A Note For ✓G. Lear
L. Heller
J. Chan
J. Ma

April 19, 1984

Dave Jeng
Looks like we getting closer to a final product.
G

From: D. C. Jeng

Subject: "Waterford 3 Basemat SGEB Evaluation Report, 1st Draft"

Based on John Ma and John Chan's draft evaluations in geotechnical and structural areas, respectively, G. Lear and myself have worked together the attached 1st draft of the subject report for the branch.

You are requested to review the enclosed with emphasis on your own sections and mark down your comments with appropriate replacement sentences and/or deletions ~~[illegible]~~ in order to expedite the completion of the task. (A reminder, this is due 27th April, out of SGEB).

I propose that all of us meet on Monday 23, p.m. in G. Lear's office for paragraph by paragraph comments discussion in order to finish the Draft.

If you have questions, please see me ASAP.

cc: FOIA-84-455

File. E/B.25

David Jeng
4/19/84

P.S. G. Lear's original marked up copy or

April 19, 1984

A Note For G. Lear
L. Heller
J. Chan
J. Ma

From: D. C. Jeng

Subject: "Waterford 3 Basemat SGEB Evaluation Report, 1st Draft"

Based on John Ma and John Chan's draft evaluations in geotechnical and structural areas, respectively, G. Lear and my self have worked together the attached 1st draft of the subject report for the branch.

You are requested to review the enclosed with emphasis on your own sections and mark down your comments with appropriate replacement sentences and/or deletions ~~[illegible]~~ in order to expedite the completion of the task, (As reminders, this is due 27th April, out of SGEB).

I propose that all of us meet on Monday 23, p.m. in G. Lear's office for paragraph by paragraph comment discussion in order to finish the draft.

If you have questions, please see me ASAP.

cc:

FOIA-84-455

File. E/B. 27

David Jeng

4/19/84

P.S. G. Lear's original marked up copy on J. Ma's draft is also enclosed for info (J. Ma's only)

WATERFORD 3

STRUCTURAL ENGINEERING

by John Ma 4/12/84

1 INTRODUCTION

The SGEB staff visited the Waterford 3 site on March 27, 1984 and was surprised to see cracks on the ring wall and wet cooling tower walls. These cracks had not been documented and brought to the NRC/SGEB staff attention. Some of the cracks were inclined to the vertical axis (perpendicular to the mat) and joined by a crack on the mat at its two ends. These cracks were believed to be shear cracks and caused concerns. Other cracks on the walls and on the mat, which appeared to be shrinkage or flexure cracks, did not present the impression that they would challenge the structural integrity of the mat.

At the site, I reviewed some construction records and interviewed some people who participated in the actual construction of the mat in an effort to understand construction problems.

Special calculations were requested, as a result of detecting shear cracks. Discussions with the NRC Geotechnical Engineering staff were held in an attempt to establish whether the static soil-structure interaction analysis was still adequate in light of new data received and reviewed.

The analysis and design of the mat in general, special calculations, construction problems, and conclusion and recommendation are discussed below.

FOIA-84-455

E/B.21

2. ANALYSIS AND DESIGN

The Applicant's analysis of the base mat utilized finite element methods and generally recognized formulas presented in a textbook written by R. J. Roark; these approaches are fundamentally independent of each other. The use of finite element methods in conjunction with electronic computers permits solutions of structures having complex geometry, loading and boundary conditions, such as the Waterford Unit 3 base mat, although correct use of this method is rather difficult. The use of textbook formulas permits solutions for ideal loading and boundary conditions, but must be utilized in conjunction with engineering judgment to obtain solutions for actual (non-ideal) conditions.

In its application of pertinent formulas, the Applicant calculated positive bending moment in the mat under the reactor building by assuming a 20% edge fixity of a circular plate under the shield building, and a uniform soil pressure beneath the mat; the Applicant calculated negative bending moment under the shield building by assuming a 50% edge fixity and uniform soil pressure under the mat.

In its finite element analysis, the Applicant calculated two bending moments in the mat, by using actual loading conditions and two separate soil conditions: constant soil modulus, and variable soil modulus in which the modulus varies in rough proportion to the deformation shape of the mat.

The top and bottom reinforcing steel bars that resist the negative and positive bending moments, respectively, were proportioned in a manner such that a surplus bending moment capacity is always provided, by comparing the three design bending moments calculated for a given location (one derived from use of the formulas and two derived from the finite element analyses). In each of these three analyses, the estimated dead load on top of the mat was multiplied by a factor of 1.5 before being used in calculating the required design bending moments (providing the 50% margin in load capacity referred to above).

The shear capacity of the base mat was calculated and provided in manner similar to the bending moment treatment described above: a surplus shear capacity is always provided, by comparing the design shear forces obtained in each of the three calculations, and the estimated dead load was multiplied by a factor of 1.5 before being used in calculating the required design shear resistance.

Based upon my review, I have determined that the procedures and approaches utilized in the Applicant's analysis and design of the base mat are sufficiently conservative and are acceptable. The sum of the top and bottom reinforcing steel bars and the vertical shear reinforcing bars has provided adequate strength for the mat to resist the load imposed by the reactor and shield buildings, if the foundation soil behaves as assumed in the analysis and construction was carried out properly so that the end product reflects the assumptions made in the original design.

However, based on the discussions (as recent as 4/12/84) with the NRC Geotechnical Engineering staff, it was reported that neither the numerical values of soil springs nor the distribution of them used in the analysis resembled the actual foundation soil conditions. If that is the case, this would raise a fundamental question about the validity of the static soil-structure interaction analysis, which was performed and its results used for design. Thus, it is required to either justify that the original assumption of soil springs will lead to a more conservative structural design of the mat than the actual foundation soil conditions being used, or perform additional analysis to account for the actual foundation soil conditions.

3. SPECIFIC CALCULATION

Since shear cracks were detected on March 27, 1984, the license was requested to perform calculations to obtain shear stresses under operating and SSE conditions, and shear capacity (strength) for Block 5A and 1, where shear cracks occurred. It was reported by Ebasco through telephone that shear stresses along the crack in Block 5A were 64 K/ft for operating and 166 K/ft for SSE and in Block 1 52K/ft for operating and 210 K/ft for SSE, and shear capacity was 274 K/ft for both blocks with shear reinforcing bars contributing 98K/ft and concrete 176 K/ft.

The shear cracks do not present a challenge to the structural integrity of the mat under operating condition, assuming the

static soil-structure analysis was performed adequately and the calculations for shear stress and shear strength were correct. This is because that shear reinforcing bars alone has provided more than adequate resistance to the required shear stress. However, it is not comfortable to compare the calculated shear stress of 210 K/ft under SSE with the calculated shear strength of 274 K/ft based on idea conditions, i.e, no cracks and voids. The cracks and voids in concrete will reduce its shear capacity. More information is needed to assess the degree of reduction. On the other hand, the design base earthquake that was used in the analysis may exceede the required SSE, and, thus, reduce the actual shear stress that needs to be resisted. More information and work are needed before a rational judgement can be reached on whether the actual shear capacity is adequate or not.

4. CONSTRUCTION PROBLEMS

Construction problems described here are limited to the first three blocks of concrete placement where major cracks occurred. Based on the limited review of construction records and people interviewed, the LP&L quality assurance group did try to make its program working. Nevertheless, the first three blocks of concrete placement did run into quality control problems. Thess problems included dropping concrete beyond 5' height at times, using vibrator improperly and insufficient vibration, and sledge hammering reinforcing bars to create openings, and thus transmitting shock waves to the concrete

below through vertical reinforcing bars. These problems are believed to be the main contributors to concrete cracking and honeycombing observed during construction in late 1975 and early 1976. Deficiency notes were written for the cracking and honeycombing, but no NCR was initiated. Stop work order was issued after the concrete placement of the first three blocks, but no drilled cores or nondestructive testing techniques used to verify the quality and strength of the trobled 5074 cubic yards of concrete. More discussion with the construction people is needed to gain a better understanding of the degree of deficiency in order to better estimate the quality and strength of that concrete.

5 CONCLUSION AND RECOMMANDATION

The problems of the mat seem to be resulted from a lack of overall coordination among the three displines: Structural, geotechnical, and construction. Each displine seemed to be able to perfurm its own work and resolve its problems. Each displine seemed to be insensitive to its impact on other displines or to being impacted by others. These put the current behavior or state of stress of the mat in the dark, which maces the adequacy assessment of the mat very difficult.

Since the problems are interrelated among displines, it is recommanded that they be solved jointly not separetely.

Specific conclusions and recommandations are listed below:

A. The mat is not currently in distress based on the crack observation.

B. To verify the adequacy of soil springs used in the analysis, as discussed in Section 2, is of fundamental importance.

C. Verification of shear capacity under SSE needs to be done.

D. A general surveillance program is recommanded for all the cracks and, for shear cracks, the length and size of a crack and its propagation against time should be marked and recorded.

E. Corrosion of reinforcing bars due to the ground water is believed to be unlikely at the site. Nevertheless, a surveillance program is recommended

DRAFT
D. Jeng
16 Apr 84

Enclosure 2

SAFETY EVALUATION OF THE STRUCTURAL ADEQUACY OF WATERFORD 3 BASE MAT

~~STRUCTURAL ADEQUACY AND SAFETY~~

~~EVALUATION OF WATERFORD 3 BASE MAT~~

1. This report provides the structural ~~Structural and Geotechnical Engineering Branch's~~ safety evaluation of the "As-built" Waterford 3 Mat. Specific conclusions and recommendations to be incorporated as part of the OL license for the plant are also listed herein.

2. Inspection of Base Mat Structure/Foundation and Review of Mat Construction Records

The SGEB staff visited the Waterford 3 site on March 27, 1984. Staff observed cracks on the ring wall and wet cooling tower walls. These cracks had not been specifically mapped and brought to the NRC/SGEB staff attention until the March 27, 1984 visit. Some of the cracks were inclined to the

FOIA-84-455
E/B.22

vertical axis (perpendicular to the mat) and were joined by a crack on the mat. Thus, these cracks were believed to be shear cracks. Other cracks on the walls and on the mat appeared to be shrinkage or flexure cracks.

At the site, the Structural Engineering staff ~~also~~ spent approximately four hours to reviewed construction records and interviewed some people who participated in the actual construction of the ~~nuclear island foundation and~~ concrete base mat.

3. Analysis and Design of the ~~Concrete~~ Base Mat

The applicant's analysis of the base mat utilized finite element methods and generally recognized formulas presented in a textbook written by R. J. Roark; these approaches are fundamentally independent of each other. The use of finite element methods in conjunction with electronic computers permits solutions of structures having complex geometry, loading and boundary conditions, such as the Waterford Unit 3 base mat, although correct use of this method is rather difficult. The use of textbook formulas permits solutions for ideal loading and boundary conditions, but must be utilized in conjunction with engineering judgment to obtain solutions for actual (non-ideal) conditions.

In its application of pertinent formulas, the Applicant calculated positive bending moment in the mat under the reactor building by assuming a 20% edge fixity of a circular plate under the shield building, and a uniform soil pressure beneath the mat. The applicant calculated negative bending moment under the shield building by assuming a 50% edge fixity and uniform soil pressure under the mat.

In its finite element analysis, the applicant calculated two bending moments in the mat, by using actual loading conditions and two separate soil conditions: constant soil modulus, and variable soil modulus in which the modulus varies in rough proporation to the deformation shape of the mat. The top and bottom reinforcing steel bars that resist the negative and positive bending moments, respectively, were proportioned in a manner such that a surplus bending moment capacity is always provided. This fact was verified by comparing the three design bending moments calculated for a given location: one derived from use of the formulas and two derived from the finite element analyses. In each of these three analyses, the estimated dead load on top of the mat was multiplied by a factor of 1.5 before being used in calculating the required design bending moments, thus providing the 50% margin (surplus) in load capacity referred to above.

The shear capacity of the base mat was calculated and provided in a manner similar to the bending moment treatment described above: a surplus shear capacity is always provided. Again, this fact was verified by comparing the design shear forces obtained in each of the three calculations. As before, the estimated dead load was multiplied by a factor of 1.5 prior to being used in calculating the required design shear resistance.

The structural engineering staff ~~Based upon my review, I have~~ determined that the procedures and approaches utilized in the applicant's analysis and design of the base mat are sufficiently conservative and are acceptable. The sum of the top and bottom reinforcing steel bars and the vertical shear reinforcing bars have provided adequate strength for the mat to resist the load imposed by the reactor and shield buildings, ~~if one can assume~~ assuming that the foundation soil behaves as predicted in the analysis and that construction was carried out properly.

However, as discussed in our geotechnical engineering evaluation (enclosure 1), the foundation soil did not behave as predicted in the original analysis. This may indicate that the concrete mat design may be inadequate because it was designed based on the original analyses. Additional analyses using the actual foundation soil conditions are required to confirm adequacy of the foundation mat design.

~~use of ... perform additional analyses to account for the actual foundation soil conditions.~~

4. <u>Specific Calculation of Key Block Mat Capacities.</u>

Since shear cracks in the reactor shield building and concrete walls were detected during the staff site visit on March 27, 1984, the applicant was requested to perform calculations to obtain shear stresses under operating and SSE conditions, and also shear capacity (strength) for base mat Blocks 5A and 1, where the shear cracks occurred. It was reported by Ebasco via telephone that shear stresses along the crack in Block 5A were 64 k/ft for normal operating loads and 166 k/ft for SSE loads while in Block 1 they are 52 k/ft for operating loads and 210 k/ft for SSE loads. Shear capacity computed in accordance with applicable ACI Code provisions was 274 k/ft for both blocks with shear reinforcing bars contributing 98 k/ft and concrete 176 k/ft. The shear cracks do not appear to present a challenge to the structural integrity of the mat under operating conditions. ~~assuming the calculations for shear stress and shear strength were correct.~~ This is because the shear reinforcing bars alone have provided more than adequate resistance to the computed shear stress. ~~We found the Ebasco methodology ... for calculation both the shear stress and shear~~

Yet, there is not enough evidence to draw the same conclusion for the mat under SSE loads by comparing the calculated shear stress of 210 K/ft with the calculated shear ~~strength~~ capacity of 274 K/ft. This is because that the shear ~~strength~~ capacity was calculated based on ideal conditions, i.e. no cracks and voids. ~~and that cracks and voids in concrete~~ do reduce its shear strength. Nondestructive testing methods are recommended to obtain information on cracks and voids in the concrete mat so that a realistic assessment of their effect on shear ~~strength~~ capacity of the mat can be performed.

Such testing and evaluation will be part of a confirmatory program because of the low likelihood of occurrence of the SSE and the inherent but not yet quantifiable safety margin available even with the cracked concrete.

5. CONSTRUCTION PROBLEMS

Construction problems described here are limited to the first three blocks of concrete placement where major cracks occurred. Based on the review of construction records and interviews, we find that Louisianna Power and Light (LP & L) quality assurance ~~group~~ group did try to make its program a success. Nevertheless, the first three blocks of concrete placement did have quality

control problems. These problems included dropping concrete beyond 5' height at times, using a concrete vibrator improperly (providing insufficient vibration) as well as sledge hammering reinforcing bars to create openings thus transmitting shock waves to the concrete below through vertical reinforcing bars. ~~These problems are believed to be the main contributors to concrete cracking and honeycombing observed during construction in late 1975 and early 1976.~~ Deficiency notes were written for the cracking and honeycombing and the cracking pattern indicates the concrete might suffer curing problems. ~~but no non-conformance report (NCR) was initiated.~~ A stop work order was issued by LP & L after the concrete placement of the first three blocks, but no drilled cores or nondestructive testing techniques were used to verify the quality and strength of the 5074 cubic yards of poured ~~paved~~ and hardened concrete to the staff knowledge.

~~There were construction problems in the first three placements of concrete blocks. However, the degree of deficiency is unclear. Reviewing construction records is being undertaken by other NRC engineering staff members. Their input together with the nondestructive testing results of cracks and voids is needed to form a basis for an realistic assessment of the structural adequacy of the concrete base mat.~~

6. Conclusions and Recommendations

A. The mat is not currently in distress based on the crack observation.

B. Verification of shear capacity under SSE needs to be ~~done~~. As part of this verification program, nondestructive testing and evaluation are recommended to obtain information on cracks and voids and their effect on the concrete mat.

C. The licensee is required to either justify that its original analyses are still adequate in light of the NRC geotechnical engineering staff evaluation mentioned above, or perform additional analyses to account for the actual foundation soil conditions.

D ~~C~~. A general surveillance (monitoring) program is recommended for all the cracks. ~~and~~ For shear cracks, the length and size of a crack and its propagation against time should be marked and recorded.

E ~~D~~. Significant ~~Corrosion~~ corrosion of reinforcing bars due to the ground water is believed to be unlikely at the site. Nevertheless, a surveillance program is recommended.

~~F E. The surveillance programs (items C and D above) should be incorporated~~

DRAFT
D. Jeng
16 Apr 84

Enclosure 2

SAFETY EVALUATION OF THE STRUCTURAL ADEQUACY OF WATERFORD 3 BASE MAT

STRUCTURAL ADEQUACY AND SAFETY
EVALUATION OF WATERFORD 3 BASE MAT

1. This report provides the structural ~~Structural and Geotechnical Engineering Branch's~~ safety evaluation of the "As-built" Waterford 3 Mat. Specific conclusions and recommendations ~~to be incorporated as part of the OL license for the plant~~ are also listed herein.

2. Inspection of Base Mat Structure/Foundation and Review of Mat Construction Records

The SGEB staff visited the Waterford 3 site on March 27, 1984. The Staff observed cracks on the ring wall and wet cooling tower walls. These cracks had not been specifically mapped and brought to the NRC/SGEB staff attention until the March 27, 1984 visit. Some of the cracks were inclined to the

FOIA-84-455
E/B.23

vertical axis (perpendicular to the mat) and were joined by a crack on the mat. Thus, these cracks were believed to be shear cracks. Other cracks on the walls and on the mat appeared to be shrinkage or flexure cracks.

At the site, the Structural Engineering staff also reviewed construction records and interviewed some people who participated in the actual construction of the nuclear island foundation and base mat.

3. Analysis and Design of the Concrete Mat

The applicant's analysis of the base mat utilized finite element methods and generally recognized formulas presented in a textbook written by R. J. Roark; these approaches are fundamentally independent of each other. The use of finite element methods in conjunction with electronic computers permits solutions of structures having complex geometry, loading and boundary conditions, such as the Waterford Unit 3 base mat, although correct use of this method is rather difficult. The use of textbook formulas permits solutions for ideal loading and boundary conditions, but must be utilized in conjunction with engineering judgment to obtain solutions for actual (non-ideal) conditions.

In its application of pertinent formulas, the Applicant calculated positive bending moment in the mat under the reactor building by assuming a 20% edge fixity of a circular plate under the shield building, and a uniform soil pressure beneath the mat. The applicant calculated negative bending moment under the shield building by assuming a 50% edge fixity and uniform soil pressure under the mat.

In its finite element analysis, the applicant calculated two bending in the mat, by using actual loading conditions and two separate soil conditions: constant soil modulus, and variable soil modulus in which the modulus varies in rough proporation to the deformation shape of the mat. The top and bottom reinforcing steel bars that resist the negative and positive bending moments, respectively, were proportioned in a manner such that a surplus bending moment capacity is always provided. This fact was verified by comparing the three design bending moments calculated for a given location: one derived from use of the formulas and two derived from the finite element analyses. In each of these three analyses, the estimated dead load on top of the mat was multiplied by a factor of 1.5 before being used in calculating the required design bending moments, thus providing the 50% margin (surplus) in load capacity referred to above.

The shear capacity of the base mat was calculated and provided in a manner similar to the bending moment treatment described above: a surplus shear capacity is always provided. Again, this fact was verified by comparing the design shear forces obtained in each of the three calculations. As before, the estimated dead load was multiplied by a factor of 1.5 prior to being used in calculating the required design shear resistance.

Based upon my review, I have determined that the procedures and approaches utilized in the applicant's analysis and design of the base mat are sufficiently conservative and are acceptable. The sum of the top and bottom reinforcing steel bars and the vertical shear reinforcing bars have provided adequate strength for the mat to resist the load imposed by the reactor and shield buildings, if one can assume that the foundation soil behaves as predicted in the analysis and that construction was carried out properly.

(geotechnical engineering)

For the first assumption, i.e., soil behavior, an evaluation by the staff has been made and in general ~~we~~ it has been concluded that the soil behavior past and future is adequately understood and is adequately accounted for in the design and expected performance of the structures (see Enclosure 1). ~~Geotechnical Engineering evaluation for more detailed information).~~

For the second assumption concerning construction, an evaluation ~~follows~~ is presented in the following sections.

4. Specific Calculation of Key Block Mat Capacities.

Since shear cracks in the reactor shield buildings and a concrete wall were detected during the staff site visit on March 27, 1984, the applicant was requested to perform calculations to obtain shear stresses under operating and SSE conditions, and also shear capacity (strength) for base mat Blocks 5A and 1, where the shear cracks occurred. It was reported by Ebasco via telephone that shear stresses along the crack in Block 5A were 64 k/ft for normal operating loads and 166 k/ft for the SSE load, while in Block 1 they are 52 k/ft for operating loads and 210 k/ft for SSE loads. Shear capacity computed in accordance with applicable ACI Code provisions was 274 k/ft for both blocks with shear reinforcing bars contributing 98 k/ft and concrete 176 k/ft. The shear cracks do not appear to present a challenge to the structural integrity of the mat under operating conditions, assuming the calculations for shear stress and shear strength were correct. This is because the shear reinforcing bars alone have provided more than adequate resistance to the ~~required~~ computed shear stress. We found the Ebasco methodology for calculation both the shear stress and shear

capacity. However, it is not sufficient to compare the calculated shear stress of 210 k/ft under SSE loads with the calculated shear strength of 274 k/ft based on ideal conditions, i.e., no cracks and voids. Cracks and voids in concrete will reduce its shear capacity. Information needed to assess the degree of reduction was sought. More information and work are needed before a final judgement can be reached to quantify this reduction of the "ideal" shear capacity in the base mat . However, an interim evaluation, based on engineering judgement, that such a reduction in strength does not exceed 20% of the ideal strength capacity is reasonable, given the knowledge already gained from the March 27, 1984 staff visits, interviews with persons from the utility, and its contractors, and our review of documents recently provided by the utility (~~listing of documents is an enclosure~~). Accordingly, it is the staff's conclusion that the base mat and other structures of a Category I seismic design which experienced cracks, can perform their intended function. Further development of our knowledge concerning the status of the three blocks ( ) will continue in an attempt to quantify specifically the reduction. Such effort may involve nondestructive testing or other physical tests, including . A plan for such confirmatory information will be developed and included as part of the operting license.

5. CONSTRUCTION PROBLEMS

Construction problems described here are limited to the first three blocks of concrete placement where major cracks occurred. Based on the review of construction records and interviews, we find that Louisianna Power and Light (LP & L) quality assurance ~~group~~ did try to make its program a success. Nevertheless, the first three blocks of concrete placement did have quality

control problems. These problems included dropping concrete beyond 5' height at times, using a concrete vibrator improperly (providing insufficient vibration) as well as sledge hammering reinforcing bars to create openings thus transmitting shock waves to the concrete below through vertical reinforcing bars. These problems are believed to be the main contributors to concrete cracking and honeycombing observed during construction in late 1975 and early 1976. Deficiency notes were written for the cracking and honeycombing, but no non-conformance report (NCR) was initiated. A stop work order was issued by LP & L after the concrete placement of the first three blocks, but no drilled cores or nondestructive testing techniques were used to verify the quality and strength of the 5074 cubic yards of ~~paved~~ poured and hardened concrete.

At present, however, one must evaluate concrete quality from QA records and verbal description of the LP & L personnel or its contractors. Interviews of construction quality control personnel who were present during this construction phase reveal that corrective actions such as the stop work order were taken, but written records of these actions are minimal, thus requiring the staff to assess the adequacy of the three suspect blocks primarily from verbal accounts.

6. Conclusions and Recommendations

A. The mat is not currently in distress based on the crack observation.

B. Verification of shear capacity under SSE needs to be done.

C. A general surveillance (monitoring) program is recommended for all the cracks. ~~and~~ For shear cracks, the length and size of a crack and its propagation against time should be marked and recorded.

D. Corrosion of reinforcing bars due to the ground water is believed to be unlikely at the site. Nevertheless, a surveillance program is recommended.

E. The surveillance programs (items C and D above) should be incorporated

Waterford (Tan briefing 4/17/84)

Team - Larry Shao (10+1 = 11)
4 consultants to C/S/P/M, 3 in piping (KIST) and 1 person (John Deever - formerly on CAT team)
Strosneider
Shewmaker - civil/struct
Hou (MEB) - Piping
Region - Tabio - civil
Johnson -
Tan

Allegations List - 60± in civil/structural
6 other areas
Concrete mat pour records reviewed
Soil/foundation records
Cadwells
} John Deever
Bob Shewmaker

FOIA-84-455
E/B. 24

Copy to Jeng (w/F)
Ma (Review action)
Haller (w/o)
Chen (Review Action)

Return original to Dr. Lear

Done

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

APR 19 1984

TECH SPECS

Docket No.: 50-382

Mr. R. S. Leddick
Vice President - Nuclear Operations
Louisiana Power & Light Company
142 Delaronde Street
New Orleans, Louisiana 70174

Dear Mr. Leddick:

Subject: Waterford Unit 3 Technical Specifications

In your application for an operating license, you included proposed technical specifications. During the course of our review of your application, we have worked with you on these Technical Specifications to reach a mutual agreement on the proper wording and substance.

Enclosed in final draft form are the Waterford Unit 3 Technical Specifications which were developed utilizing the Licensing and Appeal Board decisions in the operating license proceedings, the Combustion Engineering Standard Technical Specifications (NUREG-0212) and the Waterford Unit 3 plant specific requirements. Please review the enclosed draft and submit, in a timely manner to support license issuance under oath or affirmation, certification that to the best of your knowledge, the enclosed draft accurately reflects the plant, the FSAR, and the SER analyses. The Technical Specifications to be issued as Appendix A to the Waterford Unit 3 license are expected to be essentially identical to the enclosed final draft with two exceptions. The Basemat Surveillance Program and Engineered Safety Features Subgroup Relay Testing requirements must be resolved prior to license issuance and will require changes to the Technical Specifications.

If you have any questions regarding this matter, please contact James H. Wilson, Project Manager, at (301) 492-7702.

Sincerely,

FOIA-84-455
E/8.26

Darrell G. Eisenhut, Director
Division of Licensing
Office of Nuclear Reactor Regulation

Enclosure: As stated

cc: See next page

~~8405170142~~ 4pp

ENCLOSURE NOT INCLUDED

DRAFT

3/4.7.13 COMMON FOUNDATION BASEMAT

LIMITING CONDITION FOR OPERATION

3.7.13 The structural integrity of the Nuclear Plant Island Structure (NPIS) Common Foundation Basemat shall be OPERABLE.

APPLICABILITY: At all times.

ACTION:

With the NPIS Common Foundation Basemat inoperable, perform an engineering evaluation to determine the effects of the condition on the structural integrity of the NPIS Common Foundation Basemat; prepare and submit a Special Report to the Commission within 14 days pursuant to Specification 6.9.2: (1) detailing the results of the engineering evaluation, and (2) justifying the acceptability of continued operation; otherwise, be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.7.13 The NPIS Common Foundation Basemat shall be demonstrated OPERABLE:

a. At least once per 92 days by verifying that the measured differential settlement of the Common Foundation Basemat does not exceed 1/2 inch and the total differential settlement does not exceed 1 inch as determined in accordance with Table 4.7-2.

b. At least once per 92 days by analyzing a sample of groundwater obtained in proximity to the NPIS Common Foundation Basemat and verifying that the chloride content does not exceed 250 ppm.

c. At least once per 18 months during shutdown by verifying that no cracking exists with a width in excess of 15 mils on the accessible areas of the basemat.

FOIA-84-455

E/B. 26

TABLE 4.7-2

FOUNDATION BASEMAT DIFFERENTIAL SETTLEMENT MONITORING

BASELINE*			CURRENT**			ACCEPTANCE CRITERION
ELEV.	AVG. ELEV.	DIFF. SETTLEMENT	ELEV.	AVG. ELEV.	DIFF. SETTLEMENT	
1))			1))			
2))	X		2))			
3))			3))	X_1		
4))		$(X-Y)$	4))			
5))			5))		(X_1-Y_1)	$(X_1-Y_1) = (X-Y) \pm 1"$
6))	Y		6))			
7))			7))	Y_1		
8))			8))			

*Baseline is the differential settlement as of September 1, 1983.

**Current is the differential settlement as determined in accordance with Surveillance Requirement 4.7.13a.

DRAFT

3/4.7.11 FIRE RATED ASSEMBLIES

The OPERABILITY of the fire barriers and barrier penetrations ensure that fire damage will be limited. These design features minimize the possibility of a single fire involving more than one fire area prior to detection and extinguishment. The fire barriers, fire barrier penetrations for conduits, cable trays and piping, fire windows, fire dampers, and fire doors are periodically inspected to verify their OPERABILITY.

3/4.7.12 ESSENTIAL SERVICES CHILLED WATER SYSTEM

The OPERABILITY of the essential services chilled water system ensures that sufficient chilled water is supplied to those air handling systems which cool spaces containing equipment required for safety-related operations and, during normal plant operation, the nonessential spaces.

3/4.7.13 COMMON FOUNDATION BASEMAT

The OPERABILITY of the Nuclear Plant Island Structure (NPIS) Common Foundation Basemat will ensure that the structural integrity of the plant foundation will remain functional during normal operations and in the event of a safe shutdown earthquake. The limitation on the foundation basemat differential settlement ensures that the structural integrity of the foundation basemat will be maintained comparable to the original design standards. The limitation on chlorides in groundwater in proximity to the NPIS is consistent with concrete design specifications for Waterford 3 and is well below the threshold for breakdown of the passivating film on structural rebar which is taken as 710 ppm in the presence of free oxygen and up to 3550 ppm when free oxygen is not present. The limitation on crack width identifies any significant cracks that would require an engineering evaluation to determine the structural integrity of the foundation basemat. Cracks with seepage will be noted and the effects evaluated. In the event that any of the limitations is reached, the effects on the foundation basemat will be evaluated and mitigative measures defined as necessary and reported to the Commission.

FOIA-84-455
E/B.26