ENCLOSURE 1

IE INSPECTION RPT 50-483/78-01

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

January 20, 1978

Docket No. 50-483

MEMORANDUM FOR: Norman C. Moseley, Director, Division of Reactor Construction Inspection, IE

FROM: R. E. Shewmaker, Division of Reactor Construction Inspection, IE

SUBJECT: RESOLUTION OF ITEMS IDENTIFIED BY REGION III DURING SPECIAL INVESTIGATIONS AT CALLAWAY, UNIT 1 RELATED TO CONCRETE CONTAINMENT

TIME AND DATE: 10:30 a.m., Monday, January 23, 1978

LOCATION: P-422, Phillips Building

PURPOSE To discuss and resolve by the establishment of positions, the following concerns:

1. Radial shear tie distribution and orientation and the relation to radial tension ties, including associated documentation,

2. Concrete cover requirements as related to crack and corrosion control, including the associated documentation, and

3. The specifics on establishment of the controlling documents or various provisions of the documents, including such documents as BC-TOP-5A, ACI-318, construction specifications and drawings.

PARTICIPANTS: NRC

O. Parr, E. Licitra, I. Sihweil, et. al, NRR
R. Shewmaker, IE; R. Heishman, E. Schweibinz, G. Gallagher, RIII

Union Electric Company and Consultants

J. Bryant

R. E. Shewmaker
RCI, IE

MINUTES OF MEETING ON JANUARY 23, 1978

The first item of discussion was to correct the subject title of the meeting notice. It was noted by the licensee and verified by the Region III personnel that the subject items had been questioned as a result of a normal inspection being conducted at the site and not as part of a special investigation underway at the time. Also, as introductory material it was agreed that the meeting would proceed with Agenda Item 3 first, followed by Items 1 and 2. The licensee's consultant indicated a desire to make a brief presentation on the development and history behind the Callaway and SNUPPS design and construction criteria prior to the discussion on the three major items. Individuals present and their affiliation are listed in Enclosure C. Footnotes indicate those individuals who were not present during the entire meeting and what portions of the meeting they were in attendance.

BACKGROUND INFORMATION

The presentation consisted of relating the criteria for the Callaway concrete containment design and construction to the following documents:

a. SNUPPS PSAR
b. Callaway PSAR
c. BC-TOP-5A, Revision 3, February 1975
d. NRC Acceptance Letter on c above dated 3/28/75
   (As stated by licensee BC-TOP-5 is actually now BC-TOP-5A, Revision 3)
e. ACI 318-71
f. NRC Safety Evaluation Report, Section 3.8.1 and 3.8.3, for Callaway, 8/7/75

ITEM 3. CONTROLLING DOCUMENTS

Bechtel referenced Items a and b as the basic documents for the Callaway-SNUPPS units.

In referring to Item a., Bechtel briefly reviewed the various subsections (3.8.1.1 through 3.8.1.7) and the commitments provided as part of the license application for these subsections. During the presentations the main emphasis by Bechtel and the licensee was that there were very

clear-cut and distinct dividing lines between design and construction criteria and that in their opinion it was the lack of understanding of these dividing lines that had led to the apparent confusion by IE. This apparent confusion had resulted in the needed for the meeting since IE had perceived the need for clarifications and understandings prior to the placement of Wall Lift #4 and the licensee wished to have the uncertainties clarified prior to the placement also.

Summarized below are the relevant specifics for each PSAR subsection of Section 3.8.1 and the licensee's interpretation of the application to design and construction, or to design and to construction as separate functions depending on one's interpretation.

3.8.1.1 Description of the Reactor Building - This section was noted to include, by reference, many of the physical details of BC-TOP-5 but also included figures within the PSAR (Figs. 3.8.1 through 3.8.7 and 3.8.13). The licensee stated that BC-TOP-5A applied for this section only as referenced.

3.8.1.2 Applicable Codes, Standards and Specifications - The licensee addressed this by indicating design was in accordance with BC-TOP-5A and then briefly mentioned the job construction specifications prepared by Bechtel. Bechtel described the three types of specifications they prepared: material specifications, fabrication specifications and construction procedure specifications. The following specifications were mentioned by Bechtel as these relating to the areas of concern under discussion at the meeting:

C-101	Furnishing of Concrete
C-103	Forming, Placing and Curining of Concrete
C-111	Purchasing of Reinforcing Steel
C-112	Placing of Reinforcing Steel
C-191	Material Testing

3.8.1.3 Loads and Loading Combinations - Bechtel indicated that the various criteria portions of this section refer to various applicable sections of BC-TOP-5A except as noted in Document a where the loads are assigned numerical values.

3.8.1.4 Design Analysis Procedures - Bechtel explained that BC-TOP-5A addresses, in Sections 6.0 and 7.0 as well as Appendices B&C, the general design analysis methods. BC-TOP-7, BC-TOP-8 and BC-TOP-1 are used for the design analysis procedures in areas such as the anchorage zones, buttresses and liner details. Seismic analysis was noted as being addressed in Section 3.7 of Document a.

3.8.1.5 Structural Acceptance Criteria - Bechtel did not provide any details on this section other than a general reference to BC-TOP-5A.

3.8.1.6 Materials, Quality Control, and Special Construction Techniques - Bechtel indicated that the SNUPPS SAR, Document a, in Section 3.8.1.6 is the guidance in this area. Bechtel and the licensee indicated that this section deals only with what they term the construction aspects and does not address design.

Bechtel noted that the design and construction of Other Category I structures as described in PSAR Section 3.8.3 was in accordance with ACI 318.

Within the hierarchy of controlling documents prepared by the licensee the following order could be established as a result of the meeting.

SNUPPS and Callaway PSAR's

Engineering calculations, drawings and job specifications

Vendor shop/fabrication drawings

ITEM 1. RADIAL BARS

Bechtel explained that Section CC-3532.1 of Appendix C of BC-TOP-5A, Revision 3 allowed three configurations for radial shear reinforcement known as the transverse, simple-U and multiple-U (See Figure 1). Bechtel is using the transverse type in the normal wall sections with the other types possible for use in areas of tendon anchorages such as buttresses, penetrations, and the construction opening. Bechtel indicated that there is no requirement that the bends of bar engage and enclose the inner and outer face vertical reinforcing since the requirement is only a standard hook and 0.5 ld as an effective embedment. In order to assure proper embedment in the outer face, Union Electric will place and verify that the radial shear reinforcement has the outer leg outside the plane of the vertical reinforcing steel. Bechtel also explained that the legs of the bar could be oriented at any angle.

Upon discussion, NRR and IE agreed that these criteria were adequate for the anchorage of radial shear bars. This discussion then lead to the question of where in elevation the radial shear reinforcement was not needed and where the radial bars were then actually the radial tension reinforcement. Radial tension reinforcement is added voluntarily by Bechtel to preclude gross delamination within the shell thickness.

Bechtel indicated that for the bottom portion of the shell, radial shear reinforcement was needed over about 25' upward from the top of the base slab and from there to the discontinuities caused by the dome the radial shear reinforcement (so called) was actually radial tension reinforcement. Bechtel indicated that the same anchorage requirements would apply.

Questions were asked regarding why radial reinforcing placed in the lift ready for future concrete placement, lift #4 (Elevation 26'-36' above top of Base Mat), had resulted in some placement differences. Bechtel indicated that an 8" recess in the two areas about 20' high for the penetration banks caused a change in the radial steel dimensions. The transition region had required some field adjustments which Bechtel engineering had approved.

Questions were asked regarding whether the radial shear reinforcement in lifts 1-3 would meet the anchorage criterion and what assurances existed for lift #4 prior to its concrete placement. Bechtel, Daniel and Union Electric all indicated that they were not aware of any problems in radial shear reinforcement placing in the first three lifts and that the problems arose in conjunction with the 8" recess areas. Daniel indicated that the forms for lift #4 were in place and the verification on the placement of radial shear reinforcement was being completed from the top, from ironworkers' access inside the forms which in some cases required removal of reinforcing. The licensee indicated that the radial reinforcement placements would be verified as correct prior to the placement of lift #4.

Region III inspectors indicated that an inspection would be made one day before the actual placement of Wall Lift #4.

A discussion was provided on the various changes Bechtel had issued to construction as DCN's on the details of radial shear reinforcement placing. The technical basis for those changes were also discussed. It was suggested by the staff that Bechtel Drawing C-0R2901 (Q) be revised in the detail entitled "Typical Wall Elevation Shear Test" (actually a sectional view) so that a typical case instead of a special case is shown. A clarified drawing including an elevation would make the intent clearer (See Figure 2).

ITEM 2. COVER REQUIREMENTS

Bechtel explained that Section CC-3533.1 and CC-3534 of Appendix C of BC-TOP-5A, Revision 3 were only design requirements and that Section 3.8.1.6.6.1.C.1 of the PSAR provided the allowable values for cover for construction. Two issues related to this were discussed. The first dealing with minimum concrete cover for corrosion protection and the second with maximum depth to face reinforcement for concrete crack control.

Bechtel and the licensee took the position that the design cover of a minimum of 2 inches can be reduced by 1/3 (cover of 1-1/3") for construction under the provisions of PSAR Section 3.8.1.6.6.1. The staff including NRR and IE indicated that the 2-inch minimum was considered to be an absolute value and if the design was to allow, as an example, a 1/2-inch outward tolerance, the design would have to use a value of 2-1/2-inches for design. Bechtel indicated that in their opinion no one had ever made such an interpretation before and that the provisions of ACI 318 on tolerances were valid. The staff pointed out that the ACI-ASME (ACI-359) committee had an inquiry on the same provisions in the ASME B&PV Code, Section III, Division 2 in June 1976. The action on this item was noted as incomplete but the reply to the inquiry was that the 2 inch minimum cover was an absolute value. This was indicated by NRR to have been their interpretation of the topical report also.

Bechtel indicated that they could meet the t/5 requirement (48/5=9.6") but that tolerances had been allowed for this maximum value. Bechtel stated that they had not detailed on an engineering drawing any value greater than 10 inches. Bechtel indicated that at the 8 inch recess transition the 10 inch and 2 inch requirements would allow no tolerance for placement. The staff suggested that since the provision of t/5 had not envisioned the recess it was possible for the local area that some relief might be available without permitting any defineable decrease in safety margins.

Region III inspectors indicated that on one site inspection a dimension of 13 inches to face reinforcing was observed on a fabrication drawing. They indicated further effort would be required to follow this up with regard to a 10 inch maximum value.

OTHER

A brief discussion was held on the provisions related to the respacing of main reinforcing steel. This discussion related to Specification C-112, Placing of Reinforcing Steel, Section 7.3 entitled, "Respacing."

Region III inspectors had noted that vertical outside face reinforcing in some regions was as large as 27 inches yet the respacing of such reinforcing would be limited to 18 inches under the specifications. This seemed to be somewhat illogical. Bechtel explained that they would desire closer control on respacing. This would in effect rule out respacing of any bars originally spaced at greater than 18-inch centers.

The staff held a caucus and the positions were then presented to the licensee. The licensee made no commitment to these positions except as noted.

SUMMARY AND POSITIONS

1. Criteria for Radial Shear Reinforcement (including radial tension reinforcement) - The staff (NRR and IE) agreed that the anchorage of the radial shear reinforcement should be such that the outer leg bend of the bars be outside the vertical plane of the outside face vertical steel and that the inner leg end of the bar meet the requirements of a standard hook plus an effective embedment of $0.5\ell_d$. It was also agreed that the radial shear bars do not need to be located so as to engage any other specific reinforcing and that the outstanding legs from the standard hooks can be rotated into any 360° position. The licensee indicated that these criteria would be followed.

2. Union Electric agreed that prior to the placement of containment wall lift #4 all radial shear bars will meet the criteria of 1. above. Quality control documentation will be available to support any conclusions related to this item.

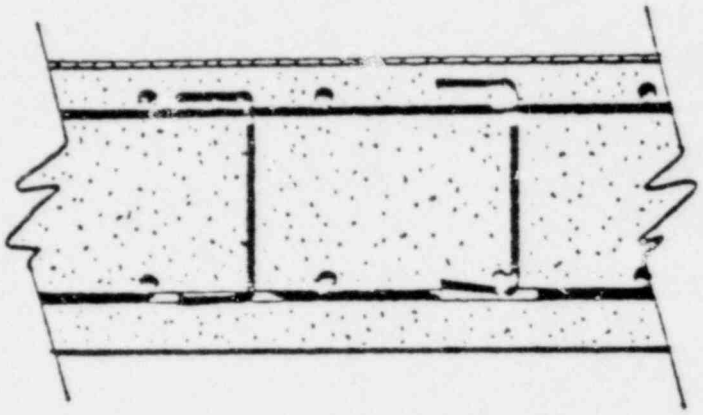
3. Union Electric will provide information and a statement regarding the location of all radial shear bars in lifts 1 through 3 already completed.

4. The staff considers that the commitment of a 2-inch minimum concrete cover for the concrete containment as made in Section CC-3533.1 of Appendix C to BC-TOP-5 for #6 through #18 reinforcing steel to control design and construction. The value is a minimum, meaning the absolute minimum cover to assure corrosion control in the actual construction shall not be less than 2 incnes. The staff expects that by wall lift #6 all reinforcing in sizes #6 through #18 will meet this requirement.

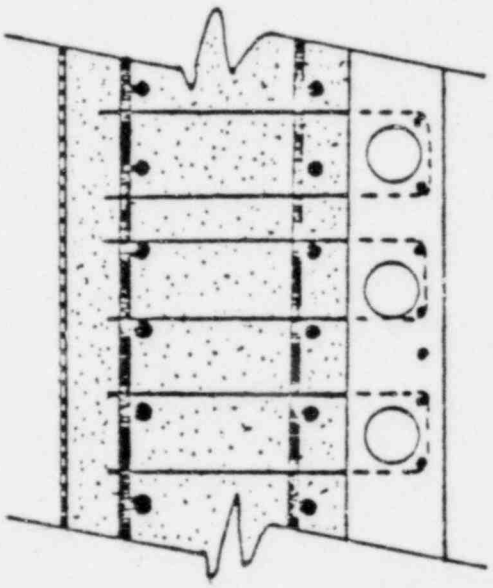
5. The staff considers that the commitment of a depth of not more than t/5 to reinforcing steel that is considered face reinforcement as made in Section CC-3534 of Appendix C to BC-TOP-5 to control design and construction. The value is a maximum as rounded to the next whole inch, meaning the absolute maximum depth in order to provide surface crack control for the concrete containment. The staff expects that by wall lift #6 all face reinforcing will meet this requirement. The staff will consider special cases on this requirement where necessary wall blockouts may require local variations to the maximum depth to face reinforcing.

6. The staff considers items 4 and 5 to apply only to the concrete containment as indicated by the licensee's commitments. ACI 318-71 provisions as committed to by the licensee will govern requirements similar to these for the other Category I structures.

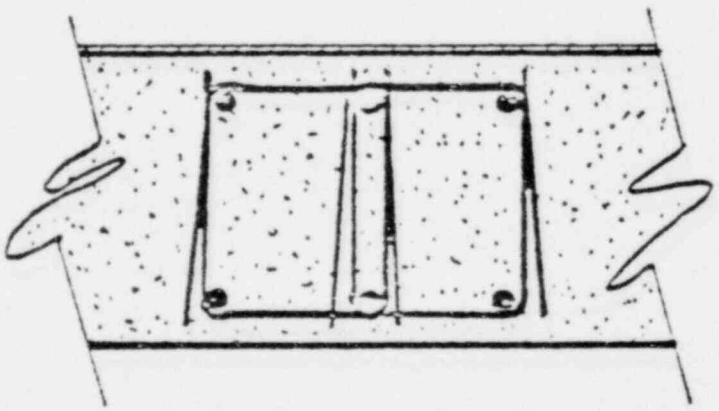
7. The staff understands that the licensee and the SNUPPS organizations may wish to submit additional information, SAR amendments or other items to the staff for consideration in relation to the above subjects.



Horizontal Wall Section
With TRANSVERSE Type Radial Shear Bars

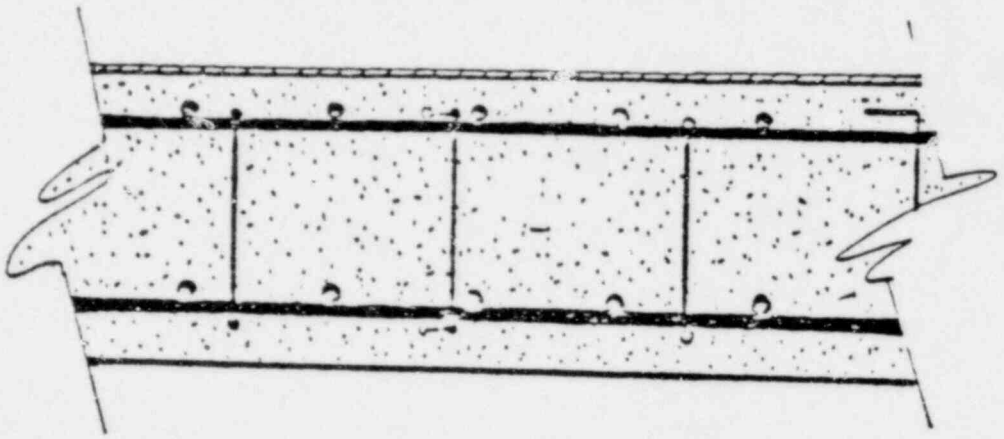


Vertical Wall Section Near Buttr
With U-BAR Type Radial S
Bars

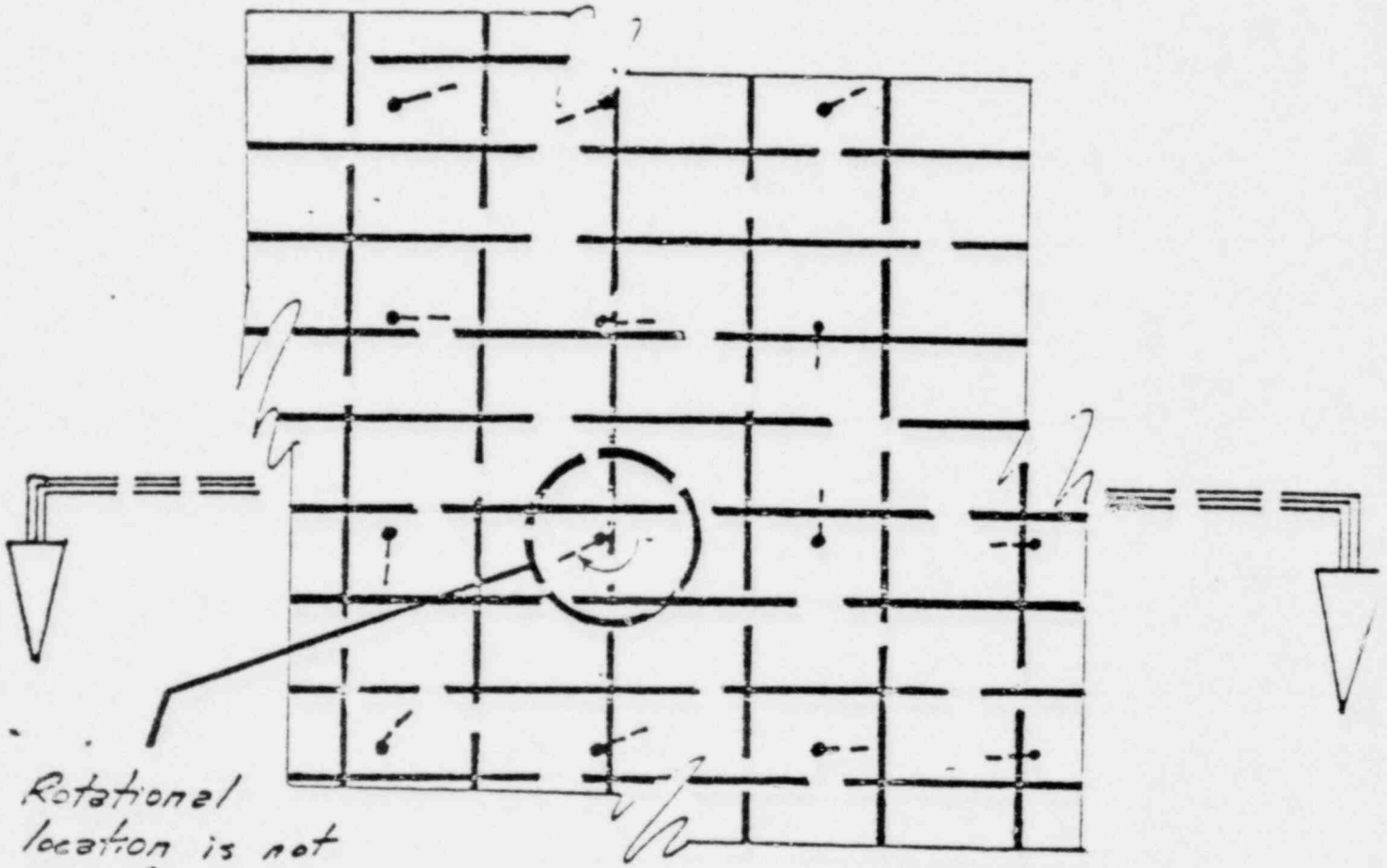


Horizontal Wall Section
With MULTIPLE U-BAR Type Radial Shear B

FIGURE 1.



Horizontal Wall Section



Rotational location is not specified. Shear bar may be rotated to clear other bars or obstructions.

Wall Elevation

FIGURE 2.

LIST OF ATTENDEES

Union Electric Company

D. F. Schnell, Manager, Nuclear Engineering
F. D. Field, Manager, Quality Assurance
W. H. Zvanut, Supervisory Engineer, Nuclear Engineering
R. L. Powers, Site Quality Assurance, Group Leader
T. H. McFarland, Construction

SNUPPS

E. F. Beckett, Licensing Manager

Bechtel

B. L. Meyers, Assistant Project Manager
P. H. Divjak, Project Engineer
Jim Whitcraft, Civil Engineer
A. G. Pecora, Civil Engineer
Marwan Daye, Civil Engineer
E. Thomas, Civil Engineer
Kenneth Lee, Civil Engineer
Joe R. Cunningham, Civil Site Liaison

Daniel International

Ed E. Nelson, Construction
Ward Malisch, Construction, Quality Assurance

Nuclear Regulatory Commission

O. Parr*, Chief, LWR Branch
E. A. Licitra, LPM
Isa Sihweil **, Chief, SEB
Charles Hofmayer**, Section Leader, SEB
Franz Schauer**, Senior Structural Engineer
R. F. Heishman**, Chief, Reactor Construction & Engineering Support Branch, RIII
E. R. Schweibinz, Reactor Inspector, RIII
E. J. Gallagher, Reactor Inspector (Civil), RIII
C. R. Oberg, Reactor Inspector, RIV
R. E. Shewmaker, Senior Structural Engineer, RCI

*Present only at closure meeting
**Absent at closure meeting

ATTACHMENT 4