US NUCLEAR REGULATORY COMMISSION OFFICE OF INTERNATIONAL PROGRAMS WASHINGTON, DC 20555 TELEX NO:710-824-0415

PRIORITY

7/22/76

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original signed by Joseph D. Lafleur, Jr.

JOSEPH D. LAFLEUR, JR., ACTING DIRECTOR 492-7788

bcc: JDLAFLEUR, I RASTELLA,IP FILE - 1.11 Switzerlanc

R. Tedesco, NR

MR. F. WEEHUIZEN DIVISION OF SAFETY OF NUCLEAR INSTALLATIONS OFFICE OF FEDERAL DE L'ECONOMIE ENERGETIQUE 5303 WUERENLINGEN, <u>SWITZERLAND</u> TELEX:53714 e1r ch

THE STATUS OF NRC MARK III SAFETY RELIEF VALVE DISCHARGE OUENCHER REVIEW IS:

- A. GE HAD PRESENTED A STATISTICAL TECHNIQUE USING TEST LATA TO PREDICT QUENCHER LOADS FOR MARK III CONTAINMENT, PLUS A REPORT ON TEST RESULTS DEVELOPED BY GE FOR BWR CONTAIN. MENTMENT AND VERTICAL VENT LOADS.
- B. NRC REVIEWED ABOVE INFORMATION AND IDENTIFIED AREAS OF CONCERN WHICH HAVE BEEN ADDRESSED IN A MODIFIED METHOD PRESENTED BY GE AT AN APRIL 2, 1976, MEETING IN BETHESDA. SUBSEQUENT TO THE MEETING, THIS MODIFIED METHOD AND PRO-POSED LOAD CRITERIA WERE REPORTED IN AMENDMENT NO.43, WHICH WAS RECEIVED AT NRC ON JUNE 22, 1976.

WE ARE FORWARDING BY AIRMAIL, OUR EVALUATION WHICH IS BASED UPON THE MODIFIED METHOD AND LOAD CRITERIA CALCULATION BY THIS METHOD. IN SHORT GE'S STATISTICAL APPROACH AND METHOD-OLOGY USED ARE ACCEPTABLE FOR ESTABLISHING THE QUENCHER LOADS FOR MARK III CONTAINMENT AND BASED UPON THE STATISTICAL METHOD CALCULATED QUENCHER DESIGN LOADS FOR SIX CASES (SEE TABLE BELOW) OF SAFETY RELIEF VALVE OPERATION ARE WITHIN

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US NUCLEAR REGULATORY COMMISSION

MR. F. WEEHUIZEN

ACCEPTABLE LEVELS. NEVERTHELESS, BECAUSE THE TEST DATA WAS OBTAINED IN A SYSTEM LACKING COMPLETE DYNAMIC OR GEOMETRIC SIMILARITY WITH THE QUENCHER SYSTEM FOR THE MARK III CON-TAINMENT, WE WILL REQUIRE VERIFICATION BY IN-PLANT MARK III TESTS.

QUENCHER BUBBLE PRESSURE MARK III, 238 STANDARD PLANT 95-95% CONFIDENCE LEVEL

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DESIGN VALUE MAXIMUM PRESSURE (PSID)

		P	+)	P _B (-)
	CASE DESCRIPTION			Star - age 2019 - 1000 - 1000 - 100
	SINGLE VALVE FIRST ACTUATIO			0 1
	AT 1000F POUL TEMPERATURE	13.	. 5	~8.1
2.	SINGLE VALVE SUBSEQUENT			
	ACTUATION, AT 120 *F POOL			
	TEMPERATURE	28.	. 2	-12.0
3.	TWO ADJACENT VALVES FIRST			
	ACTUATION AT 100°F POOL			
	TEMPERATURE	13.	. 5	-8.1
4.	10 VALVES (ONE LOW SET AND			
	NINE NEXT LEVEL LOW SET)			
	FIRST ACTUATION AT 100°F			
	POOL TEMPERATURE	16	. 7	-9.3
5.	19 VALVES (ALL VALVE CASE)			
	FIRST ACTUATION, at 100°F			
	POOL TEMPERATURE	18	. 6	-9.9
6.	8 ADS VALVES FIRST ACTUATIO	DN		
	AT 120°F POOL TEMPERATURE	17	. 4	-10.4
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US NUCLEAR REGULATORY COMMISSION OFFICE OF INTERNATIONAL & STATE PROGRAMS WASHINGTON, DC 20555 USNRC TELEX NO: 710-824-0415

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Original signed by Robert A, Stella

4/15/76

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JOSEPH D. LAFLEUR, JR., Acting Director 49-27788

DR. PETER COURVOISIER, HEAD DIVISION OF SAFETY OF NUCLEAR INSTALLATIONS OFFICE FEDERAL DE L'ECONOMIE ENERGETIQUE 5303 WUERENLINGEN, <u>SWITZERLAND</u>

THE FOLLOWING ARE ANSWERS TO YOUR TELEX QUESTIONS OF MARCH 16, 1976 :-

- 1. Q: DETAILS OF THE CRITICAL LOCA LOADINGS AND A PHYSICAL DESCRIPTION OF THE MECHANISMS INVOLVED. ARE DOWNCOMER WATER-JET LOADS, SUP_ PRESSION POOL AIRBUBBLE LOADS, AND POOL SWELL SLUG IMPACT OR FROTH LOADS IMPORTANT FOR THE CONTAINMENT TORUS AND/OF THE DOWNCOMERS AND RING-HEADER?
 - A: THE PRINCIPAL HYDRODYNAMIC LOADS IDENTIFIED FOR A MARK I CON-TAINMANT ARE (1) UPWARD AND DOWNWARD LOADS ON THE TORUS SUP-PORTS, (2) POOL SWELL IMPACT LOADS ON TORUS INTERNALS, AND (3) HORIZONTAL CONDENSATION LOADS ON THE VENT PIPES. THE DOWNWARD LOAD IS A RESULT OF THE INTRODUCTION OF THE AIR BUBBLE IN THE POOL FOLLOWING VENT CLEARING. THE UPWARD LOAD OCCURS AFTER THE DOWNWARD LOAD AND IS DUE TO COMPRESSION OF THE TORUS AIR SPACE BY SWELLING OF THE POOL SURFACE. DOWNCOMER WATER JET LOADS AND BROTH IMMERINGEMENT LOADS HAVE NOT BEEN DETERMINED TO BE SIGNIFICANT AT THIS TIME.

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- A: BASED ON MEASUREMENTS TAKEN FROM HIGH SPEED MOTION PICTURES OF THE 1/12 SCALE TESTS.
- 6. Q: ARE DOWNCOMER, CONDENSATION INDUCED, HORIZONTAL LOADS CONSIDERED?A: YES, BASED ON GE LICENSEE DATA.
- 7. Q: DESCRIBE THE JOINT GENERAL ELECTRIC UTILITY PLANT OPERATORS MARK I CONFIRMATORY TEST PROGRAM. WHAT IS THE PHILOSOPHY OF THIS PROGRAM?
 - A: THE MARK I OWNERS GROUP HAS CONTRACTED GENERAL ELECTRIC COMPANY TO PERFORM TESTING OF THE MARK I TORUS. THIS PROGRAM HAS CONSISTED OF, TO DATE, TESTING OF A 1/12 GEOMETRICALLY SCALED TORUS SEGMENT USING AN AIR BLOWDOWN SIMULATION. FUTURE TESTS ARE TO INCLUDE TESTING OF A LARGER SCALE SEGMENT AS WELL AS POSSIBLE THREE DIMEN-SIONAL TESTS. THE PHILOSOPHY OF THIS PROGRAM HAS BEEN TO DEFINE CONSERVATIVE POOL DYNAMIC FORCING FUNCTIONS, BY VIRTUE OF AIR BLOWDOWNS, BASED ON SCALED TESTS OF THE MARK I TORUS GEOMETRY.
- 8. Q: NRC HAVE PROPOSED A PRESSURE DIFFERENTIAL BETWEEN DRYWELL AND WETWELL TO REDUCE LOCA LOADS. HOW IS THIS PRESSURE DIFFERENCE SET UP, WHAT ARE THE MECHANISMS BY WHICH THE LOADS ARE REDUCED? ARE PROBLEMS ENVISAGED IN MAINTAINING THE PRESSURE DIFFERENCE OF LEAKING RELIEF VALVES?
 - A: THE PRESSURE DIFFERENTIAL IS ESTABLISHED BY MAINTAINING THE DRY-WELL AT A SLIGHTLY POSITIVE PRESSURE AND IN SOME CASES, THE TORUS AT A SLIGHTLY NEGATIVE PRESSURE. THE PRESSURE DIFFERENTIAL RE-DUCES THE WATER LEG IN THE VENT PIPES. THEREFORE, IN THE EVENT OF A LOSS-OF-COOLANT ACCIDENT, THE VENT PIPES WILL BE CLEARED EARLIER, AT A LOWER DRYWELL PRESSURE, THAN THE UNPRESSURIZED CASE.

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SINCE THE DRIVING FORCE FOR POOL DYNAMICS IS THE DRYWELL PRESSURE, THE LOADS WILL BE ATTENUATED BY REDUCED PRESSURES AT TIME OF VENT CLEARING.

EXPERIENCE TO DATE HAS INDICATED THAT THE DRYWELL-WETWELL PRESSURE DIFFERENTIAL CAN BE MAINTAINED WITH MINIMAL DIFFICULTY. THE VACUUM RELIEF VALVES WERE REQUIRED TO MEET TECHNICAL SPECIFICATION REQUIREMENTS FOR LEAKAGE PRIOR TO 'DELTA P' OPERATION.

- 9. Q: ARE ANY OTHER ENGINEERING SOLUTIONS ENVISAGED FOR THESE LOADS? WILL THE NRC ENFORCE BACKFITTING OF MARK I DESIGNS TO BRING THEM IN LINE WITH THE LATEST NRC SAFETY REQUIREMENTS?
 - A: YES, ENGINEERING SOLUTIONS ARE ENVISIONED AND HAVE BEEN INSTALLED ON SEVERAL PLANTS. FOR EXAMPLE, VERMONT YANKEE HAS PROVIDED A TIE-DOWN SYSTEM FOR THE TORUS SUPPORT COLUMNS. THE INTENT OF FUTURE NRC REQUIREMENTS AND PLANT MODIFICATIONS WILL BE TO RESTORE THE MARGINS THAT WERE PRESENT IN THE DESIGN WHEN THE PLANTS WERE ORIGINALLY LICENSED. LAFLEUR END

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