F) BFG				
Dan L. Hughes	55-30952	2						80.4	97.6	88.0	76.8	85.8	R JCH	R BFG		P JCH	P BFG	
Anthony R. Stallard	55-30951	2						86.8	97.2	88.0	82.2	88.59				P JCH	P BFG	
Calvin E. Hoffer	55-5648	3						71.7	94.0	(67.2)	81.6	(78.8)				(F) JCH	(F) JCH	
Lawrence G. Keller	55-30630	3						82.5	95.6	89.0	83.4	87.7				P JCH	P JCH	
Steven L. Laeng	55-30224	3						(58.3)	92.8	84.0	78.4	(78.8)				(F) JCH	P JCH	
Arthur J. Lewis	55-7854	3						(62.2)	96.8	79.0	70.0	(77.3)				(F) JCH	P JCH	
~~Anthony R. Stallard~~	~~55-30951~~	~~3~~						~~86.~~										
Dan T. Staudt	55-30225	3						93.5 ~~86~~	93.2	76.4	71.2	83.4				P JCH	P BFG	
Kim A. Stiger	55-30226	3						(63.9)	97.2	86.0	83.0	82.9				(F) JCH	P JCH	

EXAMINATION RESULTS

P = Passed
F = Failed
W = Waived

EXAMINER'S INITIALS

Only initials of examiner who actually administered the examination