



Commonwealth Edison

One First National Plaza, Chicago, Illinois

Address Reply to: Post Office Box 767
Chicago, Illinois 60690

December 1, 1978

Mr. Olan D. Parr, Chief
Light Water Reactors - Branch 3
Division of Project Management
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: LaSalle County Station Units 1 and 2
Mark II Containment
NRC Docket Nos. 50-373/374

Reference (a): R. S. Boyd letter to B. Lee, Jr.
dated September 18, 1978

Dear Mr. Parr:

Commonwealth Edison has completed its evaluation of the "Mark II Generic Acceptance Criteria For Lead Plants" contained in Reference (a); as it relates to LaSalle County Station Units 1 and 2. The attached revision to the LaSalle County Station Design Assessment Report documents the position of this applicant relative to that criteria.

Commonwealth Edison agrees to adopt the NRC lead plant acceptance criteria with a limited number of exceptions. This agreement is, in several cases, based on favorable consideration by the Nuclear Regulatory Commission (NRC) of the application of SRSS methods. The primary areas to which exceptions have been taken involve:

- (i) S/RV bubble frequency and phasing, and
- (ii) Submerged structures load determination.

It is expected, based on previous discussions with the NRC Staff, that resolution of these exceptions shall be accomplished before the end of 1978.

7812110109

A

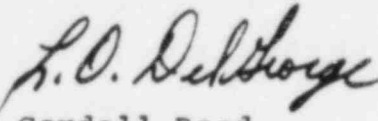
Mr. Olan D. Parr:

- 2 -

December 1, 1978

Three (3) signed originals and thirty-seven (37) copies of this revision are submitted for your review.

Very truly yours,

for 
Cordell Reed
Assistant Vice-President

attachment

SUBSCRIBED and SWORN to
before me this _____, day
of _____, 1978.

Notary Public



Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

December 1, 1978

Mr. Olan D. Parr, Chief
Light Water Reactors - Branch 3
Division of Project Management
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: LaSalle County Station Units 1 and 2
Mark II Containment
NRC Docket Nos. 50-373/374

Reference (a): R. S. Boyd letter to B. Lee, Jr.
dated September 18, 1978

Dear Mr. Parr:

Commonwealth Edison has completed its evaluation of the "Mark II Generic Acceptance Criteria For Lead Plants" contained in Reference (a); as it relates to LaSalle County Station Units 1 and 2. The attached revision to the LaSalle County Station Design Assessment Report documents the position of this applicant relative to that criteria.

Commonwealth Edison agrees to adopt the NRC lead plant acceptance criteria with a limited number of exceptions. This agreement is, in several cases, based on favorable consideration by the Nuclear Regulatory Commission (NRC) of the application of SRSS methods. The primary areas to which exceptions have been taken involve:

- (i) S/RV bubble frequency and phasing, and
- (ii) Submerged structures load determination.

It is expected, based on previous discussions with the NRC Staff, that resolution of these exceptions shall be accomplished before the end of 1978.

Mr. Olan D. Parr:

- 2 -

December 1, 1978

Three (3) signed originals and thirty-seven (37) copies of this revision are submitted for your review.

Very truly yours,

L. O. Del George

for/

Cordell Reed
Assistant Vice-President

attachment

SUBSCRIBED and SWORN to
before me this 1st day
of December 1978.

Wm. M. Lawrence
Notary Public

LA SALLE COUNTY POWER STATIONINSTRUCTIONS FOR UPDATING YOUR MARK II DAR

To update your copy of the LSCS-MARK II DAR, remove and destroy the following pages and insert pages and figures as indicated.

REMOVEINSERTTable of Contents

Page v

Page v

Appendix B

After page B.3-31, which
is Figure Q20.75-1

Sheet for Tab, Appendix C; page C.0-1;
and pages C.1-1 through C.1-11

TABLE OF CONTENTS (Cont'd)

	<u>PAGE</u>	
A.2 <u>STRUCTURAL RESPONSE TO LOCA LOADS</u>	A.2-1	
A.2.1 Analytical Model	A.2-1	
A.2.2 Method of Analysis	A.2-1	
A.2.3 Response to Jet Impingement Loads	A.2-2	
A.2.4 Response to Cyclic Condensation Loads	A.2-3	
A.3 <u>DRYWELL FLOOR ANALYSIS DUE TO DOWNCOMER WHIP</u>	A.3-1	
A.3.1 Analytical Model	A.3-1	
A.3.2 Response of Drywell Floor Due to Downcomer Whip	A.3-1	
A.4 <u>COMPUTER PROGRAMS</u>	A.4-1	
A.4.1 DYNAX	A.4-1	
A.4.2 FAST	A.4-2	
A.4.3 KALSHEL	A.4-2	
A.4.4 TEMCO	A.4-3	
A.4.5 PIPSYS	A.4-5	
A.4.6 RSG	A.4-6	
B.0 <u>RESPONSE TO NRC QUESTIONS</u>	B.0-1	1
B.1 <u>QUESTIONS OF JUNE 23, 1976</u>	B.1-1	
B.2 <u>QUESTIONS OF JANUARY 19, 1977</u>	B.2-1	2
B.3 <u>QUESTIONS OF JUNE 30, 1978</u>	B.3-1	3
C.0 <u>LA SALLE DESIGN BASIS VS. NRC LEAD PLANT ACCEPTANCE CRITERIA</u>	C.0-1	4

TAB:

"APPENDIX C"

(Tab will be supplied later.)

C.0 LA SALLE DESIGN BASIS VS. NRC LEAD PLANTACCEPTANCE CRITERIA

This appendix provides in a tabular form an assessment of the current design basis for the La Salle County Station against the NRC "Mark II Generic Acceptance Criteria for Lead Plants" of September 18, 1978. This comparison and the information provided, reflects the Mark II Lead Plant positions discussed with the NRC staff on October 19, 1978. The positions assume that the Newmark/Kennedy Criteria for use of the SRSS method of load combination will be accepted. In areas where the La Salle position differs from the NRC Acceptance Criteria, support will be provided by Mark II Owners Group Tasks and by La Salle unique efforts as appropriate.

<u>LOAD OR PHENOMENON</u>	<u>MARK II OWNERS GROUP LOAD SPECIFICATION</u>	<u>NRC REVIEW STATUS</u>	<u>LA SALLE POSITION ON ACCEPTANCE CRITERIA</u>
LOCA-Related Hydrodynamic Loads			
A. Submerged Boundary Loads During Vent Clearing	33 psi over-pressure added to local hydrostatic below vent exit (walls and basemat) - linear attenuation to pool surface.	Acceptable	Acceptable. However, it should be noted that 33 psi is a very conservative estimation of jet loads which should be applied only to the basemat in accordance with EFR (Rev. 2). The Mark II program will provide a realistic assessment of wall loads during vent clearing based on 4T results.
B. Pool Swell Loads			
1. Pool Swell Analytical Model			
a) Air Bubble Pressure	Calculated by the Pool Swell Analytical Model (PSAM) used in calculation of submerged boundary loads.	Acceptable	_____
b) Pool Swell Elevation	1.0 x submergence.	NRC Criteria 1.A.1	Acceptable
c) Pool Swell Velocity	Velocity history vs. pool elevation predicted by the PSAM used to compute impact loading on small structures and drag on gratings between initial pool surface and maximum pool elevation and steady-state drag between vent exit and maximum pool elevation. Analytical velocity variation used up to maximum velocity. Maximum velocity applies thereafter up to maximum pool swell.	NRC Criteria 1.A.2	Acceptable The impact of a 10% increase in pool swell velocity will be assessed. Although the assumptions used in the Pool Swell Analytical Model are already very conservative and eliminate the need for any additional factors, the resulting calculated load increase should not require design changes since there are only a minimum of components in the pool swell region of the wetwell.
d) Pool Swell Acceleration	Acceleration predicted by the PSAM. Pool acceleration is utilized in the calculation of acceleration drag loads on submerged components during pool swell.	Acceptable	_____
e) Wetwell Air Compression	Wetwell air compression is calculated by the PSAM. Defines the pressure loading on the wetwell boundary above the pool surface during pool swell.	Acceptable	_____

C-111

LSCS-MARK II DAR

Rev. 4 12/78

<u>LOAD OR PHENOMENON</u>	<u>MARK II OWNERS GROUP LOAD SPECIFICATION</u>	<u>NRC REVIEW STATUS</u>	<u>LA SALLE POSITION ON ACCEPTANCE CRITERIA</u>
f) Drywell Pressure History	Plant unique. Utilized to PSAM to calculate pool swell loads.	Acceptable if based on NEDM-10320. Otherwise plant unique reviews required.	Acceptable.
2. Loads on Submerged Boundaries	Maximum bubble pressure predicted by the PSAM added uniformly to local hydrostatic below vent exit (wells and basemat) linear attenuation to pool surface. Applied to walls up to maximum pool swell elevation.	Acceptable	_____
3. Impact Loads		NRC criteria I.A.6	Acceptable. Although the criteria is unnecessarily conservative investigations indicate that, due to the size and frequency of structures in the La Salle pool swell zone, the design loads used are conservative with respect to the NRC Acceptance Criteria. It should be noted that analytical work performed by Sargent & Lundy utilizing the PSIF (Pressure Suppression Test Facility) data for circumferential targets indicates that the DFFR specification is conservative for the size and frequency of structures in the La Salle Pool Swell Zone. Tests performed by EPRI (EPRI No. NP-798, May 1978) to determine flat pool impact on rigid and flexible cylinders are also in good agreement with DFFR. The Maisie report employed excessively conservative assumptions to define areas where DFFR is nonconservative. The NRC Acceptance Criteria utilized an additional assumption (I-beam impact duration is inversely proportional to velocity) which is inconsistent with theory and experimental evidence. Nevertheless, the NRC Criteria have been used to assess structures in the pool swell zone and these structures can withstand the conservative criteria.
a) Small Structures	1.5 x Pressure-Velocity correlation for pipes and I beams. Constant duration pulse.		
b) Large Structures	None - Plant unique load where applicable.	Plant unique review where applicable	
c) Grating	No impact load specified. P_{drag} vs. open area correlation and velocity vs. elevation history from the PSAM.	NRC Criteria I.A.3	Acceptable. La Salle has no grating in pool swell area.

SING

LSCS-MARK II DAR

REV. 4 12/78

<u>LOAD OR PHENOMENON</u>	<u>MARK II OWNERS GROUP LOAD SPECIFICATION</u>	<u>NRC REVIEW STATUS</u>	<u>LA SALLE POSITION ON ACCEPTANCE CRITERIA</u>
4. Wetwell Air Compression			
a) Wall Loads	Direct application of the PSAM calculated pressure due to wetwell compression.	Acceptable	_____
b) Diaphragm Upward Loads	2.5 psid	NRC Criteria I.A.4	Acceptable
5. Asymmetric Load			
	None	NRC Criteria I.A.5	Open Item. Although this load is unnecessarily conservative, a simplified assessment has been completed which shows that the current design can take this load. This assessment utilized the vent clearing pressure load (22 psig) applied over a 180° sector of the wetwell wall between the basemat and the drywell floor. Superimposed on this was the hydrostatic load (12 psig at basemat with linear decrease to zero at the water surface) applied over the entire wetwell wall between the basemat and pool surface. This load has been found to be of little significance compared to other design loads and does not affect the adequacy of the design.
C. Steam Condensation and Chugging Loads			
1. Downcomer Lateral Loads			
a) Single Vent Loads	8.8 KIP static	NRC Criteria I.B.1	Acceptable
b) Multiple Vent loads	Prescribes variation of load per downcomer vs. number of downcomers.	NRC Criteria I.B.2	Acceptable
2. Submerged Boundary Loads			
a) High Steam Flux Loads	Sinusoidal pressure fluctuation added to local hydrostatic. Amplitude uniform below vent exit-linear attenuation to pool surface. 4.4 psi peak-to-peak amplitude. 2, 6, 7 Hz frequencies.	Acceptable	_____

C-1-3

LSCS-MARK II DAR

REV. 4 12/78

<u>LOAD OR PHENOMENON</u>	<u>MARK II OWNERS GROUP LOAD SPECIFICATION</u>	<u>NRC REVIEW STATUS</u>	<u>LA SALLE POSITION ON ACCEPTANCE CRITERIA</u>
b) Medium Steam Flux Loads	Sinusoidal pressure fluctuation added to local hydrostatic. Amplitude uniform below vent exit-linear attenuation to pool surface. 7.5 psi peak-to-peak amplitude. 5, 6 Hz frequencies.	Acceptable	_____
c) Chugging Loads	Representative pressure fluctuation taken from _____ added to local hydrostatic.	Acceptable pending resolution of FSI concerns.	_____
- uniform loading condition	Maximum amplitude uniform below vent exit-linear attenuation to pool surface. +4.8 psi maximum overpressure, -4.0 psi maximum under pressure, 20-30 Hz frequency.		
- asymmetric loading condition	Maximum amplitude uniform below vent exit-linear attenuation to pool surface. 20 psi maximum overpressure, -14 psi maximum underpressure, 20-30 Hz frequency, peripheral variation of amplitude follows observed statistical distribution with maximum and minimum diametrically opposed.		

C-114

LSCS-MARK II DAB

Rev. 4 12/78

<u>LOAD OR PHENOMENON</u>	<u>MARK II OWNERS GROUP LOAD SPECIFICATION</u>	<u>NRC REVIEW STATUS</u>	<u>LA SALLE POSITION ON ACCEPTANCE CRITERIA</u>
SRV-Related Hydrodynamic Loads			
A. Pool Temperature Limits for KWU and GE four arm quencher	None specified	NRC Criteria II.1 and II.3	Acceptable
Quencher Air Clearing Loads	Mark II plants utilizing the KWU quencher use an interim load specification consisting of the rams head calculational procedure. Mark II plants utilizing the four arm quencher use quencher load methodology described in DFFR.	NRC Criteria II.2	<p>Open Item. The first four SRV discharge cases listed in the NRC Acceptance Criteria are being assessed. In addition, a simultaneous valve actuation case is considered. This case predicts variations of bubble frequency and phase shifts due to variations of line air volumes. The fifth load case defined in the Acceptance Criteria, all valve simultaneous discharge with all bubble oscillating in-phase, is unrealistic for two reasons. First, there is no mechanism or set of conditions which would cause all valves to actuate simultaneously. Secondly, even if the valves were actuated simultaneously, line length variations would prevent them from oscillating in phase. Additional conservatism is not needed in the SRV discharge case selection since the entire phenomena is conservatively modeled using rams head discharge device loads even though a quencher device is installed in the plant and the existing cases bound the anticipated discharge cases expected during plant operation as discussed in the closure report.</p> <p>Analytical models have been used to predict forcing function frequencies for the load cases considered. Because of the wide range of discharge conditions considered the frequency range used exceeds the 4-11 Hz. range specified.</p> <p>In-plant tests will be run to demonstrate the adequacy and conservatism of the design loads.</p>
B. Quencher Tie-Down Loads			
1. Quencher Arm Loads			
(a) Four Arm Quencher	Vertical and lateral arm loads developed on the basis of bounding assumptions for air/water discharge from the quencher and conservative combinations of maximum/minimum bubble pressure acting on the quencher.	Acceptable	_____

C-1-5

LSGS-MARK II DAR

Rev. 4 12/78

<u>LOAD OR PHENOMENON</u>	<u>MARK II OWNERS GROUP LOAD SPECIFICATION</u>	<u>NRC REVIEW STATUS</u>	<u>LA SALLE POSITION ON ACCEPTANCE CRITERIA</u>
(b) KWU T Quencher	KWU "T" quencher not included in Mark II O.G. Program. T quencher arm loads not specified at this time.	Review Continuing	Acceptable. These loads will be calculated using the methodology and assumptions described in DFFR for four arm quenchers, as recommended in the Acceptance Criteria.
2. Quencher Tie-Down Loads	(a) Four-Arm Quencher	Acceptable	
	Includes vertical and lateral arm load transmitted to the basement via the tie downs. See II.C.1.a above plus vertical transient wave and thrust loads. Thrust load calculated using a standard momentum balance. Vertical and lateral moments for air or water clearing are calculated based on conservative clearing assumptions.		
	(b) KWU "T" Quencher	Review Continuing	Acceptable. These loads will be calculated using the methodology and assumptions described in DFFR for four arm quenchers, as recommended in the Acceptance Criteria.
LOCA/SRV Submerged Structure Loads			
A. LOCA/SRV Jet Loads	1. LOCA/Rams head SRV Jet Loads	NRC Criteria III.A.1	Open Item. Tests show the present LOCA jet load methodology to be very conservative in predictions of jet penetration length. Using the DFFR model no structures are impacted by the jet and no loads are predicted. A more detailed model (ring vortex model) is under development and will provide verification of the absence of significant water jet loads.

<u>LOAD OR PHENOMENON</u>	<u>MARK II OWNERS GROUP LOAD SPECIFICATION</u>	<u>NRC REVIEW STATUS</u>	<u>LA SALLE POSITION ON ACCEPTANCE CRITERIA</u>
2. SRV-Quencher Jet Loads	No loads specified for lead plants. Model under development in long-term program.	NRC Criteria III.A.2	<p>Open Item. The spherical zone of influence defined in the Acceptance Criteria is not appropriate for the two arm quencher. A zone of influence for each arm will be defined as a cylinder with an axis coincidental with the quencher arm. The length of the cylinder will be equal to the length of the quencher arm plus 10 end cap hole diameters. A definition for the radius of the cylinder is being developed.</p> <p>It is anticipated that the jet penetration will avoid load impingement on any structures in the pool.</p>
B. LOCA/SRV Air Bubble Drag Loads			Open Item
1. LOCA Air Bubble Loads	The methodology follows the LOCA air carryover phase from bubble charging, bubble contract, pool rise and pool fallback. The drag calculations include standard and acceleration drag components.	NRC Criteria III.B.1.	<p>The NRC Acceptance Criteria lists a number of modifications to the present methodology. These are addressed as follows:</p> <ul style="list-style-type: none"> a) Bubble Asymmetry - Although bubble asymmetry has been in the NRC Criteria, the conservatisms used in modeling the LOCA blowdown are sufficient to account for the small asymmetric effects postulated. No additional multipliers are necessary on the fluid velocity. b) Standard Drag in Accelerating Flows - Drag coefficient will be appropriately modified as discussed in the November 14, 1978 meeting between the Mark II owners and the NRC Staff. c) Velocity and Acceleration Definition - The assumption that drag may be calculated using the velocity predicted at the center of the structure is a logical simplification of the problem. To do otherwise would greatly increase the complexity of the calculation with only minimal effect on the loads. The present method is the most reasonable way to predict the total velocity drag load on the structure. The acceleration at the center of the structure is the technically correct value to use in calculation of acceleration drag loads.

C.1-7

LSCS-MARK II DAR

Rev. 4 12/78

LOAD OR PHENOMENON

MARK II OWNERS GROUP
LOAD SPECIFICATION

NRC REVIEW STATUS

LA SALLE POSITION ON ACCEPTANCE CRITERIA

<u>LOAD OR PHENOMENON</u>	<u>MARK II OWNERS GROUP LOAD SPECIFICATION</u>	<u>NRC REVIEW STATUS</u>	<u>LA SALLE POSITION ON ACCEPTANCE CRITERIA</u>
2. SRV-Rams Head Air Bubble Loads	The methodology is based on an analytical model of the bubble charging process including bubble rise and oscillation. Acceleration drag alone is considered.	NRC Criteria III.B.2	d) Interference Effects - Drag Loads are altered by effects of neighboring structures. Loads are increased in some cases and decreased in others. The extent and magnitude of these effects in the La Salle suppression pool is being investigated. e) Interference in Downcomer Bracing - Does not apply to La Salle. Open Item a) Neglecting Standard Drag - Standard drag is calculated and included for all submerged structure load calculations. b) LOCA Bubble Criteria - The same comments apply to the SRV bubbles except for b). Standard drag is affected by the oscillating SRV bubbles. The impact of this is being investigated.
3. SRV-Quencher Air Bubble Loads	No quencher drag model provided for lead plants. Lead plants propose interim use of rams head model (See III.B.2 above). Model will be developed in long-term program.	NRC Criteria III.B.3.	Open Item The bubble location and radius recommended in the acceptance criteria is not appropriate for T-quencher. Bubbles are actually located near the arms. The bubble size is predicted from the line air volume.
C. Steam Condensation Drag Loads	No generic load methodology provided. Generic model under development in long-term program.	Lead plant load specification and NRC review will be conducted on a plant unique basis with confirmation in long-term program using generic model.	Described in La Salle Closure Report

C.1-8

LSCS-MARK II DAR

Rev. 4 12/79

<u>LOAD OR PHENOMENON</u>	<u>MARK II OWNERS GROUP LOAD SPECIFICATION</u>	<u>NRC REVIEW STATUS</u>	<u>LA SALLE POSITION ON ACCEPTANCE CRITERIA</u>
Secondary Loads			
A. Sonic Wave Load	Negligible Load - none specified	Acceptable	_____
B. Compressive Wave Load	Negligible Load - none specified	Acceptable	_____
C. Post Swell Wave Load	No generic load provided	Plant unique load specification and NRC review.	Described in La Salle Closure Report
D. Seismic Slosh Load	No generic load provided	Plant unique load specification and NRC review.	Described in La Salle Closure Report
E. Fallback load on Submerged Boundary	Negligible load - none specified	Acceptable	_____
F. Thrust Loads	Momentum balance	Acceptable	_____
G. Friction Drag Loads on Vents	Standard friction drag calculations	Acceptable	_____
H. Vent Clearing Loads	Negligible Load - none specified	Acceptable	_____

C.1-9

LSCS-MARK II DAR

REV. 4 12/78

C.1-10

<u>LOAD OR PHENOMENON</u>	<u>MARK II OWNERS GROUP LOAD SPECIFICATION</u>	<u>NRC REVIEW STATUS</u>	<u>LA SALLE POSITION ON ACCEPTANCE CRITERIA</u>
FUNCTIONAL CAPABILITY		Interim technical position (7/19/78)	Acceptable, Rodabugh criteria may be used in some cases if NRC finds acceptable.
MASS-ENERGY RELEASE FOR ANNULUS PRESS.		Verify using RELAP ⁴ / MOD ³	Acceptable
QUESTIONS MEB-2, MEB-5		15% peak broadening to be used.	Acceptable
MEB-3, MEB-5		Closely spaced modes combined Per 1.92	Acceptable. NSSS scope uses modified summation per approved GESSAR.
MEB-1		Dynamic analysis methods acceptable	Acceptable
MEB-2		OBE Damping - Level A or B SSE Damping - Level C or D	Acceptable
MEB-6		Seismic slosh-plant unique review	Acceptable
MEB-7a and b		Load Combinations: AP+SSE OBE+SRV	Acceptable. See load combination table for Cas- #2 and 7
MEB-8		Functional capability and piping acceptance criteria	See load combination table.

LSCS-MARK II DAR

Rev. 4 12/78

<u>LOAD PHENOMENON</u>	<u>MARK II OWNERS GROUP LOAD SPECIFICATION</u>	<u>NRC REVIEW STATUS</u>	<u>LA SALLE POSITION ON ACCEPTANCE CRITERIA</u>
1.		N+SRV _x To B	Acceptable
2.		N+SRV _x +OBE to B	Acceptable Approved GESSAR approach used for NSSS.
3.		N+SRV _{all} +SSE to C	Acceptable
4.		N+SRV _{ads} +OBE+IBA to C	Acceptable
5.		N+SRV _{ads} +OBE+IBA to C	Acceptable
6.		N+SRV _{ads} +SSE+IBA to C	Acceptable
7.		N+SSE+DBA to C	Acceptable
8.		N to A	Acceptable
9.		N+OBE to B	Acceptable
10.		N+SRV _a +SSE+DBA to C	Applied to containment structure only (See M 020.22 and DFFR 5.2.4)

C.1-11

LSCS-MARK II DAR

Rev. 4 12/78