

8

Midland

835230

ISHAM, LINCOLN & BEALE
COUNSELORS AT LAW

THREE FIRST NATIONAL PLAZA
CHICAGO, ILLINOIS 60602
TELEPHONE 312 558-7500
TELEX: 2-5288

EDWARD S. ISHAM. 1872-1902
ROBERT T. LINCOLN. 1872-1889
WILLIAM G. BEALE. 1885-1923

WASHINGTON OFFICE
1120 CONNECTICUT AVENUE, N. W.
SUITE 840
WASHINGTON, D. C. 20036
202 833-9730

July 18, 1983

William D. Paton, Esq.
Counsel for the NRC Staff
Maryland National Bank Building
7735 Old Georgetown Road
8th Floor
Bethesda, MD 20814

Paton / Wright
Witcoue / Chandler
Rutberg
FF

Dear Mr. Paton:

Enclosed is a complete set of all the abstracts of the transcripts in the Consumers Power--Midland hearings prepared by our office for the period December 1981 through June 1983. Together with the abstracts we sent you by letter of July 8, 1983, your entire set of abstracts should consist of the following hearing dates:

7/ 7/81	10/13/81	-11/15/82	-5/2/83
7/ 8/81	10/14/81	-11/16/82	-5/3/83
7/ 9/81	10/15/81	-11/17/82	-5/4/83
7/10/81	10/16/81	-11/18/82	-5/5/83
7/11/81		-12-6-82	-5/6/83
7/13/81	-12/ 1/81	-2/14/83	
7/14/81	-12/ 2/81	-2/15/83	-6/1/83
7/15/81	-12/ 3/81	-2/16/83	-6/2/83
7/16/81		-2/17/83	-6/3/83
7/17/81	-12/14/81	-2/18/83	-6/4/83
	-12/15/81		6/5/83
8/ 4/81	-12/16/81	-4/27/83	-6/6/83
8/ 5/81	-12/17/81	-4/28/83	-6/7/83
8/ 6/81		-4/29/83	-6/8/83
8/ 7/81	-2/ 2/82	-4/30/83	-6/9/83
8/ 8/81	-2/16/82		-6/10/83
8/10/81	-2/17/82		
8/11/81	-2/18/82		
8/12/81	-2/19/82		
8/13/81			

Sincerely,

Lawrence Hampton
Lawrence Hampton
Legal Assistant

Enclosure
cc: M.I. Miller
P.P. Steptoe

B408140102 B40718
PDR FOIA
RICE84-96 PIR

CPCo - Midland

12/1/81 HEARING ABSTRACT

NRC STAFF WITNESS:
Hood

CPCo WITNESSES:
Johnson
Burke
Corley
Sozen

- 5358 Preliminary matters.
- 5358-60 SALP Report: Staff won't offer in evidence; Stamiris wants it offered or taken notice of in order to use it in her findings; Applicant objects to it because it contradicts NUREG 9834.
- 5361-62 Stamiris not happy with idea that SALP statement can't be relied on unless in evidence.
- 5364 MIM: If SALP assessment is to be offered, then a witness should testify about the reason for inconsistency between SALP assessment and Region III people's testimony.
- 5365-66 SALP assessment is for period mid-79 to mid-80.

Paton: SALP assessment is unnecessary because the entire history of QA activity from mid-79 on is in the record, in the form of a stipulation re: second half of 1979 and testimony re: 1980 to Summer '81.
- 5367-68 Stamiris: SALP report will shed light on the contradiction between Keppler testimony and "factual documentary record." Board agrees that the contradiction must be investigated.
- 5371-72 Stamiris: the audit reports -- which are the subject of her 11/11 request -- show that CPCo conducted inadequate soils tests and then proceeded to build the DG Bldg.
- 5374-76 Board wants to know how Stamiris plans to use the requested documents.

- 5377-78 Stamiris: the 11/16 requested documents contradict Keeley and Howell testimony re: surcharge application to DG Bldg. (surcharge v. frost protection layer).
Board doesn't think the question of surcharge v. frost protection layer is important.
- 5379-85 Stamiris: The importance is that the surcharge was applied before safety questions were resolved, that is, prior to 78-20 investigation.
- 5386 MIM: QA ground rules limit the discussion to soils. The requested documents are routine inspec. reports re: electrical violations and are therefore irrelevant.
- 5387 Board: Item J or 81-20 re: QC inspectors qualifications has been an issue at these hearings, however.
- 5389 MIM: re: contradictions, actual application of surcharge consistent with Keeley and Howell testimony.
- 5390-92 NRC was notified at a 12/3 - 12/4 (year?) Bechtel/CPCo meeting of intention to proceed with surcharge. (cf. pp. 2664, 2888 of transcript).
- 5393 Discussion about date of placement of frost protection layers.
- 5395 MIM: offers to stipulate that the placement of the first sand layer ("frost protection layer") was 11/78, but Stamiris wants entire document so that the Board can consider the question "When did the frost protection layer become the surcharge layer?"
- 5396 Attachment E to Stamiris' 11/16 request received for limited purpose of dates describing surcharge application (STAMIRIS Exh. 30).
- 5397 STAMIRIS Exh. 30: a portion of CPCo 4/24/79 Response to 5054 F question 21.
- 5398 Stamiris' 11/16 Request enclosures:
(A) from CPCo 5054 response
(B) " " " "
(C) from volume accompanying 55 E Reports " "
(D) " " " "
(E) "Errata" from 55 E Report

- 5399-5403 MIM, Paton: Object to admission of audit reports because they won't add anything to record.
- 5405-06 Paton: Inspec. Report 81-20 (subject of 11/17 request) is also cumulative.
- 5407 Board suggests that 81-20 might be useful for the question of QC inspector qualifications.
- 5408-10 Stamiris: Item J (from 81-20), as well as 81-12 are critical because little is known about CPCo's QA activities at present.
- 5410-11 Stamiris says Applicant admits in its proposed findings (p. 17) that soils QA must be placed within the context of overall QA.
- 5412 SALP Report and Item J of 81-20 inspection (re: QC inspectors) are received into evidence.
- Denied: request for 77 audit reports and remainder of the 81-20 inspection report.
- 5413 MIM: the 2 open items under J of 81-20 are concerned with qualifications of QC electrical inspectors, not soils.
- 5414 Board, however, is concerned with QC inspections in general, not just soils.
- 5414 Stamiris discovery request for soil settlement cost info is deemed not significant; therefore denied.
- 5415-20 Stamiris says it was not a discovery request but a request for correction of misinformation. Board insists that the matter is of marginal relevancy. Cost isn't important unless it affects safety.
- 5421-23 At issue on SALP Report:
- (1) pp. B-2 and B-3 re: relative rankings by Region III and national staff.
 - (2) inconsistency between SALP Report and testimony by Region III's Keppler. Staff will bring a Region III witness to address that issue.

- 5424-26 MIM: factual errors in SALP Report: QA problems were identified a year before the SALP evaluation period, but SALP Report says they were identified within the evaluation period. Board agrees.
- 5427-28 Agreed that author of SALP Report should appear.
- 5429-33 Board: the "ranking" issue is not relevant: the factual inconsistencies are. MIM wants to subpoena the back-up documents for the SALP Report.
- 5434-37 Stamiris states her concern regarding the 11/17 admission.
- 5437-39 Joint Consumers - NRC Exhibit 2, a stipulation re: auxiliary building; for the purpose of expediting the Board's consideration of remedial work for the auxiliary bldg.
- 5439-41 Effect of Stipulation on management attitude issues: None. It is not an admission by CPCo that it failed to provide adequate acceptance criteria.
- 5442-43 Contention re: acceptance criteria is still outstanding and will be dealt with later.
- 5446 Stipulation appears after p. 5446.
- 5447-49 Discussion of 11/24/81 letter NRC Staff to CPCo re: Staff's concurrence to proceed with construction of access shafts and freeze wall in preparation for underpinning the aux. bldg., etc.
- 5449-66 Scheduling and Exhibit matters.
- 5466 HOOD - DIRECT
Hood is the NRC Staff project manager for Midland.
- 5467 Staff Exh. 5: 11/24/81 letter from Tedesco to Cook re: Staff concurrence for construction of access shafts and freeze wall in preparation for underpinning the auxiliary bldg. and feedwater isolation valve pits. [Received into evidence].
Hood prepared Staff Exh. 5.
- 5468-69 HOOD - CROSS (STAMIRIS)
If the 12/6/79 Order were in effect, the underpinning activity would have been prohibited.

- 5470 If there were not a viable QA program already, then the NRC would have been reluctant to enter into an agreement re: underpinning.
- 5470 Hood satisfied with Applicant's activities regarding permanent dewatering system backup interceptor wells.
- 547175 Stamiris contends that an earlier concurrence by NRC regarding CPCo's installation of a dewatering system (Staff Exh. 1 May inspection report) have led to "certain problems and certain deficiencies"; that is, "open items" in the May inspection report. The 11/24/81 concurrence may follow the same pattern.

Rebuttal:

- 5476 Concurrences on the dewatering system are dated 6/1/81, 9/2/81, and 10/22/81, while the inspection report is dated 5/81. Hood says CPCo fulfilled all its commitments regarding the agreement to allow construction of the dewatering system.
- 5477-82 Hood sees no relationship between the 5 "open items" of the May inspection report re: the dewatering system and the auxiliary bldg.
- 5482-85 HOOD CROSS (MARSHALL)
- Miscellaneous
- 5485-88 HOOD CROSS (BOARD)
- Referring to the 11/24/81 letter (last sentence of ¶2), Hood says Region III is informally notified prior to drilling so they can inquire about and observe the drilling operation if they want to.
- 5488 The last ¶ of the 11/24/81 letter refers to a subsequent phase of underpinning which will not be approved until there are further concurrences.
- 5489 Distinction between installation of the freeze wall and activation of the freeze wall.
- Installation: everything short of freezing or "activating" the soil.

5490-91 Hood not qualified to say whether Region III has received a quality plan re: remedial actions for the auxiliary bldg., nor whether any NRC inspector reviewed working drawings to determine that they are consistent with the information upon which Hood based his concurrence.

5492-93 HOOD - REDIRECT (FATON)

Dr. Landsman and Hood attended several meetings with CPCo and NRR at which the aux. bldg. and other structures were discussed, specifically CPCo's request to construct the access shaft and freeze wall.

One such meeting took place 12/4/81. Hood didn't attend but implies that Landsman did.

5494 Reiteration of pp. 5490-91: Hood doesn't know whether NRC inspectors had reviewed QA procedures and papers re: underpinning of the aux. bldg.

5494-95 HOOD - RECROSS (BOARD)

Landsman has discussed with CPCo the QA activities re: the underpinning work. Paragraph 2 of the 11/24/81 letter notes the minimal safety impact associated with such work. A proposed "lagging" procedure will prevent any strain on existing structures as a result of the underpinning.

5496-97 HOOD - RECROSS (STAMIRIS)

The I&E Dept. participates closely in concurrences.

5498 HOOD - RECROSS (MARSHALL)

"Nothing except to say that he blew my mind a few minutes ago . . ."

WILLIAMS - DIRECT

5499-5501 Witness Theodore Johnson - chief civil structural engineer for Bechtel Ann Arbor Power Division.

Witness Edmund Burke - partner in Meuser, Rutledge, Johnston & DeSimone.

Witness William Corley - engineering development division director, Portland Cement Assn.

Witness Mete Sozen - structural engineering consultant to Bechtel.

- 5501-07 Corrections to prep. testimony.
- 5508-09 P.t. of Burke, Corley, Gould, Johnson, Sozen foll. Tr. 5509.
- 5510 General description of auxiliary building underpinning procedures.
- 5510 Currently there exists:
- (a) Feedwater isolation valve pit on either end of the electrical penetration areas. (See p.t., AUX-2).
 - (b) Pair of tendons at elevation 601 is in place now. Provides additional support for electrical penetration wings during underpinning.
 - (c) Permanent dewatering system.
- 5511 Work to be done includes:
- 5512-13 Dewatering procedure (preliminary to actual underpinning) first step of which is to install a freeze curtain dam (or "Freeze wall"). Minimizes amount of groundwater seeping towards auxiliary building underpinning work.
- 5514 Grout wall has not been installed.
- 5514-15 A freeze wall is a line of bore holes used to determine pervious material (sand), and where appropriate, a freeze pipe is inserted to stop seepage of water into the pervious material.
- 5515 Freezing affects material below elevation 610.
- 5516 Freeze wall extends to clay till, approximately elevation 580.
- 5516-17 Freeze pipe goes down and doubles back up each hole; the upper part is installed so as to freeze lower portion of soil only.
- 5517 Radius of freezing around each hole approximately 2-1/2 feet. Holes spaced every 5 feet.

- 5518 Piezometers (located inside the freeze pipes?) monitor the water table.
- 5518-20 Next, install a settlement monitoring system, more sensitive than that in use since 1977. Consists of 5 benchmarks going 100 feet below location of benchmarks.
- 5520 Benchmarks used to reference vertical, not lateral, motions.
- 5520-21 Figure 36 shows lateral and vertical control points. Also referred to on page 10 of prep. text.
- 5521-22 Extensometer gauges, attached to the benchmarks indicate relative movement between the deep benchmarks and the structure.
- 5523 Absolute movement not tied to deep benchmark. Intent is to install an observation point for lateral movement on the end of electrical penetration areas "by setting up east and west of that area with a movement to read on."
- 5524 Dial gauges will indicate relative lateral and vertical movement between buildings.
- 5525 If dial gauges register any movement, absolute readings will then be taken.
- 5526 Under Bechtel's auspices, an outside specialty firm will probably be engaged to collect, analyze and act on this monitoring data.
- 5527 Access to the auxiliary building is a problem in underpinning construction.
- 5528 Worker safety in underpinning: underpinning is a common operation.
- 5529 Effect of temperature due to cold weather and worker ventilation requirements on concreting: Bechtel has developed procedures for these contingencies.
- 5530-32 QA/QC plans re underpinning: Witness panel's responsibility is to put proper QA into the design specs; it is the responsibility of the QC & QA programs to insure those designs are carried out properly.

- 5532 Chronological procedure of underpinning. (See AUX figures 30 and 24).
- 5533-35 (a) construction of access shafts, located outside feedwater isolation valve pits at either end of auxiliary building. Staff has approved first phase of the access shaft construction, (drilling of holes in line around perimeter of access shaft locations).
- 5536 (b) excavation to elevation 609, which is the elevation of underside of turbine building, feedwater isolation valve pit and electrical penetration area.
- (c) small approach pit to be dug for access to underside of turbine building.
- 5537-39 (d) placement of underpinning shafts.
- 5540 Access shaft floor approximate elevation 603.
- 5541-43 Details relating to previous discussion.
- 5544 (e) placement of heavy steel beams.
- (f) placement of cross beams.
- 5545 Pier M to have capacity of 4000 kips.
- Piers and soil will be monitored to determine their reaction to load placement.
- 5546 With completion of work at Piers N, P and R, it will be possible to lower the shaft to elevation 600, the elevation of underside of access tunnel as it comes out into the open.
- 5547 Soldier beams serve as posts in the access shaft, sunk to elevation 561 or 571, or 10 feet below final excavation.
- 5549-50 Description of work at Piers J, L, K, E and D.
- 5551-52 Supports beneath the floor of the structures will be installed progressively.
- 5553-54 Discussion of tunnel extension to various locations.

- 5555 Depth of tunnel only to elevation 580 or 585 at a certain area (not clear from the testimony).
- Work at Piers H and G will provide support along one edge of turbine building.
- No underpinning for central portions of turbine building opposite control tower. Rather, local pits will be dug for this less sensitive, stronger portion.
- 5556 Temporary underpinning for control tower, electrical penetration and turbine building is complete.
- 5556-57 Modifications in plans from original proposal submitted at 10/81 hearings:
- (a) Pier Q to be installed before Pier R.
 - (b) Piers R and Q to be installed before S and T.
- 5558-60 Details regarding previous discussion.
- 5561 "Temporary" piers actually form part of the final, permanent underpinning.
- 5561-62 Temporary underpinning referred to in figures AUX-24, -22, -33, 34 and - 35.
- 5562 Figure AUX-35 shows how control tower temporary underpinning is filled in and completed.
- 5564-68 Completion of description of how the remainder of the permanent underpinnings are installed.
- 5569 Backfill or fill that will be put back in will be from a new source and meet certain Bechtel quality criteria.
- 5570-72 How compaction procedure takes place once space between top of fill and underside of structure becomes very small.

CROSS BY BLUME

- 5573-74 "Volume change crack" could be either surface crack or through crack. E.g., a crack in electrical penetration wall at auxiliary building (between lines 8.6-9.1, elevations 628 and 642, in figure AUX-19) is a through crack.

- 5574-75 Causes of cracking, in general, include volume change and diff. settlement.
- 5574-77 Corley, Sozen examined certain cracks in auxiliary building.
- 5577-78 Johnson offers prepared sheets indicating what crack size looks like: CPC Ex. 15.
- 5578 Corely unable to determine whether some of the cracks he examined were through cracks.
- 5579 Cracks generally occur perpendicular to direction of principal tensile stress. (See prep. test. p. A-5).
- 5580-82 Corley opinion that the north-south cracks in auxiliary building caused primarily by volume change rather than diff. settlement. Doesn't think diff. settlement contributed to those cracks, because fig. AUX-8-A doesn't indicate large enough out-of-plane movements of the floor. Also, the general pattern of cracking in auxiliary building inconsistent with such a conclusion.
- 5582-84 Corley did not examine NW part of auxiliary building for cracks because he wasn't aware of any cracks there. Johnson's personnel did original exam and did not find cracks of large enough size in NW sector to warrant further investigation.
- 5584-86 Johnson opinion that crack size is critical if larger than 1/16 inch.
- 5587-90 Sozen opinion that significance of crack size difficult to determine because many standards apply: statistical distribution of crack widths, durability, etc. For auxiliary building, there is no pattern of structural distress or structural forces. Cracks in auxiliary building, some of them probably through cracks, are not related to settlement; therefore not critical.
- 5590 NRC Staff counsel suggests Sozen compare crack maps of portion of auxiliary building that experienced diff. settlement and portion that did not.
- 5590-91 Objection: not in evidence that portions of auxiliary building did not experience diff. settlement.

- 5591-92 Reviewing fig. AUX-8-A, Sozen agrees that
NW corner of auxiliary building did not experience
diff. settlement.
- 5593-94 Objection overruled.
- 5594 Sozen: comparison of crack maps at aux. building
would not change his opinion that cracks were
caused by volume change.
- 5595-96 Corley: Although volume change is primary
factor, "flexural" stresses may have contributed
to cracking in the floors. Wall cracks caused by
vol. change only.

CPCo - Midland

12/2/81 HEARING ABSTRACT

(Johnson
(Burke
(Corley
(Sozen
(Gould

PRELIMINARY MATTER

5599-5615 Board denies Sinclair's motion to subpoena the NRC Executive Director of Operations for testimony on conclusions he drew about Midland in testimony before a Congressional Subcommittee.

JOHNSON, BURKE, CORLEY & SOZEN
CROSS BY BLUME

5616-17 CPC has agreed to respond to NRC Staff's structural questions (Rinaldi questions 7, 10, 11, 12, 13) and underpinning questions (Hood, Kane, Singh testimony at Table A-20, items 3, 4, 5, 6).

CROSS BY MARSHALL

5617-18 Underpinning at aux. bldg. will be concrete, cast in place.

5618-19 Hydraulic jacks will lift 30-40,000 kips. No sand is under the jacks.

CROSS BY BOARD

5620-21 CPC will provide all information (relating to structure, at least) requested in Staff testimony at Table A-20.

5621-22 Johnson says QA procedures are updated periodically to reflect changes in NRC regs. (See QA requirements referred to on pp. 35-36 of p.t.).

- 5622 No extra precautions planned for remedial work, even given history of problems in soils related areas, because soils related areas not considered an engineering problem.
- 5623 Procedures being used have built in QA because of input from consultants.
- 5624-26 Geotech engineer who will inspect and approve subgrade not yet hired. (See pp. 23, 50). Likely to be a Bechtel employee and hired prior to remedial const. activity, although initial phases aren't Q-related and don't require presence of geotech engineer.
- 5626 Initial depth of shaft is elev. 609; there is no effect on struc. stability at that level.
- 5627 Seismic design of underpinning structures will be 1.5 x FSAR in order to cover SSRS.
- 5627-28 Staff and CPC have not agreed on SSRS, however. Sufficiency of 1.5 will be demonstrated "in near future." If insufficient, underpinning design will be modified to so conform.
- 5628-29 Ultimate bearing capacity: CPC intends to demonstrate that it can "maintain the safety factor of 2." (See p. 51 of p.t.). Current design could be upgraded if necessary.
- 5630-32 Acceptance criteria for items such as stresses and strains are generally established in national codes. Some items now being established; all will be before construction begins. (See pp. 31, 35 of p.t.).
- 5632-34 Structural analysis (pp. 43-44 of p.t.) to be completed before construction of permanent underpinnings. Modifications can be made even during temporary underpinning phase.
- 5634-35 If temporary underpinning is redesignated as permanent, it can then be upgraded to meet permanent standards. (See also item 14 in NRC/Hood prep. testimony).
- 5636 Allowable bearing pressure issue is addressed in Kane and Gould testimony.

- 5636-37 Current underpinning design, scheduled to be completed by 1/1/81, based on Bechtel's and ARC's criteria of 6.6 rather than 5.18.
- 5637-38 Major load carrying walls are reinforced concrete; some interior walls are masonry or masonry/concrete. (See p. 7, Sec. 1.3, of p.t.).
- 5638-40 6/79 report referred to in NRC/Hood testimony at pp. 9-10 is first complete report to NRC on aux. bldg. problem, although an 11/7/78 letter from Howell to Keppler (Stamiris Ex. 11) first identifies the problem. See p. 5645 infra.
- 5640 DGB and SWPS received extensive crack examination.
- 5640-41 Crack exam at aux. bldg. limited to parts of control tower penetration area and main bldg. due to complexity, inaccessibility, and size of bldg. Exam didn't necessarily cover all fill supported areas. Object of exam was to find general indicators of areas subject to high stress/signif. cracking.
- 5642-44 Convinced that crack examination program is adequate. Existence of cracks in inaccessible areas not determined, but their existence is not necessarily significant anyway. Also, settlement values and cracking are generally proportional. Settlement values in fig. AUX-8A are very low; therefore, cracking is minimal. All evidence gives witness Johnson confidence that fill material is adequate. Where not adequate, area is underpinned.
- 5645-46 Follow up to pp. 5638-40: Stamiris Ex. 11, the MCAR report of 11/3/78 in NRC Staff testimony, establishes when CPC committed to conduct additional borings. Results transmitted to Staff in 6/79.
- 5647-52 Description of 4 different underpinning plans: 6/79, 7/79, 5/81 and 10/81.
- 5652 Expect completion of "committed preliminary" design by 1/1/82.

- 5652-53 "Final" design same as "committed preliminary" except includes minor modifications such as floor thickness.
- 5653 Current plan further along than the caisson plan was at the same stage because finite element structural models have been created in conjunction with new plan. Before, only simple structural models used.
- 5654-56 Items south of column line G are to be completed by 2/15/82; remainder of building by 4/15/82.
- 5656 Underpinning presently in the preliminary mode; when finished, it will be "committed preliminary".
- 5657-58 Caisson plan was changed in part because of change in seismic criterion. Caissons were enlarged to the point that they formed one concrete mass.
- 5659 While earlier proposals were "adequate", the new one is "extremely conservative" and witness Johnson is confident it will in fact be used.
- 5659 New plan to be clarified in next few months.
- 5660-61 Current plan has changes from previous plans, partly due to changed criteria and need to be responsive to NRC concerns. In meetings with CPC, the NRC Staff never said any concept was "unacceptable".
- 5561 NRC Staff concerns: e.g., with caisson system and seismic shakedown of material under control tower.
- 5562 Underpinning designed to accomodate jacking loads of 20% greater than currently estimated. Should it exceed 20%, foundation width would be increased. (See p. 37, Sec. 5.2.2, of p.t.).
- 5663-64 Possible "remedial measures" (referred to on p. 42 of p.t.) are anticipated to be at most only minor modifications.

- 5665-68 Staff won't be consulted when CPC is merely carrying out designs according to plan, but will be consulted if CPC wants to change basic criteria.
- 5669 Bechtel responsible for underpinning design, and employs several consultants and subcontractors.
- 5669-70 Bechtel reviews or establishes QA for all underpinning design and work, such that regulatory QA requirements are met.
- 5670-71 E.g., actual underpinning const. is supervised by Mergentime Corp., but QA for that work comes under Bechtel's full responsibility.
- 5671-72 Certain initial aspects of underpinning not Q-listed because work doesn't affect Q-structures.
- 5672 Feedwater valve pit is Q-structure closest to access shafts. Base level for valve pits is about elev. 600.
- 5673 A temporary support system for the feedwater valve pits was installed 15 mos. ago because of concern that reduction in groundwater table level might cause settlement.
- 5674-78 Witness Johnson reluctant to testify about the geotechnical issue of the effect of clay/soft soil flow on stress in structures due to drilling auger holes or other underpinning work.
- 5478-79 Bearing loads on soil underneath aux. bldg. in vicinity of existing control tower approx. 5-8 KSF.
- 567981 Conclusion that cracking is attributable primarily to volume change. (See pp. A7A8 of prep. testimony).

REDIRECT BY BLUME

- 5682-84 Specs require 3-year settlement monitoring of selected points. Aux. bldg points are shown on Fig. AUX-8A. Numbers indicate vertical displacement downward. If no number is shown at a certain area of aux bldg. on fig. AUX 8A, such as NW corner, it does not mean there is zero settlement. Rather, the area is inaccessible.
- 5684-85 Fig. AUX-84 shows aux bldg tilting to south. If entire structure tilts, there is little foundation stress.
- 5686-87 "Differential settlement" means how much one part of bldg. settles relative to another part. Appears that aux bldg is not experiencing and will not experience a problem. Small amounts of diff. settlement insignificant.
- 5688-89 Methods of determining through cracks.
- 5689-90 Through cracks significant if member is to retain fluid or gas. Causes bending in a flexural member. Indicates fairly uniform stress on each side of a membrane material.
- 5691 For membranes (walls), a volume change crack is often a through crack.
- 5691-92 Through cracks usually not significant in beam members. Non-through cracks in beam members could be significant.
- 5692 Corley found no structurally significant cracks in the aux bldg.
- 5693 Criteria used in assessing significance of cracks include type of member, structural function, loads, type & distribution of reinforcement in the member, type & sequence of construction, location, length & width.
- 5694 Corley has examined 10-20 bldgs. similar to aux bldg using these criteria.

- 5694-95 Sozen notes that a crack has 2 dimensions. Disregard for this characteristic leads to ambiguity in meaning of "through crack".
- 5695 Sozen has examined 24 or more bldgs. similar to aux bldg using criteria described by Corley (See Tr. 5693).
- 5696 Corley & Sozen agree that crack width alone is an indication of significance of cracking, but is not conclusive.
- 5696-98 "Reference crack width" = statistical measure of the distribution of a certain type of crack width in a given structural element.
- 5699-5700 If a crack is determined to have met a pre-established reference crack width, Sozen would recommend a structural evaluation of the meaning of the crack.
- 5700-01 Sozen: reference crack widths for aux bldg. should be divided into non-structural and structural elements.
- 5701-04 Corley & Sozen describe as overly conservative the NRC Staff/Hood prepared testimony at Attachment 20, ¶6.2, which says .03 inch cracks will require suspension of construction activity.
- 5704-05 Structural distress = signs of impending mechanism of failure.
- 5705-08 If inaccessible areas of aux bldg were to show cracking that was significant, the adjacent areas would also show cracking. Therefore it is not necessary to observe inaccessible areas.
- 5708-09 Corley & Sozen have not seen any evidence of structural distress in aux. bldg.
- 5709-10 Correlation of crack widths to stresses is very weak and prone to error. Sozen & Corley describe the variables.
- 5711-17 If residual stress in a reinforcing bar of a cracked member is balanced by internal stress, then in terms of load carrying capacity of the elements the residual stress should be of no significance.

- 5717-18 For cracks in the aux bldg. which suggest existence of residual stresses, compensating stresses also exist.
- 5718-20 QA procedures in the design of underpinning for aux bldg.

CROSS BY SINCLAIR

- 5720-27 Johnson has "high assurance" that present QA program will result in a quality product.
- 5728 Rotation of the aux bldg. (See p. 11 of prep. test) will have not effect on equipment in the control tower.
- 5729-30 Although there is no structurally significant cracking or distress in aux bldg, CPC chose the most expensive and extensive method of underpinning primarily because it is designed for extreme loads, as required in nuclear industry.
- 5730 All Category 1 structures are designed for extreme environmental and accidental events.
- 5731 Original plan was designed for extreme events, but underpinning not a part of original design. Underpinning came about as a result of appearance of fill problem and increased SSRS factors.
- 5732-33 For other buildings, CPC will conduct seismic re-analysis to determine whether further action--such as underpinning--is necessary.

RECROSS BY BLUME

- 5733 CPC committed to design underpinning to current NRC Staff criteria identified in SER, §§ 3.8.4 and 3.8.5.
- 5733-34 CPC will provide info requested in NRC/Hood p.t. at Table A20, items 3-6, and will not begin construction until Staff approves.
- 5734-35 Item 6(B): CPC agreed to meet with Staff to determine the extent of crack evaluation required prior to underpinning aux bldg and installing permanent underpinning.

- 5734-35 Johnson considers the cracking problem extremely insignificant.
- 5736 No construction will begin without Staff approval.
- 5738 CPC committed to satisfy NRC Staff re: crack evaluation prior to construction of permanent underpinning structure, but expects Staff to be reasonable and also maintains right to appeal unresolved issues.

RECROSS BY BOARD

- 5739-40 MIM: CPC prepared to make similar commitment re: construction milestone #2; however, certain issues set forth as proposed special license conditions may be more appropriate at later milestones.
- 5740 Special license condition 2D: bearing capacity pressures.
- 5740-41 Sozen under contract w/Bechtel since 10/20/81 to study & interpret cracking.
- 5741 Corley under contract w/CPC since before 12/1/81 to conduct inspections and report on cracking.
- 5742-43 Corley verified accuracy of Bechtel crack maps (in the prep. testimony) and found only minor discrepancies.
- 5743-45 North-South differential settlement of entire aux bldg is .2 inch. Same value applies for the distance between spent fuel pool and the south end of control tower.
- 5746 Statistical uncertainty of data in figure AUX 8A.
- 5747 Data used primarily as indication of trends.
- 5747-48 Small amount of displacement (.2 inch) should lead to very low stress on structure. Would have no effect on piping or electrical lines. Underground systems designed to withstand displacement movement.

- 5748-49 Johnson has no geotechnical engineering responsibility with Bechtel. There is a geotech engineer counterpart to Johnson within the organization.
- 5750-51 Johnson thinks NRC Staff is aware of Bechtel's QA design procedure and engineering department procedures, through its audits. Doesn't think structural staff has seen them. Doesn't know how much of the plan has been approved.
- 5751-52 Hanson is Johnson's general structural consultant.

CROSS BY MARSHALL

- 5753-54 All category 1 structures designed to withstand earthquakes.
- 5754 All design work done by Bechtel.
- 5754 Geologists are used to convince Bechtel & NRC that Midland site is adequate for a nuclear plant.
- 5755 Not feasible & not necessary to build a nuclear plant on bedrock. Must be built on adequate foundation material. Glacial till upon which Midland plant is situated is adequate.
- 5755 No plans to put waste in bottom of a "void" beneath one of the structures (?).
- 5756-57 CPC Ex. 15: entered into evidence.

JAMES P. GOULD
DIRECT BY FARNELL

- 5758 Gould is a partner with Mueser, Rutledge, Johnson & DeSimone, consulting engineers.
- 5758 Gould's role in aux bldg. underpinning & SWPS concerned with geotechnical aspects.
- 5759-60 Gould prepared Sec. 8 and AUX-3, -4 and -38 of prep. test on Remedial Measures for Aux Bldg. and Feedwater Isolation Valve Pits. Entered into evidence.
- 5760 Basis of 7 ksf as average shear strength for clay till: Woodward-Clyde's dried steel strength tests on 2 sample borings (COE -17 and -18).

- 5761-62 7 kips value for shear strength based on Second Woodward-Clyde Report at App. D and E. Gould believes 7 kips is appropriately conservative for till beneath aux bldg.
- 5762-63 Bearing capacity of 6.5 (p. 52) is appropriate.
- 5763 Criteria discussed on pp. 53-54 of prep. test. is explained: (1) re: secondary compression; (2 and 3) re: performance of underpinning piers under jacking (See figure Aux-37).
- 5764-65 Based on analysis of Woodward borings COE-17 and -18, Gould says soil probably won't flow into access shaft as it is being constructed. (See AUX-38).
- 5765-66 Further discussion of blow counts.
- 5767 Extreme care necessary in sinking of the shaft and in augering to prevent lateral pressures from causing failure of shaft wall.
- 5768 West penetration wing directly adjacent to shaft would be the only portion of structure to suffer damage if soils were to flow.
- 5769-70 Recommended actions to prevent such a flow.
- 5771 No restrictions necessary on no. of holes augered at a given time.
- 5771-72 Soil flow not an issue during access shaft excavation since the shaft only goes as deep as elev. 609. Goes deeper only after adjacent structures are supported; at that point, full ground water control and dewatering will be in place. Ground water will be completely drawn down.
- 5772 Gould doesn't expect west penetration wing to be damaged by soil subsidence.
- 5773-74 CPC Ex. 16: Woodward-Clyde Second Report entered into evidence.

CROSS BY HODGDON

- 5775-76 Testing procedure used by Woodward-Clyde to determine preconsolidation stress at 30-40 tons psf was not typical. Gould fully relies on Ladd's procedure. (See p. 50, p.t.)
- 5777 Generally, a sample will be "inundated" at an earlier stage of loading, and at a lower stress.
- Standard procedure would have yielded a lower, less "clear" value.
- 5778-81 Transient forces (wind, etc.) should be used in evaluating bearing capacity or foundation stability, but they are not critical in evaluating settlement. (See modulus of elasticity discussion at p. 51 of prep. test.). In this case, transient forces were not considered; however, Gould says they are "perhaps significant" and will be considered.
- 5782 Settlement values for aux bldg. are extremely small.

CROSS BY MARSHALL

- 5783-88 Misc.

CROSS BY BOARD

- 5788-89 Average shear strength factor of 7 ksf for entire mass of till means that, averaging the full length of the structure, Gould judged that the entire length could be characterized as 7 ksf material, based on the 2 WCC borings.
- 5789-91 Bearing capacity factor of 6.5: discussion of "official safety factor computation".
- 5792-93 Feels that underpinning work is in good hands. Gould and his firm will be involved in the project as it progresses.

RECROSS BY MARSHALL

- 5794-95 Misc.

CPCo - Midland

12/3/81 HEARING ABSTRACT

(Hood Rinaldi
(Kane
(Singh

- 5799-5805 Sinclair: motion that the Board request an NRC audit of the plant.
- 5806-13 Further comments by MIM, Paton, Sinclair, Marshall.

The GE determines whether the cause of the crack is the foundation; the SE actually evaluates the effect of the crack on the structure.
- 5813-15 Board defers ruling on Sinclair's motion, also stating that the Board denied reopening the record to include the '77 audit report not because of relevancy, as Sinclair contends but because of lateness.
- 5816 HOOD, KANE & SINGH DIRECT

Hood: NRC Staff project manager of Midland
Kane: NRC geotechnical engineer
Singh: Corps of Engineers -- assisting NRC in geotechnical evaluation of Midland.
- 5817-31 Discussions of their prepared testimony and corrections.
- 5831-32 Applicant objects to Testimony p. 9, question 9 ["Has there been any manifestation of distress to these structures because of the bill problem?" Answer: "Yes] on grounds that Kane, as geotechnical witness is not qualified to testify as to structural crack problems.
- 5833-37 Kane disagrees, and says CPCo cannot tell NRC who will be responsible for what issues. Cracks issues span both geotechnical and structural engineering.
- 5838-39 Board overrules objection.
- 5840 [Testimony received].

- 5840-44 Table A20 is a proposal to the Board that certain construction activities be allowed to proceed, provided that all questions are resolved. Although NRC Staff does not currently understand CPCo's 11/16/81 response, its evaluation of the response will not be complete until it interacts with applicant.
- 5845-46 Jurisdictional discussion:
- (1) Applicant won't construct anything without staff approval.
 - (2) Staff approval may come before Board has made a decision.
 - (3) Board can approve or disapprove Staff's action.
- 5847-48 QA organization change is problematic, will be discussed at 12/14/81 hearing.
- 5849 Board is concerned that Cook might be further isolated from QA activity as a result of the organizational change.
- 5850-52 Scheduling of QA witnesses.
- 5852-55 KANE - CROSS (MARSHALL)
- There are no shifting sands under safety-related structures at Midland.
- 5856-57 Reason for underpinning the aux. bldg: a series of borings have indicated unacceptable foundation material under the electrical penetration areas and the feedwater isolation valve pits. The use of natural till material will eliminate the problem.
- 5858 HOOD - CROSS (MARSHALL)
- The borings at the aux. bldg. were not taken at an earlier date because the need for such testing did not become apparent until later.
- Objections to question of who (Bechtel or CPCo) was negligent in its failure to discover the problem early.
- 5859-60 SINGH - CROSS (MARSHALL)
- 5861 Purpose is to determine whether the cracks are the result of foundation settlement or sinkage.

5863 Settlement caused by "less than competent" soils.

5864 The aux. bldg. is indeed a safety-related structure.

5865-66 HOOD - CROSS (MARSHALL)
Hood concurs with Applicant's decision that remedial measure was appropriate.

5867-83 HOOD, SINGH, KANE - CROSS (FARNELL)
Technical discussion re: soils, remedial work.

5884-99 Scheduling matters.

5899 Decision on Sinclair's motion for an independent audit of Midland: DENIED for the following reasons:

- (1) Board is competent to investigate QA/QC at Midland;
- (2) NRC hasn't imposed such a requirement;
- (3) There is significant, relevant testimony already in the record or to be received.

Notes also that MAC already made an independent investigation.

5902-08 KANE, SINGH - CROSS (BOARD)
Technical discussion re: bearings capacity, etc.

5909-11 Stamiris wants additional time to prepare findings.

5912 Internal Staff appeal process: When and if the Staff and Applicant reach an impasse, they will inform the Board.

5913-14 Board will also be informed if Applicant has not lived up to its commitment.

5915-17 SINGH - CROSS (STAMIRIS)
Army Corps of Engineers identified a problem with the control towers on 8/28/80. A structural audit took place in April, 1981. Applicant was asked about corrective action in the course of several meetings.

5919-36 HOOD, KANE - CROSS (BOARD)
Continued discussion of technical aspects of underpinnings, etc.

- 5936-37 Table 20 A and the voluntary commitment: If the Staff finds a CCo response unacceptable or deficient, and both parties reach an impasse, then CCo can appeal to the NRC management.
- 5938-39 Board wants to be notified of both disagreements between CCo and the Staff and CCo's violations of its commitment.
- 5940-78 RINALDI - DIRECT - CROSS
[end] [Non-QA].

? 12/9 Records
12/10

CPCo - Midland

12/14/81 HEARING ABSTRACT

Kennedy (Hadala
(Rinaldi
(Matra

PRELIMINARY MATTERS

- 5981-87 Problems with 12/3/81 Transcript; scheduling.
- ROBERT P. KENNEDY
DIRECT BY STEPTOE
- 5988-89 Corrections to prepared testimony.
- 5990 Aux. bldg. model incorporates soil structure impedance functions under both aux. bldg. and electrical penetration wings. There is some uncertainty about relative stiffnesses. (See prep. test. at pp. 16-17).
- 5991 Kennedy wants to do further evaluation on uncertainty bands to present to NRC Staff, and to narrow the range from a factor of 5.
- 5992 SMA/Kennedy developed the BWST model. Kennedy's model more sophisticated than the Bechtel model -- better represents effect of fluid structure interaction and transfer of forces from BWST to soil, etc.
- 5993 CPC will use Kennedy's model.
Bechtel model more conservative; predicts higher loads.
- 5993-94 No need to redesign the BWST remedial foundation, based on Kennedy model.
- 5994 Kennedy model to be used for seismic margin review and in checking SSRS.
- 5995 Kennedy prep. test. entered into evidence.
- 5996 CPC committed to use SSRS as design basis for remedial underpinning work.

- 5996-97 Prior to now, Bechtel used an SSRS equal to 1.5 x FSAR in design of underpinning.
- 5997 SSRS: ground response spectra used in seismic analysis to define the acceleration, velocity and displacement of the structure at any natural frequency.
- 5998 Different spectra at various structural damping levels (5%, 10%, 2%, 1/2%) are all "ground response spectra". (See Fig. 1 of prep. testimony).
- 5999 "Housner" spectrum was in general use when Midland was designed. "FSAR" spectrum is same except within period range 0.2-0.6 sec, where design spectra is increased 1.5 x.
- 6000 Ground response spectrum = design response spectrum.
- 6001-04 Comparison of SSRS spectrum and 1.5 x FSAR spectrum as applied to BWST, SWPS and aux bldg. show that 1.5 x FSAR is a conservative approach to designing the remedial work.
- 6005-06 Stiffnesses associated w/soil structure interaction impedance functions have uncertainty but are estimated based upon state of the art practices.

CROSS BY STAMIRIS

- 6007 Bechtel model used for design of the fdn. remedial work; Kennedy model to be used for all subsequent work.

CROSS BY MARSHALL

- 6007 Only the BWST model was revised.
- 6007-08 BWST experienced foundation settlement.

CROSS BY BLUME

- 6009 Kennedy's dynamic models take into account

- vertical acceleration at various floor levels. Involves a 2-step process.
- 6010-11 Input to equipment is generally defined in terms of "floor response spectra", or "in-structure response spectra".
- 6012-14 Kennedy is a consultant on seismic analyses to be done at Midland. Bechtel will re-evaluate equipment within structures using Kennedy's models. SMA will re-evaluate that equipment for the SSRS. SMA will review Bechtel's work.
- 6014-15 Disc. about different effects of movement on equipment near wall v. equip. in center of floor.
- 6015 Detailed structural analysis involves both static and dynamic models. Kennedy's dynamic models predict appropriately conservative data which is then applied to a detailed analysis.
- 6016-17 In second step of analysis, Kennedy will show that there is no difference between vertical spectra at floors and at walls.
- 6018-21 Objection by PPS to question about qualification of equipment in above-ground portions of the structure on basis that it is an OL matter. Blume says he just wants to determine adequacy of dynamic analysis that is being used. Overruled.
- 6022 Kennedy not yet familiar with Bechtel's analyses re vertical floor spectra effect on equipment.
- 6022-23 Consultants are in general disagreement as to necessity of checking vertical floor spectra on floor centers and parameters. Kennedy feels it is necessary, because spectra at center and parameter are significantly different.
- 6024-26 Kennedy model accounts for entrapped soil beneath the foundation structures.

- 6026-28 1.5 x FSAR spectrum leads to greater forces on the foundation than does SSRS.
- 6030 Foundation remedial work has not modified missile shield because missile shield is above ground.
- 6031 Underpinning will have only slight effect on structural response of missile shield.
- 6032 Missile shield not being redesigned to 1.5 x FSAR; it is already designed to FSAR.
- 6033-38 Areas in which seismic margin review criteria likely to be different from SSE design criteria.
- 6039 All FSAR criteria are being applied to fdn. remedial work. Earthquake level has been increased by 1.5 x.
- 6039 FSAR damping levels, which are lower than reg guide 1.61, are being used in Kennedy's re-analysis of the structure above the fdn. level.
- 6040 All foundation underpinning design is now based on 1.5 x FSAR.
- 6041 Effect of 2.25 multiplier (?) gives added conservatism in design of SWPS, BWST and aux bldg.
- 6042 Kennedy's model indicated that BWST's structural response was 1.3 x FSAR; fdn. remedial work was based on Bechtel's model and 1.5 x FSAR. Thus, Bechtel's model yields a more conservative effect.
- 6043-46 Kennedy analysis won't include static analysis of fdn. ring for design purposes. Will review the fdn. ring during the seismic margin review, but won't advise Bechtel on how to do the design.
- 6047 Cracks in existing fdn. ring have no effect on seismic response of the tank.
- 6047-48 Has not reviewed the matter of bearing forces

- being transferred by new fdn. ring.
- 6049-52 Earthquakes produce horiz. & vertical vibrations. Disc. of effect on BWST.
- 6053 Two approaches in analyzing soil structure interaction: (1) impedance function approach; (2) wave propagation.
- 6054-56 Midland uses impedance function approach.
- Impedance function can model 3-d behavior, it requires less complex analysis, and predicts appropriately conservative responses.
- 6057 "Compliance function approach" as it is termed in Std. Rev. Plan is same as impedance function approach.
- 6057-58 SRP (Table 3.7.2-1) does not list impedance function as acceptable approach for deeply imbedded structures. Kennedy disagrees. Other nuclear plants have used imp. function for deeply imbedded structures. Kennedy & Amer. Soc. of Civil Engineers are developing a new standard for nuclear plants that will allow both approaches.
- 6059-60 Foundation rings have no effect on BWST other than to anchor the tank. Kennedy model more accurate than Bechtel model because his assumes the design is adequate to anchor the tank while Bechtel's adds in an effect of foundation ring.
- 6061 An out of plane foundation would not change seismic induced stresses.
- 6061-62 Foundation rings have no effect on ovaling of tank.
- 6062 Flexible foundation would have an effect on tank response if it was more flexible than tank; but such differential flexibility is unlikely.
- 6062 Cracks in foundation would change its flexibility if foundation remedial work was not done.

- 6063 Present cracks in foundation won't affect flexibility.
- 6063-64 In all recent radiation damping analyses, Bechtel has used Kennedy's recommended value of "75% of theoretical radiation damping levels." (See p. 11 of p. t).
- 6064-65 Bechtel has also used the FSAR criterion which limits composite model damping to 10% of critical. (See p. 11 of p. t).
- 6066-67 Staff Ex. 6 (re: Aux bldg. & SWPS models) was prepared by Bechtel. Kennedy agrees with its contents.
- 6068-69 Enclosure 3 to Staff Ex. 6 is a technical report on underpinning the aux bldg. and feedwater valve pits; not part of the other docs. in the exhibit. Staff 6 entered into evidence.
- 6069-70 Both equivalent rectangle & circular structural foundations were used in calculating horiz. & vertical spring constants. (See pp. 3-5 of Staff 6 aux enclosure).
- 6070 Basis of selection of imbedment factor of F is shown in Fig. A-12 of Staff Ex. 6.
- 6070-74 All sides of each structure were evaluated individually.
- 6075-78 Ω = frequency of vibration of the soil structure system. (See p. A-6 of Staff Ex. 6).
- 6078-81 How Kennedy estimated the effective modulus of elasticity of the soil. (See p. 8 of prep. testimony).
- 6081 Disc. of shear moduli Kennedy used to calculate the spring constant.

CROSS BY BOARD

- 6082-83 Aux bldg. is moderately imbedded. (See dimensions in Figs. 3-4 of prep. test).

- 6083-84 Clearance between adjacent structures is 2" (+ 3/4").
- 6084-85 Extremely improbable that 2 adjacent buildings would be out of phase at their maximum displacement during a seismic event.
- 6085 Kennedy doesn't know whether Bechtel sized the gaps between bldgs. on the basis of sum of root squares or of assuming maximum displacement.
- 6086-87 Kennedy doesn't know what factor of safety was put into the design of gaps prior to const. permit, but it was at least as conservative as the 1.5 x FSAR (modified Hausner) design.
- 6087-88 Behavior of 2 adjacent bldgs. impacting during an earthquake is hard to predict. There are various results.
- 6088-89 Gaps can occur between soil and sides of bldgs. during an earthquake, but Kennedy has never seen damage as a result.
- 6090 Effect of gaps is debatable.
- 6092 It is possible to calculate the forces that would cause gaps, in order to determine whether wall/soil separation might occur.
- Kennedy unable to estimate to what degree or whether separation would occur at Midland.
- 6093-94 How design response spectra (p. 9 of prep. test.) is related to a 5% damping.
- 6095 Composite damping values for aux bldg, SWPS and BWST.
- 6095-99 Torsional response of structure is added to translational response. Effects of torsional and translational input on structure. (See p. 10 of prep. testimony).
- 6099 Kennedy's model will overcompute responses in center of bldg and compute reasonably accurately at the periphery.

- 6100-02 Midland is adequately designed to resist "under-predicted rocking response." (See p. 10 of p. t).
- 6102-03 Two-step analysis: First, a dynamic analysis to compute a structure's overall shear, moments, accelerations and displacements. Second, take maximum dynamically computed forces and apply to more detailed seismic models to calculate stresses in individual structural elements. This is a very conservative approach.
- 6103 Second step is performed on each structural element during design. To be done before the OL proceeding (?).
- 6103 Detailed static analyses have been performed on underpinning. Kennedy not involved.
- 6104-05 Step 2 involves finite element model.
- 6105-07 Kennedy convinced that his model over-predicts what the building's actual response will be.
- 6107-08 More sophisticated models would require less conservatism.
- 6108-09 For Kennedy's analysis, the missile shield structure is the only one that had a response greater than 1.5 x FSAR.
- 6109 Systematic Evaluation Program work has not entered into Kennedy's recommendations for the seismic margin review. (See p. 13 of p. t).
- 6110 A seismic margin review of a plant that already exists, such as Midland, requires a more realistic, less conservative assumption (in certain aspects), than that which would be used in a new design.
- 6111 Kennedy unfamiliar with size of plants formally included in SEP program, also with fission product releases.
- 6111-14 Degree to which Midland's FSC ground motion is in compliance with 10 CFR 100, App. A.

- 6114 Kennedy does not know basis for 10 CFR 100, App. A criteria for SSE.
- 6114-16 Conservativeness of damping values suggested in Reg Guide 1.61 and those recommended by Drs. Newmark and Holt. CPC to use Reg Guide 1.61 values for civil structure, but higher values for equipment.
- 6116-17 Criteria and approach used in seismic margin review will be submitted to NRC Staff.

REDIRECT BY STEPTOE

- 6117-18 Reg Guide 1.61 damping values will be used for the civil structure in the seismic margin review; FSAR damping values for design of underpinning.
- 6118 Clarification: seismic response from more sophisticated models will be 50-100% of the responses given by Kennedy's models.
- 6119 Kennedy's recommendation re: 75% limitation of radiation damping is being followed on all underpinning work.

MARSHALL

- 6119 Misc.

HADALA, RINALDI & MATRA
DIRECT BY BLUME

- 6122 Hadala -- Asst. Chief of Geographical Lab, Waterways Experiment Station at Vicksburg, Miss., US Army Corps of Eng.
- Rinaldi -- Senior structural engineer, S.E. branch, NRC.
- Matra -- Consultant to struc. eng. branch, NRC, but works for Naval Surface Weapons Center.

6122-28 Corrections & clarifications to prep. testimony; etc.

6128 Prepared testimony following Tr. 6128.

6129-30 Hadala has done a general evaluation of methods CPC and its consultants used to calculate soil spring constants and damping parameters for the remedial work. He performed calculations differently than Kennedy did to estimate the effect of elastic contents of fdn. materials. However, Hadala achieved nearly identical results and is in agreement with Kennedy and CPC.

6131 Hadala: Kennedy's methodology is sound.

6131-33 Rinaldi: no major disagreement with Kennedy's models for SWPS, BWST and aux bldg. Staff wants certain additional info, however.

6134 Rinaldi: Kennedy's methodology is sound.

6134 Matra agrees w/Rinaldi.

CPCo - Midland

12/15/81 HEARING ABSTRACT

(Wessman (Hadala
(Hood (Rinaldi

- 6139-44 Preliminary matters re scheduling
- 6145 WESSMAN & HOOD - DIRECT (PATON)
Wessman is Enforcement Branch chief in the Enforcement Branch of the Office of the I&E. Previously, he was senior NRC staff member assisting the SALP review group.
- 6146 Purpose of SALP: Evaluate and improve licensing management performance.
- 6146-47 SALP involves 2 steps: (A) regional review
(B) national review
- 6147-48 Results of the national review, including a rating of all licensees, are published in "NRC Licensee Assessments NUREG 0834".
- 6148 Wessman's role: assembled information for national group and assisted in writing the report.
- 6149 Wessman responsible for the words on pp. B2 and B3 regarding Midland. He says he's identified several inaccuracies.
- 6150 Pages B-2, B-3 offered, but Board wants to include general information portions of the report, also, even though they discuss the rankings of nuclear plants.
- 6152-53 If entire document is offered, Paton does not want to be put in a position of amending it on the spot. He and Wessman lack such authority.
- 6153-54 MM objects: If Wessman is not the testimonial spokesman for the report, then it remains hearsay.
- 6154-58 Continued discussion of same.
- 6158-59 Board reiterates its position that national ranking is not relevant because it includes factors that this proceeding is not addressing. But because the ranking on specific topics may or may not be relevant it wants the document in its entirety.

- 6160-61 Stamiris would like to explore the factors that went into the national ranking and to cross-examine those that are relevant.
- 6162 Staff Exh. 7 offered: SALP Report NUREG 0834.
- 6162-63 Corrections to pp B-2 and B-3.
- 6163-64 Inaccuracies in the report regarding QA problems with materials and placement of soils due to the fact that those problems had been identified prior to the 7/1/79-6/30/80 period of evaluation, and therefore should not be included.
- Wessman inadvertently left out information about the immediate action letter.
- 6165 Evaluation period is 7/1/79-6/30/80, but data was gathered for a 2 year period because of overlaps in regional evaluation periods.
- 6166-69 Documents that Wessman relied upon in preparing B-2 and B-3 includes a letter dated 1/2/81 from Keppler to Moseley (Staff Exh. 8).
- Attached to the 1/2/81 letter: Regional SALP Report.
- Inaccuracy in Regional SALP Report: the non-compliance total should be changed from 10 to 19 (16 infractions and 3 deficiencies) -- due to Zack findings.
- 6170-73 Staff Exh. 9: Working paper SALP Staff Summary, Midland 1 and 2, 5/81: prepared under Wessman's supervision, and used by the national SALP review group.
- 6174-75 Staff Exh. 10: SALP Input from Midland Units 1 and 2, NRR Project Manager Comments, prepared by Hood sometime before the SALP evaluation period.
- 6177-79 Staff Exh. 11A and 11B: Computer printouts listing noncompliances at Midland, for 2 year period 1979-80.
- Wessman relied on the computer listing in his development of the working paper (Staff Exh. 9).
- 6180 In addition to Exhibits 8-11, Wessman also relied on discussions with Region III SALP people in his preparation of the working paper and the information on pp. B-2 and B-3 of the SALP Report.

- 6182-85 Scheduling matters.
- 6186-87 WESSMAN - CROSS (MILLER)
- 6188 While at Region III, Wessman had very little experience with respect to inspection of reactors under construction, other than pre-operational testing.
- 6189-92 Wessman's educational background and previous employment history. (Objections by Paton are overruled).

MIM trying to establish that the words Wessman wrote are not based on his independent appraisal as an engineer, but simply as a member of the I and E Staff.
- 6192 SALP team consisted of Wessman (full time) and several others who were part time or short term.
- 6193 Mr. Tambling of Region III provided some short term assistance to the SALP team for its review of Region III facilities.

Tambling has reactor inspection experience.
- 6194-97 Wessman present at an NRC briefing on 9/22/81 (referenced on first page of NUREG 0834).

Paton objects to question of "Who at briefing suggested assessments should be made at the regional level?" because the purpose of this exam should be limited to alleged inaccuracies on pp. B-2 and B-3 rather than the entire document with its issues of rankings. Board allows exam on entire document to determine validity of any information it contains.
- 6198 Wessman doesn't recall who suggested assessments should be made at regional level.
- 6198 Wessman says assessments should be made at the regional level.

The national review provides a national perspective and insures consistency of assessments at the regional level.

- 6199 NSOC (Nuclear Safety Oversight Committee) discussed the SALP process with Wessman on 9/2/81.
- 6199 NSOC provides a general oversight of nuclear activities and reports to the President.
- 6200-01 Wessman's comments to NSOC are memorialized in an NSOC report at Tab C, p. 4, but Wessman doesn't recall having said that the headquarters overview is of "dubious value."
- 6202-03 Headquarters overview is not of dubious value, says Wessman. It is necessary to insure consistency among regional evaluations.
- Wessman agrees with NUREG 0834 that assessments should be done at regional level, but also states that both levels are involved.
- 6203 Board sustains objection to question of whether rankings should be done at the regional vs. national level.
- 6204 Current NRC policy is that headquarters activity is to be redirected to evaluating policy criteria and methodology for regional assessment.
- 6205 At 9/22/81 briefing, the NRC was interested in having assessment process conducted at regional level because a regional staff is closer to the activity.
- 6205-12 Board overrules objections to question, "Are the regional evaluations a more reliable indicator of licensee performance?" but points out that the word "regional" includes the participation of certain people who may be at headquarters. (Hood, e.g.), and that there should be a distinction between past and future assessments.
- 6212-13 Wessman: regional assessments more "useful" to licensee--and everyone else--because they're more timely and are made by people who are closer to the activity.

- 6213-17 Board overrules staff objection that cross-exam is too broad.
- (1) "We find great merit in the SALP Regional Review Boards and the meetings between the Regional Staff and corporate management to assess licensee performance."
 - (2) "SALP methodology was neither systematic nor entirely scrutable."
- 6219 For the purpose of this discussion, "scrutable" is defined as "capable of being understood by an outside observor."
- 6219 A diversity of rating systems was adopted by different regions. E.g., acceptable = adequate; good = above average.
- 6220 Region III used the terms "adequate" and "acceptable" interchangeably.
- It also used the hierarchy average - above average - below average, and rated Midland as below average.
- 6220-21 Headquarters used the average - above average - below average system as well. Corollary terms such as "adequate" or "acceptable" could be applied to any level of the hierarchy.
- 6211 Adequate performance does not necessarily mean average performance: adequate means above the minimum threshold for adequacy.
- 6221-22 Regions II and III generally used the "average"- "above average"- "below average" system.
- 6222 13 performances or "functional" areas for which each region considered licensee performance (see last page of Exhibit 8).
- 6223 "Unacceptable" as used on p. 5 of NUREG 0834 means below the minimum threshold.
- 6223-24 When a regional assessment group identifies unacceptable performance, enforcement action ensures.

In making its comparisons, the national SALP group may discover a problem occurring in many facilities that individually may be treated as acceptable, but collectively becomes unacceptable.

- 6224 NRC directed the headquarters group to rank reactors into 3 or 5 major groups.
- 6224-27 SALP team met at least 15 times during its work. Wessman, as secretary of the group, wrote minutes of the meetings, some of which discuss the Midland evaluation.
- [MIM requests production of these documents.]
- 6228 When the SALP report was prepared, it represented the best collective judgment of the headquarters SALP group.
- 6229-30 Wessman is not a voting member of the SALP group; he assembled the data upon which the rest of the group based its decision. He also drafted the findings.
- 6229-30 Wessman's own opinion of the Midland evaluation is expressed in Staff Ex. 9, the work paper. He may have expressed his opinion to the SALP team at their meetings.
- 6231 National SALP team applied that same criteria to each facility and based its appraisal on the best available data.
- 6231-33 SALP team considered events during the 2 year period 1979-80; then they focused attention on the regional evaluation period (7/1/79-6/30/80). This was necessary because some QA issues were ongoing.
- 6234-37 Wessman asked to clarify the confusion over what period of time is used in the description of non-conformances on pp. B-2 and B-3.
- 6238 Wessman thinks the SALP team considered non-compliances that occurred during the regional evaluation period which were already in the I & E reports, and additional ones that had not yet been documented in the I & E reports.
- 6238 Wessman never specific about number of non-compliances: 12, 19, 22?
- 6233 SALP Summary gives the "typical" number of non-compliances at a plant as 18 per 2 year period, or 9 per 1 year period.

- 6239-40 Wessman says "there may be some lack of precision" in the way SALP tallied non-compliances.
- 6241 The 19 Zack non-compliances were documented in a 1/81 "enforcement package," well past the SALP period, and yet included in the SALP report.
- 6242 Wessman hopes the 19 Zack items aren't counted in the SALP II report as well.
- 6242 Cut off date for information coming into the SALP review: 5/81, when the SALP team met to make a determination about Midland.
- 6243 Wessman doesn't know of an NRC directive saying whether non-compliances belong in the evaluation year in which they arose, or in the year in which the NRC report is issued.
- 6243 P. 1 of SALP review discusses corrections that have been made to the conduct of the SALP process.
- 6244-46 Decision whether to include Zack non-compliances in the review was made by SALP review group. They decided to include non-compliances occurring:
- (a) within the regional period of evaluation;
 - (b) within the "period of interest".
- It was immaterial whether the non-compliance had actually been documented.
- 6247 Use of the "period of interest" was a uniform practice across regions.
- 6247-48 Wessman discovered the factual errors on pp. B-2 and B-3 within past 2 weeks. Had discussions with Paton and Knopp (Region III).
- 6249 Wessman does not know why the errors didn't surface earlier.
- 6250-86 SEISMIC MATTERS:
HADALA, RINALDI & MATRA (Continued From Tr. 6134).
- 6250-52 Witnesses offered for questioning re: 50.55(e) reports on seismic model of Aux bldg. CPC counsel explains that 50.55(e) reports re: seismic model are not relevant to these QA proceedings.

CROSS BY STEPTOE

- 6253-54 Rinaldi statements at p. 9 (Q. 7) and p. 15 (Q. 10) of prep. test. refer to 2 analyses: (1) to confirm adequacy of the 1.5 x FSAR basis for underpinning and (2) seismic margin review.
- 6254 Staff has not concluded its evaluation of proposed criteria for seismic margin review.
- 6254-55 Rinaldi testimony of 12/14/81 updates the portion of his prep. testimony which says CPC has not provided a dynamic model for the proposed BWST foundation support. Kennedy testimony redresses that issue.
- 6255-56 Staff has not fully reviewed information provided re finite element model and would like more information. Therefore Staff has not determined if that model is correct and accounts for the tie between the old and new foundation. (See prep. testimony, ¶2).
- 6256-57 Adequacy of finite element model to be discussed with CPC.

CROSS BY STAMIRIS

- 6258 CPC has provided adequate seismic models for aux. bldg. and SWPS.
- 6258-64 Previously, CPC informed the NRC Staff that it had identified a problem with the seismic model and planned to modify the design.
- 6258-64 NRC Staff learned more about the matter in its routine 5/81 audit of Bechtel. That audit applied only to the old design criteria identified in FSAR.
- The SSRS was still being discussed. This type of routine structural audit usually done at end of CP review, sometimes later, as in this case.
- 6263 Staff audit revealed no problems with the dynamic models for any structures at Midland except aux. bldg. and BWST (testimony about which has just been submitted).

- 6265 This hearing ltd. to dynamic models; Staff feels a final evaluation must await review of static models.
- 6266 Staff has reviewed models for old FSAR criteria; plans another structural audit spring '82 to review CPC's analysis. CPC has committed at least for the aux. bldg.; Rinaldi unsure about the other structures.
- 6267 Seismic margin review does not apply to structures on glacial till (containment bldg. e.g.). SMR criteria not yet determined.
- 6268-71 SMR criteria will be established prior to actual SMR. Guidelines will not be 100% restrictive. NRC will review the work.

CROSS BY SINCLAIR

- 6271 CPC committed to provide Staff the results of its evaluation of adequacy of aux. bldg. seismic model prior to both temp. and permanent underpinning.

CROSS BY MARSHALL

- 6272 CPC's final approach to underpinning has been established in last few months.
- 6273 Staff basically agrees with CPC's design concept; it needs to further review it for design adequacy.
- 6274 Staff will review hydraulic jacks loading in spring '82.

CROSS BY BOARD

- 6274-75 Std. Rev. Plan finds both the "half space approach" and "shear beam approach" acceptable. Staff agrees.
- 6275-76 Rinaldi's prep. testimony based on seismic model information prepared by Bechtel in Staff Ex. 6. These models are consistent with Kennedy's testimony.

- 6276-77 Staff reserves judgment, pending a review, on the assumptions in CPC's models that the effect of surrounding structures is negligible.
- 6278 Effect of jacking loads.
- 6278-79 Term "foundation" as used by Hadala means supporting soil rather than concrete foundation.
- 6279-80 Purpose of review checking (see page 9-10 of prep. testimony).
- 6281 Overstressing in control tower: information not yet provided to Staff. (See 50.55(e) at p. 2(?)).
- 6282-83 Analysis of adequacy of final design of piping systems is still an open item.
- 6284-85 Staff does not have enough information at present to perform its reviews; CPC has committed to provide most of it in February-April, 1982.
- (Technical issues resume at Tr. 7140).
- 6287-88 Decker: Although Board earlier ruled against allowing audit reports 7732 and 7721 (Stamiris 11/11 request), it wants to examine Bird and Marguglio on them anyway.
- WESSMAN - CROSS (MIM)
- 6288 Region III people, including Tambling, reviewed the draft form of B-2 and B-3. Hood did not.
- 6289-92 Facts on B-2 and B-3 most accurately characterize the licensee's performance.
- Wessman refuses to describe the changes that they made (e.g., "during" to "prior to") as significant changes. Rather, they are "more accurate".
- 6293 Wessman hasn't discussed the changes with the SALP review team, but has with Moseley. Nobody suggested that these changes might be reason to re-evaluate the performance at Midland.

- 6294 Not true that Wessman was more careful in preparing for his testimony today than he was in preparing pp. B-2 and B-3.
- 6295 Wessman doesn't know if there was a comprehensive QA inspection by Region III at Midland in 5/81.
- 6295 The stopwork action referred to in Staff Ex. 9, p. 1, was initiated by CPCo and not NRC.
- 6296-97 Civil penalty of 1/81 was for 19 non-compliances. As of 5/81, the civil penalties had not yet been paid, according to p. 2 of Staff Ex. 9.
- 6297-6301 CPCo Ex. 17: 10/13/81 letter Keppler to Cook. ¶4: "On 2/3/81, Region III acknowledged receipt of a check for \$38,000 [for Zack penalty]."
- Objections to authenticity of document and truth of ¶4 statement. Ruling is deferred.
- 6301-02 CPCo Ex. 18: 2/3/81 letter Dudley Thompson to Howell (V.P. - CPCo).
- Based on CPCo Ex. 18, Wessman says the \$38,000 was in fact received by Region III.
- 6303-04 Objections to admission of CPCo Exs. 17 & 18 as an attempt to test the "consciousness" of Wessman's statements about penalty payments in the 5/81 report.
- 6305-06 CPCo Ex. 17 admitted only for its reference to the fine in ¶4; CPCo Ex. 18 admitted in full.
- 6307-09 In ¶3 of CPCo Ex. 17, NRC Staff agrees with CPCo that 2 purported non-compliances are in fact not non-compliances. Wessman states that this must be accurate.

(CPCo Ex. 3, a 1/30/81 letter, also refers to these non-compliances).

- 6310-11 Licensee must pay or protest a penalty within 30 days. To do otherwise is considered by NRC as a serious matter. Wessman admits that the allegation in Staff Ex. 9 about non-payment is inaccurate.
- 6311 Wessman admits he does not know exactly how many non-compliances occurred during the actual SALP evaluation period.
- 6311-13 Recap:
- (a) Staff Ex. 9, p. 2, lists a figure for noncompliances based on 2 year period computer listing (Staff Exs. 11A, 11B). Includes Zack items.
 - (b) Staff Ex. 8, regional SALP report, lists 12 non-compliances for the period 7/1/79 - 6/30/81. Excludes Zack items.
- 6313-14 Absolute number of non-compliances or inspection hours/non-compliance not an accurate measure of licensee performance. Other factors include regulations applicable to a particular facility, experience of inspectors.
- 6314 Thus it is "quite difficult" to compare facilities based on number of non-compliances only, says Wessman.
- 6315 Statement on p. B-3 about "numerous items of non-compliance" refers to the regional tabulation (Staff Ex. 8) as opposed to p. 2 of Exhibit 9.
- 6315-16 Wessman doesn't recall anyone from Region III saying Midland was comparable to other plants in Region III vis-a-vis number of non-compliances per inspection manhour.

(See pp. 1 and 3 of Staff Ex. 9).

- 6317-18 Keppler testified (Tr. p. 2025) that Midland's number of non-compliances per inspection manhour is reasonably comparable to other Region III plants.
- 6319 In the table on p. 1 of Staff Exh. 9, Midland appears to have a larger number of non-compliances per inspection manhour than the Region III average.
- 6319-20 Wessman's figures for inspection manhours (p. 3 of Staff Exh. 9 do not distinguish between resident v. regional inspection hours.
- Appraisal of inspection hours based on data obtained by SALP's management informations staffs (e.g., time cards).
- 6321-25 MIM: I & E reports within the 7/1/79 - 6/30/80 period show how much time spent by an inspector. Wessman assumes that the hours indicated in a particular I & E are found in the statistics on p. 3 of Staff Ex. 9.
- 6325-26 Board sustains objection to question of discrepancy between Keppler's testimony and the statement on p. 1 of Staff Exh. 9 regarding non-compliance per inspection manhours.
- 6327 Wessman doesn't know how many of the non-compliances (39 and 42 respectively) on p. 2 of Staff Ex. 9 occurred between January 1 and June 30, 1979.
- 6327-30 Wessman doesn't know how many instances of unqualified QC inspectors occurred during 7/1/79-6/30/80, but says the I & E's would disclose such information.
- 6331-32 Definitions:

- (a) 5 unqualified inspectors in same discipline discovered at same time would be 1 instance of unqualified inspectors, but if in different disciplines, 5 instances. (e.g., see p. 19 of Staff Ex. 11B: 5 instances).
- (b) Repetitive instances are of more concern than a single instance.

Wessman says if there was 1 instance within period, but a previous history of such instances, then the statement in the evaluations should so indicate.

Note: MIM suggests there was only a single instance of an unqualified QC inspector.

- 6332-33 The instance referred to in Staff Exh. 11B at p. 19 is same as that referred to in Staff Exh. 8 at p. 3.
- 6333-35 At p. B of NUREG 0834, the plural reference to instances of inadequate control of contractor activities refers to Zack and Bechtel. Wessman unable to describe any specific example.
- 6335-36 Wessman confirms the statement in Staff Exh. 9, p. 3 ¶VIII, that the "findings by the Region has resulted in the reorganization of the Midland QA program."
- 6336-38 Wessman says the statement on the last page of Staff Exh. 9 that "the SALP Staff would view Midland as poor" was based on input from Region III. Region III's statement that Midland was "adequate" is not inconsistent with the SALP assessment of "poor." A plant can be "poor" or below average and still be above a minimum threshold of adequacy.
- 6338-39 The statement on p. B-3 of NUREG 0834 that "licensee was slow in responding to NRC concerns re soils placement" must have been based on conversations with Region III because it does not appear in the written regional reassessment (Staff Exh. 10).
- 6339-40 Scope of NRR evaluation not limited to soil settlement, Babcock & Wilcox sensitivity issues and post TMI issues, even though Hood in Staff Exh. 10 (p. 1) says it was limited to those three items.
- 6341-42 Wessman has no recollection of a 7/16/79 meeting between applicant and NRR at which Jim Knight wanted applicant to document within 30 days the information it gave at the meeting regarding soil settlement.
- 6342 Wessman does not recall meeting on 8/24/79 (see Tr. p. 2680; also Hood's notes of the meeting and meeting minutes) at which Knight said Applicant's proposals for structural foundation support were adequate.

- 6342-46 Such information would have been useful for SALP team's appraisal of Applicant's responsiveness regarding soils questions. Wessman never aware that at an 11/79 internal NRC meeting Hood had relayed that information to the NRC.
- 6346 Wessman says the SALP team's method of data-gathering provided the best available information; avoids saying it failed to provide certain relevant information such as the Hood information at the 11/79 NRC meeting.
- 6347-49 Board sustains objections to question "Isn't such a process seriously flawed?"
- MIM: Attempting to account for the difference between Hood comments in Staff Exh. 10 that Applicant's responses to soil settlement requests were untimely and inadequate prior to 1/26/79, and evidence in the record to the contrary.
- 6350 Wessman disagrees with the statement that, had he had the information regarding Knight's assessment, the statement on B-3 that the licensee was slow in its response would have been different.
- 6351-56 With reference to Hood remarks at p. 2 of Staff Exh. 10, Wessman does not know whether Consumers' use of the appeals process [as a way of allegedly delaying its responses to NRC] had any bearing on the SALP team's appraisal of Consumers.
- 6357-63 Inspection manhour figures are meant to be only a rough guide in the assessment of a facility: there is an error in the data of perhaps 20%; the number will vary depending on the stage of construction; etc. Wessman admits that the "national average" referred to in the SALP report fails to take into consideration the fact that reactors are at differing stages of construction.
- 6363 A noncompliance is generally charged to both units of a plant, but sometimes it is chargeable only to one.
- 6364 Difference in number of manhours for a 2 unit v. 1 unit plant is perhaps 25-35% more, not 100% more.
- 6365 No formal mechanism exists which will insure that Zach noncompliances are excluded from SALP II.

- 6365-68 Wessman will discuss connections regarding NUREG 0834 with SALP groups, which has ultimate authority to decide the matter. Wessman does not know whether he would recommend personally that an errata sheet be issued.
- 6368-69 Board sustains objections to question of whether it is fair to let NUREG 0834 stand as is when Wessman is aware of its errors.

WESSMAN - CROSS (STAMIRIS)

- 6370-71 During SALP group's activities, Wessman provided Chairman Moseley with staff assistance.
- 6372 SALP assessment considers 13 areas of inquiry, some not specifically QA-related. Sources of information include correspondence and meetings.
- 6373-74 National evaluation not a principal goal of the SALP program, even though consistency among regional applications of SALP program is one of the goals.
- SALP's 4 objectives are given on the first page of NUREG 0834.
- 6374-75 In the future, SALP evaluations will occur at the regional level. Evaluation criteria is "hopefully tightened" and "more stringent," and there will be no national report, no "subjective" national average.
- 6376 National ratings are of somewhat limited value. There will be, however, a continuing need for a national SALP group to insure consistent application of SALP among regions.
- 6377 Problems of terminology during the present SALP assessment were the result of a lack of precision in instructions.
- 6378 Regional differences in the way SALP was implemented include:
- (a) terminology
 - (b) other evaluation areas (in addition to the 13)
 - (c) review period
- 6379-80 SALP will maintain the national perspective by auditing and overseeing regional SALP assessments.

- 6381-82 Referring to NRC's threshold of adequacy, Wessman knows of no permanent suspensions of activity anywhere.
- 6382-83 Board sustains objections to the question, "Is permanent suspension of work a realistic option, given repeated problems and stop work orders?"
- 6384 Referring to Staff Ex. 9, item VIII, Wessman not aware of the QA reorganization which integrated Bechtel's and CPCo's QA.
- 6385-86 Reiteration of terminology details.
- 6387-88 Wessman present at the 11/24 meeting. Does not recall Keppler saying that the number of non-compliances was not as significant as their severity.
- 6388 Zack noncompliances took place around March-July 1980, during the SALP period.
- 6388-89 SALP group agreed with Region III's characterization of Midland as "below average".

6390-6403 WESSMAN - CROSS (MARSHALL)

Q: "Why is it that they get by so easy all the time?...It becomes like a sickness."

Q: "And the thing we have here is a comedy of errors, as I see it...There is a liquor store right across the street from the building of this place and everybody gets a fifth...Don't you think that we could cut down some of these errors?"

WESSMAN - CROSS (SINCLAIR)

- 6404-05 Wessman recalls sending a draft of his pages B-2 and B-3 to Mr. Tambling of Region III, and that Region III did not suggest any major changes.
- 6405 Wessman discussed his changes in sentences 3-4 ("earlier" to "most", etc.) with Dick Cunniff of Region III, who concurred.
- 6406-07 Only the national SALP group can identify trends that could be unacceptable.
- 6408-09 Even though the evidentiary record shows that C. J. first identified the Zack noncompliances, Sinclair disagrees.

WESSMAN - CROSS (BOARD)

- 6410 Wessman had no particular form of reorganization in mind when he referred to a "major reorganization" (p. B-3 of NUREG 0834).
- 6410-11 Source of comments by Wessman on pp. B-2, B-3.
- 6411-12 Wessman's reference to "increased inspection frequency" in Staff Exh. 9 and NUREG 0834 is a subjective determination by the regional office. Wessman still agrees with his conclusions in Staff Exh. 9 that Region III actions appeared to be appropriate.

WESSMAN - RECROSS (MIM)

- 6414 Reference on p. 3 of Staff Exh. 10 to events "in the past" means events prior to SALP evaluation period.
- 6414-17 Scheduling matters; areas of inquiry on audit reports.

CPCo - Midland

12/16/81 HEARING ABSTRACT

(Cook
(Marguglio
(Bird

6420-29 Staff Exh. 7: NUREG 0834 (admitted).

6429-38 Sinclair discusses Zack matter and Dean Dardy's role.

[Ruling on objections to reopening the record is deferred].

COOK - DIRECT - QA (MIM)

6439-40 Professional qualifications.

6440-44 CPCo Exh. 19: Letter Brunner to Bechhoefer, received into evidence.

6440-44 New QA organization:

Cook - Head of Project Office

Marguglio - Administers QA program; is a member of Project Office

Bird - Reports directly to Marguglio

Turnbull - Asst. Mgr. to Bird, but has specific staff responsibilities as well.

Presently there is not site QA supervisor, the position vacated by Turnbull.

6444 CPCo Exh. 20: new QA organization chart.

- 6445-46 Changes from old to new chart (CPCo Exhs. 13, 20)
- (a) Shift from a quality engineering inspection line of organization to a technical line of organization with inspection and engineering personnel organized within a specific technical area.
 - (b) Before there were 2 tiers between section heads and Cook (Turnbull and Bird); there are still 2 tiers (Bird and Marguglio) but difference is that more senior level people involved.

6446-47 Description of informal working relationships between Bird, Marguglio and Cook.

6448 Separation of duties between Bird and Marguglio.

6449 Marguglio's on-site schedule; goal of new organization is to have senior personnel overseeing both design activity at Ann Arbor and construction activity at site.

6450-51 Marguglio's responsibilities

6451 Other additions to Project Office personnel

6452 Turnbull's responsibilities

6453 No change in Cook's responsibilities

6453 Anticipated changes in QA organization as construction work is completed.

COOK - DIRECT - SALP (MIM)

6454 Cook attended 11/24/80 meeting.

6455-57 At 11/24/80 meeting, Keppler said Region III rated Midland as "average." Later, Cook was puzzled by statement in Staff Exh. 8 that Midland performance was "adequate." He then called Keppler, who said "average" and "adequate" were equivalent terms.

6457-58 At the time the National SALP report was being prepared, Davis of Region III phoned Cook to say that the national SALP people had disregarded Region III's recommendation and termed Midland "below average."

6459 COOK - CROSS - SALP (STAMIRIS)

6460-62 The Keppler phone discussion about equivalency of "average" and "adequate" took place about 1/81, after Cook read Keppler's written report. National rankings probably had not been made as of 11/80; Keppler's appraisal of Midland at that time had to do only with regional comparisons.

6463-65 Difference of opinion between region III and SALP group re ratings.

6466, Difficulty of national comparisons

6467 NUREG 0834 included all the Zack noncompliances.

6468 Keppler's "average/adequate" rating of Midland at the 11/24/80 meeting included the Zack non-compliances; it was so stated at that meeting.

6469 Cook does not think Midland plant is below the national average.

6469-73 COOK - CROSS - SALP (BOARD)

As a result of a 12/18/80 letter from Keppler to Cook (Att. to Staff Exh. 8) and I&E reports 8035 and 8036 (p. 3 "additional efforts warranted"), CPCo scheduled 3 meetings with Region III to make sure they understood the situation. There were 2 meetings in December 1980 to discuss the Staff's concerns, and a presentation in 3/81 of CPCo's planned actions.

National SALP report has not given Cook any information he did not have as of 11/80.

COOK - CROSS - AZ (BOARD)

6474 Bird has not been downgraded in the new organization.

6474 Bird & Marguglio are a team; Bird does not have to go through Marguglio to get to Cook.

6475 Organization chart shows Bird as having an additional level to get to Cook, but those beneath him do not.

6475-77 5 criteria for QA organization are outlined in Cook's 7/10/81 prepared testimony.

- (1) Management informed of issues - no change;
- (2) Communication with NRC - Enhancement because 2 senior people in a position to call NRC;
- (3) Prompt investigation of problems - slight enhancement due to Marguglio's day-to-day involvement and senior level experiences;
- (4) Expedited management decision-making enhancement due to more senior level personnel at each location (AA, Jackson, site);
- (5) Management willing to meet regulatory requirements - no change.

- 6477-78 Geographical separation of Bird & Marguglio -- such that a Jackson person reports to a site person who reports to a Jackson person -- is a nuisance but not a problem.
- 6479 Distance Jackson to site about 2 hours by car.
- 6479-80 More direct CPCo involvement and control over various sub-tier activities in contract organizations now because senior QA person is at site more often.
- 6480 "Over-inspection" function will not change.
Bird's relationship with Bechtel no different.
Cook's relationship to MPQAD is not any less direct now.
- 6481-82 Board concerned that on paper it looks as if there's an additional formal step between Cook and MPQAD.
- 6483 Bird, Marguglio on same level in terms of working relationship; Marguglio ahead of Bird in terms of rank.
- 6484-85 Line responsibilities divided between Bird and Marguglio.
- 6485-86 Change in Cook's job titles.
- 6486-87 Close out of nonconformance report; as before, it would go directly from Bird to Cook.
- 6487 As before, Bird has sufficient authority and organizational freedom to perform his crucial functions effectively and without reservation.

- 6488-89 QA is not a nuisance; it is the only way for a nuclear plant to operate sufficiently and economically. A QA staff must enforce and instill such an attitude in every worker.
- 6490 Quality is cost effective.
- 6491-92 Update on efforts to instill QA at Midland (program developed by Crosby Assocs.)
- 6492 John Rutgers became Bechtel project manager for Midland in 8/79 or 9/79, at CPCo's request.

BIRD, MARGUGLIO, COOK - CROSS (BOARD)

- 6495-96 Panel not aware of any serious incidents of harassment or intimidation of QC inspectors and supervisors at Midland; there is ample opportunity for such incidents to be reported. Reference made to Zimmer investigations.
- 6496-97 Status of quality plan for remedial actions on auxiliary building (mentioned in Johnson's testimony): Bird says plan is in final draft form and will be presented to NRR in 1/81. Bird, Keeley and Bechtel are reviewing it.
- 6497 Bird: Actions are not simply "accepted" in order to get the plant built; they are accepted if and when they meet the required standards.
- 6498 Marguglio was director of QA for Project Engineering and Construction 1/1/77-3/1/80.
- 6498-6503 Discussion of Administration Building grade beam failure and DGB settlement; Bird's and Marguglio's roles in investigation of these events; soils audit reports which had bearing on the investigations. All soil nonconformances were individually evaluated by "retesting" to determine adequacy.
- 6504-07 Audit Report F77-32: discussion of testing problems and results.
- 6508 Marguglio never noticed a trend as a result of the Audit Reports and NCR's (summarized in Gallagher testimony, Att. 7).
- 6509-11 To Bird's knowledge, Mr. Horn, who had a much more restricted area of concern, did not ever notice a trend.

MIM Interjection: Referring to p. 2333 of CPCo's response to 50.54(f) questions, he notes there is no dispute on the record re the inability of the trending program at that time to pick up this condition.

- 6511-12 Marguglio's and Bird's role in enforcement and instilling of QA standards.
- 6513-15 Written standards exist re: acceptability of corrective actions. Decker confused by ¶V of F77-32 where it states, "Determine if there are passing tests in the same area to clear these failing tests." Marguglio defers the questions to a more knowledgeable source.
- 6515-17 Referring to ¶VI of F 77-32, Decker says it appears that CPCo is telling Bechtel to find some way to approve soils samples as is. Marguglio says that is not the intent; it is a matter of phraseology.
- 6517-18 Decker also concerned that the statement "obtain rationale from Bechtel as to acceptability of tests" in F77-32 is not an appropriate attitude for corrective action. Marguglio says the intent was to get a "documented justification" as a pre-condition of soils acceptance. Phraseology again a problem.
- 6519 Marguglio: Consumers now has programs to improve communication and sensitivity to language.
- 6520-24 Marguglio explains new organization chart.
- 6524-25 Marguglio and Bird describe themselves as a Huntley and Brinkley team, sharing day-to-day management of QA activities.
- 6526 New organization chart not finalized.
- 6526-28 How close-out of NC reports works in the new organization.
- 6530 Board Exh. 3: Audit Report F77-32 (received).
- 6530-32 With reference to Hood's statement on p. 3 of Staff Exh. 10 that Midland technical competence has depended on Bechtel's selection of only some of its consultants' advice, Cook says that currently decisions about advice are made jointly by the consultants, Bechtel and CPCo.

- 6532-34 E.g., Cook involved with Kennedy's seismic margin analysis; involved in MAC report and response to MAC Report.
- 6535 Current organization's approach is to actively screen input from consultants. (Cf. p. 4 Staff Exh. 4 "A more assertive role . . .").
- 6535 Cook generally satisfied with Bechtel QC inspection program.
- 6536-40 Cook familiar with the single example of unqualified QC inspectors referred to in the SALP report. To avoid problems in future, say Bird and Marguglio they have
- (a) changed the Bechtel method of certifying inspectors from a discipline basis to an inspection plan basis;
 - (b) audited all disciplines of the Bechtel QC, and the results of the audit were favorable;
 - (c) reviewed resumes of potential Bechtel QC inspectors.
- 6541-42 With reference to the open item regarding electrical inspections in a certain I&E report (not identified), there have been and will be audits of the problem.
- COOK - CROSS (STAMIRIS)
- 6543-45 Stamiris skeptical that new organizations will improve QA because QA problems persisted throughout other reorganizations in the past.
- 6545-47 In a presentation to Keppler on 3/13/81, Cook explained the then current QA program. There have been a number of changes in the QA program over the years, as discussed in a document given to Keppler at the presentation.
- 6551-53 Cook believes the Midland QA program is currently effective. He continually searches for ways to improve it, through organizational change, program performance, team work, management function, etc.
- 6554 Examples of analyzing program performance as a way of improving QA.
- 6554 Cook satisfied with QA performances in 1980 and 1981.

- 6555 Marguglio says that previously his responsibilities were limited to overseeing the program; now they include assuring proper implementation of the program.
- 6556-57 Cook believes CPCo has maintained sufficient QA staff to meet the demands. Cannot say whether same is true earlier during the soil settlement problems because he was not involved then.
- 6557-59 MPQAD staff has increased over time, not solely because of the consolidation of CPCo and Bechtel QA. About 15-20% increase over what the 2 groups had before.
- 6559-60 Board sustains objection to question of whether Cook has dual responsibilities of (a) QA and (b) cost scheduling.
- 6560-63 Cook says a man should be judged by all aspects of his actions and his statements.
- 6563-66 Cook shares the "Crosby" philosophy of "do it right the first time."
- Cook disagrees with Stamiris' characterization of CPCo's approach heretofore as a "proceed at your own risk" philosophy. All outstanding issues are resolved by combined action of all parties.
- 6567-72 Stamiris claims that Cook's testimony is at variance with CPCo Findings of Fact, which she says advocates the "observational" approach.
- 6573-75 Question of how a second soils test which passes can clear one which does not: Marguglio says that in some cases the first test was found to be faulty in its method.
- 6575-76 Q-area soils subject to more rigid standards than non-Q-area soils.
- 6577 Cook only generally aware of the "observational" approach.
- 6578 Bird does not recall Horn expressing frustration about staffing and QA/QC.
- 6578-79 Discussion of audits re: settlement of DG Building and Administration Building: purpose of the audits when they took place.

- 6580 Follow-up to earlier question on how the second soils test results were used in F77-32.
- 6581-85 MIM: Objects that this questioning adds nothing to the record because Consumers has admitted by stipulation that soils placement QA was deficient.
- Stamiris: the problem however, is that Bird and Marguglio have been trying to justify and defend the procedures that were used in F77-32; thus management attitude on QA has not really changed since 1977.
- 6585-88 Stamiris and Decker wonder why Keeley, as Project Manager, did not inform QA director Marguglio of the grade beam failure until 7/78 or 8/78.
- 6590-95 Marguglio does not recall Stamiris Exh. 2, six audit findings from 7/80 re: soils.
- Board sustains objection to the question "Are you concerned that these soils problems are still going on in 1980?" The same question was asked of Marguglio at Tr. p. 1473.
- 6596-6601 Marguglio aware of I&E 81-12 from 5/81, which cites a noncompliance re use of audit findings. His response is to simply continue to have fullscope audits.
- 6601 All deficiencies resulting from the audit findings problems have been adequately corrected.
- 6602-03 The noncompliance cited in 81-12 is fairly inconsequential. In fact, says Cook, the NRC had complimentary remarks for CPCo at that particular interview.
- 6404-06 Back to Stamiris' claim that Cook's testimony contradicts CPCo Findings of Fact: Of the Category I structures affected by settlement problems, the DG Building underwent remedial action that was a "proof test" approach. The BWST remedial work was not a "proof test" approach.
- 6607-09 Findings of Fact pp. 86-89 say a "proof test" approach was used for the BWST. Cook agrees that such was the case with respect to soil settlement at the BWST.
- 6609-10 Cook says the proof test approach was used on structures to determine settlement; the term is not applicable to the remedial actions which may have been undertaken subsequently.

- 6611-12 BWST remedial work was not soils related; it was a replacement of foundation ring with an additional ring. In Cook's opinion, the problem was one of design, not soils.
- 6613 Using the BWST as an example, Cook defines "proof test" or "observational test" as an application of the total load the BWST will ever experience in order to determine whether there is any settlement.
- 6614-15 In the specific cases where the observational approach has been used, it has been the practice to make the settlement evaluation only after the structure is completed.
- 6616-23 Stamiris attempts to equate a "proceed at your own risk" approach to an "observational or proof test" approach.
- 6624 Cook says it is desirable to learn as rapidly as possible the extent of a problem.
- 6627-28 To Cook, the Crosby philosophy is (a) do it right the first time and (b) prevent problems.
- 6629 Relation of Crosby to cost effectiveness: Any dollar spent in prevention is a cost-effective dollar.

COOK - CROSS (PATON)

- 6631 Proof test approach was used at the DG Building.
- The "do it right the first time" approach is not inconsistent with the proof test approach.
- COOK - CROSS (STAMIRIS)
- 6631-34 Cook believes those that were working on Midland at the time of the F77-32 report did not feel that those audit reports indicated a problem. That is why they proceeded with construction of the DG Building.

- 6635-40 Board sustains objections to questions re:
- (a) NRC's authority to accept or reject Cook's dual cost scheduling/QA duties;
 - (b) 11/30/81 news article quoting Cook on Midland delays;
 - (c) Reduction of 10 mile radius for alerting population to 5 miles.

COOK - CROSS (SINCLAIR)

- 6643-50 New organizational chart was necessary because the project has grown in size and, correspondingly, the need for more supervisory personnel at the site. It is a response to personnel needs, not to specific problems in QA.
- 6650-55 CPCo policy toward workers: how CPCo protects workers against reprisals. Cook pledges positive action if Sinclair and Stamiris will simply bring the cases to his attention.
- 6655-57 QA program developed by Crosby involves every level of work force and interaction between levels.
- 6657-59 Sinclair quizzes Marguglio about Keeley's having not discussed the grade beam failure with him.
- 6660-61 Board sustains objections to question of why the surcharge proof test was not used with the administration building, before it was actually torn down.

COOK - CROSS (MARSHALL)

- 6662-64 No change in contractual agreement between CPCo and Bechtel. Bechtel still furnishes the bodies.

COOK - CROSS (PATON)

- 6666 Delegation of Bird and Marguglio day-to-day activities will be explained in a memo.
- 6666-67 Marguglio has replaced Bird as head of MPQAD, Bird's QA responsibilities have decreased.
- 6667-68 Turnbull was head of the four boxes on left side of chart; now he is in charge of the administration box only, and takes on special staff work for Bird and Marguglio.
- 66t8-69 Marguglio was shifted to site instead of Bird because of Bird's family situation.

COOK - CROSS (BOARD)

- 6670-71 Turnbull, Horsch responsibilities.
- 6672 Chart is accurate in terms of rank, but not in terms of day-to-day delegation of activities.
- 6673 Bird/Marguglio division of labor.
- 6674-76 A forthcoming memo will explain Bird's and Marguglio's specific responsibilities.

CPCo - Midland

12/17/81 Hearing Abstract

(Hood
(Gallagher

- 6680-87 Schedule matters.
- 6687-90 Commitment: Applicant will send Board and parties the routine MPQAD audit reports, and any others which, in Applicant's discretion, are relevant to QA/QC issues.

GALLAGHER - DIRECT (PATON)

- 6691 EJG is Sr. Civil Engineer in Office of I&E in NRC's Reactor Engineering Branch.
- 6692 EJG discussed Consumers Exs. 19 and 20 with Keppler, Gilray and Ron Cook.
- 6693 MIM objects to inquiry about the "workability" of the new QA organization.
- 6693-95 EJG prepared statement is based on his review of Exhibit 20 and 12/16/81 testimony regarding Exhibit 20.
- 6696-98 EJG reads prepared statement which says that he and Gilray conclude that proposed QA organization is unacceptable.
- (a) Unworkable because it is fragmented in the assignment of responsibilities
 - (b) No full time on-site QA manager
 - (c) NRC Staff not informed of QA change
 - (d) Board should require a full time on-site manager just as Marble Hill and South Texas are required.
 - (e) CPCo philosophy of "transient" or "remote control" management inconsistent with NRC policy.

- 6699 MIM objects to (1) attempted reading into record of Palladino's 11/19/81 testimony, on grounds of hearsay, and (2) admissibility of EJJ's testimony that he and Gilray agreed that the proposed QA organization is unacceptable or unworkable.
- 6700-01 Paton argues that Gilray's remarks, though hearsay, are trustworthy and therefore admissible.
- 6702 MIM rebuttal.
- 6703-04 EJJ says he only speaks for himself, not Gilray. Gilray never saw Exhibit 20, but EJJ described it to him.
- 6705 Subject is not closed; EJJ and Gilray both open to further discussion of the proposed organization.
- 6706 No one at NRC Staff saw Exhibit 20 before 12/16/81. It is dated 11/23/81.
- 6706-07 EJJ's understanding of Bird/Marguglio roles at the site.
- 6707-09 Impossible to understand Exhibit 20 without the Draft "MPQAD Reporting Relationships" (Staff Ex. 12).
- 6710-14 Staff Ex. 12 received. Consumers did not attach it to its Exhibit 20, as intended, because it is subject to minor revision.
- 6714 EJJ's opinion re Exhibit 20 based also on his review of Staff Exhibit 12.
- 6714-19 EJJ disagrees with Marguglio testimony that Keeley acted in a professional manner when Keeley did not report the grade beam failure to Marguglio. He is distressed that a bad management attitude has not improved.
- 6720 Corrections to EJJ prepared statement: p.2 line 1 change "it's the Midland project" to "more important, it leaves the Midland project;" last page line 4 change "transient" to "transient."
- 6721 Ruling on MIM motion to strike portion of EJJ testimony expressing Gilray's opinion (declined) and on motion to strike the attempted reading of Palladino's statement of 11/19/81 (granted).

- 6721-23 EGJ: the new information re QA organization (and Marguglio's attitude?) affects his recommendation to the Board regarding Selby's participation. That is, QA should be a formal management tool to achieve both correct design and proper construction.

GALLAGHER - CROSS (STAMIRIS)

- 6723-27 EJG explains how his recommendation that Selby report periodically to management and NRC would achieve an effective QA program in all aspects of the project (remedial work, construction, operation) by creating a line of communication between CPCo and NRC.
- 6729 Referring to the "lack of communication" between Keeley and Marguglio, EJG reiterates the importance of communication between project manager and QA manager. In its 50.54f responses, CPCo claimed it had made improvements.
- 6730-21 CPCo should have discussed the QA reorganization with the NRC Staff.

GALLAGHER - CROSS (BOARD)

- 6732-33 CPCo had significantly more communication with NRC (Region III) regarding the last major QA reorganization (CPCo Ex. 13), probably because that reorganization was a response to a specific problem (soils settlement).
- 6733-35 There should be good communication regardless of enforcement actions (e.g., 12/6/79) or threat of enforcement action.
- 6735-36 Board withdraws its question, "Should CPCo be ordered to inform Staff of proposed organizational changes?" MIM notes that there actually was communication --a TC between CPCo and Keppler.
- 6736-37 EJG says the Keppler TC was limited and that no conclusion about acceptability of new QA organization was reached. Same is true for Ron Cook's encounter with the new plan.
- 6738 Gilray saw CPCo Ex. 19.

GALLAGHER - CROSS (SINCLAIR)

- 6739-42 NRC policy is that non-safety related structures must be designed so they will not adversely affect safety related structures. EJG does not feel qualified to speak on this issue, however.
- 6742-43 New QA organization is no improvement over old one; it is "moving in the wrong direction" because it further fragments responsibilities and assignments and there is more transience of management.

GALLAGHER - CROSS (MARSHALL)

- 6743-46 Marshall observes that "Napoleon left Moscow because he couldn't get the bread back and forth," apparently in reference to his concern that QA problems at Midland are "habitually repetitious."

GALLAGHER - CROSS (MILLER)

- 6747 EJG qualifies the remark in his prepared statement at line 9, p.2, to say that although Consumers informally told NRC about the proposed reorganization, there was no formal communication.
- 6748 EJG: No reason to believe a formal submittal regarding proposed reorganization is not going to be made.
- 6749-55 MIM challenges EJG statement about Consumers' lack of communication with NRC, suggesting that Marguglio in fact informed the responsible individual at NRC, Mr. Haas, who is Gilray's boss. Substantive response by EJG is withheld pending determination of facts.
- 6756-58 Currently EJG is not responsible for reviewing Midland, but because of his prior Midland experience as a Region III inspector, Region III continues to seek his input on technical (soils) matters.
- 6759 EJG says Marguglio will have sufficient authority to implement QA. Also sufficient freedom from cost and schedule responsibilities.

- 6759-61 Can't say whether new QA organization is in accordance with NRC requirements.
- 6762 Term "unacceptable" as used to describe new QA organization at line 22, p. 1 of EJG prepared statement really means that, at first blush, it would appear to be unacceptable. [See 10 CFR 50, App. B, Criterion I.]
- 6762-64 NRC regs encourage flexibility in QA organization, but this in turn requires good communication between Applicant and NRC.
- 6764 Explicit NRC Regulation (Part 50, App. B, Criterion I) that QA manager have sufficient authority and freedom from costs and schedule responsibilities.
- 6765-68 "Transient" nature of senior staff at Midland: the major efforts of design, construction and operation take place at the site.
- 6767 EJG claims not to know where the major design effort for underpinning on the auxiliary building is currently taking place.
- 6768-71 No other plants are specifically required to have senior QA personnel on site five days a week, although NRC strongly recommended that senior personnel be on site 100% of the time (that is, living within close proximity) for certain plants.
- 6772-73 Does not recall Cook committing Marguglio to 3-1/2 to 4 days at site; only three days and nights.
- 6773-77 Board sustains objections to questioning re: I&E office's authority to stop the proposed QA organization (cf. EJG statement, p. 2, l. 24) saying I&E has stop work authority but in this case chose to defer the issue to the Board.
- 6778 EJG's urging of the Board to prevent implementation of the proposed QA organization (statement p. 2, line 24) is his own opinion and not necessarily anyone else's.

GALLAGHER - REDIRECT (PATON)

- 6780-82 Extent of CPCo-NRC communication on new QA: Marguglio informed Haas that Marguglio would

spend 60% of his time (3 days) at the site and that chain of command would be Cook/Marguglio/Bird.

- 6781 Haas' and Gilray's position is that a senior level QA manager should be on site full time.
- 6782-85 Paton recommended to Haas on 12/17/81 that NRC (through Haas, as the decision-making agent) should assess the proposed QA organization before taking any action. Stamiris opposes that approach as being "inaction."
- 6785-86 MIM suggests that when the Staff formulates its opinion, it should either authorize immediate action or allow the parties to respond.
- 6786 New QA organization has already begun to be implemented.
- 6786-89 Board wants to know Staff opinion on QA organization prior to remedial activities scheduled to begin in January. Discussion deferred.

GALLAGHER - CROSS (MILLER)

- 6789-92 Although EJG previously testified about how distressed he was that Keeley failed to inform Marguglio of the grade beam failure in timely fashion, there is no reference in I&E 78-20 to any failure of communication.
- 6792-94 EJG's opinion or recommendation re: Selby is same as in earlier testimony. That recommendation is reinforced by recent NRC Congressional testimony which emphasizes QA more than ever.
- 6795 Nothing indicates Jim Cook has not been doing a conscientious job.
- 6795 EJG not familiar with specific QA program at Midland that resulted from Crosby training, but is aware that CPCo executives (not Selby specifically) had participated in Crosby training.
- 6796 Improvements in communication between project manager and QA department were discussed generally, not specifically, in CPCo's answer to 50.54f Question 1 and 23.

6796 EJG not in a position to say whether CPCo is meeting the procedural requirements for good communication.

GALLAGHER - CROSS (BOARD)

- 6797-6800 Gilray and Haas do not view the Bird/Marguglio arrangement as Marguglio 60% + Bird 40% = 100%; rather, they see it as a fragmentation of personnel. It is vague in execution and implementation. Foreseeable problems: the 60% and 40% might overlap. Also, it might be easier to get one or the other's approval for a given project.
- 6801 QA manager's support staff should be in close proximity to activity; that is, on site. Proposed QA organization appears to be fragmented in terms of location and responsibilities.
- 6801-02 QA manager should be on site full time.
- 6802-03 EJG critical of CPCo policy as stated in Audit Report F7732: "Determine if there are passing tests in the same area of the failing tests."
- 6804 Inadequacy of testing procedure such as that exemplified in F7732 led to inability to predict and prevent settlement.
- 6804-05 Questionable procedures in F7732 are a reflection of management attitude to the extent that management reviewed F7732 and could have made corrections if statements were at variance with management philosophy.
- 6805 Admits that certain corrective measures have been taken. (e.g., CPCo response to Q. 23 -- testing of backfill).
- 6805-06 Statement at p. 10 of F7732 about having project engineers "justify" the material in failing tests is not on its face an indication of improper management attitude.
- 6807-08 However, I&E 78-20 delineates repeated failures which should have inspired CPCo to make sweeping changes in its approach. CPCo did not. EJG not aware of any other major QC problems subsequent to 12/6/79.

GALLAGHER - REDIRECT (PATON)

6808-09 NRC regulations require an effective QA program. The proposed QA organization could not be effective, and to that extent does not meet regulations.

GALLAGHER - CROSS (STAMIRIS)

- 6809-12 Board sustains objection to questions about (1) unique attribute of soils work that, after initial testing, the adequacy of those tests cannot be verified (reference to Q. 23) and (2) inspection of DG Bldg.
- 6812-13 EJG's opinion that QA aspects of soils work have improved since 1977 is based on his own investigations.
- 6813 EJG not aware of noncompliances re inadequate soil testing subsequent to 12/6/79. (Cf. pp. 6807-08).
- 6814 QC testing problems in F7732 have been redressed in current construction specifications.
- 6814-19 Referring to I&E 81-01, Stamiris attempts to refute EJG's testimony that no other QC testing problems such as in F7732 have occurred since F 7732. EJG says he's not prepared to discuss 1981 audit reports.
- 6820-21 NRC reviews and either approves or disapproves an Applicant's QA program. Board sustains objections to additional questioning on which branch of NRC actually enforces the regulations.
- 6822 Location of engineering offices in Ann Arbor has no direct effect on design-related problems at the site.
- 6824-27 EJG not aware until now that the new QA organization had already been implemented as of 11/20/81.

GALLAGHER - CROSS (MILLER)

- 6828 Since 1977, Consumers has had an over-inspection program re soils placement and a full-time geotechnical engineer.
- 6829 It is now the practice to conduct a "standard test" in connection with every soil test.

6830-32 10 CFR Part 50 contemplates that there are a variety of organizational structures which might satisfy the requirement of an effective QA program.

GALLAGHER - CROSS (BOARD)

6833 EJG says a full time second level senior QA manager might not be a bad idea for Midland.

6833-34 If Consumers were to decide on its own to have a full time manager and deputy manager, it would further indicate Consumers' QA commitment.

6834-35 QA organizations must vary depending on the facility, but NRC feels that every facility should have senior QA personnel on site.

GALLAGHER - CROSS (MILLER)

6835-37 One consideration in evaluating the desirability of a QA reorganization is whether or not senior staff have been replaced.

6837 EJG says he has made both Keppler and Jim Cook aware of his criticism of previous QA managers. He wants to know more about how the new plan will work.

GALLAGHER - CROSS (BOARD)

6838-39 To Bechhoeffer's suggestion that one possibility might be 2 full time QA managers, EJG says all options should be considered.

GALLAGHER - CROSS (STAMIRIS)

6839 EJG first communicated his criticism of the QA team during soils investigations.

HOOD, GALLAGHER - CROSS (BOARD)

6840 Hood and Gallagher were at the 11/24/80 SALP meeting with CPCo.

6841-42 Hood memorialized his comments at the 11/24/80 in Staff Ex. 10. It was written 3/31/81 and also includes comments based on information he had acquired in the intervening time.

- 6843-45 With reference to Staff Ex. 10 p. 2 comment about the time and effort it takes the Staff to obtain acceptable and substantive responses from CPCo, Hood says there has been steady improvement. Still not perfect.
- 6847 EJG says it took some time and effort to obtain adequate responses to 50.54f questions.
- 6848 The paragraph following the comment about time and effort in Staff Ex. 10 (p. 2) notes CPCo's steady improvement.
- 6849 Hood does not want to discourage CPCo from utilizing the NRC management appeal process; it is just that that process affects NRC's ability to conduct a timely review.
- 6850-52 With reference to his remark in Staff Ex. 10 that CPCo rarely goes beyond what the Staff requires, Hood says there has been improvement since the March, 1980 reorganization.
- 6852 Hood notes that his remarks in Staff Ex. 10 also commend CPCo's industry leadership role in TMI response matters.
- 6853 EJG agrees with Hood's comment that CPCo rarely goes beyond what the Staff requires.
- 6854 Item 2 of Staff Ex. 10 describes CPCo as average in its anticipation/reaction to NRC's needs, but Hood notes subsequent improvement in this area.
- 6855-56 Hood disappointed that CPCo did not notify NRC of proposed QA change. However, CPCo's action in this matter does not mean CPCo fails to react to NRC needs.
- 6856 EJG notes he has a different view of the matter.
- 6857-58 Item 3 of Staff Ex. 10: Technical competence undermined because Bechtel allegedly modifies or ignores advice of consultants. Hood is currently reviewing this matter and can't say yet whether there is improvement. EJG cites soil settlement example. Can't comment on whether there was improvement after 1/81, when he left.
- 6859-60 Item 6 of Staff Ex. 10: Strengths and weaknesses.

- 6860-61 Item 2 of Staff Ex. 10: CPCo as of now is "generating" the information the Staff requires in order to conduct a timely review of the proposed remedial actions.
- 6862 Hood: a more efficient and timely Staff review leads to greater safety.
- 6863 Because Applicant is voluntarily holding up construction activities which the Staff is concerned about, the public health is not endangered.
- 6863-64 The fact that the modification order is not in effect does not hinder the Staff in executing its duties re public health and safety.
- HOOD - CROSS (STAMIRIS)
- 6864-65 Staff Ex. 10 represents Hood's opinion as of 3/31/81.
- 6865-66 With reference to item 2b of Staff Ex. 10, Hood says the "contributing factor to recent improvements" is his subjective evaluation; he can't quantify it.
- 6866-68 Board sustains objection to hypothetical "What would happen if CPCo was not providing remedial plan information which the NRC needs?"
- 6868-69 CPCo disagrees with the resolution of the seismic matter, but must accept it nonetheless because the Staff agrees with it.
- 6869 NRC imposes minimum standards; it expects Applicant to initiate improvements that go beyond the minimum.
- 6870-72 Hood vaguely recalls TMI responsiveness being discussed at a "caseload forecast panel" meeting in June, 1980 re Applicant's completion schedule. Recollection is too vague for him to comment.
- 6873-74 With reference to use of consultants' advice (Staff Ex. 10, item 3), Hood cites the example that Kennedy's seismic model for the BWST differed from Bechtel's model. Hood does not recall any dispute re the selection of Kennedy's model.
- 6874 Stamiris wants to know what good it does to have a good working knowledge of licensing matters (Staff Ex. 10, item 4) if procedures are not followed properly (item 6), for example, in soil settlement issues. Hood doesn't understand the question - he says there is no relationship between soils issues and CPCo's knowledge or lack of knowledge.

HOOD - CROSS (MILLER)

- 6876 Generally, SALP reviews for other plants would cover the same topics found in Hood's Staff Ex. 10, although SALP headquarters' guidelines provided some flexibility.
- 6876-77 Hood did not discuss his report (Staff Ex. 10) with Wessman. Such reports by project managers were transmitted to Wessman through the respective I&E offices.
- 6877-78 Does not recall consulting any records to prepare his report, merely his recollection of events that took place 1 1/2 years earlier (7/1/79-6/30/80).
- 6878-79 However, comments in Staff Ex. 10 were not limited to the specific evaluation period, e.g. his comment that more than average time & effort necessary to obtain responses from CPCO.
- 6879 Wessman couldn't have known that that comment was not limited to the evaluation period. On the other hand, that comment included the evaluation period.
- 6880-81 On certain issues (not identified), Hood did identify whether he referred to the evaluation period or outside the evaluation period.
- 6881 Hood credits Applicant's management attitude for voluntarily holding soil remedial work.
- 6881 Can't think of any reason CPCO's voluntary commitment was not mentioned in Staff Ex. 10.
- 6881-82 Personnel turnover has had its effect on the ability of the Staff to conduct a timely review, which results in inefficiency of the review and greater health & safety danger.
- 6882 Hood - project manager since 8/77; Kane - key geotechnical reviewer since NRC so ordered; Rinaldi - principle structural reviewer since NRC so ordered.
- 6883 In his earlier testimony on personnel turnover, Hood meant that, generally, such a turnover contributes to loss of continuity of a review.
- 6884 In soil settlement area, Kane has been continuously employed as geotechnical reviewer since 12/6/79. Others more or less continuous, also.

- 6884 Management appeal process: Hood agrees with Kane testimony (p. 4153) that the utility is obligated to express differing views to management in order to come to a resolution.
- 6885 CPCo's use of management appeal process re soil replacement was included in Staff Ex. 10 comments to explain one of the factors which affected the timeliness and effectiveness of the licensing review.
- 6886 CPCo's use of management appeal process in fact requires additional time and effort to be expended by Staff in conducting its review.
- 6887-89 Hood's time reference on p. 3 of Staff Ex. 10 under Technical Competence ("in the past") has to do with Dames & Moore advice from 1975-77, or perhaps a "broader" period. That comment does not have reference to the way Bechtol & CPCo utilized recommendations of Drs. Beck and Hendron or any other consultants.
- 6889 Hood's reference in Par. 2 of Staff Ex. 10 to "report period" means the SALP period 7/1/79-6/30/80.

HOOD - CROSS (STAMIRIS)

- 6890 Hood not aware of instances where CPCo modified or ignored initial advice on soil settlement remedial work, e.g.:
- 6891-92 (1) Breaking up of mud mats - CPCo followed consultant's advice.
- 6893-94 Stamiris wants to know whether the statement in Staff Ex. 10 that consultants' "recommendations were taken as recommendations only in that the task force made the final decision on those recommendations and thus to modify or ignore their advice" applies to soil remedial work. Bechhoefer says Hood already said it didn't.
- 6894-95 Consequence of CPCo not upholding its voluntary commitment not to proceed with soils remedial work: At minimum, Hood would inform the Board. (MIM says there's already a commitment by CPCo to inform the Board in such an event). Hood can't say what his recommendation would be.

6896 Paton objects to question of whether the NRC would enforce a stop work order.

6897-98 Discussion of relevance of possible action by NRC: Decker says Board's major decision is whether to issue a stop work order right now. MIM responds that, under the 12/6/79 order, such an action by the Board must await an initial decision, and Applicant has the opportunity to respond to any such decision until the evidentiary record is closed.

6898-99 CPCo volunteered not to proceed with its work at least in part because it believes that if it proceeded, the NRC would find some other way to stop the work.

HOOD - REDIRECT (PATON)

6900-01 Staff Ex. B: 12/10/81 Telephone conference call re: additional temporary dewatering wells, signed by Hood. (Received).

6902 Since the 12/10/81 conference call, NRC has approved installation of the 5 wells. Their installation is substantially similar except it involves jetting, the side effects of which will be controlled. Involves a non-Q area anyway.

6903 Installation of dewatering wells in underway.

HOOD - CROSS (BOARD)

6903 Hood received drawings of well locations and installation procedures on December 9 and 10.

HOOD - CROSS (STAMIRIS)

6904 Testimony re: the 5 dewatering wells is for purposes of informing the Board. Hood never intended to ask the Board for concurrence in the decision to allow installation.

6905 Hood: If the 12/6/79 order were now in effect, the dewatering wells probably would not be permitted. He notes they are temporary and of a construction-type nature.

EJG: They would not be permitted.

HOOD - CROSS (BOARD)

6906

Basis of answer "no": The 12/6/79 order has the effect of prohibiting certain activities until such time as a request for an amendment to the construction permit is made and approved by the NRC staff.

[END]

Midland Hearing
Abstract

February 2, 1982

Preliminary Matters

- 6909-14 (1) Attorney Conduct Decision/Marguglio Testimony:
- MIM: 2/1/82 letter Miller to ASLB regarding Marguglio testimony subject to misinterpretation was prompted by ASLB attorney conduct decision of 12/24/81. IL&B will bring all relevant matters arising from attorney discussions to the Board's attention.
- Paton: Notes that Mapleton Intervenors not included in the exceptions that were taken to the remand proceedings by "Intervenors Other Than DOW." Mapleton motion for extension of time to file exceptions was denied by Appeal Board.
- (2) 100% Overinspection of QC Electrical Inspectors:
- MIM: Since the January 1982 request for 100% overinspection not complete, Gardner's testimony must be deferred.
- Paton: Wants to know schedule for overinspection completion.
- (3) QA On Underpinning Issues:
- MIM: What issues does Board want testimony on? (see pages 7122 et. seq.)
- 6914-16 (4) Scheduling matters.
- 6918 BIRD, MARGUGLIO - DIRECT (MIM)
- (BWM testimony unless otherwise indicated)
- 6919 Since 12/16 testimony, further changes in QA organization.

6919-22 CPCo Ex. 21: 1/26/82 letter Cook to Keppler & Denton, re QA reorganization.

Enclosures:

- (1) QA Topical Report (Chart)
- (2) QA Topical Report (Chart)
- (3) QA Department Procedure
- (4) QA Chart dated 1/22/82

6922 Enclosure 2 of CPCo 21 shows 3 differences from earlier charts.

6922 (a) in MPQA Box, position of Director (BWM) added on top of Manager (WRB). Before, BWM's position located in the MPO box only.

6923 (b) the position of Asst. Mgr. - Admin. & Special Projects is now given its own box.

6923 (c) Site QA Superintendent box, previously deleted, is reinstated.

6923-24 No change in allocation of BWM's and WRB's time (60% and 40%).

6925 It is a matter of opinion whether new QA organization is an improvement.

Advantage: Site QA Manager is now at site more often.

Disadvantage: Site QA Sup. lengthens line of communication.

However, new QA organization is totally adequate and not a degradation of previous one.

6925 Cook's involvement same as before.

6925-26 Why the reorganization?

At 1/12/82 meeting, NRC said it wanted either more site presence by BWM or reinstatement of Site QA Sup. position.

CPCo didn't feel either step was necessary, but in the interest of responsiveness agreed to reinstate the Site QA Sup. position.

6926-27 Curland is new Site QA Sup. as of 2/1/82, according to new chart (Enclosure 4 of CPCo 21). Marguglio describes his professional qualifications.

6928 Curland's prior connection with Midland was as consultant to CPCo.

6928-29 BOARD CLARIFICATION

Page 2 of 1/26/82 letter (CPCo 21): BWM in residence at Midland means BWM resides there and that most of his office time is spent at site, but that his job description requires his attendance at meetings in various non-Midland locations.

MARGUGLIO - CROSS (STAMIRIS)

6929 Referring to the statement in Enclosure 3 of CPCo 21 that "MPQAD reports directly to MPO," Marguglio says he reports to Cook re: status and degree of QA compliance of the QA program, hardware and activities.

6930-31 E.g., he reports orally and in writing, and identifies problems, improvements and preventative measures.

6931 Cook's involvement: BWM informs Cook and at times requests a decision.

6931-35 BWM seeks input from or defers decisions to Cook on QA matters that are beyond his authority (e.g., if it involves expenditures, or is a sensitive issue warranting Cook's involvement).

6935 Cook not considered MPQA personnel.

6936 Board sustains an objection by MIM to question re Cook's responsibilities--issues already dealt with.

6936-37 Bird & Marguglio received copies of Audit Reports dated 12/81 and 7/81, but were not necessarily involved in their preparation.

BOARD CLARIFICATION (DECKER)

6937 When BWM receives an Audit Report, he identifies and follows up on all open items.

6938-40 CPCo Ex. 22: 12/14/81 Audit Report (11/2-6/81)
re: Bechtel QC inspector training
program.

Attachments:

- (1) Audit Observations
- (2) Audit Checklists

CPCo Ex. 23: 7/24/81 Audit Report (6/2-7/3/81)
re: Bechtel QC inspector training.

Attachments:

- (1) Audit Finding Reports
- (2) 10/29/81 Letter Turnbull to
Bechtel re: Unresolved Items
- (3) 10/15/81 Letter Turnbull to
Bechtel re: Unresolved Item 03
- (4) 10/9/81 Letter Bechtel to
Turnbull re: URI's.

6941 BWM more familiar with CPCo 22 because at the time
of the earlier audit his Midland duties were
limited.

6942-43 Upon receipt of an audit report, Bird evaluates
appropriateness of action taken to prevent recur-
rence of problems.

MARGUGLIO - CROSS (STAMIRIS)

6945 Duties shown on Enclosure 4 of CPCo 21 under
Site QA Sup. used to be Turnbull's. Turnbull's
present duties are shown in Enclosure 3, Paragraph
5.14, "Asst. Mgr. - Special Projects."

6945-46 By adding Curland as Site QA Superintendent, CPCo
did not "acquiesce" to the NRC. NRC demands at
the 1/21/82 meeting were reasonable and the addition
of Curland did not harm the QA program.

6946-47 Addition of Curland is an improvement relative to
summer '81 testimony when Turnbull was Superintendent.
Relative to December '81 testimony, BWM is unable
to say. However, present QA organization is very
adequate.

- 6947-48 At 1/12/82 meeting, NRC said the addition of a QA Superintendent would be an improvement because there was a need for more senior QA management at site.
- 6948 Addition of Curland indeed gives more senior QA personnel at site, but BWM unwilling to say this constitutes an "improvement" over 12/81 testimony.
- 6949-52 BWM did not have the same assurance in 7/81 as he does now that QA would be successful, for two reasons:
- (1) Experience has shown that the Site QA Sup. position as constituted in 7/81 was too big a job. Administrative duties of the job have been assigned to separate position.
 - (2) Curland has more expertise than Turnbull. In preparation for the 1/12/82 meeting, CPCo anticipated NRC's concern; made preliminary arrangements to recruit someone like Curland in the event it needed to reinstate the Site QA Sup. position. On its own, CPCo would have stuck with its then-current QA plan (11/81).
- 6953 BWM not concerned about the 12/81 Audit Report (CPCo 22) because it had favorable results. However, he personally wanted to follow up to assure MPQAD's overview of Bechtel QC in the future. Results of 8 such overviews since then reveal that Bechtel's certification process is consistent with regs.
- 6954-55 12/81 Audit Report not a follow-up to the 7/81 Audit Report, although both deal with QC qualifications.
- 7/81 Audit asked whether Bechtel QC on the job training should be documented (it is now) and whether Level II QC engineers should sign inspection reports upon review (they do now).
- 12/81 Audit had to do with overviewing the certification process.
- 6955 The 12/81 Audit was not less thorough than the 7/81.
- 6956 BWM's role in 12/81 Audit broader than in the 7/81 Audit, but he's satisfied with both.

- 6956-57 Scope of BWM involvement in 11/81 report: he met with NRC inspector in 10/81 and decided to conduct an audit, the results of which were published in the audit report.
- 6957-59 Bird: NRC's judgment at Item J of IE 81-20 that the results of the 6/81 audit (performed in response to IE 81-12) were inconclusive was based on NRC's concern that it should look more closely at the Bechtel QC certification process.
- 6959-60 CPCo is now certain that Bechtel's QC certification process is in compliance, and Gardner concurs.
- 6960-61 Level I engineers have more limited inspection responsibilities than Level II engineers. (See CPCo 23, p. 2).
- 6961 MIM objects to this detailed exam of Audit Reports, when the basis for their introduction was to show how one particular item on a 10/81 Audit Report was closed out. (See discussion of admissibility of Item J of IE 81-20 at pp. 5403-14).
- 6963-64 Stamiris contends that a review of the audit reports is relevant background for examination of the Item J certification process matter.
- 6965-67 Even though Board earlier admitted Item J for limited purposes and decided that it would simply have a Staff witness for that examination, the Board now requests the Applicant to produce witnesses at a later time (time of final close out) on the matter.
- 6967-70 Board attempts to determine appropriate witness for examination how "equivalent experience" was closed out. (See URI #3, p.3 of CPCo Ex. 23): Bird and perhaps others.
- 6971 Board allows CPCo to determine whether any witnesses besides Bird should be produced for this matter. Bird says he feels unqualified, actually.
- 6974 BWM not specifically familiar with Turnbull's 10/15/81 letter attached to CPCo 23.
- 6974-78 MIM objects to Stamiris' continued examination on details of the Audit Reports (e.g., communications between Turnbull and others, and Turnbull's appraisals of URI's), and suggests she simply ask

whether Turnbull's performance in connection with the Audit Reports had anything to do with his change in responsibilities. Board agrees.

- 6979 BWM's evaluation of Turnbull's performance on the 7/81 Audit report:
- (a) Agrees with Stamiris that Turnbull aggressively pursued the "appropriate" Bechtel responses to problems. His actions were generally appropriate.
- 6980 (b) No correspondence between Turnbull's performance and new assignment.
- 6980-81 Although Turnbull's performance as Site QA Sup. was good, his reassignment is a result of:
- (a) need for more site presence by senior personnel, namely BWM;
 - (b) need to reduce lines of communication and put BWM in direct contact with section heads;
 - (c) Superintendent's job being too large.
- 6982 BWM reiterates that all the duties of the Superintendent's job were split; none were abolished.
- Turnbull's new administrative assignment is significant in and of itself.
- 6983-84 BWM disagrees with Stamiris' contention that Bechtel "dragged its feet" regarding improvements in QC certification (7/81 Audit Report). Rather, it was an honest difference of opinion between Bechtel and CPCo, involving nebulous and as yet unresolved generic industrial matters. (Referring specifically to URI #3 in 10/9/81 letter to Turnbull, CPCo 23).
- 6985 Problem is that there are no industry-wide guidelines for these types of inspections. Requirements regarding level of experience/education in state of flux; e.g., the industry's 1980 revision of the standards emphasized oral, written and physical demonstration tests.
- 6986 In present case, Turnbull--actually Keating, who did the audit--merely raised a question of how much training there should be depending on experience.

- 6987 A second difference of opinion had to do with whether deletion of a commitment to evaluate the effectiveness of the job site training program on an ongoing basis was appropriate, not whether such an ongoing evaluation should exist at all. (See 10/15/81 letter from Turnbull, paragraph 2 reference to Revision 3, which made the deletion)
- 6988 Bechtel was not saying they weren't concerned with the effectiveness of the training; they simply viewed such a commitment as an "unwritten warranty."

NRC had only very general requirements regarding training of personnel.
- 6989-90 Regarding the second difference of opinion about evaluating the effectiveness of training, BWM says neither was this a case of Bechtel "dragging its feet."
- 6991 While BWM agrees with Turnbull that periodic evaluation of responsibilities and procedures is necessary, he does not put the same weight on the deletion of the commitment to evaluate.
- 6991-93 Turnbull's reassignment had nothing to do with his concern about the deletion, or with any other aspect of Turnbull's relationship with Bechtel.
- 6993-94 Board sustains objection to Stamiris' question of whether it is more logical to focus on talent rather than training of QC personnel in the assessment of QC certification.
- 6994-95 Board sustains objections to Stamiris examination on details of how qualifications are to be established, but allows her to take up that issue in connection with the Item J issues later.
- MARGUGLIO - CROSS (MARSHALL)
- 6996-99 BWM established residence at Midland because Cook & BWM decided it was important, not because of what NRC said. Moreover, his Midland assignment predates the 1/12/82 meeting.
- 6997-98 QA organizational change occurred in 11/81, and thus was not a result of the 1/12/82 meeting.

- 6998 Marshall concerned about BWM's earlier testimony that changes made subsequent to 1/12/82 were to satisfy the NRC. Questions are withdrawn.
- 7000-04 Citing the law of physics that you can't be in two places at the same time, Marshall asks how BWM can be in residence at the site and yet go "flitting around" like an "international globe trotting gadfly."

MARGUGLIO - CROSS (PATON)

- 7005 BWM plans to spend 60% of his time at site. Commitment made at 1/12/82 meeting was "as much time as is necessary," which they anticipated to be 60%.
- 7006 In 10/81 CPCo was beginning to discuss reassignment of Turnbull's responsibilities.
In 10/81 BWM spent 5% of time at site.
Curland reports to BWM, or Bird in BWM's absence. If BWM is anywhere in Michigan, Curland reports to him.
- 7007 Curland contract yet to be finalized. He will reside in Michigan.
- 7008 Curland responsibilities are strictly limited to Site QA Superintendent.
- 7008 No change in Bird's responsibilities or time spent at site as result of 1/12/82 meeting.

MARGUGLIO - CROSS (DECKER)

- 7008-09 Scope of overinspection of QC inspectors greater than anticipated. When the commitment was made at the exit meeting, Bechtel simply underestimated.
- 7010-17 Decker thinks it is a shortcoming in CPCo's filing system that such [critical] info is not easily available. BWM disagrees: whenever an item or inspector is in question, you look at all the records.
- 7017-18 (Question by Paton) Bechtel originally estimated 18 overinspections because they thought the request was for a sampling, not 100%.

- 7018 Decker insists there should be a way to retrieve such information.
- 7018-20 (Question by MIM) Based on data reviewed thus far, there is only a slight chance that qualifications of any electrical inspectors will be questionable in the end.
- 7020-21 Bird, as paraphrased by BWM: Results so far confirm CPCO's original belief that the inspectors are qualified. The overinspection is simply a demonstration of that fact to the NRC.

MARGUGLIO - CROSS (BECHHOEFER)

- 7021-22 CPCo Ex. 21, Enclosure 3, Paragraph 5.1.2 says MPQA Manager reports to E&QA Director, who also happens to be MPQAD Director (BWM).

In both capacities, BWM has equal access to JWC.
- 7022-24 Curland reports to Bird only in BWM's absence. Paragraph 5.1.3 of CPCo 21 states that Curland reports to Bird because they want to preserve lines of communication in BWM's absence; but on a day-to-day basis, it is informally agreed that Curland will report directly to BWM.
- 7024 Bechhoefer suggests this arrangement should be formalized in writing. BWM says it's already published in an "informal" paper, but that in any case the arrangement is working effectively.
- 7024-26 MPQAD Organization Procedure descriptions (CPCo 21) are problematic because certain matters are best dealt with by using certain communication channels. E.g., Curland reports to various individuals depending on the issue.
- 7026 New MPQAD procedural descriptions responsive to Gallagher's assertion about fragmentation of responsibilities? BWM: Never thought there was any fragmentation.
- 7026-28 Turnbull still responsible for preparation and evaluation of the trend analysis program (See paragraph 5.1.4, CPCo 21), but now the final step of the process is a review by Curland.
- 7029 Curland to be principal communicator with site NRC person.

- 7029 New organization will not affect the expedited management decision making on programs and measures essential for successful completion of project.
- 7030 Curland will not cause a bottleneck in communication because all the administrative crap was eliminated from his position.

KEPPLER - DIRECT (WILCOVE)

- 7032-34 Keppler generally shared Gallagher's concern about fragmentation (etc.) in new MPQAD organization; he thought it might negate his Summer '81 testimony-- it might be a degradation of the 3/81 organization. To resolve the issue, he called the meeting on 1/12/82.

- 7034-37 Current MPQAD organization is acceptable; if anything, an enhancement over previous ones because additional management effort now at site.

KEPPLER - CROSS (BECHHOEFER)

- 7038-39 CPCo's written procedural description of MPQAD should be more in conformance with what really happens, although BWM's testimony would make it seem more complicated than it actually is.
- 7039 Keppler's understanding is that BWM is in charge and Bird, as deputy, shares in some of BWM's responsibility.
- 7040 Suggests CPCo submit a corrected statement about delegation of authority (paragraph 5.1.3 - CPCo 21).
- 7041-44 There should be more communication with Staff when QA changes are contemplated, although regs only require notification of Staff on very basic issues (fundamental QA changes, etc.) It is prudent to communicate, however.

KEPPLER - CROSS (STAMIRIS)

- 7044-47 Reiteration of testimony at pp. 7032-37.
- 7048-49 Describes QA organization of 11/81 as a "fundamental change." Although he thought Cook believed the changes were an improvement, he could not tell and would have to conduct further investigation. Ultimate consideration: on site full time person better than 2 part-timers.

- 7050 Board sustains object to question of whether the change was, in fact, an enhancement.
- 7051 Shared Gallagher's concerns but could not share conclusion without further study.
- After the 1/12/82 meeting, Keppler concluded he couldn't tell that the new QA organization was positive.
- 7052-53 Thinks CPCo reinstated Site QA Sup. out of necessity, but it doesn't bother him. Licensees and regulators often have differing views.
- 7054-60 Board sustains objection to question of whether there is a pattern in CPCo's behavior to make improvements only as required, even though it believes them unnecessary. (examples: the most recent QA change; additional soil borings at DGB; IE 81-01 requirement for full time on site geo-technical engineer; MAC audit of QA; Crosby QA program).
- 7060 MIM argues there is no record of "acquiescence"; some instances cited were actually regulatory requirements.
- 7061-63 Keppler testifies he doesn't see a pattern in the examples. In fact, CPCo is not trying to get by with the minimum effort:
- (a) Selby - not acquiescence but a positive move;
 - (b) Crosby - attempt by CPCo to improve QA;
 - (c) New QA - CPCo wasn't "acquiescing."
- 7064 Key question remaining in these proceedings: Can CPCo QA insure the soil remedial work will be done properly?
- 7065-67 Keppler's staff currently reviewing a QA plan for remedial action on underpinning (Report of 1/7/82, "General Quality Plan for Underpinning Activities... SWPS and Aux Bldg.")
- 7068 Keppler apparently not familiar with specifics of NRC concurrence for CPCo to proceed with underpinning work on aux bldg., but says the QA plan will be reviewed before any work starts.
- Discussion of what underpinning work has been approved.

- 7069-71 Referring to new, tougher stance on QA expressed by Paladino in 11/81, Keppler feels his actions regarding CPCo's QA reorganization were appropriate. The reorganization didn't warrant a fine or stop work order.
- 7072 NRC personnel decided against Gallagher's suggestion that NRC hire a full-time on site geotechnical engineer to review soils remedial work.
- 7072-73 Instead, Dr. Landsman will conduct such a review, initially spending 100% of his time at site.
- 7074 Board defers question about whether flexibility in the waiver provision for QA-QC qualification should be eliminated or severely reduced until Item J examination.
- 7075 Other subjects of discussion at 1/12/82 meeting:
(a) QA reorganization
(b) underpinning QA
- KEPPLER - CROSS (MARSHALL)
- 7075-77 Dealt with Gallagher concern about a full-time site manager at 1/12/82 meeting by agreeing on addition of Curland.
- KEPPLER - CROSS (SINCLAIR)
- 7077 Several QA reorganizations in past.
- 7077-79 Board sustains MIM's objection to Sinclair's characterization of past QA organizations as failures.
- 7080-82 New QA organization has better chance of success than past ones had. It is not a degradation of the 3/81 organization which NRC reviewed and accepted in Summer '81.
- 7082-84 Keppler can't say whether NRC has established criteria to determine whether a utility is capable of building and operating a plant properly. Cites examples--
(a) Zimmer project faced tough regulatory action,
(b) Palisades is a testing ground for question of whether CPCo is capable of properly constructing & operating Midland.

KEPPLER - CROSS (MIM)

- 7085 Clarify record: MPQAD formed in Spring 1980 not Spring 1981, and integration of Bechtel and CPCo QA occurred in August of 1980.
- 7086 Cook-Keppler TC in 11/81: Keppler not informed that Site QA Sup. position was to be abolished or that Turnbull's responsibilities were reassigned.
- 7086-87 NRC's resident inspector, Ron Cook, was informed of all QA changes contemplated in 11/81, but that info never reached Keppler.
- 7088 When Gallagher expressed his concerns about the QA reorganization in a TC on 12/16/81, Keppler, who was unfamiliar with the extent of the changes, told Gallagher to use his own judgment in testifying.
- 7089 In his 12/17 testimony, Gallagher not speaking for NRC Region III.
- 7090 Present QA organization meets NRC requirements Appendix B Part 50.
- 7090 Organization charts useful but most important thing is how the organization works.
- 7090-91 Based on BWM and Bird 2/2/82 testimony, the new organization is functionally equivalent to the organization reviewed in Spring '81.
- 7091-92 NRC's decisions on acceptability of QA organizations (etc.) often a matter of subjective consideration. Thus, professional disagreements such as BWM's view that the new organization is not an improvement does not mean that a utility is uncooperative or has a poor attitude.

KEPPLER - CROSS (HARBOUR)

- 7093 CPCo management attitude towards various QA firms has improved in past year.
- BWM's view that both the 11/81 and 1/12/81 versions of QA reorganization were acceptable is not an inconsistent view.

KEPPLER - CROSS (BECHHOEFER)

- 7093 Changes proposed at 1/12/82 meeting accepted by Gallagher and NRR representative.
- 7094 Gallagher's concerns over fragmentation of responsibilities and transient management have been redressed by having 2 full-time superintendents (Turnbull & Curland).
- 7095-96 Barring a communication problem between the superintendents and Bird or Marguglio, all QA matters should be properly aired.
- 7096-97 Discussion of whether Mr. Horn, for example, might wait for the person who is likely to offer the answer he wants to a particular matter.
- 7097-98 It is Keppler's understanding that Curland will have sufficient authority to sign off on certain problems.
- 7098 A regulatory requirement that CPCo clear any QA organizational change with the NRC is not necessary; CPCo is sufficiently aware that such an approach is prudent.
- 7098-99 No other requirements necessary now, but will issue stop work order if necessary.

KEPPLER - CROSS (HARBOUR)

- 7100 No opinion on education and experience standards set forth in ANSI standard N45.2.6-1973, or BWM's disagreement with those standards.

KEPPLER - CROSS (STAMIRIS)

- 7101-05 Reiteration: While Keppler shared EJG's concerns, he was unable to conclude that the QA reorganization was unacceptable; he called a meeting to discuss it.
- 7106 Gallagher was indeed the Staff representative in his testimony on 12/17/81. However, a formal position of acceptability/unacceptability is not made by a staff individual testifying at a hearing.
- 7107-08 Assessment of 11/81 QA reorganization based on whether it was a degradation of the 3/81 organization reviewed and accepted in Summer '81.

Similarly for the assessment of the 3/81 QA re-organization.

This practice is to insure that changes being made are changes for the positive, not negative.

- 7108-10 Board sustains objection to question of whether Keppler's assessment of Midland QA would be different if he could somehow forget about all his prior experience with Midland.

KEPPLER - CROSS (MARSHALL)

- 7110-13 Discussion about the weight of EJJ's opinion on 12/17.

KEPPLER - CROSS (MIM)

- 7113-14 Gallagher not a Region III person.

- 7114 Before the NRC develops a position on any proposal, there is a management review of the proposal. Such a review had not taken place as of the time Gallagher testified.

KEPPLER - COMMENT

- 7115-17 Following up on Stamiris' concern about an independent, unprejudiced review of QA at Midland, Keppler notes that a review has built-in checks and balances because there are 20-25 different inspectors.

KEPPLER - CROSS (STAMIRIS)

- 7117 As stated in I&E 81-12, one goal of the 5/81 inspection was to verify adequacy of QA.

ADMINISTRATIVE MATTERS

- 7118-20 12/3/81 Transcripts

- 7120-22 CPCo Ex. 24: 2/1/82 Letter Miller to Board
re: Hold point testimony of
BWM subject to misinterpretation.

- 7122-29 Upcoming testimony on QA & underpinning:

Harbour wants to hear about measures taken to prevent the possibility that underpinning could induce structure movement. (See pp. 31-32 of Burke et al. prepared testimony.)

Decker interested in relationship between construction & QA plans.

DARL HOOD - DIRECT (PATON)

- 7129-31 Change from Gould's previous testimony re: construction of the access shaft, specifically, a new technique for placing the hold for the soldier pile.
- 7131 Was discussed at a meeting 1/18-19/82 in Ann Arbor and Kane & Singh concurred in the change.
- 7131-33 Applicant will send letter to NRC and Board explaining the change.

ADMINISTRATIVE MATTERS

- 7133-35 Stamiris Ex. 31: 1/8/82 Letter from Bloom re: press release on cost update of Midland.
- 7136-37 Availability of transcripts via FOIA.
- 7137-38 Bechhoefer says the dike issue has not been disposed of.
- 7138-39 Kane to report on artesian pressure in one of the boring logs at time of DGB discussions (3/82 or 4/82).

ABSTRACT
MIDLAND HEARING

February 16, 1982

- 7140-56 Preliminary matters
- 7156-61 Discussion about whether PMF of dike is an OL issue.
- 7162-64 Stipulation between CPC & Staff. (Joint Ex. 3).
- BOOS, HENDRON & HANSON
DIRECT BY STEPTOE
- 7165-68 Corrections & prep. testimony on BWST remedial measures.
- At p. 12, §5.3, Williams high strength rock anchors have been deleted because grouted reinforcing steel bar is preferable.
- 7168-73 Corrections to figures
- 7174 Witnesses' roles in BWST work.
- 7175-76 Releveling of tanks. (See pp. 8-10 of p.t.). Procedure modified to include insertions of Celotex between tank & grout pad. Unit 2 won't be relevelled; it already has celotex.
- 7176-80 In-service monitoring, (see pp. 20-21 of p.t.). Will use strain gauge monitoring on concrete fdn.
- 7180-83 Corrections to Hendron additional testimony re BWST.
- 7184-86 Summary of Hendron testimony.
- CROSS BY BLUME
- 7187 CPC committed to design BWST fdns. to ACI 34979 and Reg. Guide 1.142.
- 7187-89 The crack identified as 63 mils is, after the surcharge, still "in the same range." (See pp. 3-4 of Boos p.t.).
- 7189 Only one instance of significant lengthening of cracks toward valve pit roof slab. (p. 5)

- 7190-93 Bechtel not contemplating any changes to BWST designs 4 & 5 (p. 8). Staff to be informed of any substantial changes.
- 7193-95 Stram gauge scheme is a temporary backup system during the releveling of the BWST. Within 1 month, Bechtel should finalize procedure and acceptance criteria. Staff to review before any releveling is done.
- 7195-98 Hanson: current p.t. (at \$5.2) should redress staff's uncertainty about whether long term soil plastic modules were used.
- 7198-200 Control load combinations used comply with ACI 34976. (p.t. at Table BWST &), details of equation.
- 7201 Use of short-term hydrostatic pressure from ground water would have insignificant effect on ring wall fdn.
- 7202 Dynamic spring constants used to evaluate effect of operating basis earthquake.
- 7202-04 Criteria for allowable total and differential settlements of tank ring, ring beam & valve pits.
- 7204 Worst case loading combination shown by BWST fdn. design analysis was load combination 10.
- 7205-07 Tables BWST-1 & 2 represent CPC commitment to meet both ACI-349 and Reg. Guide criteria.
- 7207 Hendron satisfied with moduli values used by CPC in seismic analysis if they did analysis for entire range they indicated.
- 7208 How short-term moduli are established.
Hendron: Values used were appropriate.
- 7209-11 Explanation of how water column was considered in design of BWST fdn.
- 7212-14 10% change in water load won't change conclusion about adequacy of ring wall remedial work.
- 7214 Although Staff indicated CPC didn't need to obtain Staff concurrence on removal of BWST surcharge, CPC intends to do so anyway.

- 7214 No need to re-evaluate BWST fdns. in light of Hendron conclusions because Hendron's moduli are encompassed by those Bechtel used.
- CROSS BY BOARD
- 7125 BWST settlement problems due to design problem, not soil problem.
- 7216 Why settlements at 2 ksf are larger for condensate storage tanks than for DGB at same pressure.
- 7217-20 Fig. BWST-8 gives magnitude of settlement and plots total settlement at a particular point.
- 7218-20 Difference in settlements between Tables 1 & 2 (BWST & Cond. storage tanks) due to more compressible soil at CST.
- 7221 Construction of BWST fdns. took long time (7/78-1/79) because of 7/78 DGB settlement problem and winter construction. (p. 6, Hendron).
- 7222 From 20 borings taken in tank farm area, Bechtel determined that the fdn. material was sufficient for the construction of the tanks. A load test was begun in 10/80 (and continues to present) to demonstrate the sufficiency of the soil & to aid in predicting future settlement.
- 7222-23 Hanson supp. test. addresses concern about necessity of water being left in BWSTs while new footing is constructed. (See p. 26, Hanson p.t.).
- 7223 Surcharge removal from valve pits currently being discussed with NRC.
- 7224-25 Timing for Bechtel & Staff review of plan of action and acceptance criteria for releveling.
- 7225 Hendron, p. 27: "static" plus earthquake load includes weight of water.
- 7226-30 Corrections to Hendron prep. test; errors in Table 3.
- 7232 DGB settlement discovered in 7/78. Const. of BWST ring fdns. was delayed in past because of exploratory borings in vicinity of BWSTs.
- 7233 Borings taken perhaps in 11/78 or 12/78, when fdn. rings were partially completed.

- 7233-34 Results of borings first available in first quarter 1979 and 8/79. Indicated acceptable soils.
- 7234 A form of stop work on fdn. rings was in effect (time reference is unclear).
- 7235 Decided in 12/78 to propose a load test for the tanks.
- 7235-36 Tank rebounds when you take water out or put it back in. (See p. 2-3, Hendron).
- 7237 Crack maps done for all cracks observed in BWST-1 fdn.
- 7238 Outer ring completely mapped.
- 7238 Fig. BWST-2 shows location of an observation pit which was opened prior to application of surcharge, to allow monitoring in the ring beam.
- 7239-44 Difference in areas of valve pits for Tanks 1 & 2 (See fig. BWST-5): #1 is less than one-third larger than valve pit #3.
- Difference in absolute settlement of BWST 1 & 2. (See Figs. 21-22): #1 slightly more.
- 7245-47 Which end of valve pit on BWST-1 settled more? Answer deferred.
- 7247-51 Discussion of impact of settlement on design of ring beam and safety of fdn due to (1) differential compressibility of soil or (2) differential in area of footings in diff. parts of tank.
- 7252 Some steel in region of the 63 mil crack has reached its yield.
- 7252 Even if there was loss of bond in any of the reinforcing, the remedial ring beam carries the entire load by itself.
- 7252-53 Purpose of finite element analysis.
- 7254 Design of new ring wall did not account for any strength coming from the existing wall, only stiffness.
- 7254-56 Basis of Bechtel's 3 proposed criteria for surcharge removal. Staff currently reviewing those criteria.

- 7257-59 Load combinations 1-8 described on p. 11 of p.t. (Boos) are based on FSAR requirements. #7 is 1.5 x FSAR.
- 7259-60 Intent of statement on p. 3 (Boos), "When tanks were relocated, original design was not modified to reflect the relocation" is that redesigning offered no advantage.
- 7260-61 Boos doesn't know dead weight of tanks with fluid, nor does he know sizes of tanks.
- 7261 A design dwg. change indicated removal of the tanks.
- 7263 If tanks had been left on the valve pits, amount of differential settlement would have reduced.
- 7263-64 Daily monitoring of cracks. (See p. 4 at & 4.1.1, Boos p.t.).
- 7264-66 Surcharge acceptance criteria (See p. 4 of Boos).
- 7266 Design changes to be discussed with Staff only if they materially affect the fix.
- 7267 In-service long-term monitoring requirements (p. 26, Boos).
- 7268 REDIRECT BY FARNELL
- 7269 Condensate storage tank settled more than the BWST, inferring that soil was more compressible under the CST.
- 7269-70 Impact of that fact on Hendron's decision to use ratio of settlement to rebound in the CST to predict rebound in BWST.
- REDIRECT BY STEPTOE
- 7271 Boos: did not intend to imply that the 5 mil crack discussed on p. 5 of p.t. was seen to lengthen after it had been discovered.
- 7272 2 strain gauge programs: (1) temporary for releveled; (2) long-term for monitoring concrete fdn. Error in discussion is corrected: .7 inch rather than .5.

- 7273-74 Range of values Bechtel used re dynamics moduli of elasticity envelopes Hendron values.
- 7274 Size & weight of tanks that were relocated: 100,000 and 130,000 pounds.
- 7275-76 Hanson's role in BWST analysis. Hanson confident about conclusions in his p.t.
- 7277 Hanson: long-term modulus was used for all factors except the earthquake; only the earthquake loading was used with short-term modulus.
- 7278 Hanson: proposed design meets ACI-349 (modified) and FSAR.
- 7279-80 Hanson: explanation of 4% excess of SSRS over 1.5 x FSAR spectra.
- 7280-81 Absolute settlements significant only for piping corrections, not structures themselves.
- 7282 Liquefaction tends to lead to non-uniform settlement.
- 7282 Hanson not aware of any pipes below BWST.
- 7283 Boos: aware only of pipes that are actually connected to BWST.
- 7283-84 Boos: based on Hendron p.t., there is no need to modify the BWST remedial work. Hanson agrees.

RE CROSS BY STAMIRIS

- 7284-86 The 5 mil crack was not noted on crack maps until after surcharge. You can't necessarily attribute the crack to the surcharge. Anyway, it is not detrimental.
- 7287-90 CPC commitments to Staff re: acceptance criteria for surcharge. The 5 mil crack was so insignificant as to not warrant informing the Staff prior to further surcharge application.
- 7291 Borings taken in 11/78 or 12/78. Boos was Bechtel's project field engineer for Midland in 1978.
- 7292 BWST fdns. began in 7/78, when DGB problem first surfaced.

- 7293 Determined that it was a reportable condition in 8/78.
- 7293 Boos aware of 1" settlement in DGB footing in 7/78.
- 7294-98 It was considered an appropriate eng. judgment to begin BWST fdns. in 7/78. Boos at the time not aware that there was a generic settlement problem.
- 7299-300 There was an interruption in const. of rings. Results of borings substantiated the adequacy of the fill.
- 7310-02 Boos aware of Ad Bldg settlement problem in 7/78.
- 7303 Keppler-Tregoe analysis performed by Bechtel in first quarter 1979.
- 7304-08 It was determined that the root cause of differential settlement was a design problem rather than a soils problem.
- 7306-07 Purpose of surcharge.
- 7309-11 Had soils been determined insufficient, the structures would have been removed and soils recompacted.
- 7312-13 Question of whether criteria for rejecting surcharge on tank and fdn. rings were pre-set.
- 7313-14 Prior to surcharge, there were cracks in fdn. ring generally of the "volumetric change" type.

CROSS BY MARSHALL

- 7314-18 Hendron's values for dynamic moduli were within range of values Bechtel indicated it would use. If they did analyze for that range, then their analysis is sufficient.

RE CROSS BY BLUME

- 7318-20 CPC committed to ACI-349 & Reg Guide 1.142 in design of fdns.
- 7320 Boos: regarding in-service monitoring, 2 observation pits will be provided for each fdn. ring for 6 months; then pits will be closed and strain gauge monitoring used.

- 7321 Crack monitoring won't be done at any place other than at the pits.
- 7321-32 Hendron disc. about whether a 2.5" settlement around edges of ring fdn is excessive, given 95% modified dry density and 2 ksf loading of full. Would expect 1.7" of settlement, and 2.5" would not be surprising.
- 7332-35 Hendron not aware of whether settlement was measured before const. of fdn. rings.
- 7335 Boos: fill underneath BWST placed in '77 or early '78.
- 7335-16 CPC will have assurance that strain gauges are accurately monitoring cracks in the fdn. ring by using fairly traditional techniques of measuring displacement.
- 7337 Boos: plan to rely solely on strain gauges. Will review plan with Staff.
- 7337-38 Hendron asked for, but never got, information on settlement measures re: fill settling under own weight prior to const. of BWST fdn.
- 7340 CAMPBELL & KENNEDY
DIRECT BY STEPTOE
- 7342-46 Corrections to prep. testimony:

pp. 2-3: Anchor bolt pull-out was checked and the capacity was calculated to be greater than 136 kips (instead of 90 kips). "136" is in accordance with ACI-349. "90" is more conservative but "136" gives better results.
- 7347-48 Kennedy recommends celotex be installed underneath the tank which is being releveled to assure compliance with code allowable stresses.
- 7349-50 The tank which is not being releveled has not experienced significant differential settlement.

Stresses for both tanks will be within code allowable values and both are adequate to withstand design loadings.
- 7350-51 Meaning of "code allowable".

ASME code has 4 service levels. It is not specific as to what the levels correspond to.

ABSTRACT

MIDLAND HEARING

February 17, 1982

- 7355 Professional qualifications of Campbell.
- 7356 QA matter: Comstock allegation.
- 7357-62 Disclosure to Board.
- 7363-65 Discussion on whether geological investigations -- subject of 2/14/82 letter from NRC ("Summary of meeting held with CPC on Geology, 12/2/82") -- is an OL issue.

CAMPBELL & KENNEDY
CROSS BY STAMIRIS

- 7366-67 Difficult to say which of the 3 causes of cracking in ring wall is primary (#1-soft soils, #2-valve pit, #3-under-reinforcing of ring wall) but under-reinforcing was probably primary.
- 7368 Fdn. remedial work will enable tank to perform adequately in future.

CROSS BY MARSHALL

- 7369 Ring wall tends to deform sufficiently that it can support its load.

CROSS BY BLUME

- 7370-71 How 2.6 buckling factor of safety is obtained.
- 7372-74 ASME v. NASA methods of calculating factors of safety. ASME code building formula too conservative; it assumes a uniform load.
- 7375 Kennedy analysis shows there is significant factor of safety against elastic buckling. Table 1 of p.t. gives best estimate of stress conditions at which tank would have initiated elastic building and stress conditions allowed by service level C.
- 7376 2.46 is a safety factor against what Kennedy predicts as elastic buckling; it is not a safety factor against the code.
- 7376 Kennedy's factor of safety is 9% under code allowable stresses.

- 7377-78 Why Kennedy concludes there is not uniform axial compression for BWST.
- 7378-79 NASA formula is somewhat conservative for the type of deformation that exists for the ring fdns.
- 7380-81 Although NASA formula is conservative, the ASME calculation leads to a lower factor of safety.
- 7381 NASA formula takes into account imperfections, e.g., roundness.
- 7382 Kennedy recommended placement of celotex under tanks. He doesn't know if it was tested before placement.
- 7382-84 SMA subcontracted with Smith, Emery to test the celotex to determine its properties.
- 7384-86 Most critical loading capacity Kennedy evaluated for BWST-1 was when it contained water. BWST-1 will never see stresses that high again.
- 7387 Most reliable way to evaluate stress in BWST was use of strain gauges attached to anchor bolts.
- 7388 Kennedy used SSRS (SME) together with Bechtel's prediction of the future shape of the ring wall in order to evaluate the peak loads of the tank in the future.
- 7388-89 Analyzed for the SSRS, not 1.5 x FSAR, earthquake.
- 7389-98 Board overrules objections to question of whether Kennedy analyzed the ring beam for effects of an earthquake. Kennedy: although he has not completely reviewed the data, results he has seen make him confident that BWST & ring wall are capable of withstanding Bechtel's predicted settlements, deformations for either SSRS or 1.5 x FSAR earthquake.
- 7398 Only load combination Kennedy used is the one dealing with SSRS (which has the highest allowable stresses).
- 7399-7400 Tank & fdn. will not fail under other loads. Doesn't know if they meet all of the load combinations.
- 7401-04 Kennedy doesn't know whether the operating basis earthquake or the SSE controls the design of the ring wall.

7405-08 SSRS shouldn't be replaced by the OBE because OBE is an earthquake that has a reasonable probability of occurrence during the life of a plant; SSRS is extremely unlikely.

7413 Load combinations that were used appear to be consistent with ACI-349 combinations. Load combination described in Boos p.t. at p.24 includes OBE, not SSE.

CROSS BY BOARD

7417-18 Source of Tables 1-1, 1-2, Figs. 1-3 and 2-3.

7419-20 Environmental qualifications of celotex: Kennedy says celotex has been commonly used for years.

7420 Table 1-1: it is likely that the datum for each tank is different.

7420-21 Table 1-3: bolts 9, 10 and 27 are stressed beyond normal condition allowables, but not beyond the faulted condition allowables.

7423-24 Explanation of p.t. at p.1-3: "Three of the bolt loads in 1T-60 exceed the faulted condition design load of 20.43 kips."

7425 Environment qualif. of celotex.

7425-26 If anchor bolts had been loose when settlement occurred, stresses in the tank would have been much less.

7426 Anchor bolts to be tightened again after fdn. of BWST-1 is releveled.

7426-28 Max. predicted fdn. settlement over 40 years is much less than what BWST's have already experienced.

7429 If settlement exceeds predicted settlements, remedial work must be done.

7429 Significant elastic buckling could have been observed visually.

7430 There were no observed problems with welds.

7430-31 Various methods of testing welds: ultrasonic; dye penetrant examination (which is easier to perform, and was used in this case).

- 7431-33 Conclusion at p.4 means that, having undergone the loading, the BWST is still capable of withstanding all original design loads. There were 2 exceptions which aren't likely to affect the safe operating life of the tank.
- 7433-34 Kennedy doesn't think that stresses the tank has seen have negative impact on future safety of tank.
- 7434 Damage that is not visually obvious can be determined by other means. Kennedy's stress analysis indicates there was no such damage.
- 7435-36 A recognized testing firm observed the results with the dye penetrant tests.
- 7437 Extent to which Kennedy & Campbell testimony relies on data provided by CPC.
- 7437-38 SMA made independent checks and found that the behavior of the tank they calculated was consistent with their observations.
- 7439 BWST settlement reference points.
- 7439 Kennedy aware of the questions that exist on high strength bolts. However, in this case, these are not high strength bolts.
- RECROSS BY MARSHALL
- 7439-40 Miscellaneous.
- RECROSS BY BLUME
- 7440 Kennedy's 2.46 buckling factor of safety is based on his calculations of stresses in the tank under the prior deformation. Those calculated stresses would have been greater absent the celotex.
- 7441 Kennedy guesses that service level C stresses would have been exceeded if celotex weren't present, but the tank would not have been present.
- HOOD, KANE & SINGH
DIRECT BY BLUME
- 7442
- 7443-45 Correction to p.t.
- 7446 Regarding the ring beam, Singh says CPC should develop some kind of long term (life of plant) settlement monitoring program and submit it to NRC Staff for review.

- 7447 Kane: the details of a monitoring program are an OL issue.
- 7447-48 Re: p.14 of testimony, Singh says the soil elastic moduli used by CPC to compute long term bending moment and shear force in ring fdn. are reasonable. But he reserves judgment on short term moduli.
- 7449 Singh satisfied now that CPC no longer needs to document the information indicated in his prep. testimony.
- CROSS BY STAMIRIS
- 7449 Differential settlement at BWST is soils related.
- 7451 Kane's opinion is that the BWST settlement was greater than he would have anticipated. The problem: fill not adequately compacted.
- 7452 Observation pits were dug in relation to problem of air leaking from a pneumatic line near the BWST.
- 7453 Hood does not recall any observation pits dug for the purpose of analyzing the soil properties.
- 7454 Hood doesn't recall details of the construction sequence.
- 7454 BWST fdns. were constructed between 7/78 - 1/79.
- 7455-58 Board overrules objections to question about how commencement of construction of BWST fdn prior to soil borings reflects on engineering judgment or managerial attitude.
- 7458-59 Hood says at the time he would have preferred more investigation. Although it was very difficult to do so, the NRC wanted to determine the implications of the problem for other structures. In 3/80, NRC issued 50.54 (f) questions to elicit further exploration of the problem.
- 7460-61 Early in the Midland project, Hood felt a tendency on the part of CPC to push ahead without proper assurances: he "supposes" that this tendency stems from managerial attitude.
- 7462 Hood recalls that the NRC was aware of DGB problem in 8/78. NRC not aware of widespread problem in 7/78.

- 7463-64 Attachment 10 to 12/25/81 letter from Tedesco to Cook lists 2 commitments on which NRC based its concurrence in surcharging the BWST's.
- 7464 Regarding commitment #2 (propagation of cracks that related to the surcharge), Hood says NRC only learned of the 5 mil crack through the testimony of Boos.
- 7465-66 Noting that commitment #2 doesn't say anything about minimum crack size, Hood says that the Staff probably would have concurred with CPC's finding. However, it should have been reported.
- 7466 2/5/82 Summary of 1/26/82 TC re: surcharge results for BWST fdns. (Stamiris Ex. 32 for ID.)
- 7467-72 Purpose of 1/26/82 TC was to discuss with CPC the settlement history of valve pits during the surcharge program.
- 7472 Kane agrees with CPC that the .5 reading from Marker D 41 was inaccurate. (See Stamiris Ex. 32.)
- 7475 Kane opinion re: the process of considering one data point to be inaccurate based on subsequent information.
- 7476-77 Kane would question a data reading that was .3 on January 12 and .4 on January 18.
- 7479 Stamiris Ex. 33 for ID: 2/8/82 NRC Summary of 1/13/82 mtg. on BWST's; with enclosures.
- 7481-85 Singh: the problem presented in Section 3, Q.1 of Stamiris Ex. 33, has been resolved. Tank load was transmitted to the ground, not to the ring fdn.
- CROSS BY MARSHALL
- 7486-87 Celotex will aid the tank in load distribution.
- 7488-90 How you can have areas of soft soil and stiff soil in close proximity.
- 7490-92 No panel member has experience with celotex response to soil moisture.
- CROSS BY FARNELL
- 7494+ 5 Fill under BWST would have settled 1/4" if compacted to 95%.

- 7496-03 Kane is asked to calculate what the fill settlement would have been under the conditions assumed by Hendron at 2/16 hearing.
- Kane says only that he would establish soil compressibility characteristics based on a consolidation test rather than using a modulus of elasticity.
- 7503-07 Question is whether Kane can determine what he believes the soil stiffness to be and relate that calculation to get the best results of the 35 feet layer of soil compacted to 95% modified dry density.
- 7507 Board sustains objections to question on grounds that neither Hendron's nor Kane's calculation is material.
- 7510 Kane's 1/4" estimate comes from experience with fills.
- 7512 Extent of Kane's experience with soils having similar properties to those at Midland.
- 7512-13 1/4" as upper limit applies to period 7/78 - 8/80. Kane would expect 1/2" settlement to have occurred from the time the fill was placed up until the time the ring was placed.
- 7513-14 Kane not aware of any recorded study regarding estimated total settlement of the Midland fill under its own weight.
- 7515 Kane doesn't recall having read the portion of the Dames & Moore report that estimated settlement of the 35 ft. of fill at 1-1/2 to 2". Kane says time frame is critical.
- CROSS BY BOARD
- 7515-16 Hood not sure whether CPC did the 8/78 & 10/78 borings on its own or did it, at least in part, upon urging by the NRC. (See p.t. at p.6, Q.7.)
- 7516 Conceivable that Midland fill would settle 1-1/2" within 9-12 months.
- 7517 Kane would expect an upper limit of 1/2" by the time placement of fill was completed.
- 7518 Hood not aware of any NRC requirements re: Celotex.

RECROSS BY STAMIRIS

- 7519 Only outside edge of celotex is observable.
- 7521 Kane would not have expected more than 1/4" settlement during the period from the time of soil placement up until construction of ring beam.
- 7522 To estimate settlement of the fill prior to beginning of the BWST construction, you would monitor settlement during construction of the fill, then measure the settlement after placement is complete. Kane does not recall that being the case at Midland.
- 7523-29 One problem with Hendron's calculation is the lack of a time frame.
- 7530 When the DGB problem was identified, the instrumentation installed indicated that the fill was settling under its own weight.
- 7530 Instrumentation was placed after 7/78 but before the decision to surcharge.

RECROSS BY MARSHALL

- 7530-34 Miscellaneous.
- RINALDI & MATRA
7535 DIRECT BY BLUME
- 7537 Prepared testimony.
- 7538 NRC still hasn't received some of the information necessary to approve certain of the as yet unresolved remedial measures for the BWST fdns.
- 7539-42 Four NRC concerns (p.9).
- (1) Computational approach.
 - (2) Load combination and acceptance criteria (unclear whether CPC is using 1.5 x FSAR or SSRS/SMR). Staff doesn't know yet whether it is appropriate to divide the 2 loading combinations, as it thinks CPC is doing.
 - (3) Commitment to perform an evaluation of any new cracks if they exceed certain criteria.
 - (4) Need details of the plan to relevel BWST-1.

7543-44 CPC has done computations which address Staff concerns, and CPC has agreed to provide justification for the amount of water column assumed to act on the ring beam.

7545 Staff has dismissed any concerns about requiring CPC to relevel Tank 2.

CROSS BY STAMIRIS

7546 Staff has required CPC to grout or epoxy the cracks that exist in the old ring, in order to arrest corrosion.

7548-49 Rinaldi has not checked for corrosion in the reinforcing steel of the ring beam, but he doesn't expect significant corrosion, if any.

CROSS BY MARSHALL

7550-52 No requirement for use of celotex.

7553 Steptoe: CPC considers the use of celotex as a commitment.

CROSS BY STEPTOE

7553 Re: concern #2, Staff still needs to check Bechtel's design calculations to confirm that in fact ACI 349-76 as augmented by Reg Guide 1.142 has been met.

7554 It is NRC Staff structural engineering branch policy to audit licensees at some time between the CP and OL for structural calculations.

7554-55 Rinaldi appears to be saying that it is satisfactory to him that CPC will provide the details of the releveling plan; that is, in about a month.

7555 Seismic margin review discussions are still going on.

7557 Rinaldi does not know of any discussions between NRC and CPC that seismic margin review amounts would involve changing other input parameters.

7558 It has never been part of the seismic margin review to change any of the input parameters other than the SSE.

7558 Rinaldi has no opinion about Kennedy's judgment that it is prudent to use 1.5 x FSAR as a substitute for SSRS.

CROSS BY BOARD

- 7559 New fdn. ring will be designed for the new criteria.
- 7559-60 Staff has requested CPC to design any new structure or new underpinning to current criteria. Rinaldi thinks CPC is complying with this requirement. The question of which earthquake is to be used will be resolved prior to any construction.
- 7561 For commitment #2 in Att. 10 to Hood testimony, there should be a definition of crack sizes.
- 7562 The 2 commitments were only applicable to an older plan which is not now being used.
- 7562 CPC has committed to monitor the new ring for a period of 6 months. Their acceptance criteria is such that, if any cracks exceed a certain size, they will perform a detailed evaluation. This is a satisfactory commitment.
- 7563 Status of Staff position on surcharge of BWST-1 valve pit.
- 7564 The tank that is being releveled is mounted on the existing ring beam and will continue to be mounted on that ring wall.
- 7565 As a result of the surcharge program of the valve pit area, that portion of the ring wall will become stable.
- 7565 Discussion of the 2 "exceptions" where stress limits of the governing design code were not met. (See pp. 3-4, Kennedy.)
- 7565 Regarding Kennedy's dye penetrant examinations, Rinaldi says any other type of examination is not required because there was not a problem with that analysis; it did not "exceed yield."
- 7569-70 Re: Boos/Hanson testimony setting forth the number of loads and loading combinations (see at pp. 11-12), along with the commitment that is stated at p. 21, Rinaldi says that CPC has not identified the load equation that would result from using ACI-349 in conjunction with 1.142.
- 7571 A remaining question is which earthquake value CPC used.

REDIRECT BY BLUME

- 7571 It is normal in the licensed process to make preliminary determination about which controlling load combinations control the design of nuclear plant structures.
- 7572 Controlling loads are determined after the design is complete.
- 7573 Presently, it is not clear to the Staff what seismic load combination CPC has used to evaluate BWST.

RE CROSS BY STEPTOE

- 7575 Although p. 12 of Boos testimony makes it clear that design for BWST remedial work is based on 1.5 x FSAR, Rinaldi says it is OK as long as 1.5 x FSAR envelopes the SSRS.
- Kennedy thinks it does; Rinaldi hasn't any basis to challenge Kennedy's opinion.
- 7575-77 Analysis of load combinations effects on different parts of structures.
- 7578 Staff is uncertain as to whether Bechtel has run through all load combinations for the various sections of the BWST fdns, and is concerned that Table BWST-2 perhaps indicates that CPC has only run the OBE load case.
- A third uncertainty, addressed in Kennedy's testimony, is whether 1.5 x FSAR should be a worse load than SSRS. This uncertainty to be resolved by checking during the normal audit process.

EXAM BY BOARD

- 7579 If CPC does not change the spec requirements, they do not have to notify Staff. Otherwise, they do. (See Boos testimony, p.8.)

ABSTRACT
MIDLAND HEARING

February 18, 1982

- 7584 Preliminary matters
- 7584-7602 (a) QC electrical inspections
- 7603-07 (b) Further discussion on how much disclosure of info is necessary; e.g., the hole that was drilled. Board says if CPC counsel presents too much info, it will let them know.
- 7608 LANDERS, LEWIS, MEISENHEIMER
DIRECT BY WILLIAMS
- Landers is Senior VP of Teledyne Engineering Services, under contract by CPC to develop an ovalization criterion for piping.
- 7609-10 Landers prepared §3.5 of the prep. testimony, which relates to the ovalization criterion.
- Corrections to §3.5 at the table on p. 25.
- 7611 Lewis is engineering group supervisor and acting assistant project engineer for licensing and safety for Bechtel, Midland project.
- Lewis responsible for §2.1, 2.2 and 3.5 of prep. testimony.
- 7612-13 Corrections to p. 11: rather than referring to the 1971 edition of ASME Code, the reference should be to the 1977 edition.
- Other minor corrections on pp. 13, 15 and 34.
- 7614 Substantive change in testimony: because agreement hasn't been reached with Staff on deomonstration of the 36" diam. service water piping, Lewis has been authorized by CPC to say that the 36" diam. piping will be replaced.
- 7615 Thus, Fig. UP-13 is revised to show deletion of four 36" diam. pipes, anchor point monitors and strain gauge monitors associated with those pipes.
- 7616 p. 34: after the statement, "The first anchor

point of all the piping systems will be monitored as the piping enters a building," add: "with the exception of the 36" diameter piping entering the SWPS."

CPC has agreed with Staff to incorporate level monitors on the pipe (referred to on p. 33 at \$5.

Number and location of these monitors still being discussed.

- 7617 Meisenheimer is Supervisor of Geotechnical Engineering for Gilbert Commonwealth. Retained by CPC to coordinate geotechnical activities re remedial soils work at Midland.
- Meisenheimer prepared §2.1 and 2.2 of the p.t.
- 7618 Corrections to p.t.
- 7619 Landers/Lewis/Meisenheimer prepared testimony received into evidence.
- 7622 CROSS BY STAMIRIS
- 7621-24 Pipe collapse points, control load, deflection, etc.
- 7625-26 Buried pipe will not collapse rapidly because it is deflection controlled. Settlement of the soil limits and prevents further deflection. (See pp. 19 and 22 of testimony).
- 7627 What the term "collapse" means to the 2 different cases given on pp. 19, 22.
- The testimony addresses 2 of many modes of failure: (1) A round pipe continually ovalizes until there is not a sufficient flow through. (2) The pipe bends until its top surface wrinkles, leading to a "collapse" such that flow through is affected.
- 7629 Strain in the pipe, which is dir. related to ovality, will be measured.
- 7630 Strain gauge will be correlated to a .04% limit for ovality.
- 7631-32 Not yet determined what action would be taken if the .04% ovality limit were reached. Such action will be defined in the tech. specs.

(Williams represents that this is an OL issue.)

- 7633 Pipe for which the .04% criterion applies.
- 7634 ASME code does not address ovality of buried piping.
- 7635-36 If the as yet undefined tech. spec. limit is reached, monitoring frequency will be increased to a monthly basis until remedial action is taken. (See p.t. of p. 34).
- 7637 The tech. spec. limit is not a failure point; a 0.04% limit, for example, incorporates a safety factor of 1.5. Thus, there is still a margin available which provides time for evaluation and decision on corrective action. (See p. 34)
- 7637-38 Lewis believes this process is consistent with the proposed requirement that when 75% of a tech. spec limit is reached, certain action has to be taken.
- See Kane testimony p. 8, noting that in a 12/15/81 report, CPC suggested a 75% notification.
- 7639 Strain on the pipe will be measured by means of an equation which converts the stress into the ovality figure.
- 7639-40 Accuracy of the ovality reading depends on accuracy of the measuring instruments.
- 7641 In converting stress to ovality, it is the development of the elliptical shape that first indicates that collapse (bifurcation) is imminent.
- 7642 Additional means of confirming the data that is gathered from the stress measurement devices:
- (1) control gauges, not attached to pipe, will be read periodically to determine adequacy of the gauges which are installed on the pipe.
 - (2) settlement monitoring of the piping.
- Justification for doing settlement monitoring only once a year after the fifth year. (See p. 34 of testimony).
- 7643 Settlement monitoring is being done on a continuous (daily or weekly) basis during the dewatering process.

- 7645 Lewis does not expect any significant differences between present readings and those that are predicated for the permanent dewatering system.
- 7646 Disc. re: whether the pipe exceeds ASME criteria.
- 7648-50 Lewis agrees with Tedesco that when you calculate stresses based on the present profile of the pipe and assume that the profile results from settlement conditions, that you calculate very high stresses in excess of the ASME Code allowable. However, he feels strongly that this is an artificial calculation whose stresses are not real. For that reason, CPC has chosen a demonstration solution of measuring the pipe and continuing to monitor its condition instead of doing an analytical solution.
- 7651-52 It is assumed for the stress analysis that the pipe was initially installed in accordance with specs, so that any change in the pipe was the result of settlement, and not entirely the result of welding.
- 7653 Can't be certain that the pipe was installed according to the specs.
- 7655 QC records indicate that piping was installed properly and the welds were performed properly.
- With some exceptions, kinks that occurred near the joint are within specifications.
- 7656 CPC not planning to do anything differently in rebedding and reinstalling.
- 7657-59 Relation of soil properties to stress in the pipe.
- 7660 Effect of soil on piping in areas of traffic.
- 7661 No indication that traffic from railroad loadings or other types of equipment loadings at Midland had caused deflections in the pipeline.
- 7662 In Fall 1981, an extensive program was conducted by SW Research to measure elevation and ovality of the piping.
- 7662-65 How ovality was checked for various pipe sizes.
- 7666 Midland soil is variable more in terms of compaction than of type of material.

- 7668-70 Referring to IE 78-20, which discusses soils under-
neath the ad bldg., and which Meisenheimer has no
familiarity with, Stamiris asks if Meisenheimer
knows of any voids or chunks in the vicinity of the
buried piping.
- Meisenheimer: The only pipes possibly having a
void around them would be pipes close to buildings.
Fill might settle away from the bottom of the pipe,
and bending might result.
- 7671 Voids around the pipe are very unlikely because
of the depth (7-9').
- 7672 Possible effect of voids.
- 7673 The 26" and 36" pipes are the most critical in terms
of response to soil settlement.
- 7675 Strain monitors will be installed in the pipes at
the points of highest measured ovality. (See p.
34 of testimony).
- 7676-77 In the future, the highest bending stress increase
will occur where there is the most differential
settlement, but there won't be an abrupt differential
settlement because of the nature of the soils. A
possible abrupt change could occur at a point of
anchorage. Points of anchorage, however, are not
moving as much as the soil is settling.
- 7679 Lewis not familiar with alleged CPC position that
ETEC is too conservative. (See summary of 1/22/82
meeting).
- 7679-80 Other than water pipes, there are two small lines,
one which carries air and the other fuel oil for
DGB.
- 7680 There are non-safety grade pipes, but no safety
grade pipes, between SWPS and cooling tower.
- 7681 Non-safety grade pipes not being monitored.
- 7683 Lewis' analyses have considered minimal allowable
wall thicknesses -- which includes a corrosion
allowance -- in the BWST piping.
- 7684 Corrective action for corrosion of pipes in 1979;
cathodic protection system.
- 7685 Lewis does not know whether that protection extended
to all piping at Midland.

7686 There was substantial review of corrosion in piping following the 1979 problem. Lewis has read a brief summary of the finding, and does not feel that it is of further concern in the context of settlement of buried piping.

CROSS BY MARSHALL

7686-87 Safety grade buried piping is fabricated to the ASME 3 code, which requires inspection and records of inspection. Those requirements and inspections provide confidence that the piping installed is fabricated and installed acceptably.

7687 Piping is all below frost line; thus not affected by seasonal variations.

7688 Vibrations from construction machinery will not affect the pipes.

7689-92 Scheduling matters.

CROSS BY BOARD

7693 Elevation tolerance of the seismic Category I piping, according to the design, is $\pm 2"$. Measurements taken indicate an extreme measurement of 12" below the design elevation (re: 26" and 36" piping). Most were in the 4" - 6" range of deviation from the design.

7694 QC extends to installation and placement of Category I pipes.

There are no NCRs on pipe deviations; there should not be any.

7694-95 2" tolerance in the design elevation is a construction tolerance. Records indicate that the pipes are in accordance with the specs, but numbers as to actual elevations do not exist.

7696 Nearly the entire body of experimental knowledge that exists re: use of strain measurements relating to ovality and buckling is referenced in Lewis' prepared testimony.

7696 Reference to "Reddy" paper.

7697 Lack of data reflects the fact that buried piping has excellent experience.

- 7697-98 Earlier, Lewis stated that the relationship between ovality and strain was based on experimental data. Correction: it is based purely on theory. (See equation, pg. 26, Fig. UP-9).
- 7698-99 Curves on UP-9 are representative of the 26" and 36" pipe, using the equations on p. 26. Data for Figure UP-8A is from the literature.
- 7700 Explan. of quantities shown in Fig. UP-8A.
- 7701 Strain in a pipe is often measured by taking the average of a number of gauges located in the inner radius of curvature of the pipe at the region where failure is anticipated.
- 7702 1.5 x FSAR earthquake used for the seismic analysis at Midland.
- 7702 Acceptance criterion for ovality of pipe contains sufficient margin for earthquake loads.
- 7703 How net differential settlement expected in buried piping was estimated.
- 7704 Occurrence of ovalization (See p. 21 of testimony)
- 7704 Strain gauges (p. 33) are trouble-free up to 20 yrs. or more, and potentially longer.
- 7705 Plan is to use strain gauges over the life of the plant.
- 7705 Sensitivity of the strain gauges is adequate for the present purpose.
- 7705 Summary of remedial actions on piping: Fig. UP-13.
- 7706 Staff concurrence on remedial actions: There is basic agreement, but still discussing exact monitoring locations.
- 7707 Explan. of details on Fig. UP-1.
- 7707-08 Differences between December '81 and February '82 testimony have been discussed w/the Staff.
- 7709 Monitoring program in December was based on some level monitoring and flow verification measurement. Now, ovality strain will be monitored based on ovality in settlement.

- 7710 Non-seismic piping is not part of Lewis' testimony.
- 7711 A road or railroad would not have significant effect on piping.
- 7711 Point at which a load would become large enough that it should be analyzed. (See response to 50.54(f) question 34). Such loads are not anticipated.
- 7713 No CPC-Staff agreement yet on whether 3" constitutes a criterion beyond which further studies should be taken (See p. 10).
- 7714 Further action will be taken if measurements exceed the criterion.
- 7714-15 Of the 22 lines of service water piping (Table UP-1), 12 were analyzed.
- 7715 Lewis has adequate data to predict what will happen to the other 10 lines.
- 7716 Not conceivable that a pipe would start leaking or breaking as a result of soil settlement and loadings.
- 7718 Where the piping comes through the building wall and leaves the soil, it is not fixed or anchored. For the seismic analysis, then, such pipe was considered a "free connection." (See § 41.3 of testimony).
- 7718 Strain measurement = degree of and change in internal energy.
- There is a specific range of acceptable values beyond which action is taken. (See p. 33)
- 7719 Disc. of 2 criteria on p. 32 of prep. testimony.
- 7720 "Seismic event", as used at p. 35, No. 3, has not yet been defined. Lewis would not expect it to mean every seismic occurrence.

REDIRECT BY WILLIAMS

- 7721 Meaning of fit up tolerances with respect to laying of pipe.
- 7723 Lewis believes that measurements of either the design location or fit up tolerance were done properly and documented properly. This belief is

compatible with subsequent measurement of the location of the pipe as it appears in the profile measurement.

- 7724 Although there are some points where measurements on either side of each weld are outside of the fit up tolerance for the pipe, they do not indicate any actual mismatch at the weld.
- 7724 Follow-up to earlier question: Lewis reviewed weld records of line 26 OHBC 56.
- 7725 Follow-up to earlier disc. about the stress analysis leading to high stresses at local points on the piping. Results of analysis show that stress loads were acceptable.
- 7726 High stresses are an artificial result of a method of calculation which did not take into account the possibility that kinks would have been caused by fit up or installation.
- 7727 Difference between analytical and demonstration approaches to the problem of the pipe.
- 7727 Follow up to earlier confusion as to placement of settlement monitoring instruments: disc. of criteria for placement.
- 7728 Type of analysis that was used to arrive at settlement projections has been based on varied markers in the fill (borros anchors).
- 7730 Amount of settlement in future will probably be considerably less than what has already been experienced.
- 7731 Any unusual development would occur in the first 5 years.
- 7732 Fundamental reason for conversion between strain and ovality is to compare existing ovalization measurement with future strain measurement.
- CROSS BY STAMIRIS
- 7733 Strain is a more direct measurement of what is going on.
- There is no technique to measure ovality during the life of the plant.

7734 Assurance re: adequacy of strain gauges based on vendor's representations and direct experience using them.

7736 There will not be a control gauge at each point of strength measurement on the piping.

7736 2 gauges measure the strain on the pipe at each point.

7736 Tech. specs (CL) have not yet been written, but if there is a reading that exceeds the spec, then any evaluation done on that reading would require Staff's approval.

7737 Technical specs will include a clear and definite time limit for reporting any measurement.

RE CROSS BY BLUME

7738 Confidence in the reliability of the strain gauge based on (1) inherent (simple) nature of the design, (2) general technical applications experience, (3) test information, (4) vendor information.

7739 Inconceivable that cracking in buried pipes would occur as a result of settlement or seismic events. This opinion based on ovalization and strain criteria that have been developed.

7739 Point at which the 26" pipes would crack.

7740-41 The most significant differential settlement affecting the pipe will occur at points of anchorage, most of which are near buildings. Could also occur where pipes pass over duct banks or concrete encased pipes.

7441 RE CROSS BY STAMIRIS

7444 Landers would anticipate cracking to occur earlier if a given length of pipe were wrinkled and thinner at its surface.

7444-45 Code requires that corrosion be considered in determining pipe wall thickness.

CHEN, KANE HOOD
DIRECT BY BLUME

- 7746 Hood is NRC Staff Project Manager for Midland.
Kane is an NRC geotechnical engineer.
Chen is a nuclear technology engineer. He is manager of the Stress Analysis Unit at ETEC and a consultant to NRC re: Midland.
- 7747-51 Corrections to Kane prepared testimony: update to reflect current CPC submittals to NRC Staff and Lewis testimony.
- 7752 Kane testimony admitted into evidence.
- 7753-61 Corrections to Chen/Hood prepared testimony.
- 7762 Chen/Hood testimony admitted into evidence.
- 7763-64 Staff concerned about whether strain gauges will last 40 years. Would like CPC to replace gauges if necessary.
- 7764 Kane agrees with Meisenheimer re: settlement monitoring program, expect he wants to put settlement monitors at locations where the largest differential settlement might occur.
- 7764 Staff hasn't yet formed an opinion re: adequacy of CPC's plan to replace the 36" SWPS pipes.
- 7765 Chen: Maximum differential settlement of pipes does not necessarily occur at the anchor points, as Lewis, Landers & Meisenheimer ("LLM") have testified. (See LLM prep. test. at p. 10).
- 7766 Not necessarily conservative to assume that all deviations from the design locations are due only to settlement. More conservative to assume maximum differential settlement along the line. (See LLM, p. 13).
- 7767 Chen: data in Table UP-2 is not plotted in figure UP-8A of LLM prepared testimony, p. 21.
- 7768-69 Regarding the statement at p. 21 of LLM testimony that "ovalization of less than five per cent are of no concern," Chen says the "five per cent" assumes compacted soils and fairly good backfill. Such is not necessarily true for Midland.

- 7769-72 Chen disagrees with the method by which CPC converted strain data to ovality data. Should account for inelastic as well as elastic behavior.
- 7773-74 Collapse is not only a yield strength phenomenon, but also a geometric phenomenon; it also depends on the D/T ratio of the pipe (See LLM, p. 23).
- 7774 Chen disagrees with procedure given on p. 24 at LLM testimony whereby plots of yield strength v. ovality are used to obtain a critical ovality for the 26" and 36" pipes. That method ignores D/T or geometric considerations.
- 7775 Regarding the two equations relating strain to ovalization on p. 26 of LLM testimony, the ovality equation is acceptable since it is based purely on geometric considerations. The W_0 equation is inappropriate because it is based on elastic analysis only.
- 7775 Chen disagrees with method of calculating seismic stresses given on p. 27 of LLM testimony.
- 7775-76 Given soils at Midland, other criteria in addition to ASME code should have been used.
- 7777 Concern about large D/T piping.
- 7777-79 Board: why all this detailed critique when NRC and CPC are in process of resolving these issues anyway?
- 7779-80 Stamiris: purpose is to allow Board to decide reasonable assurance on the issue of buried piping.
- Board allows questioning to proceed.
- 7781 Chen: ovality criterion of 4% is satisfactory to preclude buckling for 26" diameter piping (See Chen, p. 11).
- CROSS BY BOARD
- 7781-82 Hood is not certain whether CPC intends to obtain Staff approval before rebedding pipe.

- 7782-84 In the past there have been ongoing discussions between CPC & Staff on rebedding and other remedial work. If Staff agrees in concept, CPC begins the work.
- 7786-88 To Hood's knowledge, CPC's voluntary commitment re: Staff approval prior to doing any work is still in effect.
- 7789 In the past, Staff approval has been sought on remedial actions. Hood considers replacement or rebedding of pipes a remedial action.
- 7789 CROSS BY STAMIRIS
- 7790-91 Hood realizes that now that the underground pipe is a remedial action that should be subject to CPC's voluntary commitment.
- 7792 Staff & CPC are agreed on certain of the underground piping issues; others are still under review.
- 7793 36" pipe is to be entirely replaced; the 4% criteria for the 26" pipe is acceptable.
- 7793 In his prepared testimony, Chen explains the method by which he derived the acceptance criterion for 26" piping.
- 7794 Kane: Strain gauges will be monitored to ensure they are functioning properly.
- 7795 Chen: CPC proposes to evaluate the condition of the pipe in terms of strains. Chen agrees with this method, except the part which converts from strains to ovality using the Woods formula. This item to be resolved.
- 7797-7804 Objections to questioning about soil beneath ad bldg being same as soil surrounding the piping. Reference to IE 78-20 and 3/22/79 letter from Kappler to Howell, at p. 21 of attachment entitled "Review of Settlement of Ad Bldg Footings."
- 7805-06 Williams: Meisenheimer testified there was no indication that such conditions exist under any piping.
- 7807 Kane disagrees; says such conditions may exist.

- 7807 Stamiris Ex. 34 for ID: 10/20/80 letter from Tedesco requesting details of stress analysis for UG piping.
- 7809-11 Accuracy of Tedesco's statement that "the maximum bending stress due to soil settlement for several of the pipe profiles already exceeded the ASME code allowable stresses in the material yield strength" depends on which version of the code is used: 1971 - - NO; subsequent versions - - Yes
- 7811 Also depends on the "end positions" (free or fixed) that are assumed in the models.
- 7813 NRC policy is to assume safety by applying codes on a case by case basis.
- 7813-14 Some conditions that were evaluated for the pipe in 1980 (apparent reference to 10/20/80 Tedesco document) are not valid based on later and more accurate data.
- 7815 NRC policy is to use the ASME code that is most appropriate (i.e., current as of time of construction), not necessarily the most recent.
- 7815 Hood not qualified to say whether the current ASME code allowable stresses have been exceeded.
- 7819 Rebedding a pipe = relieving the existing stress in it.
- 7819-20 There were some seismic Category 1 lines which were assessed as overstressed, but Hood cannot identify them.
- 7820 Hood not aware of any NRC inspections re: rebedding.
- 7822 Stamiris Ex. 34 entered into evidence.
- 7823 Regarding Kane testimony at p. 3, Q. 8(A)(5), Kane says soil profiles were provided for two pipe lines.
- 7823-24 Not yet determined what additional profiles NRC will need to work out the details of the monitoring program.

- 7824 Chen testimony addresses non-Q piping only to extent that it runs under some Category 1 piping.
- 7825 Hood thinks that failure of the non-Q piping could have an impact on the safety system at Midland.
- 7826 Staff concerned that a break of non-seismic line directly beneath DGB (and other structures) may cause liquefaction problems.
- In its review of the dewatering system, Staff is considering those matters.
- 7827 Stamiris Ex. 35 for ID: NRC Summary of 7/18/79 meeting on Soil Deficiencies at Midland, prepared by Hood.
- 7827 Hood's summary notes a corrosion problem with the condensate storage tank piping, which is stainless steel. BWST piping is also stainless steel.
- 7828 Stainless steel is not supposed to corrode.
- 7828 It is thought that the cause of pitting in the CST piping was due to use of the pipe as a grounding for electric arc welding purposes.
- 7828-29 In about 8/81, Hood requested CPC to verify, in conjunction with its cutting of the BWST lines, that no such pitting exists in the BWST piping.
- To date, CPC has made no response.
- 7830 Chen/Hood not qualified to say whether properties of the water in the soil could cause an electrochemical attack.
- 7831 Tests were done on the chemical composition of the soil. Hood doesn't recall who conducted these tests.
- 7832 Except for the BWST and CST pipes, most piping at Midland is carbon steel.
- 7834 Hood not a corrosion expert, but says carbon steel is more resistant to corrosion than is stainless steel.
- 7835 Decker wants Staff to address the issue of piping materials.
- 7838 Stamiris Ex. 35 admitted into evidence, minus the handwritten notes.

ABSTRACT
MIDLAND HEARING

FEBRUARY 19, 1982

- 7842 Preliminary matters
- 7843 Report on meeting between Staff and CPC, evening of 2/18/82: It was determined that there was some apparent confusion on the part of people who were hearing the testimony. That confusion will be clarified in cross examination.
- HOOD/CHEN/KANE
CROSS BY WILLIAMS
- 7845 Additional items which have been resolved as a result of disc. on 2/18/82.
- 7846 Seismic analysis--rattlespace criteria: CPC will give Staff information from its soil property perimetric study.
- Monitoring program: Staff agrees that conversation between strain and ovality is possible; details to be worked out.
- Staff will not require an analysis in which a load combination would become binding.
- Staff agrees that the monitoring program for 26" pipes is acceptable in place of the analysis.
- 7847 Staff position on pipes larger than 26" is still open.
- Pipes larger than 26" will be replaced.
- Staff has no problem with pipes placed after the surcharge program.
- 7847 Chen's critique of CPC on 2/18/82 merely reflects a difference of professional opinion.
- Chen believes the acceptability of the 26" pipe, based on criteria stated in his testimony, will remain essentially the same when the formal version of the conversion curve is developed.

- 7851 Chen has reasonable assurance that the 26" pipe can function safely throughout the lifetime of the plant.
- 7852 Staff expects CPC to submit a plan for the details of the settlement monitoring program, along with three additional profiles to evaluate locations for monitoring.
- Re: strain gauge, Staff agrees generally in concept, but the details must be worked out and submitted to Staff.
- 7854 Kane: monitoring locations which have been identified are acceptable. Staff also wants additional strain gauges elsewhere.
- 7855 The additional soil profiles have been asked for in the past. Two were submitted after Kane wrote his testimony. Kane also expects the three additional profiles referred to earlier (Tr. 7852).
- 7855 List of information to be set forth in the soil profiles.
- 7856 Other open items:
- (1) Documents to support the 3" future settlement prediction
 - (2) Resolve question of what value to use for calculating a soil loading of a certain magnitude. (Reference to 12/15/81 Report).
 - (3) 36" pipe issues
- 7857
- 7858 CPC will submit a proposal re: replacement of the 36" pipe. Staff will evaluate the proposal.
- (4) Issue of dewatering and recharge tests (See pp. 12-13 of Chen testimony) is no longer an open item with the MEB.
 - (5) Staff continues its review of UG piping.

- 7863 Staff will produce a witness at next piping session to address the question of corrosion as it effects function in stainless steel piping.
- 7864 Follow up to disc. re: location of maximum differential settlement.
- 7865 Both CPC & Staff start w/assumption that the critical differential settlement is between a place which has its motion restricted and another place which had its motion unrestricted.
- 7865 Hood still unable to identify which seismic category I rebedded piping had been assessed as over stressed.
- 7867 Hood familiar with 50.54(f) Q. 17 re: overstressed rebedded pipes.
- 7868 Results of Table 17-2 (50.54(f) response) indicate that rebedded pipes listed are not overstressed, but Staff disagrees with those results.
- 7869 Hood's testimony that pipes were overstressed is based on info form CPC, but Hood unable to identify his source specifically.
- 7870 Hood says he "was under the impression that the pipes were overstressed and that that was the cause for the rebedding."
- 7872-73 Source of statement on p. 11 of Chen testimony that "CPC has previously prepared a 5% ovality criterion to preclude buckling": response to 50.54 Question 19 and discussion at mee. gs.
- 7874 Chen believes that the response to Question 19 discusses a 5% ovality criterion to preclude buckling. (Williams disagrees)
- Attachment 2 to Chen testimony is a graph which sets forth data re: ovality criterion for the buried piping.

- 7887 Staff is asking for the plotting of borings that have already been taken.
- Two profiles have been submitted; the others should not take long for CPC to produce.
- 7888 Staff's understanding is that one set of hearings will be on SWPS , DGB and permanent dewatering; another on UG piping. Staff considers offsets of 2" in joining UG piping acceptable.
- 7890 NRC normally does not request pipe profiles at the OL review stage; the reason for doing so at Midland is because of the settlement problem.
- 7891 Technical specs will indicate what action is required if maximum allowable limit is reached. (See Kane, p. 10, item (b)).
- Hood: actually, the technical specs will have a lower than maximum limit which would operate as a control.
- 7892 Rattle space is the gap opening between the pipe and the penetration in a building.
- 7893 Question of whether the geometry of the piping tank connection at the BWSTs is such that the connection could have been overstressed as a result of settlement of BWST No. 1.
- Hood not qualified to answer.
- 7894 Question of whether rebedding or replacement of pipe is a remedial action subject to CPC's voluntary agreement to seek Staff concurrence.
- 7895 Zamarin says CPC does not intend to rebed any more pipes, but before it replaces any pipe, it will seek Staff concurrence.
- 7896 Should any rebedding or other remedial action prove necessary, CPC will seek approval of the Staff.
- 7897 The only pipe that remains to be rebedded or replaced is the 36" pipe.

- 7899 Staff expects CPC to submit a proposal identifying the QA procedure it intends to follow re: pipe replacement.
- 7900-7901 Before concurring with CPC's proposal to replace the 36" pipe, Staff will require info on the manner in which future settlements will be addressed, QA procedures, ovality and profile data, seismic analyses, etc.
- 7902-7904 If distorted pipe grades are the result of as-built installation discontinuities, then there should be some type of verification as to how the pipe was installed. Kane & Hood seem to be saying they would like CPC to do more measuring of the 36" pipe before it is backfilled.
- 7908 Loadings of heavy equipment such as roads, traffic or railroads will not have a significant effect on UG piping.
- 7909 Effect of the degree of use of the road or railroad.
- 7910 Kane: some limits on the amount of time that a train should be allowed to sit on top of a pipe may be warranted, depending on what the soil profiles say.
- 7912 Hood not aware of any concern of Staff re: control room pressurization tank or its associated line.

Re: Chen's amended statement concerning buckling criteria ("There could be cracking in the piping in the presence of defects."), "defects" include corrosion, and imperfection of weld or base material.
- 7913 Staff believes that the 1-1/2 margin of safety associated with the maximum permissible ovality values is adequate. (Was reduced from 2). (See p. 11, Chen).

Less than 5% maximum ovality is adequate for pipes discussed at p. 13 of Chen testimony (referencing Stamiris contention 4(A)(4)).

7915 Decker wants future testimony on the effect of bending and the ability of the wrapping to protect against corrosion.

REDIRECT BY BLUME

7916-17 Chen: Staff will require seismic and load combinations analysis for the 36" pipe, not the 26" pipe.

7918 Chen does not expect cracking to occur in the 26" pipe during the lifetime of the plant. The 4% criterion being used will preclude cracking.

CROSS BY STAMIRIS

7919 Chen agrees with CPC testimony that the rate of collapse would not be rapid because the piping is deflection controlled.

7923 Stamiris concern about which ASME Code allowable stresses and material yield strengths are legally applicable to piping v. which are more appropriately valid.

7926 Blume: though there may be versions of the code in the future that the present piping violates, CPC should not be expected to go back and dig up every inch of pipe to comply with these codes.

7928 Board sustains objections to this line of questioning.

CROSS BY MARSHALL

7930-7935 NRC Staff policy is to issue OL's for a period of 40 years, which begins upon issuance of the construction permit.

CROSS BY WILLIAMS

7936 Hood would like CPC to make ovality measurements at the time of installation of the 36" pipes in case there is a future problem, not because of anything related to the installation per se.

CROSS BY BOARD

7937 Item G of Hood's 9/23/81 "Summary of 1/20/81 Meeting on Underground Piping", is no longer a concern.

7938 CPC Exhibit No. 25 for ID: relating to Boos testimony.

BOOS

DIRECT BY FARNELL

7939-46 Follow-up to earlier questions of whether the valve pit experienced any rotation or torsion.

7946 CPC Ex. 25 admitted into evidence.

7947-48 Difference in amount of settlement of BWST 1 and 2 (1/4" and 1.1"). (Refer to 50.54(f) Q.43 which provides a settlement plotting of BWST tanks).

7949 Max. differential settlement between points TF-4, -5 and -6.

7950 Bechtel used 1.5 x FSAR SSE in formulating the modified ACI 349 load combinations.

7950 Bechtel analyzed the fdn structure for all ACI 349 load combinations.

7950-51 Bechtel analyzed each zone or region of the new ring beam for all ACI 349 load combinations.

7951 Meaning of "controlling load combination" as used in Table BWST-2, footnote 1.

7952 Meaning of load combinations described in Table BWST-4, footnote 8.

7954-56 Compatibility of Celotex w/40 yr plant life: Boos contacted a firm specializing in placement & repair of celotex; they had no knowledge of any failure of celotex resulting in distress in a tank.

7956-57 NRC Staff reserves right to cross examine on Boos' testimony.

QA

- 7958 DON HORN - DIRECT (BLOOM)
- 7958-59 At time of Ad. bldg. grade beam failure, Horn was QA supervisor.
- 7959 Proj. Mgmt. Organization personnel informed him of the failure and gave no details. Horn kept it in mind only.
- 7960 Because the failure occurred in a non-Q bldg. and because Horn's responsibilities were in the QA area, Horn's concern was merely as a CPCo employee and not as a member of the QA dept.
- Action was taken by PMO -- several soil borings around Ad. Bldg., Evaporator Bldg. and Turbine Bldg.
- Same PMO member informed Horn of the investigation, saying the results were adequate.
- 7961 Horn did not contact QA management about the failure or investigation because it involved a non-Q area and borings indicated it was an isolated problem.
- At the time Horn was not aware of any soil settlement problems in non-Q areas.
- Horn was aware of non-conforming soil conditions in Q-areas through audits he performed.
- 7962 Audit Report F77-32, e.g., was a review of records of soil compaction and moisture tests.
- 7962-64 Horn didn't connect the grade beam failure with the F77-32 information because 77-32 had to do with other concerns and he thought the failure was an isolated case.

7964 Since then, MPQAD has adjusted its procedures re: relationship of Q/non-Q areas. Now they review data with both areas in mind.

7964-65 Corrective actions Horn recommended in F77-32:

"passing test" meant to "clear" failing tests by additionally compacting soils and then testing again;

"justify failing test" meant to "explain" the failing test by doing borings and reviewing actual test results.

HORN - CROSS (BECHHOEFER)

7966 Horn's conclusion or knowledge about the grade beam failure was not documented at the time.

HORN - CROSS (STAMIRIS)

7967 Corley was Horn's QA supervisor in early '77, then Bird in mid '77.

BWM was director of QA in '77.

Hierarchy in 1977: BWM
Bird & Corley
Horn

7967-68 Horn learned only recently that Bird knew about the ad. bldg. grade beam failure in 1977. Marguglio was not aware of it in 1977.

Why would Horn be notified of the failure and not BWM? Horn worked closely with the PMO, his source of that information.

7968 PMO (Proj. Mgmt. Org.) is CPCo's scheduling entity. Functions include everything except what QA does.

- 7969 PMO's Don Sybil informed Horn of the failure.
- 7969-74 With reference to Bird's testimony at Tr. p. 5208 that a QA professional makes the assumption that "what you are seeing is a symptom of another problem", Horn says he investigates to determine whether problems exist and further investigates to find root causes of both confirmed problems and possible problems.
- 7974-75 Soil problems in a non-Q area could be a Q-indicator and should be investigated.
- 7975 Horn did not personally make such an investigation of the grade beam failure in 1977. His conclusion that it was an isolated case was based on results of investigations others had made.
- 7976-78 In 1977, Horn believed that the 2 or 3 borings taken outside immediate area of Ad. bldg. were sufficient to determine adequacy of soils.
- 7978 Horn changed his opinion sometime after the DGB settlement.
- 7978-80 DGB settlement investigation took place in the 3-4 months following the settlement. Results of the borings taken in connection with that investigation revealed to Horn that the Ad. bldg. and DGB problems were connected.
- 7981 Horn doesn't recall the connections between the two "as reason to mention the Ad. bldg. to NRC."
- 7982 Does not recall anyone saying NRC should be informed of the Ad. bldg. problem.
- 7982-86 Chronology debate.
- 7986-87 Horn now says he doesn't recall making the connection between the DGB and Ad. bldg. per se; rather, it was a matter of site-wide problems in the borings; the investigation of which commenced after the DGB settlement.

- 7987 Borings taken over a 3-4 month period beginning perhaps in September 1978. Other borings may have been taken in the tank farm area in 1979.
- 7988 JGB: wants to distinguish between Horn's DGB knowledge and that of the QA department task force.
- 7989 (By Decker): EJG worked with Horn in investigation of DGB, which included review of previous soils problems, around September 1978 to early 1979.
- 7990 It never occurred to Horn to mention the Ad. bldg. because it was a non-Q area; NRC involved with Q areas.
- 7991 While soil specifications for the DGB and Ad. bldg. were identical (and therefore it is immaterial whether Ad. bldg. was in Q or non-Q area), the inspection of each was different.
- 7991 Distance Ad. bldg. - DGB approximately 100'.
- 7991 (By Stamiris) question withdrawn.
- 7992 Audit Report 77-32, documents the review of about 2,000 soil test records. Was not in response to Ad. bldg. settlement problem.
- 7993 Hood's conclusion following the audit was that there were errors in many soil tests and that "failing" tests would have to be evaluated.
- 7994-97 Records indicate that there was a lack of compliance to the specification.
- 7999-8002 Horn doesn't recall making the statement that "Bechtel knew of US Testing density requirements failures in 1974" at his deposition (p. 82).
- 8002-03 Midland QA properly handled the results of Audit 77-32, and it would be handled the same way today.

- 8003-04 Horn recalls discussion at p. 85 of his deposition where he said the discovery of a problem in 1977 involving fill material placed in 1974 was not timely.
- 8004-05 Horn not aware of any reason why the decision was made to begin construction of DGB in 1977 despite awareness of soils problems.
- 8006 Horn often frustrated in carrying out QA because every problem is a frustration. He takes all possible preventative measures.
- 8006-07 Never felt inhibited in carrying out necessary corrective actions.
- 8007 Has felt frustrated at the backlog of work. The backlog could have affected QA soil settlement problems.
- 8008 More employees would have been helpful. When Horn requested more people he got them, and the backlog was eliminated.

HORN - CROSS (PATON)

- 8009 Sybil informed Horn of the grade beam failure in 8/77. At that time, Horn was aware that the specs for soil placement at Ad. bldg. and power block area were same, but not aware of whether actual soil placement had been same.
- 8009-11 In considering question of whether compaction problems at Ad. Bldg. are sitewide, even given that soils specs are universal, Horn believes now as he did then that the Q-listing of the Ad. bldg. is a significant factor because the inspection was not performed by QC and overviewed by QA.

HORN - CROSS (DECKER)

- 8011-12 IE 78-20, lists 16 nonconformances prior to construction of DGB (1974-77), of various types. Actually 13 nonconformances, taking into account duplicative reports. In no cases were hardware (?) corrections inadequate.

- 8012-13 NRCs and audit reports go to project mgmt. at CPCo but probably not Bechtel.
- There were a few repeats.
- 8014 CPCo identified a few repeats among the 13 nonconformances, but in total the 13 did not establish widespread failure of soils.
- 8014 Never felt inhibited because of lack of support from supervisors.
- 8014-15 On those occasions when Horn felt that engineering did not take nonconformance findings, seriously and closed them out without adequate action, he would not accept the reports until they were adequate.
- 8015-16 In the past, Bechtel QC re: soils was inadequate; 50.54f corrective actions were taken to redress the problem. Bechtel's performance is none "better than adequate."

HORN - CROSS (HARBOUR)

- 8016 Formalized procedures for both safety and non safety areas have been in existence since 1973.
- 8016-17 Organizations within Bechtel or subcontractors oversee QA for non safety structures. Separately, the QA department oversees QA for safety structures.
- 8017-18 Since January 1982, there has been coordination between these 2 groups on soil remedial work: weekly meetings with "soils remedial" people who are part of the organization which assures quality for non safety redated structures. Participants are QC, QA, scheduling and soils remedial personnel.
- 8018 Horn discovered some of the soil nonconformances himself.
- 8018 To his knowledge, retesting of "failed tests" always involved "reworking" of soils prior to the second test.

8018-20 A recent change in specs allows certain retesting to be done without reworking soils. The change takes into account tests that are higher than what is reasonably expected. Retesting is done to determine validity of the first test results. Thus, a high test does not necessarily = failing test.

HORN - CROSS (BECHHOEFER)

8021-22 QA procedures for both non-Q and Q bldgs. existed in 1977, and provided for "interface" between Q and non-Q . (Example: mechanical welding area).

8022 No procedures existed in 1977 by which Q area personnel would have been informed in detail about problems in non-Q areas such as the Ad. bldg.

8022-23 New procedures soon to take effect will redress that problem:

- (1) integrated inspection hold points;
- (2) MPQAD review of both Q and non-Q procedures;
- (3) MPQAD will review specs and QC prior to issuance.

8023-24 Under current procedures (substantially different from those of 1977), there would be greater appreciation of the broader implications of a grade beam failure.

8025 For example, Horn would be informed of it through review of soils engineer reports, management meetings, construction meetings and more awareness generally. He would cause others to take further action.

8025-26 No action by QA management has ever caused Horn any frustration or difficulty in effectively doing his job.

HORN - CROSS (STAMIRIS)

- 8026-27 Soil retest in the '77 period always involved reworking the soil prior to the second test.
- 8027-30 Had Bechtel been aware of nonconformances identified in F77-32, Horn thinks they would have taken corrective action. (Reference to deposition pp. 82-85 (?)). He assumes that if they looked at the same records he reviewed, they would have computed the test results the same way Horn did.
- 8030 Bechtel didn't have a tracking mechanism for clearing failed tests. Does not recall whether Bechtel had mechanism for determining rework required for failing tests.
- 8030-31 BS concerned that in '77 soil work continued despite identified unresolved soils questions. Horn testified that corrective actions were taken immediately re: tracking mechanism on failing tests and clearing of failing tests by QC.

RON GARDNER - DIRECT (WILCOVE)

- 8032 Gardner is reactor inspector in electrical area in plant system section, NRC Region III.
- 8032-33 Allegations re: qualification of Comstock personnel rose from mysterious phone call to NRC inspector Foster.
- 8034 Action taken: Gardner examined certifications for the 2 Comstock employees identified by the mysterious phone caller, found that the 2 were certified. NRC does not intend to pursue the Comstock matter further.
- 8035-37 Prepared testimony - corrections: change final answer on p. 4 re: how much of inspector Urbany's work was CPCo going to overinspect.
- 8038 For all QC inspectors who will be certified under the new program (which calls for documenting all on-the-job training and QA overview of certification process), Gardner believes QC inspector certification meets Midland project requirements and NRC regs. For all others, he is unable to say.

GARDNER - CROSS (STAMIRIS)

- 8038 Gardner on the inspection team that determined the need for the QC inspector audits in 5/81.
- 8039-40 In response, CPCo has made 2 changes:
- (a) conduct 100% of the on the job training;
 - (b) QA oversees QC inspector qualifications.
- 8040-41 Gardner not a member of the 10/81 inspection team, but says that Item J of 81-20 reference to "results of July audit inconclusive" came about because CPCo's July audit states that "it is not clear that successfully completing the certification process is a satisfactory substitute for education and experience." (See URI #3).
- 8041-42 Basis for determination on p. 2 of p.t. that there were "potential deficiencies" with QC inspector experience & training:
- (a) no documentation of on the job training;
 - (b) shortness of training period.
- Neither (a) or (b) in themselves necessarily indicates an actual deficiency.
- 8043-44 No other basis than URI #3 for determination that July audit was inconclusive.
- 8044 Gardner's conclusions about adequacy of training and certification program based on thorough knowledge of the CPCo July audit report.
- 8044-45 QC training and inspection program in the past was inadequate; the new changes are satisfactory and an improvement, but Gardner reserves judgment on whether it is adequate.
- 8045 CPCo performed the 11/81 audit in response to NRC request for an additional audit.
- 8046 Adequacy of CPCo's 11/81 audit.

- 8047-51 Discussion of Turnbull's concern about the lack of objective criteria with which to evaluate QC personnel qualifications. Gardner says Turnbull changed his mind because the concern no longer existed. Gardner doesn't know how it was resolved.
- 8051 Gardner sees no problem with CPCo's method of evaluating QC inspectors.
- 8051-56 Gardner favors objectivity in the evaluation of QC inspectors, but says there is no need for a rigid standardization of criteria which does not take into account individual rates of achieving certification.
- 8056-57 Actually there are certain standards that exist.
- 8057 Any deficiency in the evaluation process will be remedied by the QA overview.
- 8057-60 Gardner's understanding of discussion at p. 4 of CPCO's 7/81 Audit re: "Present Bechtel QC": In its generic letter of 5/4/81, NRR required licensees either to comply with ANSI N.45.2.6 (1978) and Reg. Guide 1.58 (Rev. 1) or to submit an alternative method for examinations of inspectors. On 11/2/81, CPCo responded by submitting an alternative method.
- 8060 Gardner doesn't know whether NRR accepted CPCo's plan (that is, the adjusted certification process described at 8039-40). Gardner finds its acceptable.
- 8060-61 One factor upon which Gardner based his opinion that the certification process is adequate (See p.t. page 3, last answer) is that Bechtel now documents on-the-job training.
- 8061-66 Gardner aware that Bechtel at one time had a different opinion concerning the need for documentation. Refuses to characterize Bechtel as having grudgingly acceded to demands to document on-the-job training.
- 8166 Bechtel QC disagreed with CPCo QA on the matter and QA prevailed, but Bechtel is not doing a lesser job than it would have had it agreed with the ANSI regs.

- 8067 Gardner can't say whether the resolution occurred after the 10/6 inspection or whether the resolution of the documentation problem came about in response to NRC IE 81-26.
- 8068-70 100% of inspections have been "overviewed" for 8 of the 9 inspectors in question. For Mr. Urbany, 500 inspectors have been over-viewed as of now. CPCo has not yet agreed to do 100% of Urbany inspections.
- 8070-80 DISCUSSION OF PMF AT DIKE
Generally agreed that PMF at Dike is properly an OL issue, but Stamiris may be allowed to participate in the OL proceeding for that purpose.
- 8080-83 Supplemental Finding brief schedule.

GARDNER - CROSS (STAMIRIS)

- 8083-86 Stamiris wants to know if the informant in the Comstock allegation is a former Comstock employee, because if so, is that one reason he is unable to provide specifics at present? Gardner refuses to reveal the identity and to speculate.
- 808-87 Simply examining the records of the 2 individuals in question would not be helpful because that won't reveal a hidden hardware problem.

GARDNER - CROSS (BLOOM)

- 8087-88 Certification process for QC inspectors involves oral examination as well as performance test in the area of specialty.

GARDNER - CROSS (DECKER)

- 8088 9 inspectors were reinspected because MPQAD wrote NCRs on them.

- 8088-89 For one of the 9, CPCo did 250/1147 and found only one error. NRC requested they do at least 250 more; at which point it would evaluate.
- 8089 For the other 8, overinspections revealed an error factor of 5.6% (61/1084 cables misrouted).
- 8089 Gardner will determine the acceptability of the final error factor when all results and explanations are in.
- 8089-90 Some of the 9 are still working. In every case, the inspectors were given remedial training and recertified.

GARDNER - CROSS (BECHHOEFER)

- 8090 5.6% error factor applied to 9 inspectors. Urbancy individually was 6.3%.
- 8090-92 Observations on why cables misrouted:

There is no correlation between experience and education. [Gardner probably means there's no correlation between experience and education and errors.]
- 8092 Gardner thinks only the 3 inspectors with 3 weeks of on-the-job training mentioned in 81-12 and Mr. Urbany were qualified through "waiver" of ANSI requirements.
- 8093 Urbany qualified via experience; Gardner doesn't think the other 3 met the ANSI requirements via equivalent experience/training.
- 8094 Cannot say whether there's a correlation between inspector nonconformances and inspectors who are qualified via equivalent experience/training.
- 8094-95 Disagrees with Gallagher's opinion that CPCo be precluded from using the waiver method of qualification. ANSI, he says, requires such flexibility, but that flexibility should be carefully applied.

Hearings Abstract

Monday, November 15, 1982

- 8550-3 Preliminary matters: Bechhoefer denies CPCo's 11/10/82 Motion for Reconsideration (re: Stamiris's new environmental cost/benefit contention) without waiting for responses to the motion. He claims Commission's recent ruling on financial qualification does not affect scope of cost/benefit NEPA issues in OL proceedings.
- 8555-68 Board allows a limited appearance statement by Billie Garde, not for evidentiary record.
- 8568-78 Speech by Billie Garde: in praise of GAP, claims credit for shutting down Zimmer. Draws comparison between Zimmer and Midland: we got Zimmer and we're gunning for you. Questions adequacy of hearing process for protection of public. Attacks Keppler's "reasonable assurance." Questions Midland's plan for independent audit.
- 8579-8584 PFS and Bechhoefer rebut assorted accusations by GAP. Further comments on necessity of full discovery, cross examination.
- 8584-6 Dr. A.J. Hendron takes stand. Corrections and additions to prefiled testimony. Testimony is accepted into evidence at Tr. 8586
- 8587-9 DX of Hendron by PFS. Hendron explains difference between his calculation of static load including dead and live load (4.85ksf) and SSER 2's (p. 2-39, 4.4ksf): he used the maximum value attainable a year ago. The calculated value has gone down since then. So the difference is between the design live load and the actual live load. His higher value is more conservative. The lower value 4.4 ksf results in a 6% greater factor of safety.

- 8609-11 Harbour: How representative were the soil samples for shear strength calculations? If the samples were not perfectly representative, how much would safety factor and bearing cap change?
Hendron: COE boring were as close to perimeter of DGB as possible. Before surcharge there was a series of borings in DGB area, even in the DGB. From these he calculated values for presurcharge shear strength.
- 8612 Steptoe clarifies: 2.37 is factor after surcharge.
Hendron: 2.37 is a different interpretation of undrained shear strength.
- 8613-15 Bechhoefer: So how is 2.37 less reliable?
Hendron offers technical answer: He did calculation for interior, presurcharge DGB in order to determine initial stress under footings, prefatory to doing calculations on COE borings leading to 2.67 safety factor, which Hendron thinks is best.
- 8615-17 Harbour asks for and receives some clarification of definitions for variables.
- 8618-22 Paton wants to "address Contention 4" with Hendron.
PPS: Staff can present its case, applicant will present its own.
- 8623-7 Scheduling matters and discussion of contention 4.
- 8627-8 PPS introduces Hendron drawing into evidence (TR. 8268).
- 8628-30 More discussion of "Contention 4" questions.
- 8631-2 RCX of Hendron by Stamiris. Is combination of static and live loads and accident or earthquake the most conservative combination for bearing cap?
Hendron: Yes.
Stamiris: does this calculation account for severe snow and ice, more severe because of moisture in area?
Hendron: That is normally included, but cannot swear Bechtel did. Does not know what figures were used for snow and ice loads.
PPS: Wiedner will testify to this.

- 8633 Stamiris: if Hendron is testifying on Bearing Cap., should he not know the breakdown of loads himself?
Hendron: It's normally included in the basic data. And we have a 75% margin because actual live load is only 25% of design live load.
- 8634 Live load includes equipment that can be moved in or out of bldg., or equipment that is part of bldg. Snow loads and wind loads are also included under live loads. Extreme wind loads would come under accident load, but for DGB would not be as great as an earthquake.
- 8635-6 Hendron continues to breakdown live and static loads, which may overlap.
- 8637-8 Bechhoefer: Hendron accounted for final result of dewatering on bearing capacity.
PPS and Hendron: Hendron's testimony in fact, to be conservative, calculates bearing cap. in absence of dewatering.
- 8638 We made calculations for both dewatered and predewatered condition.
- 8638-41 By "best bearing cap value" Hendron means value which best represents conditions as they are supposed to be, with dewatering. His analysis does account for failure of dewatering and saturation of soils.
- 8642 Even with water at 627 safety factor is 2.67.
- 8643 At safety factor 1, footing will start to punch, but the very rigid DGB would just experience a very rigid body rotation, not necessarily failure.
- 8645 Hendron considers the samples for shear strength are representative on basis of water content and dry density compared with the water content and dry density of samples taken from under the DGB.
- 8646-7 Hendron: "void" found May 19, 1982 adjacent to DGB was produced by the drilling procedure.

- 8648 The formation of this "void" has nothing to do with "quality" of the soil. Happened because there is sand below the water table. It can happen with either very loose or very dense sand.
- 8649 Shouldn't assume that the void resulted from random nature of the fill.
- 8649 Never encountered voids in the borings from DGB. Stamiris: There were voids in soils under Ad. bldg, which were worked to same specs. as those under DGB.
- 8650 Hendron doesn't know of voids in soils at Ad. Bldg.
- 8651 A big difference between finding voids in fill and in boundary between footing and fill. There was in 10/79 a void not in fill but between bottom of footing and the fill, because one end of DGB was held up by duct bank. This doesn't mean there are voids in the fill.
- 8652-3 Stamiris: Hendron should be aware of soils QA breakdown if he accepts soils data from applicants.
PPS: never any doubt cast on COE borings.
- 8653-4 In most cases borings were taken for stratigraphy, continuous samples for length of hole. Encountered no voids.
- 8654-6 There are 7 or 8 COE borings around structure. 80 borings would be far more than anyone would ever use.
- 8656 If soils really were cohesionless, they would not support a pocket.
- 8657-8 Hendron is not concerned about voids because no voids were found. A void might not be critical because DGB has continuous footing which would bridge a void. DGB distributes load over large area. Would have to be a very large void to be critical, and boring would have found it.

- 8660 All evidence of May 19, 1982 "void" indicates it was caused by drilling.
- 8660-3 Rotation of bldg. comes from earthquake, accounted for in dynamic load. Bearing cap. failure would cause rotation only if it failed along a whole side of DGB. There was rotation under the preload, from differential settlement, not from bearing capacity failure.
- 8663 Question of effect on piezometers by cooling pond concerned consolidation under preload, not usefulness of samples for shear strength in bearing capacity calculations.
- 8663-4 With the safety factors we have, there will not be any large shear displacements due to bearing loads which could disturb underground structures.
- 8664-6 Sinclair: DGB could be more rigid with mat foundation.
Hendron: Bearing cap. is higher for a wider foundation.
- 8667-8 RCX by Harbour.
Hendron: if there was a mat across full width of DGB, the width of the foundation would be the width of the bldg., instead of 10 feet. Bearing pressures are higher with spread footings. Hendron considered entire weight of structure as resting on the footings.
- 8669 Settlement does stabilize. It has gone down slightly with dewatering, as anticipated.
- 8670 Doesn't matter to bearing cap. whether given load is included in live or dead load so long as it is included.
- 8671 RCX by Bechhoefer.
Bechhoefer: how were the 6 borings in Fig. 14 chosen?
Hendron: The 6 were taken from the COE borings in DGB area. There is no selection: we took all the anisotropically consolidated tests from those borings. Would like more, so we have Fig. 13 with isotropically consolidated tests.

- 8672 More than the number of samples, the type of tests shown in Fig. 14 more accurately represents the state of the soil before an earthquake. Fig. 14 would be better with more tests. There are enough samples given (even the lowest possible) factors of safety to cover any potential void. Further conservatives: assumed 4.86 ksf static load, when it is lighter; assumed water at 627, when it's down to 500/595.
- Hendron: Seismic shakedown.
- 8674-5 DX by PPS. Testimony into record.
- 8676-7 Hendron addressed seismic shakedown only at DGB. Testimony restricted not in concept, but by the borings studied, which were from DGB area.
- 8678-80 Originally estimated dewatered water level at DGB to be 600; will actually be around 595. Makes little difference: if there are sands, sands between 595 and 600 are denser in general than sands in sill(fill?) and are under higher initial effective stress.
- 8680-2 In earthquake, DGB would rotate to north (opposite of rotation under static settlement) on the order of 1/4 of an inch. Difference between 595 and 600 dewatered level would increase shakedown by a couple hundredths of an inch. This difference is of no practical safety significance.
- 8683 Averages of shakedown at north end of DGB is approx. .17 inches. There is some variation (up to .39), so Hendron chose .25 plus or minus .15 inches. This range includes all available data.
- 8684 May not be fair to combine the DG numbers with COE numbers, because the methods of determining relative density are different (COE used boring samples; DG used blow counts).
- 8685 .65 is a constant for reducing peak shear stress to average cyclic shear stress for duration of shaking (comes from research of Seed and Lee). As shaking goes on, you fall off from peak shear stress down to very low value.

- 8685-7 Diesel generators' vibrations could possibly cause some settlement in the sand, which would reduce any subsequent shakedown from an earthquake.
Shakedown is a non-elastic phenomenon.
- 8687 Don't have enough data at low stress levels with which to estimate shakedown from generators. Would be interesting but not at all necessary to monitor shakedown from startup of generators. Could be done with present Borros anchor system.
- 8688-90 Hendron explains way entries are made in boring log and how values are translated to a relative density.
- 8690-1 The entries made for No. 19 are made for all logs where there is sand leaking through. Not where there is clay, because clay does not shakedown.
- 8691-2 "Partially saturated": Even when water table is taken down to around 595, capillary water remains up in soils--soils are moist. Capillary water actually makes shakedown less than that calculated, which was based on almost dry sand.
- 8692-3 There are sufficient borings to calculate thickness and relative density of sand, to calculate shakedown.
- 8693-4 Mentioned case of Jensen Filtration shakedown to show comparison between the relatively new calculation procedure and observed settlement.
- 8695-6 For shakedown calculations, assumed worst case of cohesionless soils, though the soils are not cohesionless.
At DGB there is usually no more than 10-15 feet of sand in any one boring.
- 8696-7 If building rotated due to shakedown, it would be almost a rigid body rotation to north, imilar to the rotation to south in settlement, but faster. Such rotations, on order of 1/4 inch, would have no effect on safety of plant.

- 8698 Even worst case shakedown of .40 inches would be reflected mostly in rigid body rotation rather than in deformation.
- 8698-9 Range of relative densities of the sand is not great, so change in relative densities due to shakedown would change calculated shakedown very little.
- 8699 Static surcharge will not make sand significantly denser.
- 8701-9 Staff calls Darl Hood to sponsor seismic shakedown testimony, SSER#2, pg. 244, section 2.5.4.5.6.
- 8702 Corrections to testimony.
- 8709-10 Hood clarifies: 1.5 times the FSAR response spectra for designing new structures is conservative. This applies to BWST foundation rings, SWPS, Aux. Bldg.
- 8711-2 Alert and action limits (SSER2 p. 250) for strain in concrete of SWPS may be unnecessarily conservative. Staff will discuss this with applicant.
- 8716 Kane sponsors bearing capacity testimony -- sections of SER and SSER.
- 8717 Knows that Hendron's static contact pressure figure is 4.8 ksf. Kane's is 4.4 ksf. Knows that 4.8 is the more conservative. Staff thinks 4.4 is the correct figure.
- 8718 Kane has no opinion whether the seismic requirements considered in his and applicant's testimony would meet the SSRS. That is the responsibility of the structural engineers.
- 8720-4 With respect to the thought, "if safety were only consideration, DGB should be torn down and begun again..." Kane clarifies this 1981 testimony of his: recognizes that there has been a problem, but believes that DGB is nonetheless now safe.

- 8726-7 Kane: same factors of safety (3 for static etc.) are required for Midland as for any plant. Staff has satisfied itself that there is the required margin of safety to have reasonable assurance that DGB is safe with respect to bearing capacity.
- 8728 Kane: doesn't know when or why applicant changed from mat foundation to footings. It is generally less expensive to build footings.
- 8729 You would have a high (higher?) margin of safety against bearing capacity failure with a mat, if load was same.
- 8731 Even if worst case safety factor of 2.13 were used, and although Staff testimony states that 2.4 is acceptable, Staff would still find 2.13 acceptable. 2.0 is the lowest factor of safety which staff would accept.
- 8732-3 Kane is aware of no aspect of Midland that Staff approves with a factor of safety less than that required of all plants.
- 8735 Other plants Kane has been involved with have not had bearing capacity problems at DGB.
- 8735-6 Many structures are built with wall footings as at Midland.
Soil problem at Midland is not bearing capacity but settlement. Other projects have had settlement problems.
- 8737 Settlement problem at Midland is comparable to problem at North Anna; it is not as bad as at Zimmer.
- 8738 There has been settlement at both north (sand side -- approx. 3 inches) and south (clay side -- 6 to 7 1/2 inches) sides of DGB.
- 8738 Soil problems have no relation to bearing capacity.
- 8739 (Seismic shakedown, again) vibration from generators could cause a very small amount of settlement -- as shown in applicant's testimony (Dr. Woods) -- much smaller than earthquake induced shakedown.

- 8740 Kane hopes applicant will monitor settleme t
due to shakedown before and after startup of
generators.
Staff and applicant are working out long-term
settlement monitoring program, which would
include pedestals on which the generators are
founded.
- 8741 The long term monitoring program will be part
of a tech. spec. Monitoring at startup of
generators ought to be included.
- 8742 PPS will check with CPCo about monitoring
commitments and inclusion in tech. specs.
- 8742 CPCo may already have committed to monitoring
at start up of diesel generators.

Hearings Abstract

Tuesday, November 16, 1982 TR 8741-8972

- 8746-7 Preliminary matters. Board has received copies of new S-3 policy statement. Board is inclined to dismiss the proposed S-3 contentions, but will allow parties to make a statement.
- 8747-9 Sinclair offers the exact quote of Kane on option of removing DGB and starting again (Tr 4209). Sinclair states that Palladino has strongly criticized consideration of cost and schedule.
- 8749-50 Paton responds to Sinclair's statement. NRC can only require spending to reach safety requirements, not to surpass them.
- 8750-4 Stamiris adds her comments. Sinclair goes on.
- 8755-6 PPS: There has been no compromise to the safety of the DGB. Sinclair misinterpreted CPCo's concession. CPCo conceded only that appraisal of ad. bldg. grade beam failure as an isolated event was a mistake.
- 8757-61 Scheduling matters. MIM makes statement on construction schedule. Seems clear schedule has slipped. We'll let you know more exactly in first quarter of 1983, after we have actual experience in underpinning. Construction cannot be done by 7/83.
- 8761-8783 Paton pushes for schedule now. MIM's statement not satisfactory. Forecast panel has not and will not visit site for a while, at CPCo's request. Further discussion by all of scheduling.
- 8783-85 Further preliminary matters: proposed stipulations on SWPS and on DGB.
- 8786 Stamiris requests extension of discovery deadline on cost/benefit contention.

8790 Preliminary: NRC should offer staff witness, during QA hearing, on NRC enforcement policy, standards for implementation.

KANE

8796 Kane Testifies on Stamiris 4-A-1.

8797-8 Stamiris contends that preload did not change composition of the soils. Staff's position is that it did. Preload increased density of the cohesive materials. We know the shear strength and compressibility of the soils. Staff agrees that there is an adequate margin of safety against bearing capacity failure.

Soils are not now at 95% maximum modified density, but we have required the equivalent in shear strength and compressibility.

8799-8800 CX by Board. Cohesive soils are at 95% density or better. Cohesionless soils are not made dense by preload. Hence question of seismic shakedown and liquefaction, addressed elsewhere.

CX by Stamiris.

8800 In checking applicant's calculations, Staff first agrees that correct shear density is used and then checks methods of calculating safety factor.

8800-3 Kane knows of no plant where NRC does its own boring and lab tests. COE observed the 6 borings at DGB.

8803-4 Do not feel there is bearing cap. failure at DGB(?). There has been differential settlement, and it would have been better to have had 95% modified maximum density before building.

8805-7 The separation of geotechnical evaluations into distinct elements is rational procedure. Analyses of bearing cap. and liquefaction are put together, with the help of SRPs and Reg. Guides, in the SER and SSER and thus insure that safety requirements are satisfied.

88077 There is generally one reviewer in each engineering specialty in the NRC who gathers the separate assessments and judges safety.

Usually one plant will have one geotechnical reviewer. Because of difficulties at Midland, NRC has used more consultants than usual, and Kane has coordinated and summarized their efforts in the SER.

- 8809-11 Other problems with DGB--structural integrity etc.--caused by inadequate compaction will come up in DGB hearings. We will not go back and prove 95% compaction has been achieved.
- 8811-14 Stamiris on Ad. Bldg. voids and settlement. Kane: There were voids in the fill.
- 8814-15 Kane on possibility of voids under DGB. There were many borings including 6 observed by COE, sufficient to insure that there are no voids.
- 8816 If there were voids, their effect on bearing cap. would depend on their size. Small voids would be bridged by wall footings. Large voids would significantly affect bearing cap.
- 8816-18 There are more borings at DGB than one normally has.

Staff felt additional borings were necessary to demonstrate effectiveness of pre-load. Staff is now confident of results.
- 8820 Re: May 19, 1982 "void". Kane is as certain as can be that the "void" was caused by drilling.
- 8821-2 If it really were a void, it would be important for bearing cap.
- 8823-4 Kane believes snow and ice loads are included in the calculations of bearing capacity. The magnitude of those loads is the responsibility of the structural engineer. Geotech calculates their effect on foundation and bearing cap.
- 8825 Kane doesn't know if unusual snow and ice loads have been taken into account.
- 8825-6 Through cracks would not influence bearing capacity analysis unless they were very large, because they would not cause a major redistribution of load.

- 8827 If DGB really were -- as Dr. Anderson said -- a pile of rubble, that would not affect bearing cap. analysis. It might make you wonder about settlement and its future impact.
- 8828 Bearing cap. does affect structural integrity but not vice versa, unless there has been redistribution of loads.
- 8829-38 Marshall on "reasonable" and "one stinking little void".
- 8838 What is a "reasonable" number of borings depends on what you find with the borings. A smaller number is "reasonable" if your first borings indicate uniform conditions and allow you to understand the geology, so that you do not anticipate significant changes.
- 8840 Method for establishing, for the static condition, safety against bearing capacity failure is widely accepted.
- Hendron's method for evaluating safety in earthquake is not as widely accepted. It is a newer sort of problem. NRC has reviewed Hendron and Bechtel's calculations and have concluded that there is an adequate margin of safety.
- 8841 As far as he knows, there was only the one "void" produced by drilling
- There may have been a SWPS boring that had difficulty clearing an obstruction and thus loosened material in that area.
- Both these events are being examined to demonstrate that drilling was the cause.
- 8842-3 Hendron did calculations, reviewed by staff, based on the six COE borings.
- One set of Hendron's calculations was based entirely on the COE borings.
- 8843-4 Hendron also did calculations based on all the borings.

8845-57 Afternoon session, scheduling and discussion of SWPS and DGB stipulations. If we are not able to stipulate, NRC presentation of DGB case will be very different.

LEWIS

8857-63 Donald Lewis testifies on UGP, additions and corrections.

8863-8 Examination by Board questions Lewis's qualification to sponsor the testimony.

8868 Lewis's testimony into the record.

8869-70 Exam by Board (Harbour). Acceptance criterion for settlement is 75% of 3 inches (guide line No. 1). Guideline 2, for location of future potential high settlement due to underlying utilities, is also 75% of 3 inches.

8871 The guidelines apply at each individual marker. Guideline 2 locations were set up to show any unexpected effect from underground utilities.

If a settlement marker exceeds allowable settlement, there would be an investigation, whether there is differential settlement along a pipe or at a point.

8872 Strains would be different if resulted from 75% X 3 inches over 30ft. or from the same over 1 foot.

8872 Harbour: There are no criteria which specify allowable combinations of differential settlement over lateral distances (e.g. one inch settlement over 1 foot laterally is acceptable ?).

8873 CX by Stamiris. We have proposed technical specifications for monitoring longterm settlement - ch. 16 of FSAR. It may become more specific in the process of being approved.

8873-4 Applicant now plans to monitor more frequently than originally planned, until we demonstrate that condition has stabilized.

- 8875 Monitoring frequency is now at least every 30 days during first 6 months or until settlement has stabilized at less than or equal to .1 inches from previous reading.
- 8875 There was an inspection of BWST supply line. The inspection found no corrosion problems.
- 8876 Evaluation of 1 inch control room pressurization field line -- the only buried, safety-related stainless steel line presently installed other than the BWST supply line already investigated -- is not yet complete.
- There is stainless steel non-category 1 piping at the plant. Corrosion that was found on this piping was localized pitting. If undetected in other pipes, it could result in leakage. Those are condensate pipes containing water.
- 8877 Carbon steel pipes are protected from corrosion by a coating and by a cathodic protection system.
- 8878 At some locations the welding machine was grounded to the grid of copper wires, the plant's grounding system. The ground connection from grid back to component being welded may not have been solid. Current sought path of least resistance, through the piping, which caused pitting. Coating on carbon steel is a high resistance barrier between piping and ground.
- 8879 There are procedures to prevent stray current from affecting stainless steel pipes. Workers now take greater care to assure a firm grounding path for welding.
- 8880-1 All safety grade stainless steel pipes were inspected, except the 1 inch control room line, which is still being evaluated.
- 8882 Carbon steel pipes are more common at plant (at least among non-safety grade).

- 8882-3 The coating on all carbon steel pipes, excavated for various reasons, is inspected visually. If there were pitting, it would occur where coating was damaged.
- 8883 The coating is a coaltar base coating covering entire outer surface of pipe. Stainless steel pipes do not have this coating.
- 8884 Combined with the February testimony, the present testimony covers all category I piping.
- 8884 Outside of pipes excavated and rebedded, we have not inspected any other carbon steel pipes.
- 8885 Thermal analysis considers temperature of contents of the pipe and changes in that temperature. Resulting stresses were acceptable.
- 8886 Chemical corrosion was originally thought the cause of corrosion in stainless steel pipes. This hypothesis was abandoned.
- 8888 UGP corrosion was last discussed at February hearings. It was then under investigation.
- 8889 Lewis was not aware of the specifics of the investigation in February.
- 8890-1 CPCo documents (SCRE 12, 10/21/82) on UGP corrosion and investigation have been forwarded to ASLB.
- 8892-4 SCRE 12 shows that investigation was going on long before February hearings, though not necessarily publicly known.
- 8897 In SCRE 12, the event or finding was determined not to be reportable under 55(e).
- 8898 Doesn't know if CPCo notified ASLB or parties of the corrosion concern, other than in response to Stamiris' questions.
- 8899-0 Block 5, pg. 2, paragraph 8 of SCRE 12 seems to say that at that time there was possibility of corrosion in non-safety grade piping. There was no evidence of corrosion in safety grade piping at that time.

- 8890-2 Corrosion in non-safety grade piping raised concern for corrosion in safety-grade piping.
- 8902-3 The coating on carbon steel pipes is flexible enough to undergo anticipated bending and still protect the pipe.
- The coating is not unique in industrial applications. SSER No. 2 says same.
- 8904 To Lewis's knowledge, applicant did not study the coating for flexibility.
- 8904 Bechtel did not change conclusion on source of corrosion (chemical or stray current). They merely considered various possibilities. Evaluation of chemical properties of soil ruled out chemical source of corrosion (study referenced in SCRE 12).
- 8906-7 Bechtel merely looked into the possibility of chemical contamination leading to corrosion. To Lewis's knowledge, Bechtel never attributed corrosion to chemical contamination. Lewis can't testify to all that is in SCRE 12, because he did not prepare it.
- 8908 We inspected the areas of buried safety-grade (Q) stainless steel piping, because we believed that was the material susceptible to stray-welding-current corrosion.
- 8909-10 We identified all buried stainless steel safety-related pipe in the site. This was the subject of the investigation.
- At that time, the identified buried Q stainless piping was the BWST supply lines. Portions of these lines had been excavated and were therefore inspected. Doesn't believe 100% of those lines were inspected. SCRE 12 says lines of BWST near copper grounding grid were excavated.
- 8910 Doesn't know whether it would have been more difficult to pinpoint likely areas if corrosion were chemically caused.

- 8911 Investigated chemical properties of the soil. This investigation could not be as geographically confined as investigation for stray-current caused corrosion.
- 8911-12 Cooling pond does contain chemicals. Doesn't know specific chemicals, but knows the water meets federal standards.
- 8912 Lewis's testimony speaks directly of BWST supply lines. Does not specifically testify to overall safety of piping at plant.
- 8912-19 Discussion of who should testify on overall piping.
- 8919 Potential chemical attack and stray current on pipes were studied and we concluded there was no effect. (I think he means the synergistic effect of chemical plus current.) Likewise the effect of settlement on corrosion was studied. Conclusions on chemical attack, stray current and settlement in relation to corrosion are mutually supportive. Evaluation was done by one group to determine cause of corrosion.
- 8921 Can't testify about plant's water system or behavior of liquid contaminants or constituents throughout the pond and soils.
- 8922 Under normal dewatered conditions, the BWST supply lines will be above the water level. So if there are chemicals in the water he doesn't see how they could contaminate the piping.
- 8923 Corrosion removes material from pipe wall, which would cause leakage. Leakage is not necessarily serious. SWPS piping leaks a nominal amount: it would have no effect on plant operation.
- 8924 Non-safety piping would not have an unacceptable impact of safety piping.
- 8925 Corrosion could take place in base metal alloy or in the weld joining sections of pipe.

8926 On some piping, he believes, grinding wheels are used to smooth welds.

8926-8928 Sinclair on grinding wheels and corrosion. No questions.

8928-34 Sinclair: anonymous informant on piping welds: grinding wheels are not of the required safety code. We used cheaper wheels, containing ferric oxide, which will corrode the welds.

8935-39 CX by Marshall.

8939-40 CX by Wilcove. There are certain category I 26 inch pipe lines that penetrate the valve pit at DGB. We do not now intend to monitor the rattlespace at those penetrations. This is a subject of proposed tech. spec.

8940 Where there was more potential for bending strain on the utilities there are 3 rather than 2 strain gauges.

8940 Any pitting visible to naked eye on BWST line would have been detected. Don't know exactly what percentage of pipe was inspected, but does know that vicinity of the grounding grid was inspected.

8941-2 Enclosure 2, Table 4, Seismic SSE column, of prepared testimony calculates stress on pipe by "seismic shakedown earthquake" (?). Calculations were based on a dynamic type of analysis, which used the response spectrum method.

Dynamic strain analysis was based on .18G, which is 1.5 times FSAR earthquake. Under special loading the analysis used .12G.

8942 [not comprehensible] Footnote 2, enclosure 2 states analysis using technique in approved BC-TOP-4 will be done. This uses 1.5 times FSAR earthquake. Piping not being replaced or installed was analyzed using 1.5 times FSAR earthquake. Piping being reinstalled and checked will also be analyzed with 1.5 times FSAR earthquake.

- 8944 In analysis of seismic load for buried piping, 1.5 times FSAR SSE does envelope the SSRS.
- 8944-5 Elbow on 26 inch/OHBC-15 pipe at a rattlespace (p. 2 of reference 1, 3rd paragraph, Lewis's testimony) is within 5 to 10 feet of building. If fill settled, pipe would settle with respect to building. If the building settled with respect to the fill, the shear zone at wall would probably be a gradual zone, though possibly a discontinuous zone.
- 8946-7 Settlement of structure relative to fill could possibly cause a vertical change in the rattlespace at the penetration. We will be monitoring that rattlespace.
- 8947-8 The 3 inches of predicted settlement over forty years is settlement from about mid 1981.
- 8498 It is possible that some pipe could have settled up to 15 inches from design elevation after 40 years.
- 8949 The differential position of pipe is not necessarily all from settlement.
- 8950 Piping that is being reinstalled is being laid at design elevation.
- Applicant is not doing detailed analysis of pipe not reinstalled. Instead we are monitoring it, especially for strain.
- 8951 Differential settlement of 3 inches is figure used for reinstalled pipe.
- Between SWPS and new flyash cement, because we are excavating and filling back up, we estimate 1 1/2 inches maximum differential settlement.
- 8952 Gauges used after 5 years would be subject to same maintenance and inspection scheduled as those used in first five years.
- 8953 Pg. 14 of Lewis testimony indicates several precautions against damage. All of these will be used in one phase or another. Procedures are not yet precisely defined.

- 8953 We are staking all utility locations prior to excavation. These locations are all shown on pg. 14 paragraphs C and D.
- 8953-4 Figure 4 shows dimensions of compressible material accomodating differential settlement where pipes pass between 2 types of fill. The compressible material is 40 feet long, six inches thick.
- 8954 Effect of compressible material protecting pipes is to "suspend" pipe at each end of the 40 foot lengths.
- 8955-6 To be conservative, we assume a plane shear slip between new and old fill. Essentially all motion is absorbed by the compressible material.
- 8956 In 9/81, as assistant project engineer, Lewis was given responsibility for managing resolution of concerns about the effect of settlement on buried utilities. He has for past year actively directed that work be done and gathered information on piping concerns. He has also been liason for Bechtel to CPCo, NRC, and ASLB.
- 8957 Vertical settlements (p.5 of testimony) are not used to measure differential settlement over length of pipe. See last paragraph of § 3.2. Differential settlement would be identified by gauges showing strain at a point. Vertical settlement would provide additional information.
- 8957-8 Where there is a possibility for high future differential settlement, there is concern for failure of pipe and loss of function. The strain gauges respond to that concern.
- 8958 Strain gauges on the pipe at same location as settlement markers provide direct measurement of strain on pipe.
- 8958 Design of BWST stainless pipe, as well as the other lines, inclues an allowance (thickness) for corrosion. Doesn't know exactly what the design allowance is for that particular pipe.

- 8959 Inspectors in 7/82 looked at BWST supply lines, including areas immediately adjacent to grounding grid, and found no pitting corrosion.
- 8960 That 7/82 report is summarized on last page of SCRE 12.
- 8961-2 Differential settlement is measured for new piping. Distance between points for measurement of differential settlement varies.
- 8962 Permanent monitoring system for pipe could end after 5 years, if data warrants an end. System has capacity to last for life of plant. It is a permanent system.
- 8964-5 Even with dewatering failure, would not expect change in elevation of pipes. The gauges would indicate such changes. Water pipes tend not to float.
- 8965 Tech. specs. for rattlespace monitoring for 26 inch pipe (pg. 2, Reference 1) were submitted to NRC in 9/82 FSAR. There has not yet been final approval.
- 8966-7 Marshall, comments on Bechtel.
- 8967 Settlement will be monitored at each end of transition zones.
- 8971 SCRE 12 into evidence as Staff exhibit 15.

Hearings Abstract

Wednesday, November 17, 1982 TR 8973-9192

8975-95 Preliminary matters.

CHEN and KANE

- 8995-7 DX of Chen and Kane by Wilcove. Sponsor sections of SER and SSER2, with corrections and additions.
- 8997 Chen: based on initial specifications for piping, ".12 response spectrum", the code criteria have been satisfied.
- 8998 Corrections and additions by Kane.
- 8999 Kane: Table 2 of Lewis's testimony attempts to identify permissible loads over UGP during operation. This is the first we've seen these proposed loads. (They amount to proposed tech. specs.) Staff has questions about basis of the proposed loads.
- 9901 CX by Sinclair. Kane: UGP will be monitored during operation both for settlement and strain.
- 9901-2 CX by Stamiris. There are also provisions for monitoring rattlespaces at bldg. penetrations.
- 9902-3 It is unlikely that settlement and strain monitoring of UGP will end after 5 years. But continuation of monitoring will be decided on basis of data collected thus far. There are no set criteria for deciding to continue monitoring UGP settlement after 5 years.
- There is no chance that strain monitoring will end after 5 years, only that monitoring intervals might be extended.
- 9004 Such decisions are made by engineering judgment based on safety considerations.

Kane feels that since it was necessary to install the monitoring system, those concerns (strain? settlement?) will last for the plant's life. But if you are recording at a set interval and registering no changes, that is reason for lengthening the interval.

9005 Bechhoefer raises question whether it would be better to specify that monitoring could not be ended but only the intervals increased. As it stands now, it seems that CCo could legally stop monitoring after 5 years.

Darl Hood takes stand to answer that question.

9005 Hood: Tech. Spec. review is still under discussion. Kane and Chen have expressed what they expect will happen. Staff will determine what happens to tech. spec. and monitoring once they have the data from monitoring. Staff would have authority to require continued monitoring: tech. specs. are written by the staff. They have final word. NRC has mechanism to assure that appropriate specification is in place.

Doesn't think it is necessary to specify now that monitoring will continue over life of plant.

9008 Lauer: Lewis's testimony commits to monitoring at least once a year after 5 years. So there will always be monitoring. Only the interval may vary, based on review after 5 years.

9009-10 Kane: the tech. spec. should be resolved before operation.

SSER p. 2-53, table 2.8, lists unresolved items and items still under review. So items in SSER are not all finally approved.

9011 Kane has no problem with resolution of loading over UGP in a tech. spec. later on, even though this is an OM/OL hearing on pipes.

There will be OL hearings later on. Tech. Specs. are appropriate subject for OL hearings.

- 9012 Hood: special NRC group handles tech. specs. Process begins with review of FSAR and accelerates as FSAR approaches final form. So fine points of tech. specs. - e.g. monitoring intervals - will be finalized in the last 6 months of review before issuance of operating license.
- Fact that it is in SSER is assurance that issue will not be lost.
- 9014-5 Likewise NRC does not have final agreement on some fine points of protecting dikes. It is in SSER as an open item. All these items will be resolved before plant operation.
- 9016 The 5 year initial period is Applicant's suggestion. Staff has not decided what initial review period for monitoring will be.
- 9016 Chen: if there is no seismic event in first 5 years, monitoring will still continue.
- 9016-7 Applicant has submitted tech. specs. on long-term settlement monitoring in Fall of 82 FSAR amendment.
- 9017-8 Kane: Staff has agreed to initial 5 year period for monitoring, at which point they will evaluate the frequency of monitoring.
- 9019 Monitoring data in the field is the responsibility of the Region.
- 9020-1 Kane: There is added concern for UGP because it cannot be visually inspected. However, work so far has identified the problem areas, and remedial measures (e.g. reinstallation of 26 inch and 36 inch pipe) have been carried out.
- Staff relies on monitoring for those areas where Staff has confidence in the installation or remediation. Monitoring gives assurance that nothing unanticipated is happening.
- 9021 Region will be checking the records to keep an eye on the accuracy of the gauges. Anything questionable in the records would lead them to check the gauges or how they are read.

- 9023 A constant reading would seem questionable. There are also other gauges in the area to say if a given reading is reasonable. There is also an indirect check between settlement and strain gauges.
- 9023-4 Chen: SSER is not specific about redundant gauges. Believes there are redundant gauges at specific points.
- 9024-5 If redundant gauges disagree, then you look at the other gauges in the area to decide what is happening.
- 9026 There are strain gauges at every settlement marker, but not vice versa.
- 9027 There are strain gauges at rattlespaces, that is, above ground.
- All readings both "favorable" and "negative" will be recorded.
- 9028 Kane: There could be a temptation to reject a "bad" reading in favor of a "good" one. Would rely on professional ethics. But could not pick and choose which reading to accept, because a rejected reading requires the replacement of the gauge.
- 9029-32 All readings would be available to NRC. All readings in excess of tech. spec. are reported to NRC. Current proposed tech. spec. requires that reading at allowable limit be reported to NRC, even where there are redundant gauges in disagreement.
- 9033-4 CX by Marshall. Depth at which pipes are buried varies. Some of the larger pipes, like 26 inch, are at about elevation 600. Some of the smaller pipes, like diesel fuel oil lines, are as shallow as 2 to 3 feet beneath the surface. Most of the service water lines are at elevation 625, 626, about 9 feet beneath surface.
- 9035 Diesel fuel lines are approx. 1 1/2 - 2 inches in diameter.

- Diesel fuel lines are not all at same depth.
- 9037 Diesel fuel lines are carbon steel.
- 9039-40 Kane: In reference to missile protection, there is concern about the depth of the diesel fuel lines.
- Applicant has agreed to put a concrete slab over diesel fuel lines for missile protection.
- 9041-42 MIM: Lewis identified pipe to be rebedded or reinstalled and that seismic criteria for those pipes will be .12G. Applicant is currently reanalyzing that pipe to current seismic criteria. Applicant will offer results of that seismic reanalysis for the record.
- SSRS in some instances is a proxy for 1 1/2 times the PSAR earthquake. Analysis would demonstrate that it meets current seismic criteria.
- Necessary changes, if any, to meet those criteria would be made.
- 9043 Procedural discussion on how such report and response would go into record. Staff makes no final commitment on format.
- 9044 Chen: Such reanalysis might necessitate some changes in SSER2 at p. 3-39, item 3.
- 9045 Chen: .18G was used in calculating "the soil contents for that analysis" (of SSER p. 3-39 ?)
- 9046 New data from Applicant's reanalysis will be incorporated and SSER analysis will then be complete and valid.
- There are now two sorts of seismic analysis under consideration: response spectrum analysis and BC-TOP-4 analysis.
- 9047 CX by RJL. Strain gauges can be checked against hand-held vibrating devices, to check calibration.
- This kind of check can be made every time a reading is taken.

9048-9

CX by Harbour. Settlement markers will be installed where there is possibility of high differential settlement due to underlying utilities. Marker does not measure differential settlement but settlement at that location. There are also strain gauges at these locations.

There are not settlement markers at all utility crossings.

9050

Possibility of high differential settlement is based on review of soil profiles and behavior of pipe as indicated by pipe profiles.

9051

No meaningful correlation of crossing utilities with high differential settlement. Fill, pipes and duct banks would sink together, so there would be no "hang up" over the duct banks.

In principle, duct banks are hooked up at the end, so this settlement would be limited. But most of the anticipated settlement at plant has already occurred.

9052

Guidelines 1 and 2 in Lewis's testimony resulted from discussions between NRC and applicant.

There are no criteria required as a result of Lewis's guideline 2.

9052-3

Chen: differences in settlement effects have been considered indirectly by choosing strain gauge monitoring locations based on the profiles.

Asked for profiles in combination with the borings so that we could understand where there might be softer areas. Did this by looking at blow counts.

9053

Also required settlement markers in some areas based on blow counts.

Required settlement markers where SW pipe goes from SWPS to DGB. We put settlement markers inside and outside surcharge area to verify that future differential settlement would not be a problem because of the differential loading.

9054

Piping may be bridging soft areas.

- 9054-5 Chen agrees with Lewis's testimony that any bending moment due to soil settlement will be transformed to an equal torque value; that is, bending moment would now be converted to a torsional moment.
- 9055-7 At bldg. penetrations (rattlespaces) there will also be pipe monitoring - visual check and measurement (also strain gauge?). There are provisions at penetrations to measure the annulus.
- 9057-8 Further correction to testimony: SSER Fig. 2.11.
- 9059 3 inch maximum settlement figure does not come from a particular code or criteria. The value is an estimate of maximum settlement of pipes under their own weight. Don't expect them to settle that much. Chose a conservative limit in design to show that even with 3 inch settlement pipe would not be overstressed.
- 9060 2 1/2 inch settlement figure at construction stage was for DGB, not pipe.
- 9060 Re possibility of exceeding settlement limits: staff will attempt to insure that foundation conditions of natural soil and replacement fill will preclude this. Staff will demonstrate by lab tests that natural soils will not settle unacceptably. Staff is requiring, for compacted fill, a high degree of compaction.
- 9061 Where there might be settlement, it is designed for and monitored.
- There's no specific regulatory limit for settlement. Limits are site specific.
- 9062 RCX by Stamiris. 3 inch settlement was obtained by extrapolating data from Borros Anchors where fill was not loaded with a structure over 40 years. These figures were well below 3 inches, except one which, when you consider dewatering etc., would indicate maximum settlement less than 3 inches.
- As a design condition pipes will tolerate at least 3 inches settlement during operation.

9063-4

Kane: Three inches maximum refers to future settlement from the time the Borros Anchor plots began, approx. November 1981.

The tech. spec. has not been finalized yet. But it will set the 3 inch maximum future settlement from the time the monitoring instruments are installed.

Kane: "Total settlement" would be settlement from the time we began the initial reading. This amount will not exceed 3 inches.

9064-5

Staff has addressed total settlement since installation of piping, by establishing pipe profiles etc. (?).

Applicant has proposed and staff approved check on stressing of pipe to a criteria "which is the strain in the ovality" (strain determined by ovality?). This check on settlement strain has resulted in calling for removal of certain pipes.

9065

There were no limits set for pipes which if they were exceeded would necessitate removal.

PSAR and early FSAR identified anticipated settlement for piping and structures.

Confident that PSAR and FSAR did not set limits for pipes.

9066

Doesn't recollect exact figure in PSAR and FSAR for original anticipation of settlement for pipes. These values would have depended on amount of fill under pipes. The settlement anticipated would have been nowhere near that indicated by the pipe profile.

Kane's understanding that pipe that settled 21 inches was between Turbine Bldg. and DGB -- that is, in the area of the surcharge. Surcharge and resulting settlement were not originally anticipated.

It is not now correct to add 3 inches to that 21 inches, because that specific pipe was excavated, cut and refitted.

- 9067 The settlement markers are not yet installed. Period for 3 inch settlement expectation will begin where the markers are installed.
- Until the markers are installed, we can check settlement with Borros Anchors. They indicate settlement has leveled off and will not approach 3 inches.
- 9068 Conservatism in the predicted settlement comes from designing for such a large difference in settlement. 3 inches is the maximum the pipes could settle under their own weight.
- 9069 Kane: The three inches is the maximum difference in settlement allowed in design between pipes in fill and pipes connected to structures. That difference in settlement is being demonstrated to be acceptable.
- 9070 Bechhoefer: should the period for 3 inch settlement have begun in 81 when readings were begun?
- Kane: Borros Anchors indicate that settlement occurring between the time we made our estimate (3") and time gauges will be installed is so small as to be within the extra margin built into the 3 inch estimate.
- 9070 3" estimate is a design value. Does not apply to 36" and 26" pipe being (re)installed. Chen: for those portions of 26" and 36" pipe in vicinity of SWPS founded on old fill, the 3" differential applies. For pipes founded on K-Krete, 1 1/2" was used. "So the three inch was considered for piping to be rebbeded or replaced. But I think 3" was considered in the analysis for the 26" lines which are going to be monitored".
- 9071-2 3" settlement figures does not apply to rebbeded or reinstalled pipe in vicinity of DGB surcharge. It does apply to the other rebbeded or reinstalled pipe founded on "old fill". That 3" would be differential settlement.
- 9073-4 Necessity for specific starting date for 3" settlement figure depends on the use of the figure.

For pipes in the fill, 3" settlement estimate over 40 years begins at date when Borros Anchors were installed and read. "So that is more than 3"."

2 "conditions" of when we are using the 3" figure: when we talk of "design" and of differential settlement between where pipe is supported as it enters the structure and where pipe is out in the fill. We analyze design and evaluate stresses using the 3 inches.

9074-5

Could call the 3" "expected" maximum future settlement.

Settlement monitoring will begin when settlement instruments are installed.

9076

Hood attempts to clarify preceding very confused testimony: Time from October or November '81 to date measurements will begin is insignificant. Borros measurement will tell us if that assumption is incorrect. If it is incorrect then "that amount of settlement will be taken out of the criteria."

9076-77

Kane: do not consider a variation of 6 months or a year in starting time for measurements significant because Borros Anchors indicate settlement of fill under its own weight has leveled off and is insignificant.

9078

Kane would not be concerned if measurements began any time before plant operation, so long as Borros readings showed nothing of concern.

9079

Kane agrees with Hood's statement on 3" figure at Tr. 9076.

9080

Markers will be installed as a redundant system to the strain gauges. The real criterion on the effect of settlement is the strain gauges and ovality. Ovality, which we've measured, is a reflection of strain. Ovality will indicate any future settlement. The settlement markers are not intended to reflect earlier settlement, because that is shown in ovality measurements.

- 9081-2 There are strain and ovality criteria for pipes entering buildings. They will be part of a tech. spec.
- 9082-3 Chen: Stress from whatever cause - voids, dewatering, whatever - is monitored by the monitoring program.
- 9084 Existence of a 6' X 6' void could cause "arching action in the soil." However, category 1 piping would bridge such a void.
- 9085 Monitoring really addresses strain from differential settlement.
- 9086 Kane: Because of profiling done to identify high strain areas, there is no concern that possible weak spots, especially due to voids, will not be monitored. Have conservatively required monitors wherever there could be a problem.
- 9086-7 Where pipe bridges soft soil, stress point would be pipe in the soft soil. If it did deform, profiles would show it.
- 9088 Kane: "Soft Spot" is a relative term; it does not necessarily mean it is so soft as to cause problem. To be conservative, we've installed settlement markers wherever, based on the borings, we found a change in density. Do not see any problem: pipes will be supported by the material as it exists now.
- 9089 Pipe may "bridge" in places where borings indicate change in density. Can't name specific plant locations.
- 9090 Where strain in pipe would depend on how soft a pocket is relative to adjacent areas.
- 9090 Markers placed where borings indicated less dense soil. Markers were not located because of or at possible bridging points. Location of strain gauges was based on profiling.
- If there were strain from soft spots (or whatever) indicated by profiles, we put a strain gauge there.

9092-3 CX by Marshall. Re: upheaval (by frost or whatever) Diesel fuel pipes are very flexible. Applicant has evaluated the situation and found no problem.

[Record very unclear: Line 15 and following, Kane: shallowness of pipes being addressed because they not be deep enough for protection]

9094-5 CX by RJL. Chen: plans for monitoring, reporting to NRC, and evaluating to insure safe function of the pipe if it reaches 75% of the 3" settlement are acceptable to Staff.

9095 Regardless of how much settlement, so long as strains are below limits to be imposed, the pipes will function adequately.

9096 Settlement of fill decreases over time.

9097 Hood doesn't know if a discrepancy between gauges must be reported within 24 hours. If such a condition did come under special reporting requirements, a verbal report must be made within 24 hours and a written followup within 30 days.

9100 Preliminary matters: RJL reads proposed tech. spec. from FSAR on monitoring and reporting requirements.

CHEN

9101 Chen back on stand. DX by Paton. Stamiris 4-A-4.

9102 Chen: Understands the contention to address the effect of preloading the DGB on underlying pipes, conduits and nearby structures. Here he addresses only underlying pipes. DGB piping as identified in D.10.1 figure .11 of the SSER page 3-7 (?). Some pipes were profiled, have been rebedded, some verified, some are going to be rebedded, and others just monitored.

The figure also identifies rattlespace to be monitored and strain gauge locations. Diesel fuel lines within DGB were not in place during surcharge program and hence will not be affected. Remedial action for pipes is identified in SSER under § 3.9.3.1.

9104

4 lines shown near DGB, 8" BC, 3-10 and 3-11, 8" 2HBC81 and 82. These have been verified. Current ovality is less than 5%, which is acceptable. Rattlespace where they enter DGB will also be monitored. Criteria there will be 4% ovality and .40% of strain.

The 26" lines to which these 4 lines connect and where the 26" lines enter valve pit west of DGB will also be monitored. On north side of DGB, 8" 1" BC 81 and 82 have been rebbed (shown on detail No. 1 figure 2.11). These lines have been cut loose, recentered in their rattlespaces and rebbed.

9105

8" 2" BC 3-10 and 3-11 lines will be rebbed and the 10" OHBC and the 27 and 28 lines have been rebbed.

Diesel fuel lines were not in place during surcharge and hence were not affected (all or some?).

All rebbeding happended after removal of sur-surge.

Any impact of surcharge on piping has been acceptably remedied.

9107

Stamiris 4-C. Stamiris 4-C concerns seismic loading zone of UGP and conduit. Chen addresses UGP.

26" lines near SWPS: Applicant has committed to performing dynamic seismic analysis and BC-TOP-4 analysis, based on SSRS. Applicant is committed to whatever fixes are necessary for that pipe line to meet criteria based on SSRS.

On all other lines Applicant is committed to analysis based on 1 1/2 times FSAR, which envelopes SSRS.

[Very unclear]: Analysis indicates that the additional information associated with SSRS is small relative to existing ovalities. So pipe would withstand SSRS without damage.

HOOD and CHEN

- 9108-9 Warren 3, Hood joins Chen on stand.
- 9110 Chen: Fuel oil lines were not in place in preload, hence were unaffected.
- 9110-1 Hood: Circulating water lines are not seismic category lines, are not safety-related. They are used to cool main condenser, so special provisions are made for inspecting that line from the inside. They are 95" in diameter and are at elevation 606. Staff has reviewed effect of failure of that line on dewatering. Line has been inspected since surcharge and no signs of stress were found. Previous Staff review of water line with respect to dewatering is in SER 2.4.6.3.
- 9112 CX by Sinclair. Identifies service water lines in Figure 2-37, detail 1.
- 9113 They were cut loose after preload.
- 9113-4 Profiles of the lines indicated large stress after preload. Visual inspection found the lines O.K.; they were cut loose; and then they were recentered.
- Doesn't know the criteria for the visual exam. But the settlement stresses were secondary stresses. Cutting the pipe loose would remove settlement induced stress. Remaining stress would be small and not accounted for in analysis for any code.
- 9114 Re damage done to rattlespace during surcharge settlement: at penetration of DGB the lines go vertically up the wall in a pit area and go across into DGB. That portion of the line was not in place. So it had 3 ends inside the DGB.
- 9115 To his knowledge, no part of DGB hung up on pipe, nor did pipe restrain settlement of DGB at any point.
- 9115 Condensate line goes beneath DGB.
- 9116 There are 2 condensate lines under DGB.

- 9117 Both these lines are non-category 1. Have looked at consequences of their failure on dewatering. This is addressed in SER and SSER2. The result is acceptable.
- 9118 Was some confusion whether condensate lines were cut on both sides of the DGB or one side, and whether pipe had been cut immediately after the recommendation was made or after some interval.
- The pipe was cut, just on south side of DGB, some interval after the recommendation to cut was made.
- 9120 Doesn't know if both pipes were cut at south side of DGB. Not sure which of the 2 was cut. The condensate line whose elbow showed high stress was the line cut, after the removal of the preload.
- KANE, HOOD and CHEN
- 9121 Kane joins Hood and Chen on stand.
- Hood: The pipe was disconnected at the time of the preload. There was also measurement of rattlespace between that line and the concrete encasement during preload.
- Kane: Understands that the lines were cut only on north side. Eventually Applicant decided to cut on north side before surcharge.
- Hood now agrees. High stress point, however, was on south side.
- Kane thinks only one pipe was cut. Hood disagrees.
- 9 3 (Harbour-open issue): Figure 2.11 in SSER shows only one line from condensate tanks going under DGB, while Hendron cross-section shows 2 condensate lines under DGB.
- 9124-30 Procedural matter.
- 9131 MIM refers to 50.54f question 19, which indicates 2 condensate lines. They were severed at Turbine Bldg. to prevent stress build-up by differential settlement between Turbine Bldg. and DGB. The 50.54f #19 is from 2/80.

- 9132 MIM: From Staff prepared testimony for 7/16/81 (p. 17), condensate lines cut as of 2/23/79.
- Hood agrees.
- 9133 Staff has addressed effect of preload on all seismic category 1 pipe in vicinity of DGB and further has addressed effect on seismic category lines of failure of non-seismic category 1 piping.
- 9134 To the best of Hood's knowledge, no damage to circulating water lines under DGB.
- 9134-5 Chan: Worst cases relating to effect of failure of non-category 1 pipes on category 1 pipes were examined throughout whole area of DGB. This worst case concerned depth of non-category 1 pipe beneath category 1 line, and depth of category 1 line beneath surface.
- 9136 EX by Harbour. Failure of condensate line under DGB would not have unfavorable effect on dewatering, on protection against liquefaction. This is addressed in SER § 2.4.6.3.
- 9137 Condensate line failure would not adversely affect dewatering because the line has limited volume (300,000 gallons).
- Analysis considered flow line of condensate through underlying soils to deeper natural sand. Concluded there would be no rise in water level from condensate line failure.
- Kane: Analysis conservatively considered condensate water going to foundation of DGB, restricted to a conservatively small area. Calculated water would not rise to level of concern, elevation 610.
- 9138 Felt that condensate water from failed line would be picked up by dewatering system.
- Analysis reflects complete failure and emptying of condensate line.
- 9139 Bottom elevation of condensate line is at elevation 620. Soils below 610 are not susceptible to liquefaction. Water spilled from condensate lines would not unacceptably raise water level above 610 from dewatered elevation 595.

- 9141 Time limit for heavy loads over UGP depends on time required for consolidation settlement, time required for water to be squeezed out. This will be covered in a tech spec.
- 9142 Time limit will be on order of a week. Any longer and ought to consider the effect of load on settlement.
- 9143 Condensate line is not part of monitoring program -- it's not category 1. Level of condensate tank can be monitored.
- 9145 Hood clarifies, again, on condensate lines.
There are 4 condensate lines. All go all of way under DGB. All were cut before surcharge.

WEEKS

- 9146-7 Dr. Weeks to the stand. DX by Wilcove. Prof. qualifications into record after Tr. 9147.
- 9148-9 Excavation of 36" pipe will be an opportunity to check pipe draftings.
- 9149 CX by Sinclair
Knows of 2 materials carried inside UGP: Service water and water from BWST.
- 9149-50 Doesn't know if UGP will carry low-level radioactive waste.
Doesn't believe low-level radioactive waste would influence corrosion. Were there high-level radioactive waste in the UGP, along with "some more aggressive coolants", presumably pipe material would be chosen to accommodate it.
- HOOD joins WEEKS on stand.
- 9151-2 Shown p.C-8 of "environmental statements", listing "corrosion and activation products" as liquid effluents (?) from plant.

Weeks states that these very small quantities are not likely to be corrosive.

9153-4

Weeks: Radiation does not have significant effect on corrosion unless the seals (?) are extremely high, as in the core. Even then the effects of radiation are not more than a factor of 2.

Corrosion problems at nuclear facilities are not significantly different. They get more attention.

Because they are nuclear plants, constraints on operator to control corrosion are much tighter. Corrosion of no concern elsewhere becomes a concern at a nuclear facility.

9155

Radiation does not have any (significant?) effect on rates of corrosion.

9155

Hood: Not aware that corrosion products listed on C-8 of environmental statement are carried in UGP.

9156

Weeks: Wouldn't matter if they were.

C-8 "Corrosion and Activation Products" enter the reactor coolant. If there's leakage they could enter right-of-way system.

These are corrosion products from process of corrosion. Never say there's no corrosion.

9157-8

Thermodynamically, the metal is in an un-stated (?) phase. It is protected by a series of oxides. There is some dissolution of the oxides. They have a finite solubility, especially in the high-temperature, primary and secondary coolant of the reactor.

Some of these corrosion products in coolant go to core where they are activated to form the species shown (on C-8?). By various routes -- some of which is unavoidable -- those get into right-of-way system. They are products of a very low corrosion rate over a large area of pipe.

They are not affecting corrosion in the low temperature waste pipes though which they flow. They might even improve corrosion resistance in the waste pipes.

9159-60

There are various techniques for protecting piping from the outside. There are standard, commercial means for protecting carbon steel pipe from ground water attack. This would be as good quality as would be available. Doesn't know any better. Both suppliers are reputable and established.

9160

Re: "independent check" in SER 3.12. The coated pipes have been in the ground for 3-4 years. Given the coating and galvanic protection, doesn't expect any significant changes. At some point we will replace some 36" pipes. At that time a corrosion inspector can look at the pipe. This would be a third, independent, check on the system.

9161

Weeks has not emphasized, as Sinclair does, the "highly chemical environment" in specifying corrosion protection. Has seen analysis of river water. With UGP, the corrosive species one worries about are chloride, oxygen and pH. Both the cooling pond and soil leach water are slightly alkaline. There is a fair amount of chloride in cooling pond. Doesn't know how that could get to pipes - leach from chloride from soil was not high.

9162

We do not have an environment unique to this community which Weeks would classify as highly corrosive.

9163-4

If the environment is high in chloride, would have seen it in analyses of pond water or of fill.

Along with a mild soil we have protection system -- painting and wrapping on carbon steel pipe. Redundant to that is the galvanic system which would protect carbon pipe if coating failed and stainless steel pipe which is uncoated. There would be adequate protection in a much more aggressive soil.

9165-5

Dow does have great corrosion problems.

Conclusion that pitting resulted from stray current based on fact that soil and leachables would not have produced environment sufficiently aggressive to stainless steel to cause such pitting over a few years.

For soil of this category, reference texts cite maximum chemical pitting depth of 3/10 of a million after 15 years.

9166

Pitting at Midland was very localized and very severe -- about .10" deep or more, 1/3 of the way through the wall.

Galvanic protection system could shut down because of power failures, etc. But the corrosion rate is sufficiently slow that interruption of galvanic system would not be serious for a long time.

9167

Voltage and current of the rectifiers and galvanic system are checked twice a month. The system is presently operable.

Protection of zinc annals: zinc is electrical-ly positive and thus much more readily corroded than iron. It (the zinc annals?) serves same purpose as voltage in normal galvanic system. They are redundant. Zinc would corrode instead of iron.

9168

CX by Stamiris.

9168

Galvanic protection system has been operating approximately 2 years, since 7/22/80.

9169

Galvanic system protects all the buried carbon and stainless piping he knows of.

Does not know whether the system protects non-safety lines as well. Pipes grounded into galvanic lines are protected. Hood can't say all piping is so grounded.

9170

Stamiris wants diagram of system and piping it protects.

- 9171-3 Doesn't know how many pitting incidents there were. He read two failure analysis reports by Bechtel done in 1979-81. He has reviewed Refs A and B in SER.
- 9173 Ref A is Bechtel failure analysis report on buried stainless steel piping with pitting corrosion, removed from site.
- Weeks concluded that the soil was not aggressive enough to have caused pitting which was so deep but localized.
- By eliminating chemical corrosion, Weeks agreed it could be stray current. Weeks and colleagues at Brookhaven did not think of anything else which could have caused the pitting.
- 9174-5 Presumes the report was written after the failure analysis was completed. The pipe was removed in summer 1980. By the time Bechtel finished analysis it was 1/81.
- 9175 Ref A of SER is the second Bechtel failure analysis report. Results of the 2 reports do not differ. The first did not state a cause. The second report came up with idea of stray current. They had seen field construction procedures that could allow such stray current.
- 9176 Bechtel did not attribute pitting to chemical contamination.
- 9177-8 Weeks believes the 2 Bechtel reports are the only Bechtel documents involved.
- 9179- Weeks reads excerpt from first Bechtel report which speculates about chemical corrosion, particularly about the possibility that pipe was splashed with corrosive (not that corrosive was leached down from the ground).
- 9180 Report read is Log No. 567177, Condensate Tank Fill Pipe Corrosion Study, prepared for R.L. Castlebury, project engineer.

Second report was prepared for different person. Which may be why this report is a little more definitive.

- 9181-2 Did consider ground water effects on piping. Considered that piping is above the water table. That's better than having pipe below the water table. If dewatering system failed, the coatings and galvanic system would be adequate protection.
- 9182-3 SER p. 3-42 states that leaching tests on sand from backfill at site show only trace amounts of chloride and pH greater than normal. This is part of background of his conclusion that corrosion protection is adequate. Further, the protection would be adequate even in a much more aggressive environment.
- 9184 The coating and galvanic system would be adequate in almost any ground water. Ground water around the country ranges in resistance from 100 to 5,000 ohms. Midland is at around 5,000 ohms. The system would be adequate protection against 100 ohms.
- 9185 Corrosiveness of soil is a function of amount of oxygen present, electrical conductivity of any water present, the acidity and the chloride content. In 3 of these 4 Midland is good: chloride is low, acidity is low, resistivity is high.
- 9185-6 Chlorine gas added to a lot of domestic waters as bactericide. Of itself it will not affect corrosion. When it reacts with foreign chloride, it can affect corrosion. It is more harmful to fish than metal (see FES p. 5-12, p. 4-5).
- 9187-8 None of chemicals listed on FES p. 5-12 cause concern for corrosion in carbon and stainless steel pipe. They are all commonly present in the pond water and in service water in pipe.
- 9188 Chlorine in the sodium hypochlorite would be an oxidizing agent. Would probably contribute to passivity of stainless steel. Doesn't think it would be harmful.

9188-9

The amounts of chemicals in FES. 5-12 are too small to be significant. Even the permitted instantaneous release of 750 milligrams per liter would not have an effect. Does not see that within the 500-750 milligrams/liter there could be a high enough concentration of any one chemical to cause concern.

9190

The chance of the worst case, 750 milligram/liter concentration of sodium chloride for an extended period, is remote. Nonetheless, that much sodium chloride in the neutral-alkaline pond water will not be very corrosive.

9190-2

Hood: Letter, Weeks-Bernard Turoblin, 6/29/82, states that the pond water is neutral to alkaline, approx. pH 8.29. The river at the site averages 65 parts/million chloride with possible concentration of 2.3. By evaporation of pond, service water could contain chloride up to 200 parts/million.

Hearings Abstract

Thursday, November 18, 1982 9193-9428

9195-9209 Preliminary matters. Procedure for Stamiris Contention 4.

WEEKS and Ron COOK

9209-12 Weeks and R. Cook testify. Corrections and additions to testimony of Wednesday 11/17/82.

9212 R. Cook: There have been some problems with galvanic protection system. E.g., anodes are encased in concrete.

This was discovered in excavation for BWST water lines. Encasing anodes in concrete would reduce effectiveness in protecting stainless steel pipe.

9213 Lugs attaching wires were heavily corroded: there was stainless steel transition weld to carbon steel lug. Heavy corrosion of lug not conducive to adequate cathodic protection.

Has no examples, but suggests that because of ways wires are laid through a construction site there is the possibility of damaging the wiring and interrupting protection.

9213-4 Cook did not see any corrosion of the pipe due to corroded lug. There was oxidation from the carbon steel lug, but it did not damage the pipe itself.

Also examined the rest of the stainless steel pipe in that area and found no signs of aggressive corrosion, probably because the soil is not very corrosive.

- 9215 In August 1982, inspectors noticed blown fuse links at junction boxes in galvanic system. They have since been replaced.
- 9215-6 Cook does not know if galvanic system is presently operating. Galvanic system has been turned over to CPCo.
- 9216 Cook: "Saw no aggressive corrosion" means he saw no corrosion on the stainless steel pipe other than surface rust "in a dirt condition", which was wire brushed off. Saw no pits nor wastage of pipe. Did not test for attack on base metal.
- 9217 Weeks: There are 3 parts to Midland corrosion protection: quality of soil, use of stainless steel or wrapped and coated carbon steel pipe, and galvanic system. Galvanic system is extra insurance. Loss of galvanic system for short periods not serious.
- Weeks is concerned whether all anodes are buried in concrete or that was an isolated case, or whether it was a conducting concrete used on purpose.
- 9217-9 Cook: CPCo says they will not use the anodes buried in concrete. There are several buried in concrete. CPCo has brought a blueprint showing some such locations. CPCo is installing a large number of anodes throughout the site. Doesn't know if there will be enough anodes. Will be installing more than 100 new anodes.
- 9220-22 Procedural.
- William Woodby
- 9222-3 William Woodby testifies for applicant about galvanic protection system. Professional qualifications.
- 9223-4 There are approx. 120 anodes currently installed. Approx. 14 are encased in concrete. They are primarily located in the BWST area. There are some concrete-encased anodes at the south end of DGB. Have records showing where these concrete-encased anodes are.

Site geotech. engineer did not want to take any chances in Q-soil area (because of compaction ?) so asked that those anodes be put in concrete. Used concrete backfill when installing those anodes. This was in summer of 1980. The practice of concrete encasement ended almost immediately, because of concern that concrete would insulate anodes from piping, which would defeat purpose of galvanic system.

- 9925 Records indicate that concrete encased anodes are actually working. Calculated current with voltage meters: a high current indicates something is coming out. Very high or very low current would indicate either a short or non-performance.
- 9226 Plan now to replace the anodes in concrete in first part of '83. Plan now -- not finalized -- to backfill with "coke breeze" for proper compaction and conductivity.
- Further plans to upgrade the galvanic system: in addition to present 120 will install approx. 190 new anodes near added utilities, in Spring '83.
- 9228-9 Last time galvanic system was shut down for any length of time was from February through August 1982. Was out of service for soils work and to protect workmen. To his knowledge system has never been shutdown inadvertently for an extended period due to blown fuse or anything else. Woodby would know if it had.
- 9230 CX by Stamiris. System is inspected twice a month, and Woodby checks everyday, generally. So he cannot say system was on 100% time. He has been personally in charge of the twice monthly inspections since approx. 12/80.
- 9231 Galvanic system was first operating around mid November, 1980.
- 9232-3 Encasement of anodes in concrete met all specifications for installation and "application" of anodes.

- 9234 CX by Harbour. During testing, voltage varies, depending on number of anodes in the system and on how much current you want in the system. Presently, they are trying to put 1/2 to 1 amp. on each anode. Anodes in concrete tested at approx. .7 amps, those not in concrete at between .86 and .84 amps.
- 9236 CX by Stamiris. Woodby: all those anodes not working are out for obvious reasons-e.g., lead disconnected because of digging in the area. Right now some anodes in concrete are exposed. Anodes not working are documented and will be repaired.
- 9237-41 Stamiris meets objections. No questions.
- 9241-2 Woodby does not make design specs. He tests them. There is a specification sheet specifying encasement in concrete.
- 9242 He verifies installation after it is complete. Testing is a form of QA.
- 9242-3 Woodby is from the technical department. He is neither a QA nor QC engineer. He works under the guidance of MPQAD.
- 9244 Assistant field engineer for the construction site is responsible for installation. Work crews perform the work. Galvanic system is not a Q or class 1-E system.
- 9245 Reports on tests of anodes, how much current they produce, are filed. If an anode is out of service, Woodby initiates repairs procedure. That repair report goes to the general services organization, which does the repair.
- 9246-8 If system goes off and is then turned on it will function as before.
- 9248-9 If system breaks, it will not come on again unless repaired. He has never seen nor expects to see system develop problems which repaired themselves.

- 9250-2 We do have outages, which can be planned or unplanned.
- The daily checks are just to see that the system is energized.
- 9253 Use a volt meter in twice monthly inspections. The twice monthly inspection is not mandated by a design specification, but by instructions from general office.
- 9255 There is a volt meter on the rectifier itself, which Woodby checks visually.
- The twice monthly inspections are scheduled activities separated by a couple weeks.
- 9256-8 Only anodes encased in concrete will be replaced. Those anodes have performed adequately.
- Because soil conditions may change moisture content and the concrete and how it acts as an insulator and because dewatering may change conditions, we are going to replace concrete encased anodes, thereby avoiding any questionable anodes.
- 9258 The AE (?) for Midland develops specifications for anodes.
- 9259 There is not an electrical code for the anodes.
- 9260-7 CX by Marshall. Obsession with Bechtel, Schultz and farmboys.
- 9267 RDX by Wilcove. Oxidized carbon steel lugs found on stainless pipe last summer (81 or 82?) were removed.
- 9267-8 Have separate controls for voltage and current for each anode. Does not know off hand if concrete encase anodes need higher voltage to same currents.
- Does not know about blown fuse boxes testified to by R. Cook. Galvanic system was intentionally shut off in August. Stainless pipes from BWST are protected by the concrete encased anodes.

- 9269 Additional anodes to be installed will protect systems not previously protected: domestic water lines, some fire protection water lines going out of protected site area, fire water lines for project office, some additional nitrogen lines. Pipe systems that are being added will be covered by the additional anodes.
- 9269 Do calibrate voltmeters. They were last calibrated at "checkout". Doesn't know when they are next scheduled for calibration.
- 9270 CX by Harbour. Woodby has other responsibilities. He spends 10-15% on galvanic protection system.
- 9270-1 Whole system was out from 2/82-8/82. There could be other anodes that may have been out for a longer period of time. Removal of one anode will not totally degrade the system. It would reduce the level of protection for piping in the area of the dead anode, but it will not completely negate protection.
- 9272 To his knowledge there are not substantial segments of the system which might have had defects or been out for more than 6 months. Individual anodes might be, but not entire segments.
- 9272-5 RCX by Stamiris.
Objections.
- 9275 There is no such thing as a melted fuse link. What R. Cook was referring to (?) are shunts for checking the system. Fuses are only inside the rectifier where you could not see if they were melted or not.

He is not aware of any problem with fuse links at DGB.

He disagrees with Cook's testimony on melted fuse links.

- 9276-6 Cook was referring to 2 junction boxes in front of DGB. They are shunts, not fuse links. If there had been any damage, he would know about it and it would be documented.
- He inspected the system during the 6 months it was turned off. Twice monthly inspections continued to March. Inspection involved looking at the junction boxes.
- 9277 There was a system check August 3-11 which found no damaged links.
- 9278-9 When there is a problem it is noted. No notation is made if a component is O.K.
- 9279-80 A Bechtel study in 8/82 based on records of lugs attached to pipe concluded that they had found all the carbon steel lugs. Pipes with carbon steel lugs were found on BWST pipe, approx. in 7/82. The lugs were removed. Not in his jurisdiction to say whether it was proper to install carbon steel lugs.
- 9281 The carbon steel lugs were removed because those sections of pipe cut out to install temporary piping.
- Not his responsibility to say if carbon steel lugs on BWST pipe were within design or technical specifications.
- 9282-4 Objections.
- 9285 Stainless steel BWST pipe was removed in summer of '82.
- 9286 Can't specify which lines at BWST were removed. Can't say whether it was safety or non-safety piping.
- 9287 Doesn't know whether it was injection piping, nor whether it was condensate piping.
- Dewatering may affect conductivity of the concrete and encased anodes.
- Not qualified to say whether dewatering would only affect anodes encased in concrete.

9287-8 His concern was not with dewatering but with whether concrete would act as an insulator.

9289 Concern about effect of dewatering was conveyed to him by someone else.

9292-3 Preliminary matters.

WEEKS and Ron COOK

9294 EX by Board-Bechhoefer. Cook: what Cook called "fuse links" are probably "shunts". But they are needed to carry current to anodes.

9295 Landsman, Burgess (instrumentation inspector), and Garfnder (electrical inspector) all observed the blown boxes.

9296 Cook: They (?) looked into the boxes this morning and the old shunts had been replaced. Woodby may be very concerned with how they got replaced.

9297 PPS: Don't doubt Landsman's word that he saw blown boxes. Wilcove: Don't doubt that Woodby didn't know shunts were blown.

9298 Don't yet have an exact date when blown shunt boxes were seen.

9299 There would not have been an inspection report on the blown boxes. It is a non-Q system.

Cook: We knew that galvanic system was not fully operational at the time blown shunts were seen, along with other "discrepancies" in galvanic system, and thought they would be resolved.

9300-1 Don't know if system was operational when saw the blown shunts, but it would have required voltage to melt the shunts.

Weeks: No, nothing he heard this morning would lead him to modify his testimony. He was notified that concrete encased anodes maintained approx. same current as other anodes. We know that galvanic system was down for approx. 6 months. Stainless pipe excavated at end of that period showed no corrosion.

9302

So the morning's testimony would not affect Weeks's testimony.

Reason for having anodes scattered around the site is to prevent "IR dropper", voltage drop, on pipe when current enters pipes at different locations. A few missing anodes will not have major effect on overall potential of pipe. Purpose of the system is to maintain pipe as a cathode at specified potential.

9302-3

Soil at Midland has higher resistance, probably almost as high as the concrete, which may be why the concrete anodes are working. Should site get flooded with water of higher conductivity then perhaps concrete anodes would not work as well.

Do not feel that conductivity is going to be significantly higher with the coke breeze.

9303

Coke Breeze is basically cinder from burning coal, like cinder ash. It is porous to allow moisture and water through. It would improve conductivity of material immediately in contact with it. Doesn't know if it would in effect enlarge surface area of anodes.

9303-4

Dewatering probably will have no effect on galvanic system, since the system is already operating above the water table.

9304-5

Cook: Concrete was a good conductor probably because of weather conditions and porosity of concrete used as backfill.

Weather will influence galvanic system.

Weeks: But there still won't be a corrosion problem. In fact, the drier the soil, probably the less corrosion problem in the absence of the galvanic system.

9305-6

Weeks: If a few anodes were out for a period of time in addition to the 6 months the system was shut down, it would not make a difference to corrosion in the system. Galvanic system is another line of defense for UGP. Because of nature of soil, coatings on carbon pipes and stainless steel for others, we could probably do without system for periods up to 6 months. A few anodes out for 8 or 9 months would not affect corrosion protection.

9306-7

If an uncoated carbon steel lug is on stainless steel pipe, the lug will corrode, not the pipe. The carbon steel lug can give the stainless pipe roughly the same sort of galvanic protection as a zinc anode might. Possibly not as large in potential, but could work the same way.

In some systems at Brookhaven we have carbon lugs with stainless pipe. It is always the carbon lug that corrodes.

Carbon lugs on carbon pipe should be protected the same as the carbon pipe.

In an exhibit cited yesterday, in reference to pipe dug up in June, Bechtel recommended that the carbon lug be coated as the carbon pipe is.

9308

Use of coated carbon lugs would not be bad practice.

Corroded lug would not affect pipe unless lug was too corroded to function.

Lugs carry current to pipe. Pipe and anode act as terminals in a circuit.

9309

Lug is approx. 12" by 3" in diameter.

Distance from pipe to anode is specified.

Cook: Anodes appear to be made of some sort of carbon material.

9310

Anode design life of 40 years is based on using high silicon cast iron anodes-14 1/2 % silicon case (?) iron.

9310-1

CX by Stamiris. Weeks: Do not know if NRC told applicant about blown shunts.

9313

Cook: Blown shunts would have safety significance if resulting outage of galvanic system allowed corrosion in piping you needed during a severe accident transient. Doesn't seem likely, given the redundancy of corrosion protection and the monitoring by applicant.

- 9314 Observation of blown shunts was in period when whole system was shut down.
- Cook: Guess that approx. 40 anodes would have been shut off because of blown shunts.
- Weeks: That exceeds the "few" anodes whose failure for up to six months would not affect protection.
- 9315-6 Cook: There was no galvanic protection until early 1980 anyway.
- All junction boxes on the site are accessible to visual inspection.
- Did not look at more than the 2 shunts at DGB. We knew the system was not operating and that it was non-Q (hence lack of vigorous inspection).
- 9317 Cook: Thinks there are about 6 shunt boxes on site.
- 9318 Weeks: We do not have any records of when CPCo restarted the galvanic system.
- Woodby said it was in early August, 1982.
- It is possible that restarting the system caused the boxes to melt, but doesn't know if it did.
- 9319-20 Cook: Woodby would get voltage readings from the shunt boxes.
- Woodby agrees.
- 9321-2 Cook: Melting of shunt boxes could indicate galvanic system was malfunctioning: it would take many amps to melt the boxes.
- Would be more concerned if there were instances where almost enough current went through to melt the boxes. Would be worried about corrosion accelerated by induced current similar to electroplating.
- If random melting kept up and cause not found, would be concerned about what really was happening to the system, whether system was capable of its design function, whether galvanic system was instead doing damage.

- 9323 Weeks: If the current surge was instantaneous, as when a fuse blows, would see no serious concern so long as it did not recur.
- Have heard no testimony that the melt occurred more than once. If malfunction is correctible, system will function normally.
- Corrosion from a brief surge of current would be very small.
- 9324 Objections.
- 9324 Galvanic system is D.C.
- Weeks: Higher current would not induce corrosion so long as the current continued to render pipe cathodic. To cause corrosion, current would have to reverse; that is the current would probably have to come from some other source.
- So long as polarity of current remains correct, does not matter how high the current is.
- 9325-7 Speculation. Weeks suggests possible causes for melted shunts: short circuit when system is switched on or possibly a short between galvanic system and welding ground cable, or possibly lightning.
- 9328 If CPCo compared records on the boxes to see if they were similarly affected, might narrow down the possible causes of melted shunts.
- 9328-9 No questions.
- 9330 Cook: Only assessment he made of cause of corrosion of carbon steel lug was that it was carbon steel near stainless steel. Carbon steel would corrode in an electrolyte environment.
- 9331 Wire brushed the rust away to see if pipe was damaged.
- 9332 Cook: same procedure and assessment applies to the corroded wires.

Also noticed that a building ground wire was very near to stainless steel pipe. Examined this, but found no damage.

9332-5

Objections.

9335

Extended failure of an anode would not significantly reduce overall effectiveness of galvanic protection. Extended failure of a given anode would slightly reduce galvanic protection for a portion of pipe.

9335-6

Failure of an anode might change voltage slightly in that area and thus slightly reduce protection. Would not be significant.

9336

Galvanic system is effective at any potentials below approx. 500 millivolts negative to that reference. We keep pipe at 850, which gives some latitude. So local variation due to failure of water to anodes (?) is not going to have a major effect.

Cook: Is not familiar with what applicant is going to do with the carbon steel lugs. Haven't checked the repair because more work would be going on in that area. The pipes are not installed now: they cannot do any excavation anyway.

9337

Based on the amount of corrosion, the corroded lugs were uncoated.

9338

Cook: Found 2 heavily corroded lugs.

Would be a good assumption that the other buried carbon lugs on site were uncoated.

9339-41

CX by Marshall. Cook was on site in period when concrete backfill was used (for bedding anodes?)

Did Bechtel do it?

9342

Cook: putting carbon steel lugs on stainless steel pipe was not bright. Can see why they used lean concrete to backfill against anodes, but they probably weren't aware of its effect on cathodic protection.

9343 Weeks: it is the anode which corrodes, not the cathode, which is the piping.

9343-4 Weeks doesn't know much about electrolosis of chlorine gas.

9344-7 Marshall wants to ask QA questions.

9347 RCX by Stamiris.

9348-9 Field engineering should have prevented use of backfill which hampered galvanic system, but Cook doesn't really know.

QC inspectors would have checked if the back-fill met requirements as lean concrete. But the anodes are not safety-related. But would expect field engineer to be aware of pipes and anodes and their requirements.

9350 Would say it was responsibility of Bechtel field engineer to provide link between Q and non-Q areas.

9350-1 Stamiris examines Weeks.

Weeks had "Reference A", 1981 study on corrosion, in 3/82 and 11/22/79 study in 3/82. "Reference B" he reviewed yesterday.

9352 Weeks read References A and B together. Relied on them for their discussion of soil chemistry and observed pitting corrosion (see SSER 3-43).

9352 Did not rely on SCRE 12 in preparing testimony.

9353 In preparing testimony Weeks also used detailed specifications for the galvanic protection system and for the protective coatings on the pipes. He also talked numerous times with the suppliers of the coating, with the NRC staff and with CPCo. Also with Ron Cook. Also used standard textbooks etc. of his own.

9353 Did not do an independent investigation of his own in that he didn't design the system. Never examined first hand samples of sand or corrosion etc.

Validity of his conclusions depends on the validity of the samples and data in the documents supplied from several sources, and on what he considers good practice.

- 9355 Has not heard of "random fill" problem nor that fill was dug up from cooling pond area.
- Did receive detailed specifications for the backfill that was used. Was told that soils were selected not to cause a corrosive environment.
- 9355-6 Objections.
- 9356-7 Chemical analysis he used of soils and of the solution leachate from them came from samples from the Midland site.
- 9357 Lumps of clay in sandy soil would not affect corrosion, unless they contained large amounts of chloride or were very acidic, which is very unlikely at this site.
- 9357-8 Pipe trenches were backfilled with clear river sand, which was controlled.
- 9359 Weeks has the specifications for controlled sand for pipe trenches.
- 9359-62 Objections.
- 9363 In placing piping, fill material was carved away and sand backfill was used to bed the pipe.
- Thinks that specifications he reviewed in preparing testimony talks about backfilling with sand different from the random fill.
- 9363-4 As Weeks understands it, the sand backfill is used on top as well as beneath the pipe.
- He is referring to Bechtel Specification 7220-Q112 Division 13.
- A different term is used for structural backfill within 3 feet of the exterior of structures. But he cannot find the reference.

- 9365 There is a total of six samples for the 2 reports on soil analysis. There is remarkable uniformity in pH, conductivity and chloride, the components important for corrosion.
- 9366 He considers the number of samples adequate. Report specifies only that the samples come from the Midland job site.
- 9367 Objection.
- 9368 There is nothing in his testimony he'd want to change.
- 9369 Did find inconsistencies between 1979 and 1981 soil analysis/corrosion studies. 1981 report is more conclusive. 1981 report itself discusses its discrepancies with 1979 report. 1981 report points out that findings of 1981 and 1979 report are really the same. He agrees with 1981 report where there is a difference from 1979 report.
- 9369=70 Maximum depth of corrosion of condensate pipe was 75% through the wall. He might yesterday have said 2/3 way through.
- 9370 1979 and 1981 reports on corrosion problem were based on samples taken before the galvanic system was on. The amount of corrosion found in those reports is of concern.
- 9371 Weeks did not personally analyze how widespread that corrosion was prior to start of galvanic protection system.
- The BWST lines, addressed in the corrosion studies, are safety-grade (or does he mean condensate fill lines. Transcript is not clear).
- 9372 Galvanic system affects both safety and non-safety piping. Doesn't know if condensate lines are safety grade.
- 9373 Doesn't know if nitrogen lines are safety grade.
- 9374-84 Procedural. Discussion on corrosion. Stamiris lists "discrepancies" between 1979 and 1981 reports on corrosion.

9385

Weeks: There is nothing in what Stamiris said which he has not taken into account, nothing that would affect his overall or subsidiary conclusions. He noticed these discrepancies and relied on the 1981 report because it was based on a larger sample.

1981 report makes 2 recommendations: cathodic protection system should be activated, and should consider methods to determine integrity of other buried stainless steel pipe in terms of freedom from pitting.

9385

This latter investigation was made last summer ("Reference B"). Approx. 1/3 to 1/2 of the piping in BWST lines was unearthed and inspected.

Pictures taken there indicate no corrosion. R. Cook has no evidence of corrosion.

This inspection gives us a second check on current status of remaining safety-grade piping.

1981 report attributes pitting to stray welding current but does not answer 1979 report's statement that there was no welding in that area at the appropriate time.

9386

The subsequent inspection of substantial portion of remaining UGP which showed no corrosion is the best assurance that condition of the pipe is satisfactory.

9387-93

Statements by Stamiris etc.

Stamiris Exhibit 36-38, corrosion reports, accepted into evidence at 9392.

9393

CX by PPS.

9393-4

(In reference to SSER 2 p. 3-42, which is Week's testimony) If in fact the Bechtel people who inspected for defects in pipe coating were not from QC, it would not change his testimony or conclusion.

9394-5 EX by Bechhoefer. He has been told that proper ground for welding is now in practice at the site.

9396 Procedural.

9397 Thiosulphate line has been retired.

SHUNMUGAVEL and KRAUSE
(Harbour questions)

9398-9400 Statement of professional qualifications.

9400 Krause is responsible for instrumentation on site (at Aux. Bldg. underpinning).

The instrumentation is linear variable differential transducers which measure movement. We also use dial gauges to measure differential and absolute movement. We are going to install strain gauges on the structure.

There are extensometers, a variation of LVDT, installed on walls to measure movements of walls. We are doing crack inspection. There are thermocouples on the deep-seated benchmarks to measure variations in temperature down there.

9401 The instrument systems are described in SSER2. The description in SSER is accurate except for extensometers, which are 11 and 20 feet in length, not 5 feet.

The instrumentation is state-of-the-art. The HP Data Acquisition System is the most advanced we can get for this kind of monitoring. The H-P Data Acquisition System is part computer. It is a 2 part system.

9402 The instrumentation is controlled by the computer. Computer scans every hour the complete cycle of equipment, compares and reduces data, and compares data with alarm values. If alarm value is reached, data is printed out and alarm sounds.

Every 4 hours data prints out, with or without alarm.

Printout goes to resident structural engineer.

Data Acquisition System is monitored (by people) at all times and will be during course of underpinning.

9403 There are 2 procedures for monitoring: OP-40, for normal monitoring and OP41 if an alarm value is reached.

9404 PPS: These procedures are attached to Staff testimony.

Krause: In case of loss of power, there are backup mechanical gauges at each electronic measuring point. People would have to go out and look at the gauges. OP-40 and OP-41 will specify which gauges to check and how to check.

9404-5 Krause: Doesn't think there will be large gaps in data because maximum time between readings, either electric or mechanical, is one hour.

9405 The instruments are all out of the construction area and have heavy metal covers. There is no reason they should be covered up (with sand) at all.

9405 Doesn't think instruments will in any manner be degraded by anticipated environmental conditions during underpinning. We check electronic against dial gauges and would pick up any deviation.

BURKE

9406 Burke on Harbour questions.

If there should be structural movement during underpinning, plan is to jack additional loads onto the piers and underpinning already installed. It is possible to jack on additional loads because the loads imposed on the piers during underpinning are quite low compared to capability of the underlying soil. Jacks will also have excess capacity much beyond their safe limit.

Aux. Bldg., EPA will be supported first by grided system beams, projecting under the extreme tip of the EPA. Grided system supporting piers and columns has been designed for capacity of some 4,000. With this much capacity, they will be able to bear the entire end of the EPA going off the main part of the Control Tower.

9407

There is one area in the lining of the tunnel underneath the end of the electrical penetration wing where we might have to jack without a pier to arrest structural movement. To put in the grillage and posts to support grillage, there will be a period of time in which the tunneling will expose the end of the electrical penetration wing to settlement. During that period there will be on site posts and bearing pads, supported on underlying fill in the tunnel area and activated by jacks, which will press up against the underside of the electrical penetration wing and provide a reaction (?). The pads are reasonably small and can be installed in a very short time if needed because of settlement.

There is a written procedure for such corrective action.

9408

Boos: The plan is specification C-200. Among other things, it outlines a variety of events developed in review by designers, consultants and subcontractors doing the work. Specification lists events and recommended corrective actions.

(Specification C-200 has been filed as an attachment to Staff's testimony.)

Based on his experience Burke would say any settlement would be gradual and there certainly would be time to perform corrective measures. There would not be an emergency situation requiring very quick action.

9408-9

Boos: under Spec. C-200, data from Wiss, Janney goes to the resident structural engineer who evaluates the data and as appropriate begins action or notifies others to act.

In unlikely event of substantial movement, category I event, where there is danger to personnel, subcontractor is authorized to correct the condition. There are provisions for follow-up evaluation of impact on sub-structure and changes to take care of the situation.

9410

In more likely event of very slow movement, people making decisions are determined by the various limits. If there is a trend, but still below the limits, it is the resident structural engineer who feeds data back to design engineers who along with the consultants recommend changes. If the alert limit is passed, there are formal provisions for alerting other personnel. The primary function of resident structural engineer is to inform design engineers and consultants who develop plan of action.

9410

Boos: There are actually 3 levels (of limits) for the Aux. Bldg.: alert level, action level and requalifying level. There are 2 levels for SWPS: alert and action level.

Managerial and administrative actions at various levels for Aux. Bldg. are shown in flow charts attached to specifications. At alert level, which is well below points where structure would be endangered, resident structural engineer evaluates situation for possible corrective action. Specification requires him to notify Bechtel project engineers within 24 hours to begin their evaluation of possible actions.

9412

Emphasizes that no action may be necessary; specification merely requires evaluation.

At action limit, structure is not endangered. But is closer to the working capacity of structure than at alert limit.

At action limit resident structural engineer must notify engineering department.

Before alert or action limits, there will generally be a trend in the data, possibly precipitating one of the plans of action Burke mentioned, e.g. increasing jacking force. Ultimate action would be work stoppage, either generally or locally.

If we exceed action limit, we must notify CCo so they can notify NRC.

9413

Shunmugavel: re derivation of alert and action levels. Analyzed building's condition and determined what is tolerable deflection for the structure. We submit these calculations for NRC review and agree on action limits. Generally, alert level is half the action level.

The limits are very conservative. Re: alert and action levels for strain. We monitor at critical locations on the structures. (Ask Thiru about Tr. 9414. Very unclear, seems to say:) We have actual strain measurement from which we derive limits in 2 ways: 1) by calculating strain structure can tolerate; 2) by estimating how much strain one could expect.

These limits are reviewed by NRC. Alert and Action limits are fractions of yield strain, typically 1/3 and 2/3.

9414

As required in spec. C-200 these limits are directly tied to Krause's instrumentation and measurements.

9415

Wiss, Janney information goes to resident structural engineer in reduced form; he does not do any data reduction.

9416

There are no action or alert limits for Aux. Bldg. based on strain; they are based on displacement and crack monitoring. The strain instrumentation is back-up.

9416

Re: Harbour concern for possibility that Turbine Bldg. will rotate toward Aux. Bldg. due to tunneling under Turbine bldg. Shunmugavel responds by addressing clearance between the buildings and how much is needed in SSE.

- 9417-8 With figures gives one example of 8" clearance. Some components will crush or collapse if they meet in rotation.
- 9419-20 In SSE, assuming worse case of buildings moving toward each other, there is total combine deflection of 2.7 inches in SSE, so we have extra clearance.
- The SSE here is the FSAR SSE, not 1.5 X FSAR SSE. For to larger site specific earthquake, the flexible Turbine Bldg. still deflects 2.12 inches. Deflection of Aux. Bldg. also remains the same: in this frequency range it (?) is not sensitive to SSRS.
- 9420 "Site Specific Earthquake" refers to SSRS used by Kennedy in seismic margin evaluation. Even with this larger earthquake the clearances are adequate.
- 9420 Concrete floors at elev. 629 of Turbine Bldg. could be chipped back if need be for clearance. Doesn't believe it would be necessary. Deflection at cler. 629 is .9 inches and there are 2 inches between the buildings.
- 9421-2 There are 3 deflection measuring devices at elev. 695 between Turbine and Aux. Bldg. They measure horizontal deflection between the 2 buildings both East-West and North-South.
- They are installed and capable of registering any horizontal deflection indicating rotation of Turbine Bldg. toward Aux. Bldg.
- Each of 3 locations has 2 extensometers -- one measuring N-S, one measuring E-W -- so there are actually 6 meters.
- 9423 Turbine Bldg. is typical industrial building, about 440 feet E-W and 135 N-S and about 100 feet tall. Major portion is made of steel frame structure. It has a concrete mat foundation covering entire plant dimension of the building.

- 9423-4 There is a minor discrepancy between some of the numbers for deflections in tables of sketch 1 of applicant testimony and SSER 2 p. 3-5.
- 9425 Numbers in sketch 1 of applicants testimony are slightly smaller than those of SSER 2 p. 3-5 (on the order of 2.7 vs. 3.1). Numbers in SSER are based on deflection data of a few months ago; numbers in sketches are from most recent analysis of Turbine Bldg. These latter are therefore preferable.
- 9426-7 There are further differences for some reason. Differences are on order of 1/4.
- SSER 2 numbers come from Bechtel.
- 9428 Applicant's Exhibit 28 - 5 sketches used by Shunmugavel-into evidence.

NRC HEARING
DECEMBER 6, 1982

10151- Preliminary Matters
10179

10178- Dr. Peck is a consulting engineer and has previously
10180 testified in this proceeding. His prepared testimony
 was admitted without additions, changes or corrections.

Cross Examination
(by Ms. Stamiris)

10181- Objection to question re whether Peck's testimony
10185 represents a scientific or engineering effort
 followed by explanation by Peck.

10186- In order to draw proper conclusions it was only
10192 necessary for Peck to initially know that settlements
 had occurred. It was not necessary to know what
 the preconsolidation of the soils was before
 surcharging or the precise ground water level
 before installing the piezometers. He took no
 measurement of these.

10193 General information about ground water levels near
 the DGB was known before the surcharging. Peck
 did not remember meeting notes that state that
 ground water levels were not well known at the end
 of 1978.

10195 The piezometers were almost all located in submerged
 zones and began providing information before the
 surcharging program began. The water level before
 surcharging (using Figure C-27 as a reference) was
 624 to 627.

10196 The level of the cooling pond was raised for the
 purpose of getting the tips of the piezometers in
 the water and "to have the low water level as much
 of the plant fill beneath the building as possible"
 (transcript unclear)

10197 Had the cooling pond water been at its maximum
 before the surcharge Peck's interpretation would
 have been simplified, but it was not made impossible
 or impracticable by the water not being at its
 maximum.

- 10197-
10198 The four borros anchors beneath the DGB added in June, 1979 were deeper than any others. These four had dial guages rather than optical levels and therefore were about 100 times more accurate. There were 1-2 dozen borros anchors using optical levels.
- 10199 The piezometers were affected by the rise in the cooling pond water.
- 10199-
10201 All of the settlement and piezometric data has been incorporated into Peck's studies unless indicated otherwise or omitted unintentionally.
- 10202 The deep borros anchors serve as a good benchmark at the site.
- 10202-
10210 Peck forgot to state earlier that the results of the sondex devices were not used in reaching his conclusion. He does not think the sondex data would affect the analysis he made subsequent to his last testimony since he regarded it as inferior to data from the borros anchors. Objections. Paton added that the staff has not relied on the sondex data and will not do so if asked.
- 10211-
10215 Five types of measurement devices were used: original borros anchors, piezometers, Sondex instruments, deep borros and settlement plates. The original borros anchor data revealed a normal range of scatter (range of error). The settlement reference represented by DG-16 equals about 3/4 of an inch. There are no corrections to borros anchor data in Peck's testimony.
- 10216-
10218 The first observations, made in 6/79, were of C-12. The deep borros anchors did not provide the only information used in the decision to remove the surcharge. Peck could not identify the particular date on which it was decided to remove the surcharge. Afifi, Hendron and Peck concurred that it was appropriate to remove the surcharge.
- 10219-
10221 Objection and discussion.

10222-
10224

Although the dissipation of pore water pressure after a load is applied is gradual, it is not necessarily slower than dissipation of pore air pressure. Extremely sophisticated equipment is required to measure pore air pressure. Despite his testimony (p. 30) stating that the dissipation rate was rapid, it was rapid only in comparison to the rate at which the load was applied. The measurement would have indicated that the piezometer tube was dry if it had been.

10225-
10229

Reference points were changed three times during the course of settlement observations. It is very common to change reference elevations as circumstances dictate. The covering and uncovering of the reference points did not affect the plotting of the data. At the time that the initial reference points were established no one anticipated that they would be covered up by surcharging.

10229-
10232

Peck thought that the rebound measurements taken at four different locations were reliable and essentially correct. Page 42 of his testimony refers to three episodes of settlement. (DG1, DG9 and DG12). Since the settlement curve had three steps, which corresponded closely to the increments of loading, Peck concluded that the consolidation occurred very rapidly.

10233-
10238

Peck identified where DG1, DG9 and DG12 are located. It's an oversimplification to talk about three load increments. The data in the graph in Appendix E was arrived at by averaging pressures over considerable areas. "There should be a reasonable correspondence between points in a general area and loading in that general area. But you can't relate a settlement of one point which is receiving stress from loads in many areas to the load determined in a particular area."

10239-
10244

Peck examined every settlement and load curve and found a "general correspondence." The "correspondence" was best with respect to the three increments in the west end of the building. Every major well-defined episode of loading has a corresponding settlement episode. Figure 6 in Appendix E shows loads that were not applied simultaneously. There is no exact one-to-one relationship between loading and settlement, but the relationship is real nevertheless.

10245-
10246

Figure C-3 represents three episodes of settlement. The reference points DG1, DG9 and DG12 (p. 42 of Peck's testimony) are not the only reference points where there was a three-stage settlement. It is fair to assume that each of the three settlement episodes was caused by stress associated with loading. Settlement was fairly rapid and tapered off in a period of a month.

Afternoon Session

10247-
10258

Preliminary Matters

10258

The variations in the piezometric data discussed on p. 44 of Peck's testimony can be attributed to a slight extent to the heterogenous nature of the soil. By and large the variation is due to differences in the way the stresses are distributed in the soil mass.

10259-
10260

There are records of the soil types where the piezometers were installed. Generally, however, one could not determine whether a piezometer was penetrating a hard or soft spot. Piezometer 22, which recorded greater and longer pressure responses than the others, was hardly, if at all, affected by water seepage from the cooling pond. The curve recorded by the piezometers was associated with the loading and included whatever minor influence the cooling pond may have had.

10260

The behavior of piezometer 22 is anomalous in the sense that no other piezometer shows comparable results. (Figure C-1)

10261

Piezometer 22 reflected the same pattern of increase and decrease in pore pressure as other piezometers, only its magnitudes were larger. Piezometer 22 was the deepest of all the piezometers in the DGB. Peck had no reason not to believe piezometer 22 was accurate.

10262-
10265

Peck cannot recall for sure but thinks two of the piezometers were terminated before the surcharge removal because they were damaged by the surcharge. (p. 52) If Peck had had some indisputable reason

to believe that the erroneous observation mentioned on p. 53 of his testimony was actually correct, his interpretation would have changed and he would have been confused. The piezometer in question had recently been flushed and probably had excess water in it at the time of the observation.

10266-
10268

If flushing were going on at one piezometer, it is likely that there would be indications of that operation in nearby piezometers. If flushing and anomalies in piezometers occurred in the same location, Peck presumed that the cause of the anomaly was flushing. Lenzini had more detailed information and his conclusions were drawn independently.

10269

Water dissipates rapidly from a flushed piezometer located in pervious material. A piezometer located in more impervious soil retains flushed water long enough for its effect to be seen. Flushing is a maintenance operation although it is not done routinely. If piezometric levels remain stationary for a while the piezometer probably is not working properly.

10271-
10273

Peck would not have recommended surcharging had he not thought the DGB could withstand its effects. As structures go the DGB has a high rigidity. It was less rigid at the beginning of the surcharge program because its walls were not completed. At the time the settlements were first noted there were gaps under the footings in some locations above the mud mats. Peck is confident that the surcharge closed any such gaps. In the future any soft spots will still be shielded by hard spots since the hard spots carry most of the load.

10273

Peck was not involved in monitoring stress in the floor of the DGB and did not believe such monitoring would show whether any soft spots were not sufficiently homogenized.

10273-
10275

Live loads affecting settlement include the weight of the equipment, the weight of any permanent furniture and any other nontransitory materials. The long-term live load is the only load that produces significant consolidation and settlement. Peck did not know what percentage of the live loads was due to snow and ice. He discussed live and dead load stresses with Bechtel. The structural records would reflect their discussion.

10276-
10278

There is a great tendency to overestimate live loads. Heavy snow and ice on the DGB over a period of months would probably be distributed uniformly over the structure's footings. Earthquakes and winds are transitory forces and would have a negligible influence on the settlement of clay soils.

Cross Examination
(by Ms. Sinclair)

10286-
10289

Objection sustained re question as to whether Peck's recommendation to surcharge was made by him alone.

10289-
10295

Peck relied on a simple extrapolation of a time settlement curve, established by observation, when forming his long-term consolidation prediction. He did not rely on any theories, including any of Dr. Casagrande.

10295-
10300

Peck does not believe soil mechanics can change substantially over time so as to alter his prediction. His settlement prediction is based exclusively on the secondary consolidation observed. He is not aware of any secondary consolidation that can cause considerably larger settlements than he predicted.

10301-
10302

None of the examples mentioned on page 13 of Peck's testimony involves surcharging done after construction was well under way and sinking and cracking had already occurred. The Car Fork project mentioned on page 16 is an example of such settlement. The time to surcharge is when it's needed, which can be before or after construction is started.

10302-
10305

"Secondary consolidation of clay" means that the volume of the clay decreases under stress without measurable and significant excessive pore water pressure. There are other ways by which volume decreases occur in soils but those mechanisms are not active in this instance.

10279-
10280

Peck did consider the effects of dewatering in determining the future long-term settlement of the DGB. He predicted the upper bound of static settlement due to secondary compression at 1.5 inches for the DGB. The figure on text figure 8 (1.98 inches) represents the highest future settlement expected. Peck expected only 3/4 inch of differential settlement to occur after 1981.

10281

Future settlement will be monitored at a number of points in the building. If settlement goes beyond 3/4 inch Peck would recommend they fire him. He added that even if the settlement exceeded that limit it would have no practical import.

10282

Peck's prepared testimony submitted today is a supplementary statement that encompasses the net result of everything he previously testified to. One of the principal reasons for the boring and testing program was to be able to predict settlement due to dewatering.

10284-
10285

Even though Peck's revised statement indicated that certain borings were likely to produce un-dependable data, he and the staff thought that the overall settlement predictions, including the borings, were reasonable. It actually never became necessary to rely on the predictions.

10305

There should be some additional secondary settlement associated with lowering the ground water table in addition to the primary consolidation that has now occurred. Its magnitude would be indistinguishable from settlements resulting from the preload. Peck predicts that settlement will not exceed 1.5 inches.

10307-
10314

The procedure for determining the upper bound of differential settlement is the same as for determining maximum settlements. Settlement curves are extrapolated to determine the most and the least points of settlement and the difference between these equals the differential settlement. After objections Peck stated that it is his understanding that any critical piping under the DGB has been rerouted or the design accounts for possible movements.

10315-
10316

No other consolidation theories could be applied that would change the upper bound of the settlement since the soil's "behavior" is fixed.

10317-
10328

Some portions of the soil under the DGB are entirely sand and others are mixed clay and sand. Peck was shown a copy of the 11/16/81 testimony by Mr. Singh, of the Army Corps of Engineers, at the ALSB hearings on the DGB. After objections Peck stated that the Corps did high-pressure laboratory tests (involving pressure much higher than the constant low stresses the DGB is actually under) and found that under highly elastic strains sand can be crushed. Since the stresses on the DGB will never be that great and will not be increasing the Corps' findings are inappropriate. Peck agreed that there can be a change in the behavior of a material due to high stresses.

10328

Crushing of the sand under the DGB would alter the secondary settlement: however, conditions permitting the crushing of sand do not exist there. Peck did not think such conditions would exist under a seismic event.

10329-
10333

Objections and discussion re questions on seismic shakedown. Even during a .12G earthquake Peck would not expect a rejuvenation of clay settlement.

10333-
10335

Appendix A is devoted to recalculating raw data (i.e., all of the settlement observation data re the DGB and all of the piezometric observations). The data was recalculated not because it was in error but because Peck wanted to check Lenzini's work to make sure that any aberrations that occurred were not the result of an arithmetic error.

10336-
10338

Some changes were made, including some significant changes, but almost all were such as to strengthen Peck's original interpretation of the data.

10338

Peck's testimony from last year briefly discussed the effect of secondary settlement on the structure.

10338-
10341

Figure 6, following p. 79, shows settlement of the DGB measured since the preload was removed as 1/2 inch. Most of that settlement was due to the drawing down of the water table by about 25 feet. Differential settlement associated with dewatering would be very small. Since the temporary drawing down of the water table produced a 1/2-inch settlement, any additional settlement due to the lowering of the water table with the permanent dewatering system will be negligible.

10341

Kane stated that the permanent dewatering system is in operation now.

10342-
10344

Figure 6 shows that there was no increase of settlements after the second drawdown. It was necessary to protect the turbine building from the effects of the surcharge on the DGB although there undoubtedly was still some small effect.

Hearings February 14, 1983

11230- Preliminary Matters
11387

Direct Examination of Ross Landsman, called as a witness by counsel for the regulatory staff.

11388 He is a reactor inspector with the Region NRC Staff III NRC office. Landsman has a copy of the quality assurance testimony, dated 11/29/82. At this time he would sponsor questions 1 and 3, with attachments 2, 3, 4 and 5.

11389 Mr. Wilcove offers into evidence Questions 1 and 3 with the corresponding attachments.

11390- Question 3 relates to Mr. Gardner as well as Mr.
11391 Landsman, but Mr. Gardner will not need to appear.

NRC Staff testimony of Cook, Landsman, Gardner & Shafer with attachments is read into the record.

Cross Examination of Mr. Landsman by Ms. Stamiris.

11392 Landsman states that there is a protective plan for structural movement for the underpinning operations and there are actual set numbers that, when reached by the instruments, certain actions will take place that are clearly specified. Stamiris asks any investigation to determine whether problems with trending of quality assurance data, that were established in the 2/8 QA breakdown, extend into the soils area.

11393 Wilcove & Miller object to the question. Stamiris restates the question.

11394 Landsman states that quality assurance trending and trending of instrument data are two different things. Trending of instruments consists of getting reading every four hours and plotting them on a graph to evaluate the trend.

Cross Examination by Ms. Sinclair.

John Darby is the Bechtel resident structural engineer who evaluates the trend data.

- 11395 Darby is not a QA person and Landsman hasn't evaluated his qualifications. According to Landsman he only has to watch the graph. A computer, as well as other people, also watch the graph and if it reaches a certain numerical limit action is taken. This type of trending is in no way related to the chart they received on the
- 11396 quality trend graph, which was a nonconformance type trending analysis. Landsman has seen the recorded performance record at the site. They initially had problems but Landsman thinks they are straightened out.

Cross Examination by Ms. Stamiris.

- 11397- The .110 inch at which the audible alarm sounds
11398 (on page 3 of his testimony) refers to the degree of displacement beyond which would not be tolerated by this quality program. This is described on page 2-49 of the Midland SSER Supplement #2. The computer is set to give an alert at 1/10 of an inch and there is an action limit set at 1/15 of an inch. During construction a building cannot move more than fifteen hundredths of an inch. When the action alert is activated, action must be taken.

- 11399- Page 2-49 of the SSER has a chart that shows the
11400 allowable alert limits climbing as the phases advance. Landsman cannot explain why this is shown. Joseph Kane of the NR geotechnical engineering section is called as a witness. He explains that as the underpinning work progresses and they remove the foundation support the movement may build up. It was anticipated not to have all the movement occur in early phases of underpinning so it was graduated on the basis of recognizing the maximum movement that could be taken and allowing increment progression during phases of construction.

- 11401 On page 3, the last line of the second paragraph, Landsman is referring to their final check where no major instrument problems were identified. Landsman thinks he and Ron Gardner were just trying to get on the record that all their previous concerns had been taken care of.

- 11402- On Attachment 2, section 3.4 Landsman refers to a
11403 "Category 1 Event", which is an emergency situa-
tion endangering the people involved in the
underpinning. The sentence "Implementation of any
corrective measures in this category is not Q
listed" refers to this situation not requiring QA
people before action can be taken.
- 11404 The above Sentence means it would only free the
corrective action itself from QA requirements not
any aspects of the structure from QA requirements.
- 11405- Mr. Wheeler and Mr. Bird are called to the stand.
11406 Bird is the QA manager for the MPQAD. Wheeler is
the soils section supervisor for Consumers Con-
struction Dept.
- 11407- They are sponsoring the testimony of W. Bird and
11408 R. Wheeler, with attachment #1.
- 11409 Bird states that the attachments to be written
testimony filed by Messrs. Cook, Landsman, Gardner
& Shafer are all true. Bird testifies that the NCR
he spoke of in his testimony as #051 has since
been completed. It dealt with the excavation and
some disturbed material near the borated water
storage tank valve pit. Page 5 of NCR #4245
refers to the void formed during drilling that Dr
Hendron explained at the hearings last fall.
- 11410 According to Wheeler, since the time the excavation
permit system has been in effect excavation permits
have been issued. On 2/10/83 they were shallow
probing in front of the water service building
when a drill operator accidentally hit the side of a
bank duct.
- 11411 This was a case where the utility was exposed and
the drill operator was careless. Wheeler doesn't
think this incident questions the adequacy of the
excavation permit system.
- Cross Examination of Wheeler by the Board.
- The operator was using a hand-held core drill.
- 11412 The permit system was adopted on 5/24/82. An NCR
has been issued on this incident but Wheeler
doesn't know about a QAR. Bird has no idea what
the number of the NCR report is.

Examination by the Board

Wheeler states 137 excavation permits have been issued.

Cross Examination of Mr. Bird.

- 11413 Since the procedure was adopted, there has only been one incident and a permit was issued for that drilling. This incident, called the 7A drilling incident, took place in Q-soils.
- 11414 It was the practice at the time that the geotechnical engineer did not have to be involved with the removal of soil or fill.
- 11415 Consumers Power had a non-conformance report written to address their concern that for this drilling in Q-soils an onsite geotechnical engineer should have supervised. A change in their QA program resulted from the incident.
- 11416 Section 6.9 of Procedure FIC 5.100 would be the governing procedure for this type of incident. The next NCR, Dr. Landsman's attachment 7B appears to have occurred prior to the change in the QA program.
- 11417 Bird states that a change was implemented after the first non-conformance report was written and went into effect in May.
- 11418 The first drilling incident occurred on 2/2/82 and the second incident occurred on 3/8/82. It took until May to do an investigation and set the specific controls in place.
- 11419 According to Bird, after May there were no other incidents of unauthorized drilling or excavating in quality soil without the proper approval.
- 11420 Stamiris asks Bird whether he considers the 4/21/82 drilling incident near the BWST to constitute an unauthorized drilling incident in Q-soils. Bird states it was not a drilling incident but an authorized excavation where some concrete soil came out from the area near BWST. A non-conformance report was made.

- 11421 The workers were authorized to be out near the BWST to do excavation work but Bird doesn't know whether they were working close to the perforated water storage tank.
- 11422 It is Mr. Bird's understanding that, while excavating, a chunk of material was inadvertently removed from underneath the foundation area. There were other incidents that were written up in non-conformance reports, but Bird believes that even if they had never occurred they would have instituted the same excavation permit procedure. The other incidents are attached to his testimony as exhibits.
- 11423
- 11424 An excavation permit copy is attached to Bird's testimony, attachment 1. It covers both drilling and non-drilling type excavations in Q and non-Q soils. On page three of Bird's testimony he refers to a discrepancy about the presence of the on site geotechnical engineer when the 4/21/82 incident occurred.
- 11425 The geotech's log had not made reference to him being on site for the grouting of the hole in Q fill. On the basis of what was in the log, the nonconformance report was written. They later discovered he had been on site because of his signature on a pour card for the filling of a hole in Q fill. This is not the same geotech engineer that was present at the first incident related in Attachment 7A.
- 11426 The second incident related in Attachment 7A constituted non-conforming drilling in Q soils. Procedurally, the geotechnical engineer should not have been present while drilling.
- 11427 Ms. West objects to Ms. Stamiris's question of whether the lack of an on site geotech engineer during placement, compaction and testing of these fills lead to the soils problems.
- 11428 In Bird's opinion, if a geotechnical engineer had been at the drilling he would have found it perfectly appropriate to have allowed them to do what they did. The issue, as MPQAD raised it, was whether approved engineering procedures were needed.

- 11429- The ~~quality control~~ system provided the con-
11430 trols MPQAD was worried about. Before the ex-
cavation procedure was adopted, there was no
formal quality controls applicable to excavation.
Neither of the drilling incidents appear to have
damaged the Q soils. With the 7A incident, there
is a 36 inch casing, so there was some local
disturbance and filling was necessary. In the
second case, the 4 inch by 48 ft. hole in Q fill
has backfill in it, so any further disturbance is
prevented.
- 11431 The first incident was related to closed bottom
casings used for erecting a crane mast. The an-
nulus between the 36 inch casing and 42 inch
diameter hole provides a volume allowing some
disturbance, unless you physically put additional
material around the outside of it. After the
closed bottom casing was inserted into the hole
the water level rose and it floated up out of the
hole.
- 11432 The annulus between the 36 inch casing and the 42
inch diameter hole hadn't been grouted at this
time.
- 11433 The casing sticks up about 4 feet, with water and
fallen material in the bottom of the hole. The
casing has been used as a mast but didn't sink
down into the hole. The purpose of the casing is
to provide a container to assure some working
space to erect a long member. Attachment 7A
refers to the "floating up" incident, but does not
include the specifics.
- 11435 Attachment 7A is the nonconformance report written
by Consumers Power on Bechtel.
- 11436 Bird doesn't have the technical expertise to
estimate how much water was expected. Ms. West
objects to questioning re: history of water
risings through the soil. On page 4 of Birds
testimony, he discusses nonconformances on
Attachments 7E & 7D from Mr. Landsman. Witness
Bird's testimony states that a duct bank was
damaged on 4/24/82 during the drilling of an
ejector well for the freeze wall monitoring pit.

- 11437 The NCR #4199, represented by Attachment E, is the first notification of a nonconformance regarding this incident. A stop-work was initiated on 4/28/82. The 24th was the first time they were over this location and hit an
- 11438 obstruction, and it was on a Saturday. They went back to drilling on the 28th and discovered mud coming out some conduits in the Auxiliary Building. Bird believes it was the 27th when they noticed the drilling mud coming out.
- 11439 It was written by the people doing the drilling and keeping the logs and they made the decision that the obstruction they hit was not a Q related utility. At this point in time there was no known or expected nonconformance on a safety-related system. A nonconformance report must be issued only if you hit a safety related system.
- 11440 If you drill close to a utility which is non-Q, that is in an area with no safety related utilities, then no MPQAD would be involved if you hit an obstruction. Witness Wheeler states that there is alot of lean concrete backfill on the Midland site, so it isn't unusual for a driller to hit concrete.
- 11441 If a driller hits something, he must stop drilling until there is a determination made by the on-site geotechnical engineer, the lead civil engineer and MPQAD as to what he hit. This is part of the excavation permit and was in effect after 5/24/82. It was not in effect at the time of the duct bank incident.
- 11442- To prepare for testimony Bird read the notes and
11443 logs of the people involved, who did not recognize that they were as close to the Q duct bank as they were.
- 11444- Bird believes they had some technical rationale
11445 which supported their decision. The verbal stop work order was issued by the site manager on 4/28 and followed up by a confirmation letter written the same day. Witness Bird thinks it is significant that they lost their drilling fluid after hitting the obstruction. It isn't common to lose drilling fluid in the natural materials at the site.

Witness Wheeler

- 11446 There was still some drilling associated with Mergentime and their subcontractors to be done on the freeze wall when the work-stop order was issued on 4/28. The hole was eventually not used for its purpose. According to page 5 of Wheeler's testimony the verbal work stop order was lifted on 5/26.
- 11447- The official title of the quality paper for the
11448 stop-work order was FSW-22, written on 5/19. The stop-work was lifted after the implementation of our excavation permit.
- 11449 Ms. Stamiris states that on the FSW-22 in Attachment A to her motion it notes that the stop work written on 5/19/82 was to be retroactive to 4/28/82.
- 11450 The 5/19 formal stop work order was not recorded earlier even though it was related to the April incident in NCR 4199. Work had been physically halted by the site management, so Bird did not have a required stop work order written up. It was a management decision to write up a closed loop mechanism involving MPQAD. This incident was not related to the drilling incident that took place in observation Wall 4 where the void was encountered.
- 11451 On 5/11 during drilling related with observation Wall 4 a void was observed, the non-conformance report for this drilling incident #4245 was not written up until 5/19/82.
- 11452 Witness does not know why if the NCR was written on 5/19 when the hole was drilled on 5/11. He speculates that it might have taken that long to verify if there was a void.
- 11453 Bird recalls there was some subsidence in the area adjacent to the drilling hole and an investigation was underway, but he doesn't know if it would have taken 8 days.
- 11454 Bird is certain that there are logs, etc. that would document the investigation. Ms. West thinks the 5/11/82 date that appears in the testimony might be a typo and will look into it further.
- 11455 Bird would be comfortable with all that he has said even if 5/18 was the date the hole was drilled.

11456 Bird's information was not from personal observation but from other people. He cannot recall the date he was first told about the void reported on 5/19/82.

11456- Chairman Bechhoefer would like a description
11458 of the QA procedures prior to the excavation procedures.

Midland Hearings
February 15, 1983

<u>Page</u>	<u>Text</u>
11459-92	Preliminary Matters, statement of Col. Gadler.
11493-4	Cross Exam by Ms. West of Mr. Bird and Mr. Wheeler. The drilling at OBS No. 4 was started on 5/18 and on 5/19 the subsidence was noticed and NCR 4245 was written. Mr. Wheeler was at the drilling site when the void occurred. There was a void near the surface that you could physically see. After the void was discovered the rig was removed.
11495-500	Cross Exam by Ms. Stamiris. According to Mr. Bird the 5/11 date in the testimony on page 5 was a (typographical) error. Mr. Wheeler states that he isn't aware of anyone observing the void at OBS 4 on 5/11/82. Wheeler saw the rig and void himself on 5/19/82. Witness Bird recalls that there were alot of activities going on from May 19. Mr. Bird is shown page 11452 of 2/14/83's testimony.
11501	Witness Bird recalls that there was "some subsidence there that clued people in that there was something wrong."
11502-4B	Bird was speculating on what occurred during the time the void was discovered and when a nonconformance report was written. The nonconformance was actually written the same day that the void was discovered. Both Bird and Wheeler agree that the first indication of any problem with OBS 4 was the subsidence. Wheeler remembers they first saw a void adjacent to the casing of OBS 4 that was approximately a foot in diameter. He doesn't remember if the void was directly adjacent to the casing.

- 11504D-I Discussion of whether Col. Gadler can cross examine the witness for Mr. Marshall. Witness Wheeler remembers the void was close to the casing, but he cannot estimate how close. After the void was discovered Wheeler was called out to the field and they decided the work should be stopped. Wheeler doesn't recall who called him out to the sight. The organizations involved in the stop work decision were the site management organization, Bechtel QC and Consumers QA (MPQAD). Bob Sevo of MPQAD saw the void on 5/19/82.
- 11504J-K Rod Bennett of Bechtel QC also saw the void. Wheeler and Don Miller represented site management. Wheeler doesn't remember who saw the subsidence first. There was a Bechtel Soils engineer assigned to that rig on 5/19/82. Gene Smith was the PFQCE, the highest supervisory level Bechtel quality control person on site.
- 11504L-M Wheeler doesn't know what Smith's involvement was when he first saw the incident. The verbal stop work order for the drilling incident #4199 on 4/24/82 was lifted on 5/26/82 according to FSW-22. Bird doesn't remember any CPCo NCR's written for the 4/24/82 incident referred to in Bechtel NCR 4199, which was written on 4/29/82. On 4/24/82 they were not aware that there was a nonconformance. The evidence that the duct bank was damaged was fluid that came out of the auxiliary building after 4/24/82, so a NCR wasn't written on 4/24/82.
- 11505-8 Witness Bird feels this was the proper handling of events. When the incident occurred on the 24th they were not aware they had hit any safety related structure. When it was ascertained that a safety related structure was damaged, Bechtel QC began the NCR paperwork. Bird doesn't know why the drillers thought they were not that close to the duct bank. The CPCo QA became aware of incident in the same time frame as Bechtel QA, and since Bechtel had already initiated the appropriate action and paperwork there was no need for CPCo to duplicate it.

- 11509-12 Bruce Peck of CPCo also initiated a verbal stop-work directive. MPQAD, though not involved directly was made aware of it shortly afterwards and supported it. A formal written stop work order, FSW-22 was written, as well as a letter from Don Miller confirming the verbal directive on 4/28/82. There is nothing in the QA program which gives Mr. Miller the authority to stop work, but as site manager he has the management authority to stop work. Miller and Peck were there at the drilling site and saw there was a problem so they stopped work.
- 11513-18 A formal QA stop work order could have been written, Bird doesn't know why it wasn't done. According to Bird, the verbal and written stop work directives are followed in the same way. Bechtel procedures require that they look at NCR's for aspects of reportability, then recommendations would go to their project quality assurance engineer. NCR incidents 4199 and 4245 were determined not to be reportable. NCR 4199 was written by Bechtel on 4/29/82 and is Attachment 7E to Mr. Landsman's testimony. Mr. Miller's written letter re: the verbal stop work is not the only other CPCo written action. Bird is aware of a telephone record between himself and Mr. Wayne Shafer of the NRC, and a memo from Peck to Shafer.
- 11519-26 In the memo from Peck to Shafer, Bird states that the 4/24/82 drilling incident is being documented. Bechtel 4199 was entered into the trending system of MPQAD. The formal stop work order was not written until 5/19/82 because, according to Bird, there was no reason for the FSW-22 since work had physically been stopped on 4/24/82. The MPQAD stop work was issued later so that it could be more visibly/formally lifted. Misters Cook and Marguglio encouraged Bird to write the formal stop work order.
- 11527-33 Bechtel issued the NCR, CPCo issued the stop-work order. The nonconformance reports get put into the trend program. Mr. Cook and Marguglio were in on the distribution of Miller's letter. Bird can't recall if he had any conversations with Cook or Marguglio about the drilling incident around 4/28/82. Bird does not keep records of conversations with the NRC.

11536-39 Cross Exam by Mr. Wilcove.

Miller, the CPC site manager, stopped all Mergentime drilling activities. Wheeler has 3 engineers and two construction supervisors working under him. Miller has other groups who report to him as well as Wheeler's section. Miller stopped all Q and non Q drilling by Mergentime mainly because of the 4/24/82 incident. Mergentime was going to drill the hole again and he felt Bechtel did not have "their subcontractor under control". Miller stopped work, and not MPQAD, because he was on site at the time.

11540-46 Miller had knowledge of 2 previous incidents, the drilling in Q area and BWST undermining, for which NCR's were written. Bird feels MPQAD should have stopped work in the case of NCR 4199. Bird sees all the CPCo NCR's, but he doesn't routinely see Bechtel NCR's. There are five nonconformance reports attached to Dr. Landsman's testimony, but Bird is only aware of 3 incidents.

11547-49 Direct Exam of Richard Woods.

Witness Woods is employed as a consultant to Bechtel. The testimony of Dr. Woods is admitted into evidence.

11550-52 Mr. Steptoe asks the witness a question re: his 11/20/82 testimony where he cited a Swiger & Christian reference. Woods states his purpose was to cite examples here liquefaction had been studied. The paper he cited doesn't include information on the lateral extent of those liquefaction incidents.

11553-55 Board Exam by Judge Cowan

Woods refers to the diesel storage tanks and that a 1/10 inch shakedown presents no hazard. He states that duct work and piping are designed specifically to 1/4 inch differential movement. The 1/4 inch is a differential amount, which would imply next to a 1/4 inch settlement there would be zero.

Board Exam by Judge Bechhoefer

The railroad bay is designed to accept a 1/4 inch settlement too. Most testing of sands for shake-down settlement up until the Pike, et. al. paper, had been done in one dimension where a sample was shaken horizontally. An earthquake doesn't work this way. Pike did studies at U. of C. on the effects of multi dimensional shaking. For each additional component of motion there was additional settlement of dry sand. So to make a conservative estimate you multiply one dimensional shaking by three.

Direct Exam of Joseph Kane

- 11556-59 Kane testified previously as to the seismic shake-down characteristics of the DGB, The seismic induced settlement for the DGB was presented by Dr. Hendron and maximum settlement was estimated at 1/4 inch plus or minus .15 inch. Kane has no problems with these calculations.

Board Exam by Judge Harbour

- 11560 The methodology represented in Dr. Woods testimony is acceptable according to Mr. Kane. Kane doesn't think it is acceptable to say that because it is three-directional shaking a factor of three should be used. But a factor of three would include the cases Kane is aware of.
- 11561-66 Mr. Paton states that the SALP report that was to be issued 6/1/83 is going to be delayed by Region III.

Cross Exam by Ms. Stamiris

- 11567-70 Bird doesn't remember whether he ever questioned if a formal stop-work order by MPQAD should be issued around the 4/28/82 incident.
- 11571-75 Discussion between Ms. Stamiris and Ms. West. Ms. Stamiris identifies a quality action request dated 7/21/82, from Davis (Bechtel) to Byron Palmer, re: underpinning deficiencies reported between 7/8/82 to 7/19/82. Ms. West sees no connection between this document and these witnesses.

- 11576-81 Ms. Stamiris is asking whether the MPQAD considered issuing a stop-work order around the same time that the site manager issued it, for the time period 4/24/82 to 4/30/82. Mr. Bird is requested to search for any oral or written information relating to this question.
- 11582-84 Bird states that Mr. Miller issued the verbal stop work because he happened to be there first. In Miller's written record of the verbal stop-work order, he perceived that Bechtel did not have control over Mergentime and their subcontractors. Bird agrees that Miller was correct in this perception as of 4/28/82.
- 11585- Bird got a phone call on the 28th saying that they thought the Q electrical duct bank had been hit during operations. Bird doesn't remember any information re: hitting anything on the 24th in the initial conversation with Mr. Miller. Miller's stop work on 4/28/82 did cover drilling in both Q and non Q areas, but it applied only to Mergentime and its subcontractors. There were other people still drilling, which is why drilling was going on re the 5/19/82 incident in Attachment 7D. In NCR 4245 there is a reference to Kelly dewatering, who was a subcontractor to Bechtel, but not Mergentime. Mergentime and its subcontractors were involved in the freeze wall and some temporary dewatering wells.
- 11589-93 According to Bird there were 3 other incidents written up on MPQAD NCR's which Miller had to be aware of because he's on the distribution list. Kelly was not involved in the incidents. Mortrench, a subcontractor to Mergentime was involved in installing the freeze wall. Neither Bird or Wheeler are aware of drilling problems with Kelly Dewatering. Stamiris Exhibit 39 is introduced into evidence. It is a letter from Miller confirming the verbal stop-work order of 4/28/82. The verbal order and the written letter were done the same day.
- 11594-97 Bruce Peck is the construction superintendent. Fischer, of Bechtel is the subcontractor's manager for the soils work. Bird can't remember what MPQAD people were aware of the 4/28/82 incident or the confirmation of the incident on 4/28/82, nor who called him to relay this information. Don Horn cannot recall whether he called Bird.

- 11598-99 The people drilling on 4/24/82 didn't know they were that close to the duct banks because the rig had been misplaced a few feet. The drawings indicating the duct bank location were accurate. The first two Mergentime drilling incidents had nothing to do with the physical location of the hole. The 4/24/82 incident was the first case where they made a location error.
- 11600-2 During the 4/28/82 period the soils remedial work was under the control of MPQAD, but Bird can't confirm when the soils remedial work was put under MPQAD as opposed to Bechtel. The quality assurance aspects of soils remedial work were always under MPQAD.
- 11603-7 During the 2/82 incident described in NCR MO1-4-2-008 Bechtel had an administrative guideline entitled Excavation Permit System. It was not a formal procedure and didn't fall under the QA program. A more stringent excavation permit system was implemented on 5/24/82 and was revised as of 6/24/82. Revision #1 of 6/24/82 includes a drawing list which Revision 0 of 5/24/82 didn't have. There were some other minor changes which Wheeler doesn't know offhand.
- 11608-12 Ms. Stamiris requests a copy of Revisions 0 and 1 to compare. On NCR 4199, Attachment 7E to Dr. Landsman's testimony it states that no hold tags were applied on 4/29/82, but a Bechtel QC hold tag was applied to that location as of 5/10/82. The letter before the date 5/10/82 appears to be the initials JWM, which would be Miller's, who wrote the NCR initially. Bird would not assume that the date 5/10/82 at the right hand column corresponds with that same date in block 16. The purpose of a hold tag is to prevent further work on that item as described on the hold tag. Bird would assume no hold tag was applied prior to 5/10/82. The 4/28/82 stop work directive was from a different organization and applied to Bechtel, Mergentime and its subcontractors. Bird recalls he discussed a hold tag with MPQAD and they decided one was necessary. H doesn't know why, on this document in box 22, the word "repair" has been replaced with "rework". They are basically synonymous. The duct banks have not been repaired by Mergentime.

- 11613-15 Protective measures were taken on the duct banks to prevent further degradation. In block 16 it says that it is undetermined if any other conduits in the duct bank are damaged. Bird doesn't think they found any damage besides the water coming out of the conduits. The source of the water in Cable Pit IBMH004 was probably drilling mud or ground water, but Bird isn't sure. The drilling fluid found in the Auxiliary Building is a soybean derivative used to stabilize the hole. It is similar to "thin mud". The duct bank that was damaged goes to the service water structure, east of the Turbine Building. The drilling fluid ended up in the Auxiliary Building because that is where the low point of the duct bank is.
- 11616-17 The damaged duct bank runs from the Auxiliary Building to the Service Water Pump Structure. Bird doesn't know if the water found in the cable pit at the Auxiliary Building was found at the same time the drilling fluid was found in the Auxiliary Building on 4/28/82. For the BWST excavation incident on 4/21/82 they were physically trying to get next to the tank. With the 4/24/82 incident procedurally they should have stayed 2 feet from any utilities.
- 11618-19 Ms. Stamiris reads excerpts from Bird's testimony and from a letter dated 5/25/82, from Brunner to the Board re NCR 4245. Bird agrees with Brunner's description of the incident at the time. Bird has stated that the subsidence was the first indication of a problem. He was not present on site when the 4/24 or 5/19 incidents occurred. He went out several days after the 5/19 incident to see it.
- 11620-23 Bird has read the geotechnical report re the 5/19 incident. They believe it was caused by the bailing action of the drill rig they were using and the way they were advancing it into the ground, causing the suction of material from outside the casing up through the top. Wheeler saw this site in the afternoon and noticed the subsidence. Wheeler understood that they hit an unidentified obstruction first before observing subsidence. Neither Bird nor Wheeler know if drilling stopped after hitting something. On page 5 of Bird's testimony he discusses the void formation re NCR 4245. The conditions at OBS-4 and the drilling were unique and this type of condition hadn't happened at any other well.

- 11624-30 On page 2 of NCR 4245 it refers to another 12 inch hole/void created at another well. Bird doesn't see any connection between the two incidents. He states that this reference is used only to aid the investigation and discover the real cause of the void at OBS-4. Wheeler states that the 12 inch hole, drilled by Mergentime, collapsed because after time the revert that's used breaks down, so the hole collapsed under its own pressure after the well was left open. Dr. Hendron testified on 11/15/82 re the NCR 4245 void created during drilling. The geotechnical report on OBS4 was written by Bechtel people. Neither Bird nor Wheeler know if the void at OBS-4 extended towards the 12 inch well. In Attachment 7D packet of documents it states that the drill hit an obstruction at OBS-4 at 35 feet. Bird assumes they ascertained what the obstruction was sometime after hitting it.
- 11631-35 Ms. West objects to questions re the void because Dr. Hendron has already testified to this. Bird doesn't know whether the geotechnical people considered the possibility that the void existed in the soils separate from the drilling incident. There was no formal stop-work order for the 4245 drilling incident because Bechtel had already stopped work and issued an activity hold on 5/19/82. This information is from the Midland Quality Control Activity Hold Order. Ms. Stamiris reads this document into the record. Bird didn't receive copies of Bechtel activity holds. MPQAD went on site to check the void at OBS-4 but probably generated no real paperwork.
- 11636-37 MPQAD did write an SCRE to examine the 5/19/82 incident for reportability. Bird himself didn't consider a stop-work for this incident. Bird feels adequate tracking and trending was provided for An NCR was written to document the nonconformance Bechtel issued a stop work and Consumers Power initiated the SCRE that dealt with reportability.
- 11638-41 As of the date 6/1/82 the Bechtel activity hold had not been lifted. In Attachment 7D is a Bechtel nonconforming installation conditional release dated 5/24/82, which allowed the void to be backfilled. The activity hold order applied only

to drilling. Bird believes the conditional release is against the hold tag that was placed on the observation well, not the activity hold. There is another conditional release dated 5/26/82 in Attachment 7D. It allows cleaning/flushing of the casing and an inspection of the 12-inch circulating water drain line that was hit during drilling on 5/19/82. According to Wheeler they were concerned at the time about the water level within the casing being maintained so no more materials would come into the casing.

- 11642-47 Bird was on site on 5/19/82 when the incident occurred and had discussions with his staff to get the details. Wheeler was called in to look at it on the afternoon of 5/19. Bob Sevo of MPQAD was there. Ms. Stamiris reads from a Bechtel field engineers report dated 5/19/82. It states that drilling on OBS-4 continued for 4 hours after hitting the obstruction. Bird says that the drillers did not know a utility line was in the area. Bird states that the only similarity between this incident and NCR 4199 is in the lack of consensus as to what was being hit. Knowing what they know how Bird states that drilling should have stopped sooner than it did.
- 11648-52 Ms. Stamiris introduces Exhibit 40. The stop work order FSW-22 dated 5/19/82 re the 4/24-4/28 incident in NCR 4199. Neither Bird nor Wheeler are aware of whether the NRC was advised of the 5/19/82 incident. There are well logs that exist for the drilling incidents at Bechtel.
- 11653-55 Mr. Hood (NRC) testifies that on 5/21 he and the ACRS subcommittee toured the site and were briefed by Jim Cook on the penetration of this duct. During a tour Hood and Landsman observed the cavity itself. Wheeler was present when the ACRS toured the site.
- 11656-59 Ms. Stamiris reads from another field engineer's report dated 5/28/82 re a rise in the water level around the casing. The engineer states it might be due to heavy rains. Ms. Stamiris reads from a field engineers report dated 6/1/82 re a polyethylene film used to cover the cavity to keep rain water out. Neither Wheeler nor Bird know anything about these.
- 11660-66 Ms. West objects to Ms. Stamiris' questions re ground water rise and its geotechnical significance. Ms. Stamiris refers to a Bechtel Power Corp. daily report, number 10FI, dated 4/27/82 in Attachment 7D.

- 11669- Preliminary Matters
11690
- 11691 Direct Examination of Mr. Wheeler by Ms. West

Ms. West asks Mr. Wheeler what the purpose of Bechtel Power Corps. Daily Report Sheet 10F1 is that is included in Attachment 7-D of the Staff's Testimony.
- 11692 Witness Wheeler:

On the NCR 4245 there is a reference to an abandoned 12-inch drill hole. The dai'y report, which refers to ME-54, a dewatering well hole, is attached because the 12-inch hole and ME-54 are the same.
- 11693 The transcript reference from 2/15/83 where this question was asked is page 11663. The ME-54 well referred to is 30 ft. from OBS No. 4. The ME-54 well is a temporary well for pumping water out. OBS No. 4 is part of a permanent dewatering system for observing water levels in that area.
- 11694 Cross Examination of Mr. Bird & Mr. Wheeler by Ms. Stamiris

On sheet 10F1 Mr. Wheeler refers to the well ME-54 in the first paragraph. Wheeler still agrees with his characterization of the first paragraph.
- 11695-96 With respect to temporary dewatering wells, which are covered under the Mergentime & their subcontractor's stop-work, there have been problems with drillings. With Kelley dewatering wells, like OBS4, there were no drilling problems prior to 4/28/82.
- 11697-11700 Bird has stated that the person who initiated the stop-work directive was certainly aware of more incidents. As a quality assurance professional Bird would have to consider if the drilling incident was the first such one, or a repeated occurrence. At the time of the 4/28 incident Bird became aware of other instances because he was on the non-conformance report distribution list. He was aware of the 42-inch hole incident, referred to as #008.

- 11701 Ms. Stamiris asks Witness Bird to look at an interoffice Memo to Mr. Leo Davis in packet 7D. Bird doesn't know what FCR 3987 is in reference to. FCR stands for Field Change Request. BCBE is a letter serial.
- 11702 Bird would agree with the assessment of project engineering (in memo) that OBS-4 was an isolated case and would not prevent the continuing installation of OBS-1A or other permanent wells. However, he was not aware of this memo when it was written. His opinion is based on his reading of the geotechnical report and other information.
- 11703 There was no formal stop-work action instituted by MPQAD in relation to this 5/19 drilling accident.
- 11704 Bird recalls that after the 5/19 drilling incident took place he became aware that work had physically been stopped, so there was no need for a formal stop-work order by MPQAD.
- 11705 Ms. Stamiris marks an oral communications record dated 5/19/82 as Exhibit 41. This exhibit summarizes a Consumers Power Co. conversation in which Mr. Peck requested that MPQAD stop drilling operations by Kelly Dewatering.
- 11706
- 11707 Mr. Peck is a member of site management. Witness Bird considers Exhibit 41 a request that MPQAD make sure that certain actions are taken, not that MPQA take any action. Bird has no knowledge re: whether drilling continued for 4 hours on OBSW 1-A after the obstruction was hit on OBS 4.
- 11708-711 Bird can't comment on whether it is good quality assurance and control procedures to continue drilling for 4 hours on Well 1A before ascertaining whether the void and obstruction hit at Well 4 would affect other drilling. Well 1A is southeast of the Diesel Generator Building. Well 4 is between the Diesel Generator and Turbine Buildings. So the wells are approximately 100 feet apart. These wells were two of the last ones Kelly drilled for the dewatering system.
- 11712-714 Bird has no specific knowledge of why drilling was stopped on Well 1A at 2:40 p.m. Well 4 was not completed when the void was encountered, and has never been finished.

- 11715-18 Mrs. Stamiris' Exhibit 41 is entered into evidence. Stamiris shows Witness Bird Exhibit 42, SCRE 51, a safety concern and reportability evaluation that Bird made regarding the drilling incident on 5/19/82. Bird states that page 2 of the SCRE, which shows the distribution, is missing, as well as other pages. Bird has with him an original copy of the exhibit, marked as Exhibit 42.
- 11719-22 In Bird's safety and reportability evaluation he states that there was a possible flow of structural backfill material from the void into the conduit, but that the safety impact is undetermined and must be evaluated. Ms. Stamiris asks Witness Bird what criteria he applies in reporting events under 50-55(e). His first condition is whether the event could have an adverse safety impact if undetected. Then there are four conditions that have to be met if the condition is to be reported:
- a QA programmatic breakdown.
 - a significant deficiency in the released design documents
 - a significant construction deficiency or damage which would require extensive evaluation, analysis or corrective action or fix.
 - a deficiency in the performance operation of the plant, i.e. the equipment.
- 11723 Bird interprets 50-55(e) requirements such that the first criteria must be met as well as one of the other conditions. Bird does not believe that the law required reporting an incident if it had only a potential adverse safety impact.
- 11724-26 SCRE 51 does not make a determination of reportability. The studies regarding the void that was created near OBS 4 are not completed at this time. On this SCRE 51, which goes toward the 50.55(e), there have been no further changes in the reportability of this document. On the maps for Exhibit 42, "elevation view A" refers to OBS 4.
- 11727-28 The 12-inch drilling hole that was abandoned is to the west of OBS 4, approximately 30 ft. away, according to the NCR.
- 11729-11733 On page 8647 of Dr. Hendron's testimony he states that the void was produced by the drilling procedure. Mr. Steptoe objects to Ms. Stamiris' line of cross examination.

- 11734-35 The 12-inch hole was drilled on 4/27. The obstruction was hit on 4/24 and the fluid was found leaking into the Auxiliary Building on 4/28. NCR 4245 refers to OBS-4, and NCR 4199 refers to when the Q duct was hit.
- 11736-38 One cannot assume that the well is as deep as the void above it. The hole that was drilled by the duct bank damaged an area on the east side of the Turbine Building. The damage was to the duct bank that ran to the Auxiliary Building, where the drilling fluid was observed. It was approximately 200-300 feet between where the duct bank was hit and where the abandoned 12-inch hole collapsed. Witness Bird doesn't think there is a causal relationship between the damaged duct bank and the 12-inch hole that caved in on 4/27.
- 11739-40 Witness Bird believes that the stop works and excavation permit system that were instituted were effective in preventing further damage and drilling incidents.
- 11741 Stamiris Exhibit 42, 4 pages, is admitted into evidence.
- 11742-44 Stamiris marks Exhibit 43, a Bechtel quality control activity hold over for the drilling incident on 5/19/82. Witness Bird recognizes the exhibit. The bottom left hand corner of the document indicates it was filled out on 5/19/82 at 3:30 p.m. Bird is not familiar with the investigation status at OBS 1-A.
- 11745-49 On page 20 [of 22 pages] is a release that took place on 7/9/82. Ms. Stamiris asks Witness Bird why an activity hold was placed on Well 1-A when no relationship existed between Well 1-A and OBS-4. Bird states that it was from 10:30 until 2:40 p.m. between the recognition of the void and stoppage of work on 1-A. At that time there was no apparent connection, but the work stoppage was the "conservative thing to do."
- 11750-51 Mr. Wheeler reads from a daily geotech report to clarify the progression of events. On 5/18/82 at 1715 (5:15 pm) hours the drillers hit an obstruction at 34 ft. The shift ended at 1730 hours and the drilling ended. On 5/19/82, at 7:15 am, Chuck Wilson was informed of the obstruction at OBS-4. Wilson checked his drawings and stated there were no known obstructions so drilling could proceed. At 7:30 am drilling resumed. At 9:30 am drilling stopped due to lack of progress.

After conferring with geologists in Ann Arbor, drilling was continued, but pieces of wood were being drilled and the casing bounced back while being driven. These conditions had been observed in the C-118 wells where wood obstructions were encountered.

- 11752 The above described document is marked as Applicants Exhibit 31.
- 11753 Bird states that hitting obstructions while drilling is not uncommon, but the concern at OBS-4 was hitting an obstruction and discovering the void.
- 11754 Bird believes that the same chain of events would have taken place on 5/19 whether the NRC inspectors had inspected OBS-4 at 1:00 pm that day or not.
- 11755 Ms. Stamiris introduces Exhibit 44, a list of utilities' piping that was hit during unanticipated events. According to Bird, there has not been a precise record kept of these drilling/excavation incidents considered unanticipated.
- 11756-58 The list mentioned above was done by a Mr. Netzela, recorded on his own for a period of time in 1982. Ms. Stamiris offers Exhibit 44 into evidence, which is the 1st 5 pages of enclosure B, excluding the handwritten list.
- 11759-61 The excavation permit system requires that after encountering a utility three organizations, including MPQAD, must approve before work can proceed. The term utility refers to any obstruction encountered.
- 11762-64 Bird describes incidents where obstructions were hit while underpinning at the Auxiliary Building. In one of the access pits they encountered a grounding grid, which is copper cables used for grounding under the plant. Bird is familiar with the incident where concrete was encountered in the excavation work with Pier 12. The drift to Pier 12 on both sides was all lean concrete backfill. According to Bird, the Turbine Building has alot of lean concrete backfill under it, so the concrete backfill incident was not unexpected.

- 11765 The work for the Auxiliary Building is covered under C-200, not the excavation permit system. C-200 does not require MPQAD involvement to proceed with the work. Bird is not qualified to say whether the underpinning work is the most critical excavation work at the site.
- 11766-67 The excavation permit system is used for general types of excavation/drilling that occur for short periods of time. The C-200 relates to underpinning specifically, which is engineered with detailed drawings. MPQAD would be involved in improving drawings, etc.
- 11767 Cross Exam by Mr. Marshall
Mr. Bird stated he was not qualified to answer Ms. Stamiris' last few questions. This is because he is not a geotechnical engineer.
- 11769-11802 Afternoon Session
Preliminary matters re: Mr. Gilroy's testimony.
- 11803-05 Cross Exam of Mr. Wheeler by Ms. Sinclair
In Applicant's Exhibit 31, the words "lack of progress" refer to the driller continuously hitting an obstruction. The abandoned well 30 ft. west of OBS-4 is termed ME-54. The well was drilled on 4/27, and caved in some time after 4/27. According to Bird there was no obstruction hit on well ME-54, only on OBS-4.
- 11806-11807 Witness Wheeler states that according to the daily report they drilled 28 ft. and hit an obstruction. Wheeler cannot determine from the sketch on Stamiris Exhibit 42 whether the void would extend to elevation 625 or if it is 9 ft. deep. Under Count 16 of NCR 4245, which is Attachment 7D to Dr. Landsman's testimony, Bird and Wheeler are not sure if 9 ft. deep means "in elevation" or "9 ft. measured in the diagonal back into the hole." Bird believes that the field reports attached to the NCR discussed whether any soil material entered the 12 inch line for OBS-4.
- 11808-09 Witness Bird doesn't know anything about the 12-inch line. He believes that Dr. Landsman brought the void problem with the BWST valve pit to MPQAD's attention. Bird assumes this was an item of non-compliance in Inspection Report 82-03. Bird does not believe there is a NCR on the damaged rubber coating referred to in Stamiris Exhibit 44.

- 11810-11 Bird states that the list is not accurate, re: the rubber coating was not Q. The list they're referring to was prepared from Netzela's (Bechtel) handwritten list. The trend analysis does not have a specific category for drilling incidents. Bird assumes the trending analysis breaks NCRs down into Civil NCRs. Witness Wheeler states that there was a possibility they would hit concrete backfill under the Turbine Building, and during the drifting of Pier 12W and 1280.
- 11812-14 Witness Wheeler doesn't think the drillers necessarily anticipated there would be concrete in this area. The final engineering report on this has not yet been completed. On page 7 of Bird's testimony he refers to some incidents that require further investigation and the NCRs remain open. The pipe line that was damaged during the drilling of OBS 4 is a condensate line, but is not a Q listed pipeline, though the incident occurred in a Q-soil area.
- 11815-16 Nothing has been done to repair the line. With this type of drilling you bale cut the inside as you advance the casing, it was the casing which contacted the line, not the cable tool drill. This type of drilling is the cable tool method. The geotechnical report states that the baling method was the cause of the cavity formation. The fifth page of the Attachment 7D to Dr. Landsman's testimony is a conditional release to perform certain excavation activities, dated 5/24/82. The procedure indicated by this page is different than the procedures referred to by the excavation permit procedure.
- 11817 The backfilling procedure was a temporary solution that did not come under the excavation permit system. The 5/26 conditional release did not come under the excavation permit procedure either. They were only trying to ascertain whether the 12-inch line was damaged, they were not excavating a hole to put something in it.
- 11818-21 These two incidents didn't involve any disturbance to the soils in that area. The excavation permit procedure did apply to the partial release allowing drilling operations on OBS 1-A. Under the excavation permit procedure, since this was in Q-soils, MPQAD would have to approve restart of the drilling. Under the current procedure, if any obstruction were hit, work would be stopped. With the

older procedure MPQAD would be involved only when someone from the construction site determined that a Q line/structure were involved. Now MPQAD would work with other parties and confirm what obstruction, regardless of what it is, was hit prior to restarting operations. The drawing, C-45, conforms to the latest version of that drawing as approved by the Staff. C-45 has been changed, and includes comments associated with the board order.

11822-23

The C-111 drawing picks up the requirement for the cooling pond dike adjacent to the emergency cooling pond and the baffle dike, which hasn't been issued yet. When it is issued, they will be included in the current procedure. The staff additions to the drawing have already been included in the procedure. Witness Wheeler believes there was a letter to the board confirming there were no Q utilities outside of C-45's defined area. The letter is one of the attachments to Don Lewis' Testimony (11/82 or 12/82).

11824

In Section 7.4 of the new excavation procedure FIC 5.100, the notification should take place soon after the event is discovered, and before any work can proceed the parties must agree that work continue. Both Bird & Wheeler agree that the first time you hit an obstruction you stop, and notification takes place. Hypothetically, some one could not hit an obstruction and move somewhere else to drill, because notification must take place upon hitting an obstruction.

11826

With underpinning the procedures are different. The C-200 requires the same stop action, but it is engineering's job to make a disposition of what to do. MPQAD would be involved in approval of new plans and would have to develop the inspection plans to cover the new work.

11827-29

For underpinning work, detailed design disclosure documents are required. MPQAD is involved with drilling procedures for underpinning work, from reviewing drawings, etc. to concurrence on implementing procedures. If an obstruction were hit that hadn't been determined yet MPQAD would be involved before work restarted, because all work under the Board order requires QA whether it is on a Q list or not.

- 11830 MPQAD would be involved prior to restart in determining whether appropriate steps had been taken. There also has to be a documented engineering decision on what to do if an obstruction is hit.
- 11831-32 During tunneling or other pick and shovel (hand) type excavation the C-200 procedures take effect. If a utility obstruction is hit, the determination of what to do is a project engineering disposition. Witness Bird states that there would probably be a MPQAD person present.
- 11833-36 There is no requirement that MPQAD be notified of an unidentified, unexpected permanent utility being hit in the same time frame as that under the excavation permit procedure. Horizontal (core underground) drilling is done in the course of underpinning. Soils stabilization drilling might come under C-200 procedures. Mr. Bird's title is Manager of MPQAD. The Executive Manager of MPQAD, Mr. Wells, is Bird's supervisor. Under the FIC 5.100 and C-200 procedures, a geotechnical engineer must be present when drilling activities occur.
- 11837-38 On page 4 of Bird's Testimony, he refers to the damage to the duct bank and that procedural control wasn't adequately implemented. Witness Wheeler states that the procedure at the time was that the driller could move within a radius of 5 feet of the drill hole location. The procedure wasn't adequate in terms of protecting the utilities. Wheeler states that the drilling procedures have been changed so the driller can't move more than a foot from the drill location. Also there is an independent survey needed to verify the location for the drill hole.
- 11839 Stamiris Exhibit 40, a stop work order FSW-22, was issued as a "closed loop mechanism" to assure that the required procedural controls were in place. NCR 4245 was a partial lifting of the stop work order or activity hold, issued by Bechtel QC. There wasn't anything prior to the stop work order in the first instance, which was comparable to the Bechtel stop work order.
- 11840-41 Redirect Examination by Ms. West
- An NCR should be written every time a Q utility is damaged. Bechtel NCR's are put into the trending program. A final geotech

report has been prepared on the subsidance in the void off OBS-4. They will also probe the areas to determine soil distrubance and a report will be made. Under C-200 all work done is Q except when emergency action which cannot be preplanned is called for. There is full Q inspection of all work done under C-200.

- 11842 Before FIC 5.100 was implemented it was mandatory to contact that Q organization that had jurisdiction if a Q utility was damaged, but not necessarily MPQAD. At the end of August/early Sepetmber 1982 QC soils became MPQAD's responsibility. Witness Wheeler states that FIC 5.100 is part of the total QA program onsite.
- 11843-44 The purpose of the closed bottom casing that was involved in NCR 008 was to provide an annulus for a hole puncher. The hole puncher was set inside the casing but didn't rest on the casing itself. A crane supported the hole puncher. Under the old procedure, Revision 0 of FIC 5.100, it was mandatory to contact MPQAD whenever an underground utility was damaged. Witness Wheeler wasn't referring to the FE administered program which preceded that.
- 11845-46 Ms. Stamiris would like the geotech report re the cause of the void submitted as evidence. Chairman Bechhoefer states that a copy should be provided to the staff and Ms. Stamiris.
- 11847-51 The circulating water line and the condensate water line are two different lines. On Attachement 7D, the reference to a 12-inch circulating water drain line. Wheeler doesn't know if the circulating water line was hit in relation to drilling incident 4245. Witness Bird believes there is an error in the terminology and it should be condensate water line.
- 11852-54 Neither Wheeler or Bird knows which of these lines would have had green dye in them, as referenced in the NCR 4245. Mr. Budzik of Consumer's Power states there is only one line, the circulating water drain line. It connects water from the cooling pond to the condensor and is non-Q listed. No one is certain this is accurate and it will be verified later.
- 11855 There is a corps of geotechnical soils engineers that are required to be present for underpinning work under C-200.

11856-60 Mike Lewis is the only 'one Wheeler can name now. Well 1-A, drilled on 5/19, was one of the last wells Kelly Dewatering drilled. There are more drilling operations going on. Ms. West objects to Ms. Stamiris question.

11861-62 Ms. Stamiris asks if there is a trending record of all Q drilling incidents. Ms. West objects.

11863-64 The C-200 system for the underpinning work would be used for the excavation at Pier 12. Bird says he did not specifically say it was a requirement that MPQAD would be called in if an unanticipated structure was hit.

11865 MPQAD would possibly be involved only because they have extensive quality control coverage of the work. They would become aware of an obstruction being encountered soon. MPQAD would get formally involved in reviewing design documents for the soils remedial work. In the Pier 12 incident where unexpected concrete was encountered during excavation MPQAD was already present.

11866 Witness Bird was not personally present. Bird states it is not a nonconformance to hit concrete which is accepted backfill material in that area.

11867 Cross Examination by Mr. Marshall

With the Pier 12 incident, they were not drilling in a former dump site.

11867-70 Cross Examination by Mr. Wilcove

When Bechtel initially started excavation at Pier 12, they did not have to get an excavation permit.

February 16th, Evening Session

11873-75 Direct Examination of Ross Landsman

Landsman is with the Region III Staff. He is sponsoring #5 in the QA Staff Testimony dated 10/29/82. The corresponding attachments are 7A, 7B, 7C, 7D and 7E. The question and response are entered into evidence. Landsman was on-site on 5/18/82 when a 12 inch non-Q condensate drain line was hit. (NCR 4245). He spoke to two drillers on the rig, the QA person there, Mr. Wheeler and various MPQAD people. The driller notified the QC inspector or hydrogeologist on the observation well when he struck something.

11876 Landsman was on-site with the NCR & ACRS people on 4/14 when NCR No. MQ-1-9-2-051 occurred, re the undermining beneath the southwest corner of the BWST valve pit. They heard a jackhammer, leaned over the BWST concrete retaining wall and saw a man with a jackhammer removing the foundation support from the BWST valve pit. Landsman told CPCo MPQAD about it. He issued an I&E Region III Inspection Report #8203.

11877-81 Cross Examination by Ms. Stamiris

The driller told Landsman he had told the QC inspector he was hitting something solid at various times, but CPCo told him to continue drilling, until they finally broke through the pipe. CPCo Exhibit #31 records the various conversations. Landsman is referred to Attachment D re a Bechtel report on some drilling incidents dated 4/27/82. The Ejector Well ME-55 incident is similar to what happened on OBS No. 4. Landsman isn't aware of any other incidents like these. The paperwork generated on 5/19/82 in response to the 4245 drilling incident might have been the result of Landsman and Cook's visit that afternoon. He doesn't know if FSW-22 had anything to do with his visit. Landsman doesn't think the QA procedures were adequate in relation to these 5 drilling incidents.

- 11882-87 Landsman thinks the 4245 and 4199 incidents were not handled properly. With 4245, 2 drillers informed their QA people for 4 hours that they were hitting something solid, but they were instructed to continue drilling. For NCR 4199, a drilling rig was allowed to be positioned anywhere without approval, and a duct bank was hit on 4/24. Yet the NCR wasn't even written up until 4/29. Also on NCR 4199, the top level of management got involved when Don Miller wrote the stop work order. All this indicates to Landsman that all site management was inadequate.
- 11888-90 With incident 4245 it wouldn't have mattered whether MPQAD wrote up a stop-work order because the hole was so big that the drillers couldn't work by it. It would have been better for MPQAD to have taken some formal action for the normal trending program. Landsman isn't aware of any other drilling incidents where the soils were depressed under where the rig had been. When he refers to "procedures implemented by Bechtel to control excavation on site" he is referring to the excavation permit system implemented on 5/26/82.
- 11891-93 The work authorization procedure was implemented on 8/12/82. There were incidents that necessitated establishing the work authorization procedure. Once CPCo was digging below the duct bank, which they had not been authorized to do, and another time they were excavating a temporary fire line in front of the service water pump structure. There is an investigation by the Office of Investigation into these events. Landsman doesn't know if it has been completed yet.
- 11894-99 Landsman doesn't believe the work authorization procedure has controlled NCRs adequately. There was an incident in October where the licensee was placing rock on a portion of the perimeter of the dike adjacent to the ultimate heat sink. The riprap on the perimeter dike was supposed to be covered by the QA program. Landsman discovered in October that the perimeter and baffle dikes were not included as Q areas on drawing C-45.

They are included now. Ms. Stamiris asks whether the cause of this incident is similar to other incidents which the work authorization procedure was established to correct. Landsman states that the problem with the riprap isn't the same as the 5 NCRs. He has a list of NCRs written that has to do with soils.

11900-03 Landsman believes the work authorization procedure provides adequate control over soils remedial work activities. The excavation permit system was not working alone without the work authorization procedure. The incidents involving the Q duct banks, the excavation for the temporary fire line and the service water pump structure occurred after the excavation permit system was installed, but prior to the work authorization procedure.

11904-05 Cross Examination by Ms. Sinclair

Ms. Sinclair reads off a sheet re an obstruction hit at 34 feet at OBS. This is Landsman's Attachment 7D re the 4199 incident. He believes (quoting Bird & Wheeler) that their records for non-Q or temporary utility buried installations are not very good.

11906-10 A non-Q utility can be considered a Q structure because if a Q utility is in an area the soil immediately around it becomes Q, so if there is a non-Q utility through an area it could become Q. Ms. Sinclair shows a document called a Quality Action Request, F-197, from Palmer to Davis, dated 10/19/82. Landsman has never seen any graphs showing the trends of the numbers of deficiencies in the soil. Ms. Sinclair requests that the more recent of these graphs be distributed to the parties.

11911-12 The above described graph trends NCRS, IPINS, and QARS.

11913-16 Cross Examination by Mr. Marshall

Mr. Marshall asks Landsman about an inspection report where he was upset because the CPCo remedial soils group kept drilling instead of stopping as Landsman suggested. According to the Atomic Energy Act and NRC regulations the Applicant, CPCo, is responsible for all work at the plant.

11917 Landsman states that they started excavating below the duct banks even though he warned them three times that they didn't have prior NRR approval.

11918-21 Cross Examination by Mr. Miller

Landsman's answer to question 5 of his prepared testimony is correct and true. He feels that the 5 NCR incidents were instances where they lacked the requirements to control the work. With the riprap incident, they had all the appropriate requirements, but it is labelled remedial soils work only by the Board Order of 4/30/82. The 4/30 Board Order requires prior NRC approval before Q work is done. Landsman states he was shocked when he was on site and saw that the placement of the riprap wasn't Q. This was an example of a misunderstanding between the Staff and CPCo.

11922-25 Landsman was concerned in his 2/8/83 inspection report because the perimeter and baffle dikes adjacent to the emergency cooling pond weren't included as Q on Drawing C45. This wasn't an item of noncompliance because the licensee wasn't doing any work in those areas. Landsman was on site when the undermining of the water storage tank valve pit incident occurred. He wrote up NCR 8203 because the soil was subsiding in the area. He assumes excavation permits were issued for CPCo's excavation below the deep Q duct bank and for the fire line.

11926-27 Landsman states that at the time he wrote a memo to Shafer, dated 8/24/82, he was concerned about the technical adequacy of the continued excavation under the deep Q duct bank. But the memo states that his "concern was with the ASLB order requirement to notify and receive prior staff approval before proceeding below the duct bank."

11928-30 Board Examination

Landsman was present while the underpinning of the BWST valve pit was going on and observed the soil beneath the foundation being removed. He would describe it as lack of attention to detail or carelessness, and lack of common sense. There was an electrical duct bank next to and beneath the BWST valve pit. Remedial work involved placing a new ring beam foundation around the old one, by removing the duct bank. There were no excavation controls on excavation, only on replacement of material. They removed the concrete giving lateral support to the dirt underneath the valve pit, allowing sand to slide into the void created by the duct bank.

14444

BY STAMIRIS & BERNABEI

[Bernabei says she will examine on the following topics: Research certification; requalification of QC personnel; lack of QA experience and competence of CPCo management; DGB inspection; findings and CPCo responses; and CCP & adequacy of independent audits. Stamiris will examine on the Spessard memo issues and SALP.

BY BERNABEI

14449-64

Gardner summarizes findings in IR 82-06, which indicated problems with qualification of Bechtel QC inspectors: Following the 5/81 inspection (See IR 81-12), the Staff asked CPCo to reinspect Class 1E cables to determine the adequacy of installation and of the original inspection. The Staff undertook to upgrade the Bechtel QC certification process by requiring documenting of on-the-job training and an overview by QA beginning in 12/81.

The QC certification program is still inadequate, though. Reinspection of 1,084 cables (See IR 82-06) showed 55 misrouted cables. The "unresolved item" status of the cable installation and inspection was thus designated a "noncompliance".

Regarding the pipe support installation problem identified in IR 82-07, Gardner says 45% of previously accepted hangers were deficient in one way or another. Both the cable and the pipe support problems caused Gardner to be concerned about the QC inspections.

In summer of 1982, the Staff directed CPCo to do a 100% reinspection of Class 1E cables previously installed and a reinspection of pipe supports installed between certain dates.

The Staff then recommended that CPCo take over the Bechtel QC functions and that it change its procedure re: recertification of QC inspectors to better conform with Reg Guide 158 and ANSI 14526. CPCo subsequently integrated QC into MPQAD (except for ASME QC functions).

- 11931-36 Landsman has reviewed excavation permit procedure FIC 5.100 and believes this procedure is adequate. He believes that Seciton 741 is too restrictive and should say "...if any unidentified obstruction is encourtered..." instead of utility. Because of Section 2 an excavation permit is not needed for remedial soils work because these are covered by the design documents. Landsman would like to see excavation permit controls for this. C-200 is for identification and initiation of administrative action and corrective measures for underpinning activities. In Appendix E C-200 it is listed as a corrective measure for unplanned events. Landsman would like to see a document like FIC 5100 to control the underpinning work.
- 11936-37 Landsman feels stop work orders should be issued by the lowest level of management possible, such as QA.
- 11938-40 Redirect Examination by Mr. Wilcove
- The 8/24/82 memo Landsman wrote dealt with the violation of the Board order. What he meant re this memo, transcript page 11926-27 was that his concerns were with the violation and not with technical adequacies. He didn't mean to state to Mr. Shafer that he had no technical concerns. When his answer to Question 5 of the prepared testimony was written he thought the excavation permit system applied to the remedial soils work.
- 11941-44 Recross Examination by Ms. Stamiris
- Landsman intended for his 8/24/82 memo to Shafer to deal with violations of the Board's order, nothing more. But the licensee was aware that he had some other technical concerns. When Landsman prepared his testimony sometime prior to 10/29/82 he didn't have the riprap incident in mind.
- 11945-50 When Landsman wrote his answer to Question 5 he thought the excavation permit system was also controlling the excluded remedial soils work, the underpinning work. The October riprap incident should have been Q work, but wasn't being done as Q work.

- 11951-53 Landsman states that he thinks the work authorization procedure and the excavation permit system should control the remedial soils work for underpinning. Having both the C-200 and 51C 5100 procedures would be an improvement. Landsman needs to clarify a previous statement. An excavation permit would not be needed for the riprap because its non-excavation work.
- 11954-58 The Bechtel excavation permit system in itself is not adequate as evidenced by the need for the work authorization permit adopted in 9/82. He thinks that some QA/QC principles should have been more vigorously implemented in the BWST incident.
- 11959-64 Recross Examination by Mr. Miller
- Landsman would interpret obstruction as used in Section 741 (FIC 5100) to include encountering lean concrete backfill. So with open pit excavation if the licensee encountered lean concrete backfill they would have to follow the procedures in FIC 5100. Landsman is shown an inspection report, dated 7/2/82, dealing with the BWST incident. It refers to Specification C-211 and non-compliance with it because the appropriate controls weren't included in C-211. He has reviewed other procedures that cover underpinning work. The licensee has to do advance planning to comply with these other procedures. For procedure C-200, in Appendix E, encountering unexpected utilities is considered an unplanned event. Landsman states that in view of the history I wouldn't expect "CPCo to plan for excavating around utilities." He later states he expects they would plan for utilities whose location they know as they advance underpinning work. The Pier 12 excavation incident was completely unexpected, but C-200 procedures were followed.
- 11965-67 The excavation for underpinning work was estimated to take 60 weeks. He wouldn't expect one excavation permit to be issued for all this work if his suggested amendment to FIC 5.100 was implemented. His suggested addition would insure that various inspectors of Bechtel and CPCo would look at the drawings and plans and sign their names after doing so. To his knowledge, there is no comparable sign off for the present excavation planning function for underpinning. Landsman has reviewed C-200 and FIC 5.100 before but didn't make this comment.

11068-71 Mr. Shafer, to whom the 8/24/82 memo is addressed, is Landsman's immediate supervisor. In the memo he tries to describe his conversations with the licensee during his exit meeting on 7/30/82. Landsman didn't discuss any technical concerns re excavation to the licensee during the meeting, but did prior to that. Kane and Landsman discussed their concerns re excavating below the duct bank to Mr. Hood and various other people at a meeting on 5/20/82.

11971 Redirect Examination by Mr. Wilcove

The technical concerns Landsman's been discussing haven't been resolved or discussed by the Applicant with NRR.

11972 Recross by Ms. Stamiris

Landsman previously stated that C-200 procedures are to respond to problems. He believes his sign off suggestion would remedy this concern.

NRC Hearings February 17, 1983

<u>Page</u>	<u>Text</u>
11972-95	<u>Preliminary Matters</u> <u>Direct Examination of Palanichamy Shunmugavel</u> (by Mr. Steptoe)
11995-97	The witness made several small changes to his testimony concerning the structural evaluation of the Auxiliary Building for seismic shakedown settlement. The testimony was then admitted into evidence. <u>Cross Examination of Palanichamy Shunmugavel</u> (by Ms. Wright)
12004-8	The 1/4 inch settlement values mentioned in the witness testimony refer only to seismic shakedown settlement in the north end of the Auxiliary Building, where there is some sand backfill. Settlement values due to normal (static) settlement mainly affect the control tower area and have been considered by others. A structural analysis of the railroad bay area was made by softening the soil spring to simulate shakedown settlement and its effects on the structure. Since the railroad bay area settles or deflects by 3/10 of an inch at the northernmost end, under regular dead end load, seismic shakedown settlement of 1/4 inch will not cause a void. The concrete connection between the Auxiliary Building and the railroad bay would crack due to seismic shakedown so that the stress could go to the steel. He did not know exactly how extensive the stress would be but the reinforcing steel would be stressed to approximately 30 KSI, which translates to 30 mils.

Board Examination of Palanichamy Shunmugavel

12008-10 The figures used in the load combination formula correspond to those given in the ACI 349 and ACI 318 codes. The building can withstand deflection of around .5 to .47 inches.

12010-11 Cross Examination of Palanichamy Shunmugavel

(by Ms. Wright)

Total deflection equals dead load plus live load and the effect of shakedown.

Direct Examination of Palanichamy Shunmugavel

(by Mr. Steptoe)

12011-16 Witness cited corrections he wished to make to his testimony concerning seismic category 1 duct banks at Midland and it was then admitted in evidence.

12017 It will be necessary to use ethafoam to isolate the duct banks north of the Service Water Pump Structure. All of these banks must be isolated at the point where they interface with the service water pump but only one requires isolation at the interface between the flyash cement mixture and the backfill. The buildings and duct banks meet acceptance criteria.

There are other ways to accomplish isolation besides using ethafoam but ethafoam is going to be part of the remedial soils measures subject to work authorization procedures.

Cross Examination of Palanichamy Shunmugavel

(by Ms. Wright)

12020 The concrete duct banks near the service water pump structure have no structural function but merely provide space for cables. Since the electric cables can withstand being placed directly in the earth they are not impaired by the cracking or concrete duct banks or by the leakage of water through plastic conduits.

A large shear at a concentrated point could cut the cables although this is unlikely to happen since the conduits are only 20 to 50% filled with cables and can accommodate some shearing by packing the cables together.

12023 The witness expects the FSAR to be revised by the summer of 1983 to reflect actual conditions in the field concerning duct bank sections.

Board Examination of Palanichamy Shunmugavel

12023 Laitances are cement drippings that form obstructions when they harden.

The grade 60 reinforcement in the duct banks has no structural function but rather is used to avoid surface cracking as the concrete cures. A minimum number of temperature reinforcements are required by the codes.

The purpose of the ethafoam in the duct banks is simply to provide a crushable material for the cables. The witness has seen no test results assuring that the ethafoam will maintain its physical or structural integrity over the 40 year life of the plant.

12026 The service life for cables buried directly in the earth is 40 years. The witness evaluation, cited in his testimony, did not take into account seismic deformation. The maximum strain from earthquake translates into 3 inches of differential settlement over about 20 feet. The effect of live loads on the cables would be minimal since the duct banks are at least 3 feet below the ground surface and they are additionally cushioned by the ethafoam.

12030 The ethafoam is about 6 inches thick and can compress 3 to 4 inches.

Redirect Examination of Palanichamy Shunmugavel

(by Mr. Steptoe)

12031 A quarter inch of the 3 inch settlement refers to shakedown settlement due to seismic shaking, however, Shunmugavel's testimony generally refers to settlement effects rather than earthquake effects.

Cross Examination of Palanichamy Shunmugavel

(by Mr. Marshall)

12033 The cables are encased in plastic conduits.

Cross Examination of Palanichamy Shunmugavel

(by Ms. Wright)

12033 Shunmugavel's evaluation of the duct banks did not consider the strength of the reinforcing steel since he was calculating only strain in the cables. Live loads have no effect on the cables.

12034 The area north of the service water pump structure will be backfilled with K concrete (flyash cement mixture). All but 10 feet of the duct banks will be supported by soil. The cable can tolerate a 10 to 30% strain.

Direct Examination of Frank Rinaldi

(by Ms. Wright)

12040 Rinaldi agreed with Shunmugavel's testimony and had no comments except to say that he thought the Applicant is using a reasonable approach in evaluating the shakedown problem in the north part of the Auxiliary Building.

12043 Cross Examination of Frank Rinaldi

(by Mr. Marshall)

Rinaldi took no exception to any part of Shunmugavel's testimony.

Board Examination of Frank Rinaldi

12043-48 Rinaldi thinks the applicant is taking the various loads -- dead load, live load and seismic load, for both the Auxiliary Building and duct bank into account adequately.

He agrees that the cables are adequately protected against shear forces caused by an earthquake.

Afternoon session

12049-65 Preliminary Matters

12065 Direct Examination of Joseph Kane

(by Ms. Wright)

With respect to Stamiris Contention 4A of sub-sections 3 and 5 Kane stated that the staff evaluation of the preloading of the Diesel Generator Building has already been provided in past testimony and the SSER. The results of subsurface explorations and laboratory testing indicated to the staff an acceptable margin of safety for bearing capacity, liquifaction potential and seismic induced settlements.

12068 Concerning Stamiris Contention 4A5 Kane stated the staff agrees with the statement that preloading yields effects not scientifically isolated from the effects of the rising cooling water but it is their understandings that the piezometric levels were measured properly. The boring and laboratory test results have been used to establish the condition of the soil with respect to settlement and thereby overcome piezometer data difficulties.

12070 With respect to Stamiris Contention 4C(a) Kane stated that SSER No. 2 addressed differential soil settlement for both the feedwater isolation valve pit and the electrical penetration areas. Jacking beneath the pit will cause most of the settlement to occur while the jacks are in place and before the final load transfer is made to the permanent foundation. Differential settlements in the electrical penetration areas are anticipated to be small after the final load transfer has been made to the permanent underpinning wall.

12070 Stamiris Contention 4C(c) addresses the borated water storage tank. The staff presented its evaluation of the surcharging fix performed by the tanks in SSER No. 2. Kane also submitted testimony 2/17/82 on this contention. He concluded that differential soil settlements will be small following the surcharging of the valve pits in the ring foundations and will be within acceptable safety limits.

12071 Contention 4C(d) concerns the diesel fuel oil storage tanks. Kane testified on this 2/18/82. Settlement values since that testimony indicate that following the 1979 surcharging the tanks experienced a maximum settlement of 1/4 inch. In 1980 temporary dewatering caused additional settlement of 1/2 inch. Additional future settlement is estimated at 1/2 inch with a maximum of 1/10 inch under seismic loading.

12073 The 12/6/82 - 12/10/82 transcripts provide discussion on Stamiris Contention 4C(e), settlement of the Diesel Generator Building. The Applicant used a best fit straight line approach for the actual measured and predicted settlement values although Kane and the geotechnical engineering consultant thought this approach inappropriate. The NRC Staff preferred using actual measured settlement values.

12075 Stamiris Contention 4C(f) concerns the effect of differential soil settlement on underlying piping and conduit. At the 2/82 hearing session Kane indicated that the staff agrees with the Applicant's estimate of 3 inches of maximum future settlement for underground piping. Staff also agrees with anticipated duct bank settlement testified to today.

12075 With respect to Warren Contention 1 Kane stated he testified 2/17/82 that Staff was not in agreement with Mrs. Warren's characterization of the plant fill. Staff concluded that preloading in the Diesel Generation Building area and the borated water storage tank area improved the soils properties. The effects of preloading have been evaluated and reported in SSER No. 2 and discussed at great length in previous testimony.

Direct Examination of Frank Rinaldi

(by Ms. Wright)

12079 Two corrections were made to the document entitled "NRC Staff testimony of Frank Rinaldi regarding Stamiris Contention 4C(a)(c)(d)(e) and (f) and Warren Contention 3" and it was then admitted into evidence.

12081 With respect to Stamiris Contention 4A(2) Rinaldi stated, and Hood agreed, that his previous testimony contains the staff position on 4A(2).

Cross Examination of Joseph Kane, Frank Rinaldi and Darl Hood

(by Ms. Stamiris)

Mr. Kane

12083 Most of the settlement at the feedwater isolation valve pit will occur as a result of jacking. The amount of settlement anticipated during jacking (4/10 to 5/10 of an inch) is larger than that anticipated after the final load transfer is made to the permanent underpinning wall. Both the EPAs and the feedwater isolation valve pit area are to be jacked.

12085 The surcharing at the borated water storage tank is now completed and settlement has been estimated and allowed for with respect to the new wall.

Kane is responsible for assuring that the estimated settlements are reasonable and acceptable for use in design analysis. He did not determine whether a 4/82 jackhammering incident at the BWST had an impact on further differential settlement at that structure.

Once Staff is satisfied with the design and has completed its safety evaluation report the region is responsible for overseeing construction. Mr. Hood commented that the NRR has a responsibility to evaluate the significance of the asbuilt conditions but is not immediately involved with problems in the field unless requested by the region.

12090 The 1/2 inch settlement for the diesel fuel oil storage tanks after the 1980 dewatering rebounded to 4/10 of an inch.

12093 Kane personally thinks the use of a straight line best fit was inappropriate for the analysis of the Diesel Generator Building. The best information available is the actual measured settlements. The staff agreed that there were definite settlement values for different time frames.

- 12097 Mr. Kane and Mr. Hood both believe that Dr. Heller, Kane's supervisor, is the only other staff member who has the opinion that the straight line best fit use of the settlement data is inappropriate. He also is the only other geotechnical staff member who has looked at the question closely enough to give an opinion.
- 12100 Kane indicated that the word "reasonable" used in his testimony referred to the fact that the staff considered the settlements observed and forecasted for the future reasonable.
- Mr. Rinaldi
- 12101 From a structural point of view one must dewater in order to construct the underpinning walls. The Applicant's commitment to dewater two feet below the deepest excavation was acceptable to the staff.
- Both the construction dewatering plan and the permanent dewatering plan must be designed to withstand a "worst condition" load.
- 12103 Mr. Kane
- The temporary dewatering plan would lower the water table more than the permanent plan.
- 12105 Mr. Hood
- The effects of differential settlement seen at the Midland plant are not typical of nuclear power plants. The remedial actions taken at Midland are also somewhat unique.
- 12106 Mr. Rinaldi
- The standard review plan (SRP section 3.8.4) identifies what loads need to be considered in the evaluation and design of Category I structures, other than the containment. The staff determined that settlement load is equivalent to a dead load and therefore a load factor of 1.4 should be used. The Applicant had wanted to use a load factor of 1.0.

- 12108 The 4 duct banks attached to the Diesel Generator Building caused a load on the building it was not designed to handle and consequently cracks appeared in the walls. The duct banks were separated from
- 12110 the building before surcharging. In determining the effect of differential settlement stress the staff used the crack evaluation along with all the other load figures. Therefor, dead and live load were
- 12112 considered twice.

Mr. Kane

- 12112 The Staff's overall acceptance of the stress levels at the Diesel Generator Building was based on both the crack study and the settlement readings.

Mr. Rinaldi

- 12114 With respect to seismic considerations the response spectra (the FSAR, the original SSE) is multiplied by 1.5.
- 12117 The overall seismic margin review for all the structures will be submitted to the staff prior to 4/1/83.
- 12118 To assure themselves of the accuracy of the data they received the staff examined the loads used in the analysis, the model used and the results obtained. These were compared to what is allowed by the codes.

Cross Examination of Joseph Kane and Darl Hood

(by Ms. Sinclair)

Mr. Hood

- 12118-21 The FSAR will ultimately reflect the condition of the plant as constructed but until it is completed it is a "living document" which is continually updated.

Mr. Kane

- 12122-23 Kane has read about corp of engineers projects containing permanent dewatering wells. The operation of such wells does effect the integrity of soil

overtime by causing settlement due to increased load. Prolonged pumping can prevent the fines from being pumped into a well. The Midland dewatering system, however, is satisfactory to Kane.

- 12124 The effect of switching from the temporary to the permanent dewatering plan will be to give a minimal amount of rebound to the structures.

Board Examination

Mr. Kane

- 12125 Settlement monitoring of the BWST continues to be recorded. There has been no submittal of settlement data on the borated water storage tank that Kane knows of. Neither he nor Mr. Hood know whether the region has received such information. Settlement was under the valve pit and not on the ring beam foundation.

Mr. Rinaldi

- 12128 Probable maximum flood level is the flood level figure required in the Standard Review Plan to be used for plant conditions.

Rinaldi's calculations concerning the use of 1 1/2 times the FSAR spectra is based on preliminary information provided by the Structural Mechanics Associates. That information indicates that the 1.5 times the FSAR spectra figures is more conservative than the site specific spectra attributed to the site by the geologists.

12131

Stress results that the staff has seen are greater for the 1.5 FSAR spectra than for the site specific spectra input.

Mr. Kane

- 12132 It is not normal procedure to use the crack system to estimate settlement of the Diesel Generator Building. That is not Kane's area of expertise.

Recross Examination

(by Ms. Stamiris)

Mr. Kane

12133 When water is drawn down its lateral force on structures is removed.

Mr. Rinaldi

The Applicant has accounted for any potential reduction in lateral forces due to drawdown of the dewatering system in the design of the structures. Rinaldi has not seen the Applicant's seismic margin review but imagined a similar approach, of considering 2 limiting cases, was used.

12138 The seismic category review will apply the site specific response spectra equally to all category one structures needed for safe shutdown of the plant.

Any further settlement of the ring support would either cause no change or be beneficial.

Cross Examination of Frank Rinaldi and Joseph Kane

(by Mr. Marshall)

Mr. Rinaldi

12140 Even though concrete floats and can harden underwater a construction site must be dewatered so that men can work safely.

Mr. Kane

12142 The temporary dewatering operation lowers the water table below the level of where the underpinning piers are going to be installed so that the workmen can work safely. The permanent dewatering system has nothing to do with concrete or concrete curing. It deals with loose sands that potentially could liquify.

Direct Examination of Darl Hood

(by Mr. Paton)

- 12143 Hood is the NRC staff's Project Manager for the Midland project. He had no corrections for his "loose sands beneath the service water piping" testimony and the document was admitted into evidence.
- 12145 The purpose of the 3/3/82 meeting between the staff and the applicant was to discuss dewatering plans for the Midland site. Consumers stated that they wanted the staff's agreement to dewater 2 specific areas: the Diesel Generator Building and the railroad bay area. They indicated that dewatering could be limited to those 2 areas on the basis of studies performed by Bechtel's geotechnical section under Dr. Afifi. Dr. Afifi's study was not available at the meeting, but did become available later that month. The NRC ultimately concurred with the conclusion that dewatering could be limited to the 2 areas even though Dr. Afifi's study mentioned a 3rd area north of the service water pump and the adjacent circulating water intake structure.

Cross Examination of Darl Hood

(by Ms. Stamiris)

- 12147 The Applicant had made a commitment to the NRC to seek staff concurrence prior to doing any soils related work. No specific remedial action was requested at the 3/3/82 meeting and it would have been inappropriate for the Applicant to ask for the Staff's approval without providing details at the same time.
- 12156 Hood did not know whether the Applicant had reviewed Dr. Afifi's study by 3/3/83 but said it is possible that they knew his study showed 3 areas which needed dewatering.
- 12160

Cross Examination of Joseph Kane

(by Ms. Stamiris)

12161 Kane and Hood both stated that the Consumers people indicated they were aware of the results of the Bechtel study but neither knew whether any of the Consumer people had read the study by 3/3/82.

Mr. Hood

The Applicant only mentioned 2 areas for dewatering at the 3/3/82 meeting.

Mr. Kane

If the Applicant had knowledge at the time of the 3/3/82 meeting that a 3rd area needing dewatering, it should have disclosed that information.

12165 Kane first learned of the 3rd area during a 3/12/82 telephone conversation.

Up until 3/3/82 the NRC Staff had made its own independent liquefaction analysis and did not think it needed Dr. Afifi's analysis. When they realized that the extent of dewatering required was different from what they projected they asked for Dr. Afifi's results.

12170-79 Discussion and decision to call Mr. Budzik as a witness to ask him whether Dr. Afifi's analysis was in written form at the time of the 3/3/82 meeting.

MIDLAND HEARINGS
February 18, 1983

<u>Page</u>	<u>Text</u>
12184-85	<p>Direct Exam. of Dennis Budzik</p> <p>Dennis Budzik is employed by Consumers Power and is a section head for the licensing section of the Safety and Licensing Department. He attended U of I, receiving a degree in engineering physics, then Naval Post Graduate School in Monterey, receiving a M.A. in nuclear physics. He was in the Navy for 7 years and was a nuclear trained officer on a submarine. He is still in the Naval Reserve. After service, he joined CPCo (1976). Two and one-half years ago, he took on his present assignment which involves coordination of licensing information for NRC to review.</p>
12186-89	<p>Budzik attended the 3/3/82 meeting with the NRC Staff concerning liquefaction potential at the site. Hood's summary of the meeting does not include Mr. Brunner or Mr. Paton, who Budzik thinks were there. One of the reasons for the meeting was that Mr. Gonzales, the hydrology reviewer for the Midland docket, had been unavailable for a year. The meeting was called to discuss hydrology aspects of the dewatering system and discuss the recharge test being done. Budzik understood that the design basis of the dewatering system was to prevent liquefaction of soils in two areas-- the DGB and railroad bay. They discovered that there was a misunderstanding with the Staff re the purpose of the dewatering system. Questions 24 and 47 of the NRC questions re 50.54 were ambiguous.</p>
12190-92	<p>The Staff thought the design basis of the dewatering system was that most of the site would be dewatered to some level. Mr. Paris of Bechtel explained that the primary area of recharge is around the service water building. It was easier to intercept water where it entered the power block area of the site--the Service Water Building. They actually ended up dewatering the whole power block area. The Staff hadn't understood this so Mr. Hadala would have to look again at the boring data. The Staff also discussed loose sand near the diesel fuel oil tanks and the need to evaluate it.</p>

12193-95

Budzik doesn't recall any discussion re loose sands north of the SWPS. When the dewatering system was designed they wanted time to repair the dewatering system before the liquefaction potential would occur above elevation 610 for the two areas. When Budzik learned of the loose sands he called Hood and stated that in his opinion they would have to replace the sand with more competent material because the recharge rate in that area is so quick. Meisenheimer, who attended the meeting, was a liquefaction expert but hadn't reviewed the boring data to make any analyses. No one from Dr. Afifi's geotechnical group was there because they hadn't intended to discuss liquefaction. Dr. Hadala had done an independent evaluation of liquefaction and came to the same conclusion as Budzik.

12196-200

There was no evaluation report from Dr. Afifi's group re liquefaction potential in existence on 3/3/82. A report was submitted to the NRC on 3/12 from Dr. Afifi's research based on the NRC request for it at the meeting. Budzik indicated at the meeting that there were only two areas that he was aware of where liquifaction would occur. He was not aware of anyone deliberately attempting to deceive the NRC re the loose sands. Dr. Afifi was involved in preparing further information for the NRC based on his files, and it was reviewed by Meisenheimer.

Cross Exam. by Mr. Paton

12201-04

Budzik did not refer to any information prepared by Afifi at the 3/3 meeting re dewatering or liquefaction potential. Dr. Afifi's evaluation of " was provided to Mr. Paris so he could design the dewatering system." He never discussed it with Afifi but understood that the site had 2 areas with a potential for liquifaction, the DGB and railroad bay area. Budzik did indicated his understanding of the potential for liquifaction and said the information came from Afifi. He got the information from various people, half a dozen discussions, but never saw any papers developed by Afifi. It was not mentioned that Afifi's information showed there were three areas and not two.

- 12205-08 Budzik does not remember asking the Staff at the 3/3 meeting to approve a dewatering plan which recognized a potential for liquefaction in only two areas.
- 12209-11 Budzik had no "specific awareness" of what information Afifi had developed by 3/3/82. Dr. Afifi's group is the only Bechtel group capable of generating this information. Budzik did represent to the Staff that there were only two areas of potential liquefaction.
- 12212-13 As soon as Budzik discovered that information developed by Afifi showed a third area he contacted Hood. Budzik remembers discussions with Paris, Vengadan and Keeley re liquefaction and none mentioned that there were three areas. He does not recall who told him. He has not to date read Afifi's information, that is not his job.
- 12214-16 The borings used for the evaluation were used in the initial site investigation and were old.
- 12217-22 Cross Exam. by Ms. Stamiris
- Budzik was not aware of any written report by Afifi in existence prior to 3/3/82. He believes the basis for the "evaluation" he understood was in existence on 3/3/82 is the boring data taken around the site, and it was the design basis for the dewatering system. He does not know in what form the information was given to Paris.
- 12223-25 Budzik assumes the Afifi information was based only on boring logs because they give you the characteristics of the soil that you need to evaluate liquefaction. It was CPCo's intention to discuss hydrology with the hydrology reviewer at the 3/3/82 meeting, not liquefaction. Budzik agreed with Hood's characterization of the meeting on the subject of dewatering criteria, but to him this meant the recharge test. He states he went to the meeting intending to get "a yes to his statement that the dewatering system was designed to prevent liquefaction in two areas of the plant."
- 12226-33 Budzik means he wanted "agreement with the reviewer on the design of the system for two areas" not approval of the Staff for installation. Budzik is head of the licensing section, res-

possible for providing the information the Staff needs to review and license. He is not responsible for reviewing adequacy of information only pulling the information together. After he makes a determination as to the adequacy of the design he presents the adequacy of that design to the NRC. That is why he called Hood to inform him of the third area of liquifaction when he discovered it. He admits he failed in his responsibility to provide accurate information because of this and the loose sands information omission. Budzik did not hold a premeeting to review the information before the 3/3/82 meeting.

12234-41

Budzik got involved in the soils licensing area around 5/8/81 and processed some submittals to the NRC. The design details are still being developed and changed. He went to the 3/3/82 meeting without looking closely at the liquifaction issues because he assumed they had been resolved prior to his 5/81 involvement. A year went by without dealing with this issue because there was no one on the Staff to deal with the design of the dewatering system. They had it on the "back burner." Budzik admits he should have brought it forward before the 3/3/82 meeting, but thinks that on 3/3/82 (albeit what he knows now) he acted responsibly.

12242-50

He does not recall what day he called Hood. He reviews the 3/12/82 telecon record of a Kane/Meisenheimer conversation. They agreed to provide the Staff with an evaluation. The memo reflects they agreed to provide the results on Dr. Afifi's evaluation of liquifaction. The exhibit represents that they agreed to provide 3 summary items. The information Meisenheimer agreed to mail to Hadala on 3/12 was generated between 3/3 and 3/12/82. The purpose of NRC agreement with the design was for feedback, then more detailed design information would be reviewed by the Staff and a SER on the information would be written.

12251-58

At the 3/3/82 meeting Budzik was not looking for approval to implement the dewatering design. None of CPCo's people had firsthand knowledge of Afifi's information, they were not geotechnical people. He assumes there had to be conversations between Afifi and Paris.

Budzik believes the communication breakdown occurred between these two. He feels CPCo on 3/3/82 presented incomplete information to NRC Staff. The Staff was not misled because they asked for additional information.

12259-63

Budzik states there are other people at the meeting who were equally responsible for providing accurate and complete information to the NRC. Bechtel did not provide CPCo with sufficient information re liquifaction. Dr. Afifi and his group did not express to Bechtel and CPCo the boring logs information. Paris, of Bechtel, is in the hydrology group, not the group that works for Afifi.

12264-68

Budzik recalls another incident of inaccurate information being given to NRC re the materially false statement in the FSAR that has been stipulated in these proceedings. There was an investigation into a materially false statement re installation of instrumentation for underpinning the Auxiliary Building, but CPCo was cleared. Mr. Boos was involved in this incident.

12269-73

Cross Exam. by Mr. Marshall

A triga reactor is a research reactor. Budzik worked with propulsion reactors that drove the ship when he was in the Navy. Mr. Budzik has said he isn't perfect, but Marshall says he is a perfectionist. Who cares?

12274-79

Board Examination

The 3/3/82 meeting notes mention "an evaluation by Dr. Afifi's geotechnical engineering group." Budzik does not recall this, but everyone had a general understanding that Afifi had evaluated boring information re potential liquifaction. Absent the work authorization procedure, to implement the dewatering design in the PSAR they would need a construction permit. At the operating license stage it would be subject to Staff approval in the form of a SER. If the dewatering system was included in the original construction permit it could be installed. But this system was not, so it would be researched in the PSAR and CP license. If it was outside the scope of these (which it wasn't) an amendment to the license would be necessary.

Due to an agreement with the region before construction proceeds the information must be in a SAR change notice, approved for inclusion in the next FSAR revision. As of the 3/3/82 meeting the dewatering system was being handled differently due to Board order.

12280

If, hypothetically, the dewatering system was not within the scope of the construction permit, the 3/3/82 meeting would not have been sufficient to begin implementation.

12281-90

Cross Exam. by Mr. Paton

Budzik told the Staff at the 3/3/82 meeting that no liquifaction concern existed for seismic category 1 structures other than DGB and RBA. He remembers telling the Staff there were two potential areas of liquifaction. Dr. Afifi's name was brought into it because he does this type of evaluation. The information that the Afifi study showed, in fact, three areas came to Budzik after the 3/3/82 meeting. He got the information from Paris and other people that there were two areas.

12291-96

Mr. Budzik reads from Attachment 2 to Staff testimony. He agrees that the 2 sentences under summary are accurate. Budzik does not think he acted irresponsibly at the 3/3 meeting but had incomplete information. He acted "in error." Budzik did not give the Staff information they should have had on 3/3 and became aware of it some days after the meeting.

12296-300

Mr. Steptoe objects to questions, discussions.

12301

Budzik's purpose in testifying before the Board today is to tell the truth, provide the Applicant's viewpoint of what occurred before/during/after the 3/3/82 meeting. He has done his best to do this.

12302-07

Cross Exam. by Ms. Stamiris

Budzik cannot recall when he called Hood. Mr. Steptoe objects to Ms. Stamiris' questions.

12308-11

Recross Exam. by Mr. Marshall

Dr. Afifi is qualified to do both a study and evaluation, and at this time both exist.

Budzik did not know of both at the 3/3/82 meeting. He agrees the rules make it his duty to report such events as he becomes aware of them.

12312-15

Direct Exam. by Mr. Paton of Kane and Hood

Witness Kane recalls that shortly after the meeting began Budzik indicated one purpose was to get Staff agreement that 2 areas, DGB and RBA, were involved in the liquifaction question. Questions developed with respect to this. Also boring DF5 that had a three foot layer of loose sand was discussed and whether this was a widespread problem. Kane recalls the basis for CPCo saying there were two areas was Dr. Afifi's study evaluating the boring information. He recalls Budzik initially made this statement. Kane thinks the request for Staff agreement was made more than once. It is his opinion that the agreement would then be followed through by technical specifications. The area judged to have loose sands requiring replacement of the two 26-inch diameter service water lines runs in front of the north side of the circulating water intake structure and SWPS, approx. 250 feet long.

12316-17

Afifi's study eventually showed loose sands in the area where pipe rebedment was necessary, but this had not been indicated at the meeting. Meisenheimer called Kane on 3/12/82. The record accurately reflects what occurred. This is the first indication of a remedial measure needing to be performed because of loose sands other than the DGB and RBA. It became clear at the 3/3 meeting that the loose sands above elevation 610 were not being addressed by the dewatering system. Hood agrees with Kane's answers.

12318-19

Hood first became aware of loose sands in that area in mid-80 through the boring data. On 3/12/82 he was notified remedial action would have to be taken by learning of the phone call between Meisenheimer and Kane.

12320-25

Cross Exam. by Mr. Steptoe

Hood does not remember any phone call from Budzik after the 3/3/82 meeting. The Staff

CPCo/MIDLAND

4/27/83 HEARING ABSTRACT

STAFF WITNESSES:

COOK, R.
GARDNER
LANDSMAN
SHAFFER

14274-368 Preliminary Matters. Highlights:

1. Discovery controversy over affidavits of Anderson and Babbitt: whether there is need for an order for reconsideration;
2. GAP says Staff is withholding documents re: CPCo's honesty and competence, which they need because Staff is not introducing direct testimony on the subject;
3. Three Board Notification items: to be explained by Staff panel. See Tr. 14370.

14368 STAFF WITNESSES: Cook, Gardner, Landsman, and Shafer.

DIRECT BY WILCOVE

14369-70 In 4/82, Shafer became Chief of the Midland Section of the Office of Special Cases. He was recently succeeded by J. Harrison.

14370-71 Three Board Notification items:

1. CPCo notified Region III that 2 cracks in SWPS break mantling reached the "alert limit";
2. CPCo inadvertently drilled into a Q electrical duct bank while shallow probing around the SWPS;
3. PLO test for Pier 11 W was problematic.

14372-74 Staff QA testimony and Attachment 10 (IR 82-06), supplementing JGK 10/29/82 testimony, follow Tr. 14374.

14375-76 Attachments 1A, 1B, 1C, and 2, supplementing JGK 3/83 testimony, follow Tr. 14376.

Attachment 1A -- IR 82-20
Attachment 1B -- IR 82-21
Attachment 1C -- IR 82-26
Attachment 2 -- 12/10/82 letter from JWC to Denton
regarding 5/25/82 letter from
Eisenhut to JWC.

- 14377 Landsman says Board notification item 2 is not the same incident as WRB's February testimony about a hand drill knicking a duct bank.
- 14378 [Wilcove notes that there is no written notification other than what Landsman has testified to; nor will there be any.]
- 14379-80 [Miller believes notification item 2 is the same incident as that described by WRB in February and that which is documented in the NC report of 2/14. Landsman says he'll check on whether it is the same incident.]
- 14381 Referring to WRB's QA testimony at p. 2, Landsman says it is a serious concern when a field change notice (FCN) is issued where an NCR should have been.
- FCN is a document prepared onsite to change a design property prior to construction.
- NCR is intended to document a violation of intended design.
- 14382 Shafer says that because no NCR was written at the time, the incident was not subject to review under the corrective action system.
- Instead, the incident was subject to a review by MPQAD.
- Use of the term "FCN" indicates that an incident is subject to engineering review.
- 14383 Referring to Q.2 of WRB testimony, Landsman says MPQAD was not properly responsive to the incident; it wrote an NCR two weeks after the FCN was issued.
- 14384 Landsman doesn't think Bechtel QC was ever notified of the incident. QA, however, was notified immediately.
- 14385 Referring to Q.3 of WRB testimony, Gardner says there is a commitment in FSAR 8.3.1.4.2 to install cables in accordance with design drawings and schedules.

14386

With reference to page 4 of Rutgers' testimony, Gardner states that CPCo's position was that 38/55 misrouted cables were insignificant problems. In contrast, the NRC staff thought all the misrouted cables were significant problems.

NRC Staff also rejected CPCo's position that a walk-down inspection would be enough to identify 100% of misrouted cables.

NRC Staff will require all Class 1E cables to be re-inspected to ensure that they meet the FSAR requirement.

Presently, CPCo is within 500 cables of compliance with this requirement.

14387

Referring to Q.4 of Rutgers' testimony, Gardner says CPCo's position on pipe support hanger installation was that many misinstalled supports were not significant safety problems.

In contrast, the NRC Staff thought CPCo should do a complete reinspection to ensure that all misinstallations were identified. [Gardner adds that the NRC took this position in order to keep QC from thinking that misinstallations can be tolerated].

14389

Cook says CPCo interpreted the data on misinstalled pipe supports in such a way as to suggest there were only 3 to 4% misinstallations. The Staff interpreted the same data as suggesting a 50% figure.

The differing views are the result of 2 different manipulations of the data, which identified 1000 attributes (or types of defects), 100 hangers total, and 50 hangers having a single attribute:

- (a) looking at the number of violations of each attribute produces the result 50/1000, or 5%;
- (b) looking at the % of hangers having a defect produces the result 50/100, or 50%.

14390

Referring to Q.7 of Rutgers' testimony, Cook says material storage and maintenance is still an ongoing problem at the site, most recently with respect to the DGB inspection and Zack HVAC components.

14391

Staff has pointed out noncompliances periodically. E.g., in 1/82, it pointed out piping that had missing caps.

- 14392 Staff recently uncovered a problem in the laid down area -- nonconforming equipment was being stored in the same location used to hold other equipment, but it was not segregated. It is possible that drainage in the laid down area could creep up on the equipment being stored there.
- 14393 Shafer says this incident is typical the way CPCo does not take initiative to identify and correct problems until the NRC or QA identifies problems and informs CPCo.
- Cook testifies that CPCo and Bechtel, by implementing changes, show that they are committed to an [effective? -- testimony not clear] storage and maintenance program. [See Q.8, para. R, Rutgers' testimony].
- 14394 Referring to Q.10 of Rutgers' testimony Cook says he still agrees with the statement in Att. B to JGK testimony that Bechtel's work is "slipshod".
- 14395 Referring to p. 18 of Rutgers' testimony, Shafer says the Staff wants to see quality installed, rather than installation followed by an inspection for quality.
- 14396 Shafer also notes that Bechtel QC's standard of acceptability is not the same as the Staff's standard.
- 14396-97 Landsman says there is a general reluctance on part of CPCo to provide information to Staff inspectors; for example, information about the QA experience of MPQAD personnel and the Aux. Bldg. beam calculations. Cook offers two additional examples (anchor bolt calcs for paneling, and the battery charger room).
- 14398 [Motion to Strike Cook's Answer as hearsay is denied].
- 14399 Cook offers further examples of CPCo reluctance in providing information:
1. Took several days to get calcs re: DG mufflers;
 2. Staff had difficulty in getting calcs regarding a weld connection for mounting the instrument panel.
- 14399-404 Regarding CPCo's 3/10/83 response to a 2/8/83 Notice of Violation and imposition of civil penalties, Shafer says the Staff's further response is still being finalized, but will include a decision about the request of mitigation.

Referring to Q.12 of Rutgers' testimony, Shafer discusses the reluctance of CPCo personnel to speak candidly with the NRC. E.g., at the DGB inspection, the Staff sought information from Mr. Kripple about the hangers. Kripple told the staff he couldn't talk with them without going through his boss. This incident is not documented, but an 11/10/82 directive from Bechtel re: communication was the direct result of it. CPCo realized that an earlier directive from 1/81 was inadequate.

14404-06 CPCo's decision to take control of Bechtel QC function does not indicate strong initiative on CPCo's part; they were doing only what Staff had recommended. (See Attachment D to JGK testimony, Letter of 8/18/82).

14406 CPCo was first informed of Staff concerns re: IPINs in 10/82 during DGB inspection, not on 1/18/83. [See Wells testimony at p. 11 (sec. 4 re: IPIN)].

14407 Although CPCo was aware of the IPIN problem in 10/82, it did not discontinue the use of IPINs for non-soils work until 1/25/83. The Staff considers this untimely.

14407-11 Staff Exh. 18: IR 83-03, dated 4/7/83, is received into evidence.

Landsman makes an addition to Q.7 of Staff's Suppl. Testimony of 3/25/83, to be identified as paragraph F. The new paragraph makes reference to IR 83-03.

14411-12 Staff sees a need for an expanded excavation permit system which provides a final review of construction drawings.

Since the February hearings, Landsman has had further discussion with CPCo about such an expansion. CPCo is reluctant to do it because, as it states in its 4/4/83 letter to Region III, no additional control on underpinning is necessary.

14413 It is not yet the official Staff position that an expanded excavation permit system is necessary.

14414 Current Staff position: There is no regulatory requirement that CPCo abide by Landsman's recommendation for an expanded EPS. However, the Staff has not yet had time to answer CPCo's 4/4/83 letter.

- 14415 Contrary to Wells' testimony at p. 9, Shafer believes that the IPIN inspection was not augmented by outside consultants. There were 4 Argonne contract employees who were merely in training.
- 14416 [For reference, Wilcove provides Board a copy of a Bechtel memo from Davis to D.B. Miller, dated 12/16/80 and referred to in Cook's testimony].
- 14417-20 Staff Exh. 19: Handwritten document containing 5 items, headed "Priority Items - Civil". (Received in evidence).
Staff Exh. 19 refers to a Mr. Sevo, who is an MPQAD supervisor and Bechtel employee.
Landsman takes Item 4 of Staff 19 to mean that CPCo disapproved of regular communication by MPQAD personnel with NRC inspectors.
- 14420-24 Office of Special Cases is a team of 6 (including Warnick, as director) who review significant issues that are brought before it.
Warnick has ultimate authority, but team members' opinions are given substantial weight. A dissenting opinion can be formally preserved in written form.
BY MARSHALL
- 14426-33 Both CPCo and Bechtel have failed, says Landsman, to properly respond to nonconformances brought to their attention. Both are responsible for the nonconformances.
Landsman is unwilling to term such conduct "negligent".
The NRC Staff is doing its best to discourage nonconformance. Landsman can't say exactly what has caused Midland's nonconformance problem.
- 14434-41 NRC has attempted to get CPCo's and Bechtel's attention on the site through various meetings; e.g., the 1/18/83 Enforcement Meeting.
- 14442-43 Cook has not changed his mind that the work at Midland is shoddy.

On 9/23 and 9/24, Landsman & Gardner investigated MPQAD's recertification program and found problems; e.g., excessive repeating of questions by examiners in order to get a satisfactory response; relevant questions that were marked N/A; questions that were insufficient to detect weaknesses in knowledge; and examiners using PQCIs that were not the same version as those used by examinees.

The Staff required CPCo to commit itself to four actions. See Att. 1A to 10/29/83 Staff testimony.

- 14466 [The above review of the remedial soil QC recertification program is also found in Att. 1-B (IR 82-21) to JGK 3/83 testimony].
- 14467-70 With respect to reinspection of work in the balance of the plant (vs. remedial soils work), the NRC Staff took the position that all work done by individuals who didn't pass the requalification test had to be reinspected.
- CPCo contended that reinspection on a sample basis would be adequate. Later on, CPCo policy was to give an examinee more than one chance to pass the test; once he passed it, the reinspection was deemed no longer necessary.
- CCP made this difference of opinion a moot point: under the CCP, CPCo was required to do a 100% reinspection.
- 14471-2 Prior to the CCP, a memo by Wells which documented an agreement about reinspection indicated that CPCo was not eager to do a 100% reinspection.
- 14472-7 A review of QC inspectors in 11/82 revealed that 2 out of 19 failed the exam. The monthly status report from 12/10/82 -- of which Landsman is the co-author -- says CPCo agreed to reinspect 100% of the work performed by the 2 failed examinees. Shafer doesn't know whether CPCo followed through.
- 14478 Shafer says the Staff did not require CPCo to do 100% reinspections for all its work; it only required CPCo to decertify the present QC Staff, retrain and recertify them.
- 14479-80 Inspectors were recertified as to work done under existing PQCIs, but not for work done under new PQCIs.

- 14481-2 The cause of the problems documented in IR 83-03 was that CPCo, in its rush to have QC inspectors available to perform necessary functions, often did not devote adequate time to the recertification effort; e.g., instructional material was not always available; questions raised at training sessions were not always readily addressed; and prerequisites for certain PQCI's were not well defined.
- 14482-4 Citing the 1/10/83 letter from CPCo to NRC (Attachment to JWC testimony, at p. 7) stating that CPCo's schedule for retraining would be done so as to support ongoing work and system activities, Gardner says this coordination of ongoing work and retraining was perhaps a major concern of CPCo's.
- 14483 Gardner says CPCo has taken steps to correct some of the problems documented in IR 83-03.
- 14484 CPCo's "scheduling" needs had an impact on the quality of recertification training.
- CPCo has no firm schedule as yet for recertifying QC inspectors. Gardner is sure the NRC has one, though.
- 14485 Since CAO, the Staff hasn't found any deficiencies in soils recertification activity -- but then it hasn't yet had time to look for them either.
- 14488-9 There is no decision yet as to whether a 100% reinspection will be done. However, the Staff sent CPCo a letter on 3/28 telling them to either do a 100% reinspection or explain why it is not necessary.
- 14489 As for the remainder of plant work, there is no decision about whether a 100% reinspection will be required: the NRC & CPCo are still working it out.
- 14492 Stamiris Ex. 46 into evidence.

NRC Hearing April 28, 1983

<u>Page</u>	<u>Text</u>
14496-521	<u>Preliminary Matters</u> <u>Cross Examination of the NRC Staff</u> (by Ms. Bernabei)
14521	Due to lack of time there have only been limited inspections by the Midland team of the requalifications or retraining of QC inspectors. Landsman still agrees with Stamiris Exhibit 47, a 9/8/81 letter from Warnick to Consumers Power, that the QA organization "is not adequately qualified for the complex remedial soils works".
14523	Landsman and Shafer constructed a history of the changes in Consumers Power's QA Management organization since the 9/2/82 letter. Wells became executive manager of QA in 10/82. Under MPQAD Mr. Glendy took over quality control functions in the soils group and Mr. Oliver took over the quality assurance engineering. Mr. Meisenheimer became soils superintendent for civil and remedial soils in 7/82 or 8/82, but that was before the 9/2/82 letter.
14527	Wells is responsible for both QA and quality control functions. Fredrick and Curland were at one time superintendents of QC. Lenard is the current superintendent. Shafer believes there has been a great deal of turnover in supervisory positions in MPQAD because of NRC staff recommendations. Landsman believes changes were made in response to concerns raised by the staff that the particular individuals replaced were not qualified to do their jobs.
14531	Cook and Shafer agreed that having Bechtel personnel in lead QA positions continues to concern the NRC staff. They do not want Bechtel inspectors to report to Bechtel supervisors, however, this situation still exists.

- 14534 Curland was brought in, from outside Consumers Power, to fill a position of upper QA management at the NRC's request. He has an extensive QA background.
- 14535 Jim Meisenheimer is the current Superintendent of the remedial soils group. Mr. Oliver heads the quality assurance engineering section and DeWitt heads the quality control group. Meisenheimer reports to Wells and Wells reports to Cook. None of these men except DeWitt, has any quality assurance background.
- 14539 Bird is manager of quality assurance in the Jackson, Michigan office. He does not have direct responsibility for the operation of MPQAD.
- 14541 Stamiris Exhibit 48, a document concerning a 12/15/82 telephone conversation between Wells and Shafer, states that the NRC and Shafer were concerned with Wells' and Meisenheimer's lack of QA background. Shafer thinks some but probably not all the QA staff changes were made because of the NRC Staff's concerns. Shafer remembered telling Wells at some point that there would be possible disruptions on the CCP if QC personnel were not put under Consumers supervisors.
- 14547 Stamiris Exhibits 47 and 48 identified and received into evidence.
- 14551-4 Stamiris Exhibit 49, a memo to Novak, Assistant Director for Licensing, dated 10/29/82, from R.F. Warnick, describes a 10/28/82 inspection. Landsman stated that the licensee did not voluntarily comply with Region III's interpretation of Regulatory Guide 1.29.
- 14554-62 Mr. Cook stated that on 11/30/82 about 150 Zack workers were laid off because welding was halted due to the questioning of welding procedures. The Board took notice of the fact that there is an ongoing investigation or inspection of QA problems at Zack.
- 14564 The real reason Zack workers were laid off was because the welding procedures at the Midland site were not being followed. Cook believes there is

a Consumers Power employee in Cicero to oversee Zack's operation there. That person should have some responsibility to oversee the QA pertaining to equipment and qualifications of welders for components going to the Midland site.

- 14567 Shafer stated that the majority of the allegations made in the summer of '82 relate strictly to the Zack activity/ in Cicero as opposed to site activity. The staff has no knowledge of the inspection work done in connection with the 7/82 allegations and does not know whether the summer of '82 problems are the same as those alleged in 12/82.
- 14569 Cook mentioned that the staff did do an equipment inspection at Zack's Cicero operation. In the last 2-3 weeks approximately 60 Zack personnel were laid off at the Midland site because welding procedures have not been requalified to the NRC's satisfaction.
- 14570 Since 3/83 Photon Laboratories has no longer been used to qualify welding procedures. The welders themselves are not at fault, there just are no qualified procedures for them to follow.
- 14574 Cook stated that he has been concerned with the statistical analysis of the licensee in that it was "spread so thin" as to create misleading trends.
- 14575 Landsman encountered and continues to encounter reluctance on the part of Consumers Power to give the staff requested information. He thinks it should not be necessary to justify their wanting to see particular documents and feels it has inhibited their activities as inspectors at Midland. Shafer cited an example of how the Staff had been inhibited in its inspection because it did not receive requested information.
- 14579 Cook added that the reluctance to provide documents apparently stems from Bechtel not providing them to Consumers. Landsman noted an example of this.
- 14583 This indicates to Landsman that Consumers does not have adequate control over its contractors.
- 14586 Twelve years of construction history of the plant led him to this opinion.

Afternoon Session

- 14587 Stamiris Exhibit 49, 10/29/82 memo from Warnick to Novak, was admitted into evidence.
- 14588 Obtaining documents from Consumers Power has been a problem for a long time and this has not changed since 1979, says Cook.
- 14593 Landsman still believes, as he stated in his 10/82 testimony, that the CCP's QA staff was not commensurate with the complexity of the QA remedial soils work task.
- 14594-600 With respect to Stamiris Exhibit 50, NRC Inspection Report 8301, issued 3/4/83, which states that the inspector found cracks in the containment wall that had not been reported by the licensee, Shafer and Landsman said this would not necessarily support an opinion that there were problems with the Licensee's QA program. Landsman was surprised Consumers hadn't discovered the cracks but added that there are no requirements that they go around looking for cracks in the containment building.
- 14602 Landsman and the other staff members did not know how many soil inspections there were in 1982 or how many of them revealed noncompliances.
- 14603-11 What Ms. Bernabei marked as Stamiris Exhibit 51 was identified as Inspection Report 8226 which is already in evidence as Attachment 1-C of the March staff testimony. Landsman believes the excavation permanent system should be expanded to include the underpinning work because of problems with the work packages such as inadequate documentation.
- 14609 The Work Authorization Program started in 8/82. Deficiencies in the work packages were first discovered in 12/82. Between the 4/30/82 order and 8/82 when the Work Authorization Program was started Landsman only allowed work to be done on site for which he had a NRR letter stating the design was adequate. He did not know whether Consumers made specific requests to NRR for permission to do specific work.
- 14615

- 14617 The work packages problems identified in Inspection Report 8226 have now all been resolved.
- 14618 Two changes were made to Drawing 7220-C-45 in order to comply with the Board order; first the licensee had to confirm by a sworn letter that no Seismic Category 1 underground utility extends beyond the boundaries of the drawing and second that the riprap on a portion of the perimeter baffle dike adjacent to the ultimate heat sink is included as a Q on the drawing.
- 14621 There have been problems in the past with utilities not being constructed where they are designed to be. In response to Judge Harbour Landsman stated that he knew of no utilities outside the Q boundaries of C-45 that have been damaged by drilling. No key utilities have been located outside the boundaries since the staff received the sworn letter from Consumers.
- 14627
- 14628 Landsman previously testified that no problem with CPP's performance of actual underpinning activities has been so significant as to warrant a recommendation that work be halted. Ms. Bernabei's line of questioning focuses on problems with those activities and whether Landsman has changed his mind.
- Landsman's 2/15/83 memo to Warnick expressed concern about three problems encountered during the underpinning operation.
- 14632 In 1/83 the NRC and the Applicant discussed loads to be applied during the FIVP five point jacking. Landsman was concerned that the existing grillage support structure would not hold the full weight of the FIVP and that the rock anchors that attached the grillage assembly into the roof of the FIVP were inadequate. Consumers fought the jacking plans for a year by saying they did not want to follow the NRC's suggestions because it would throw them off schedule. This was not cited as noncompliance. At that time Stone & Webster was not required to review drawings for technical adequacy.
- 14634
- 14636 During jacking two problems were encountered, cracks on the top slab of the structure and resistance on the part of Wiss Jenney, the contractor for Bechtel taking down the data, to wait long enough after the jacks were released to record data. Subsequently procedures have been established by Consumers concerning when to record data.
- 14640

- 14641-58 A Construction Technology Laboratories report to Consumers Power dated 2/19/83 was identified by Landsman as a report given to the NRC by Consumers concerning the cracking on the feedwater isolation valve pits that took place during jacking. It was marked Stamiris Exhibit 51. The report states that Dr. Corley informed Bechtel about 1/2 hour after inspecting the cracks that they could resume construction. Consumers has never supplied Landsman with any other report about the cracks and has never expressed to him their belief as to the root cause of the cracking.
- 14859 Landsman described another recent cracking incident concerning 2 cracks in the surface water pump structure due to settling. There are now 4 cracks in all since there is one in each feedwater installation valve pit. He has not received any reports about the two most recent cracks. NRC will do its own investigation of the cracks. Landsman was not sure when or how the licensee notified him of the new cracks.
- 14862-64 Board decided to withhold questions concerning a recent incident where Consumers drilled into a Q electrical duct bank.
- 14664-69 The licensee recently tried to confirm the design parameters assumed on the permanent underpinning wall by conducting a load test on Pier 11 West. The upper Carlson stress meters malfunctioned and resulted in incorrect load readings. Landsman assumed the gauges had been tested for accuracy and therefore did not know what the problem was. Landsman considers his testimony on this as roughly paraphrasing a document from Bechtel to K. Ross Denn dated 4/27/83. (page 14670 is missing) The pier is "on hold" currently.
- 14671-74 Referring to a 2/3/83 letter from Steve Poulous of Geotechnical Engineering Inc. to Mr. Kane, Landsman recounted discussions he had had with structural engineers and the licensee about settlement of the electrical penetration area. They had not examined the deep seated bench mark data. The NRR staff and its consultants considered the data accurate and attributed any recorded movement of the EPA to temperature variations between the inside and outside of the building.

- 14674 Landsman had meetings with numerous Consumers people about the EPA movement and their resident structural engineers are now responsible for reviewing data on this. Consumers previously did not follow its own review procedures.
- 14677 If after an informal meeting there is still a difference of opinion between the NRC and Region III differing professional opinions can be written.
- 14677-85 Stamiris Exhibit 52, a letter to Kane from Poulos, dated 2/3/83, was not recognized by Landsman although he did identify it as concerning the rising of the EPA. Landsman believes a work stoppage is not warranted because work can be controlled through the Work Authorization Program.
- 14685-92 If explicit prior approval from NRC was not required Landsman thinks the soils work should be halted. He does not trust Consumers and thinks there are too many occasions when they have put cost and scheduling ahead of quality.
- 14692-95 A 3/28/83 letter from Keppler to Cook identifies additional information needed concerning the construction completion program. Shafer stated that the NRC recognized a need for "hold points" in the Construction completion program while at the same time Region III management wanted the staff out of the review process and back into regulatory responsibilities. The program does not include soils work.
- 14696 If the NRC were to no longer monitor the hold points Mr. Cook said he would. The hold points were placed on the construction completion program, not the Diesel Generator Building. The reason the NRC got involved in the review progress at all was because the Midland section of the NRC did not trust the licensee to proceed without hold points.
- 14702 Mr. Gardner added that the need for a work authorization procedure was exemplified by the NRC's wish to ensure that the Board's order would not be violated and also the wish to have prior review of the underpinning since it is a unique operation.

- 14705 The NRC's removal of itself from the approval chain does not indicate an increased level of trust in the licensee. Shafer said neither he nor anyone else on the panel is really familiar with who will replace the NRC's hold point.
- 14709-17 Stamiris Exhibit 53, 12/9/82 Consumers Power memo, was identified by Shafer as containing instructions to Consumers personnel to check with Cook before speaking with NRC concerning the CCP. This was to avoid erroneous information being given to the NRC. Shafer contrasted this with his earlier testimony where he said that Bechtel appeared to deliberately withhold information on specific technical subjects.
- 14719 Cook construed Exhibit 53 as limited to the development of the CCP not its implementation.
- 14722 Landsman considers the Applicant's direct testimony of 2/14/83 to be a gross mischaracterization of an incident when Consumers drilled into the electrical duct bank 14 times.
- 14724 Stamiris Exhibit 54, a 2/14/83 nonconformance report by Consumers written on Bechtel forms, (also stamped 3/24/83) details the drilling into the electrical duct bank incident. NRC regulations require that nonconformance reports include an analysis of the reason for the problem. Landsman first heard of the incident two months after it occurred. There is no time limit within which Consumers must inform the NRC of such incidents.
- 14729 Consumers must inform the NRC of such incidents.
- 14730 Landsman stated that if he thought such incidents were significant enough he would halt work. He considers such incidents the result of lack of attention to detail by the workmen and poor management by both Bechtel and Consumers.
- 14733 In response to a question from Chairman Bechhoefer Landsman stated he did not know whether the workmen had adequate supervision/instructions.
- 14735 Stamiris Exhibit 51, the Construction Technology Laboratory report by Dr. Corley concerning cracks in the feedwater isolation pit, was withdrawn after lengthy discussion.

CPCO/MIDLAND

4/29/83 HEARINGS ABSTRACT

NRC STAFF WITNESSES:

SHAHER
LANDSMAN
GARDNER

14753-
56

Preliminary matters.

BY BERNABEI

14757-
60

NRC issued 9 reports in 1982 on soils issues, 7 of which cited items of noncompliance re: soils remedial work. The remaining 2 reports (82-20, 82-26) contained "concerns" (as opposed to open items).

82-10: re: QC training

82-16: Subpart A re: QC training

Section 1 re: soil work packager

Section 2 re: FIVP proof load jack.

14763

Except for the 9 reports of 1982, neither Landsman nor Gardner looked at soils issues in the inspections they conducted.

14763-
64

SALP panel for the 4/20/82 SALP Report did not include Shafer, Landsman, or Gardner.

14764-
66

Referring to the statement at p. 7 of the 4/20/82 SALP report (Stamiris Ex. 55 for ID) that:

"... every inspection involving regional based inspectors and addressing soils settlement issues has resulted in at least one significant item of noncompliance,"

Shafer says the Midland Section feels CPCo's performance since the 4/82 SALP report has not changed; Cook rated CPCo's performance in 4/82 as level 3.

- 14765-
66 Landsman says the two 1982 reports that describe certain deficiencies as "concerns" categorized them as such because they were discovered prior to construction. Otherwise, they would have been "noncompliances". He adds, however, that a "concern" is as significant as a noncompliance.
- 14768-
69 Shafer says the SALP Report is an assessment by Region III of licensee performance. It is an overall rating for particular areas of inquiry, but these areas may change depending on the facility involved. E.g., one variable is whether the facility is operating or is under construction. With respect to plants under construction, Shafer cannot say positively that the NRC is consistent in its evaluations.
- 14770-
71 SALP 2 report (4/82) rates specific areas of inquiry according to a three-tiered system. (See Stamiris Ex. 55 at p. 4)
- 14772-
73 Shafer says Category 3 indicates "minimally acceptable performance". While there is no category for unacceptable performance, it is the NRC's practice to make recommendations for increased inspection and licensee attention to certain issues. (See Stamiris Ex. 55 at p. 15)
- 14773-
76 Shafers says the only difference between the Preliminary Report (Stamiris Ex. 55) and the final version is that additional information might have been appended. He doesn't recall whether the Preliminary SALP 2 Report was in fact appended. In any event, none of the Midland ratings have been changed.
- 14776 Shafer testifies that the Soils and Foundations, Elec. Power Supply & Distribution, and Piping System & Supports categories received a Category 3 rating. Referring to JWC's testimony on 7/81 that there was still construction activity to be done in those categories, he states that he does not disagree with this statement. He notes, however, that priorities shift over time.

- 14780-
81 Stamiris Ex. 56 (for ID):
 CP response to SALP: 5/18/82 letter.
 [Something missing in the transcript].
- 14781 Stamiris Ex. 57 (for ID): Shafer's comments on
 CPCo's 5/17 response to SALP. (Handwritten notes
 within left-hand margins are by GAP, not by
 Shafer).
- [Bernabei seeks Shafer's comments on the following
 Ex. 57 passages to discern what portion of the
 CPCO 5/17 response they address.]
- 14786 Referring to Stamiris Ex. 57, Item C, p. 1-4 (re:
 electric power supply and distributor), Shafer
 says this passage addresses 7 IONC's (Items not in
 compliance), which CPCo felt were "not excessive"
 but which Shafer thought indicated lack of rigorous
 QC coverage. Shafer also cautions that these
 notes must be taken "for what they are": Staff was
 preparing for a meeting (second public meeting) with
 CPCo to resolve the issues.
- 14787-
92 Referring to the paragraph in Stamiris Ex. 57 that
 addresses p. 1-16 of the response, Shafer cautions
 that, as his comments indicate, CPCo had not
 determined the "extent of the problem". Shafer says
 he had first concluded, based on what CPCo had said,
 that CPCo's failure to identify and control [refer-
 ent is not clear] was deliberate. Later discussions
 indicated, however, that this was not the case.
- 14792-
93 Referring to his comment in Stamiris Ex. 57 re
 p. 1-7, Ex. 1 of the response, Shafer says that he
 had perceived an attempt on the part of CPCo to
 determine what constitutes an inspection. Such a
 determination, though, is for the NRC to make.
- 14794 In his comment in Stamiris Ex. 57 regarding p. 1-12,
 Item G, Shafer voiced disagreement with CPCo's
 position that there should have been only one item
 of NC for a QA defect and not two (a construction
 defect and failure to identify the defect). He
 felt that two were appropriate.

14795-
96

As for the comments "I don't believe this!" and "Are we lying?" in Stamiris Ex. 57 regarding p. 1-19, Item O, Shafer emphasizes that he had no further information at the time he made them, and that the notes were only intended as a working document.

14796-
99

Shafer's comment in Stamiris Ex. 57 regarding p. 1-20, Item P. 2 arose out of his irritation with CPCo for analyzing some statistics on the number of its appeals and HVAC items granted in such a way as to make its record appear better than perhaps it was. Shafer felt that CPCo spent too much time trying to justify its behavior. The Spessard memo (attached to JGK 10/82 testimony), he says, is further evidence of the same. [At Tr. 14800-801, Shafer identifies the comment about CPCo justifying its behavior as an overall remark about CPCo's 5/17 response].

14799-
800

Referring to his comment in Stamiris Ex. 57 about p. 1-20, Item P. 1, Shafer says he thought that misrouting of the Part 21 Report reflected poorly on Bechtel's ability to control documents and CPCo's ability to control Bechtel.

14801

Purpose of Shafer's comments was to provide background information for Staff's [internal?] use; they were not intended to be conveyed to CPCo.

14804-
06

Stamiris Exs. 55, 56, 57 admitted.

14808

Stamiris Ex. 58 (for ID): R. Cook's notes on SALP report. Referring to the first paragraph, which expresses the opinion that CP's inability to manage the Midland project led to formation of the separate Midland section, Shafer says that he neither agrees nor disagrees with this opinion. It was the SALP report and response that were a major factor in the formation of the Midland section.

14819

[Bernabei's line of questioning attempts to establish whether panel agrees with Cook's opinions about CP's character, management attitude, and QA practice.]

- 14820-
21 Landsman was present at 6/21/82 meeting (second meeting) at which SALP report was discussed. Shafer was not present.
- One reason Keppler formed the Midland Section and the Office of Special Cases was that he did not know what was "not working" at the plant. Landsman does not recall one of the reasons being an inability on the part of CPCo to manage the Midland Project.
- 14822 Shafer has no opinion about Paragraph 1-C of Stamiris Ex. 58 (where Cook expressed his opinion re: adequacy of number of QA/QC personnel).
- 14823-
28 [Further questions postponed until R. Cook is available].
- 14829 Shafer was not present at 4/26/82 public meeting on SALP, and he doesn't know whether R. Cook was there. He does not recall whether it was a public meeting at which Keppler made comments on the SALP 2 report.
- Shafer is aware of a second meeting on SALP on 6/21/82 only as of today.
- 14829-
30 Landsman was present at 6/21/82 meeting and says Keppler voiced some concern that the position of the NRC inspectors and the SALP Report was completely different from that of CPCo in its response.
- 14830-
31 Landsman does not remember JWC saying that "[CPCo was] disappointed by the [NRC's] 4/26/82 response on SALP". He states that Keppler announced the formation of the Office of Special Cases at the 6/21/82 meeting, but does not recall the reasons for its formation.
- 14831-
32 Landsman remembers Keppler saying he was worried because he did not know what the problem was at Midland. He can't recall, though, on which occasion Keppler made this remark.
- 14833 Landsman does not remember any comments he made at the public meeting re: drilling the dewatering well.

14834-
37

Stamiris Ex. 59: Notes that appear to relate to subjects discussed at the 6/21/82 meeting. Landsman doesn't know whether JGK discussed the bracketed material at p. 2 of Ex. 59. Referring to the p. 2 material, Landsman explains that early in the Soils remedial work, he went to the site to approve additional soil borings requested by NRC. He found so many (15) deficiencies in the QA and QC manuals that the borings were postponed until CPCo could correct the deficiencies. He adds that CPCo also claimed to have found the deficiencies.

14837-
38

Landsman does not recall Keppler saying at the 6/21/82 meeting that NRC "flatly disagreed with CPCo".

Purpose of 6/21/82 meeting was to discuss CPCo's response to the SALP report.

14838

CPCo's position at 6/21/82 meeting was same as in the 5/17/82 response; CPCo's attitude at the meeting was argumentive.

14838-
39

Landsman recalls JGK saying that perhaps he misled the ASLB in his prior testimony. He doesn't know whether JGK made that statement at the 6/21/82 meeting, however.

14839-
40

Shafer testifies that the SALP Board and Region III determine how activity areas discussed in the SALP Report are to be "characterized". Not every plant is evaluated for all activity areas. If there haven't been inspections in a particular area, then no evaluation is attempted.

14840-
44

Stamiris Ex. 60 (for ID): Contains (1) memo from G. Pirtle (SALP coordinator) to D. Boyd, project leader, Midland SALP report, re: supp. SALP Midland input for 10/1/81;

(2) 9/22/81 memo Pirtle to Boyd re DETI SALP input for Midland;

(3) Summary of Contents

(4) Master Sheet

(5) DETI investigation and inspection: man hours for an area.

(6) Div. of Eng. and Tech. Inspection SALP input for Midland (6 pages).

14845-
47

Shafer doesn't know who is the SALP coordinator for DETI; but like all other divisions within regional office, DETI's role is to compile information for SALP Report. 3 divisions were involved: DETI, Div. of Resident and Project Inspection, and an Environmental and Materials Division. Generally, each inspector would provide input to the SALP coordinator.

14847-
49

Norelius, the Division leader, had ultimate responsibility for input into SALP report. His normal practice was to delegate responsibility to the "section chief" (also known as "project leader"). Gardner thinks that Boyd was the project leader for the 1981 SALP report.

14850-
55

Shafer states that the 10/1/80 memo (Stamiris Ex. 60) indicates that its purpose was to convey information from SALP coordinator to Boyd re input to SALP report.

[Objection to Q of whether memo indicates that DETI recommended a below average (category 3) rating for the QA area (because admissibility of the memo is in doubt)].

14855-
57

Shafer says the SALP Board would consider input from all three divisions (whose ratings might differ) and from the NRR in order to reach a final decision on how to rate a facility. In this case, the DETI "may indeed have recommended a below average ... rating." Shafer notes that within a division there is often a split opinion as to how to rate a plant.

14857-
59

Gardner states that DETI was requested to compile a list of inspections conducted at Midland on electrical and instrumentation work. The SALP coordinator would then probably use input and suggested ratings from the various DETI inspectors (and any other division inspectors involved with electrical work) as a basis for rating the plant.

- 14861-
62 [Nonevidentiary matters].
- 14862-
65 Shafer doesn't know of any discussions between Region III and CPCo following the 6/21/82 meeting; however, JGK and Staff did discuss supplementing his testimony in these hearings. Paraphrasing JGK's 10/82 testimony, Shafer says a primary reason for the supplemental testimony was Cook's statement that if he were to rate the soils area today, he would give it a Category 3 rating.
- 14866 Shafer does not recall JGK saying that he might withdraw his reasonable assurance, or whether CPCo should change its response to the SALP report. According to Gardner, though, the NRC expected CPCo to re-evaluate its position.
- 14867-
68 Gardner testifies that the NRC's position at the time was as stated in the SALP report. He recalls being told that CPCo was in the process of revising its response, and that a meeting with CPCo would be forthcoming. At that meeting, Roy Wells would present the CPCo response.
- 14869-
70 Shafer doesn't know whether the fact that NRC was "unhappy" with CPCo's original response constituted "pressure" on CPCo. CPCo wanted to discuss 4 issues at the 8/5/82 meeting and to re-evaluate its position on the others; NRC agreed to this procedure.
- 14870-
71 Gardner says Wells told the Staff that a revised SALP response was being prepared, and that there would be a meeting to discuss it.
- 14871 According to Shafer, CPCo was told that the Staff was not going to change its position from that expressed in the SALP report. Certain other information, however, would be -- and perhaps was -- appended to the report.
- 14872-
73 Shafer says the 8/5/82 meeting took place before the filing of JGK's Supp. Test. He doesn't recall whether JGK withdrew his reasonable assurance in the Supp. Test.

- 14873-
74 Early in October 1982, Shafer met with Keppler, Paton, Wilcove and Warnick to discuss Keppler's 10/29/82 testimony.
- 14874-
78 [Board sustains objection to question about substance of early October discussions.]
- 14878-
79 The panel does not recall any conversation in the August-October 1982 period about JGK withdrawing reasonable assurance.
- 14879-
81 Shafer recommended to Keppler the use of additional personnel on the Midland section; the recommendation was not adopted. [See 8/18/82 letter Warnick to Keppler: Att. D. to JGK 10/29/82 test]. A similar directive was issued as a NUREG in ca. 1/83.
- 14881-
84 Sometime during the August-October 1982 period ACRS recommended that CPCo hire an independent third party to do a vertical slice review. Shafer thinks JGK argued for this recommendation.
- During the same period, Keppler also recommended that Bechtel QC report to MPQAD. Shafer does not know whether Keppler recommended either to CPCo or Keppler's "superiors" (defined as "I&E") that BWM and WRB be removed from Midland; he did not discuss it with Shafer's section.
- 14884-
86 Around 8/82, Shafer recommended that all exit interviews be conducted with both construction and QA; that any inspector coming on site would have "primary communications" with personnel responsible for the work, and that auditors were welcome to attend. Keppler did not formally adopt these recommendations, but if they were unacceptable to him he would have told Shafer.
- 14886-
87 Midland Section also devised the recommendation that all commitments from CPCo and all NRC approvals be in writing. Keppler "tacitly" adopted the recommendation as his own: if he had found it unacceptable, he would have so informed the Section.

- 14887-
89 Shafer says Keppler did not adopt a policy that the written commitments by CPCo and written approvals by NRC were to be transmitted to the ASLB.
- 14890-
91 Shafer recalls that sometime after 1/83 Keppler considered the possibility of meeting with the president of Bechtel, partially in connection with work on the Zimmer plant. Shafer's section did not generate this idea.
- 14892-
95 There were many communications in 8/82 between NRC and Region III re: CPCo's management attitude. Shafer cannot testify as to the substance of any meetings on this topic because he was not present at any of them. (See Keppler Test., 10/29/82 submittal, Encl. C which refers to a meeting which may be the one under discussion).
- [Shafer testifies that Keppler met with Selby and Cook perhaps on 8/29 and 9/2/82, and although he was not present, he is certain that they must have discussed CPCo's management attitude. Answer is stricken].
- 14895 Shafer wrote the first draft of JGK's 10/29 Suppl. Test. in early October at a meeting with JGK.
- 14897 There is not yet a SALP report for July '81 to July '82. The report was not "postponed"; rather, the SALP period was "extended."
- 14897-
903 Stamiris Ex. 61 (for ID): 8/6/82 memo, Spessard to Cook re: extension of SALP 3 evaluation period to 3/31/82. (Contains highlights and other markings which don't appear on original; also a typo regarding the SALP dates -- should read 7/1/81 through 6/30/82.)
- 14903-
905 At the time it was written, Shafer agreed with Cook's statement in Stamiris Ex. 61 that a review of the inspection and enforcement record for the period 7/1/81 - 6/30/82 indicates that some of the areas identified as Category 3 during SALP 2 would remain Category 3 during SALP 3.

- 14905-
906 Shafer agrees with Cook's recommendation in Stamiris Ex. 61 that extending the SALP period might serve to motivate CPCo to improve its performance.
- 14906 Tambling reports directly to Norelius as a technical assistant and is responsible for coordinating the SALP report for the entire region. He did this in 8/82 as well.
- 14906-
907 Stamiris Ex. 62 (for ID): 4/11 memo to DeYoung (I.E. Office) from Keppler re: SALP for Zimmer and Midland. Shafer never saw this memo but is aware of it. He is aware of Keppler's request for approval to postpone SALP for both Zimmer and Midland.
- 14907 Shafer recommended to Keppler that the Midland SALP be postponed because it was a better use of manpower to conduct inspections than to write a descriptive report.
- 14907 Shafer agrees with Keppler's statement in Stamiris Ex. 62 about recognition of QA, construction and management problems at Midland and Zimmer, and the statement that "It is ... clear to the parties concerned what steps are necessary to resolve problems..."
- 14908 [It is pointed out that Stamiris Ex. 61 talks about dispensing with a SALP report for Midland altogether, not about postponing it.]
- 14908-
909 The result of Keppler's request in Stamiris Ex. 61 was that a "modified" SALP would be written. Shafer was only recently told by Keppler about this "modified" report. He does not know what JGK means by "modified", but says it has to do with a change in content and not simply a change in dates. [At Tr. 14911, Shafer notes that JGK used the term "limited" rather than "modified" SALP].
- 14910 Stamiris Ex. 63 (for ID): 4/18/83 memo from JGK to Hind and Warnick re: SALP appraisals for Zimmer and Midland.
- 14911-
13 Shafer testifies that Keppler's 4/18 memo indicates that work would be allowed to continue "to safe related work" [testimony unclear], and that the memo clarifies what Keppler meant by a modified SALP report.

- 14914-
16 Stamiris Exs. 59-63 received into evidence.
- 14917-
18 Shafer states that there has been no improvement in QA since the SALP 2 period; the construction completion program is representative of a continuing problem.
- 14919- CROSS BY STAMIRIS (Re: DGB inspection reports)
- 14919-
23 Landsman says the underlying dispute between the NRC and CPCo regarding QC recertification circa 9/82 had to do with the soils area, and not with the rest of the plant. [Reference is made to the 9/24/82 CAL]. However, at an exit meeting prior to issuing the CAL, the NRC did raise the concern that the problem might extend to the rest of the plant. The CAL itself notes this concern as well. See last para. of CAL. Landsman also notes that following the exit meeting, CPCo asked the NRC whether it thought the QC certification problem could be site-wide.
- 14923-
24 Specifically, a Staff meeting was held on 9/29/82 to resolve the soil qualification problem and to decide whether the stop work order should be extended to rest of plant. Landsman does not recall what decision was reached.
- 14924-
26 Shafer, who was present at the meeting says the Staff decided not to recommend a shutdown of safety related activities because it lacked adequate information to make such a recommendation.
- 14928-
30 Shafer testifies that his group informed CPCo that it would recommend to Keppler that CPCo take over QC. His group also informed CPCo that, upon assumption of QC work, it expected CPCo to recertify the QC inspectors in accordance with 1978 ANSI standards rather than earlier standards. CPCo agreed; Landsman & Gardner went to site on 9/23-24 and a confirmatory action letter was issued. Staff found the exam procedure deficient, and informed CPCo that the 1978 standard required the examinations to be written.

14931-
35

At the 9/29 public meeting, CPCo described the training program and its effect on non-soils QC activity. The Staff "caucused" and decided, by majority, that it did not have sufficient information to make a shutdown recommendation. Landsman was the only dissenter among the group. Gardner, who was also present at the 9-29 meeting, does not recall there being any reason for this decision other than lack of information.

14935-
37

Gardner explains that they took previous problems (e.g., electrical worker qualifications) into consideration in determining whether to extend the CAL beyond soils. Deficiencies in cable and pipe support installation had already led Staff to require recertification of QC inspectors. Gardner first identified the problem with electrical work in IR 81-12.

14940-
41

Landsman says one reason the Midland section decided at the 9/29 meeting not to shut down the entire plant was that CPCo promised to reinspect everything done by any inspector who failed the recertification exam. Landsman recommended shutdown, however, because there were "enough indicators for the past 12 years" to warrant such a recommendation.

14941-
42

In forming his opinion at the 9/29 meeting, Landsman did not take previous qualification problems into consideration; rather, he relied on a 54-page document on the history of the Midland plant, which had been prepared by Gardner and sent to ACRS.

14942-
44

Landsman went along with the decision reached at the 9/29 meeting because of CPCo's promise to reinspect. Later, though, it appeared that CPCo was not going to reinspect everything that the failed inspectors had inspected. He does not know whether this problem -- which CPCo termed a "misunderstanding" -- was ever resolved.

14944-
45

Shafer says he and Gardner met with Wells; Wells' position was that a failed examinee should have a second or third chance to pass, while the Staff said the first failure of the exam should trigger a reinspection.

14947-
51

Reasons for conducting the DGB inspection, according to Shafer:

1. recertification issue
2. Staff wanted more current information than the 1981 inspection reports on hangers and conduit could provide. Cook suggested looking at work done in past year; they decided to inspect the DGB building because it represented recent work. Landsman does not know what percentage of work encountered in the DGB inspection had been done in the previous 12 months.

14952-
53 and
14956

By inspecting the DGB, says Gardner, the Staff could see whether CPCo's various retraining programs were effective in correcting problems.

14953-
54

Shafer states that although the Midland section was not requested to do so, it wanted to make some recommendations to management (i.e., to Warnick and ultimately Keppler). It conducted the DGB inspection in order to formulate such recommendations.

14954-
55

Gardner does not believe CPCo's retraining and other corrective measures have eliminated QA/QC problems at Midland.

14956-
57

Shafer testifies that the purpose of DGB inspection was to inspect the quality of "work implementation"; that is, to inspect the "quality program" as opposed to the actual work done.

14962-
63

Shafer doesn't believe CPCo claimed in fall 1982 that its problems did not go beyond the soils area.

14963

Gardner explains that CPCo was "not stating that ... there were problems in the balance of the plant"; it would be normal for a licensee to "state that there is not a problem in the balance [of the] plant".

14964 Landsman thinks CPCo was telling NRC that everything was ok in the balance of the plant. He further states that CPCo never acknowledged that there was a problem in the soils area.

[objection: no time reference given]

14964-
67

Stamiris Ex. 64 (for ID): 9/22/82 letter from DSH re: summary of 9/8/82 meeting on soils QA improvements, Attachment: 9/7/82 draft letter.

14967

Referring to Para. 2 of 9/7/82 draft letter (Attachment to Stamiris Ex. 64), Shafer says SALP addressed QA as opposed to the Quality Program.

14970-
71

Shafer believes that at time of DGB inspection, "[CPCo was] aware that they had or certainly that we had concern in both the soils area and non-soils area". CPCo issued two letters on 9/17/82 regarding the soils and non-soils problems, respectively.

14972-
77

[Non-evidentiary matters.]

NRC HEARING APRIL 30, 1983

14980-82 Preliminary Matters

Cross Examination of Ross Landsman, Ronald Gardner, and William Shafer (by Ms. Stamiris)

14982-89 Stamiris Exhibit 65, a memo from Warnick to Keppler concerning Consumers Power commitments, docketed 9/24/82, was shown to Shafer who stated that he had told Mooney what conditions he expected to exist before soils work should proceed and that these conditions were included in Consumers 9/7/82 draft letter.

14990-15000 A 2/8/83 NRC Notice of Violation (attachment 3 to Keppler's March testimony) was shown to Landsman. He stated that if the licensee knew about deficiencies in other areas of the plant and did not inform the NRC about them until after the Diesel Generator Building inspection that that would affect the NRC's opinion about their actions since they would be violating NRC regulations.

15000 During the DGB inspection Consumers made their own inspection and informed the NRC of deficiencies they found. This is referred to in the 2/8/83 Notice of Violation.

15001-12 With respect to the 3/10/83 Consumers response to the DGB inspection report (attached to Bruce Peck's testimony) Gardner stated that the NRC expects the licensee to take corrective action consistent with 10 CFR 50 Appendix B. The NRC and the region differ regarding the issue of safety related classifications. The Staff is currently waiting for a letter from NRR. If after receiving the letter they still disagree each side can write professional opinions.

15012-18 Mr. Miller pointed out that attachment 3 to Keppler's testimony, Notice of Violation, pages 9 and 10 sets forth the format by which the licensee is to respond to the NRC's list of violations. Landsman agreed that it is important from a quality assurance point of view that the licensee address both past and potential future violations.

- 15019-25 Directed to page A2-6 of Violation B of the DGB report Gardner stated that the licensee identified the cause of that particular violation as being inattention to detail. He expected them to take actions to prevent recurrences. Whether the corrective steps Consumers listed for No. 3 on page A2-6 will be adequate will be determined during future inspections. The construction completion program will include attempts to identify whether there are other instances of noncompliance.
- 15026-33 Gardner thinks that the portion of the licensee's quality verification plan which addresses "past areas of potential nonconformance" is essential to the NRC's assessment of the adequacy of their response. Shafer added that in each instance where the licensee admits noncompliance the construction completion plan addresses the generic implications of the admission.
- 15033 In response to Judge Harbour Landsman stated that a written commitment by the Applicant to accomplish something as part of the licensing request is not a legal commitment to do so. A "deviation" occurs when a licensee does not meet a written commitment.
- 15036-42 For individual items of noncompliance the NRC does not "close" those items based merely on a promise to correct the violations. Shafer stated that the staff recommended to Keppler that the licensee be locked into its CCP with a confirmatory order. Keppler has the final say concerning their recommendation.
- 15043 Once the construction completion program has been approved by the NRC it cannot be deviated from without explanation to the staff. Gardner, Landsman, and Shafer all concur with the recommendation that Consumers be locked into the finally approved CCP with some sort of confirmatory order.
- 15044-45 When asked whether the use of a confirmatory order indicated a lack of trust in Consumers Shafer stated that the order was just to avoid future argument. Landsman agreed it did indicate a lack of trust since there have been a lot of promises Consumers has not abided by in the past. Gardner thinks confirmatory orders would remove possible future misunderstandings.

- 15051-60 Continuing to refer to examples of Consumers' response to violations identified in the DGB inspection report Gardner stated that the extent of non-compliance indicates a problem with adhering to design requirements. Landsman believes the problem stems from lack of proper training and lack of attention to detail. The lack of attention to detail appears to result from both lack of ability and lack of willingness to attend to details. Examples of their inability include many obvious design deficiencies, besides the major 50.55(e) official ones, such as the design of the control tower and electrical penetration areas, design of the service water pump structure and design of the Diesel Generator Building. "No engineering company would ever design cantilever structures like that."
- 15061-63 In response to a question from Chairman Bechhoefer Shafer stated that various ANSI standards spell out the skill and training required of QC personnel.
- 16063-68 On 11/8/82 Shafer met with Wells to discuss the QC issue - the two disagreed as to whether QC inspectors should be reinspected if they failed the first written exam. On 11/10/82 the Midland section team met for a DGB inspection exit meeting among themselves. Burgess, Cook, Landsman, Gardner and Shafer attended. Dave Barrett, from the Division of Engineering, may have been there, too.
- 15068-74 Everyone at the exit meeting informally agreed that all safety related construction should be stopped because of substantial noncompliance found during the DGB inspection. In September, 1982 the team had considered recommending shutdown but did not have sufficient evidence. Mr. Warnick was informed of the 11/82 opinion and told them to submit their findings in their report. The enforcement board saw a draft of the report around 12/22/82.
- 15074-83 On 12/23/82 Consumers Power was informed of the NRC's DGB inspection findings. Shafer announced that he was going to recommend enforcement action and Warnick informed them that the group wanted all work stopped. Stamiris Exhibit 66, Peck's notes from the 11/23/82 meeting, refreshed Shafer's recollection that something was said at the meeting to the effect that it would take about 2 weeks to write the staff report and that the licensee was free during that period to initiate a work stoppage themselves.

- 15083-86 Neither Gardner nor Shafer remembered suggesting that Consumers present them with a plan prior to the 12/7/82 meeting with the NRR. The licensee was clearly told they were expected to take action if they wished to avoid an order. According to Exhibit 66 Cook indicated that he would do everything he could to prevent the NRC from initiating such an order but neither Gardner nor Shafer remembered him saying that.
- 15086 On 12/2/82 the licensee announced that they were going to shut down the HVAC work, the soils work, the B&W work and some continuing engineering work.
- 15088-89 Gardner and Landsman affirmed that there was discussion about the size of the civil penalties, although they were not involved in it initially. Gardner was satisfied with the amount suggested however he personally focused on the stop work and construction completion program. The range of the severity level discussed was in the category of 2 and 3.
- 15090 Landsman also stated that he and Gardner would have been happy with the civil penalties whatever their amount. The important thing in their minds was the work stop, not the amount of the penalties.

Abstract

Examination of James G. Keppler

May 2, 1983

Vol. I

<u>Page</u>	<u>Text</u>
15101	DX by Paton
15102-3	Voir Dire by MIM: status of Keppler's 10/29/82 in relation to his 3/25/83 testimony. 10/29/82 testimony reflects Staff position on QA as of 10/29/82, a status report.
15103-9	MIM moves to exclude 10/29/82 testimony from the record. Discussion on need for some parts of 10/29/82 in record; how that need for background to 3/25/83 testimony might be met. Paton and Bernabei oppose motion.
15511	Keppler's 10/29/82 testimony is accepted into evidence.
15114	Keppler's 3/25/83 testimony is accepted into evidence.
15115	Additional DX by Paton.
15115-6	JGK been responsible for NRC RIII for 10 years. Dealt with CPCo management all that time. Won't use word "shoddy": but despite CPCo efforts there have continued to be QA problems. This is one reason Staff will require verification of completed work.
15116	Paton: work today "shoddy"? [JGK avoids word "shoddy"] but clearly NRC in DGB IR, and CPCo subsequently, identified a number of QA problems.
15117-9	Paton refers to 4/27/83 Marshall CX of Landsman, at Tr. 14433. NRC won't grant OL until know utility has built and can operate plant safely.

NRC is insisting on extensive verification program and on 3rd party overview, to verify proper implementation of QA program in future.

- 15119 Paton refers to 4/28/83 transcript, Tr. 14685.
- May someday recommend lifting 4/30/82 Board Order, but not for awhile, not until he's sure QA and 3rd party overview are doing their job. Enforcing/ implementing 4/30/82 order is enormous drain on resources.
- 15121 Paton refers to 4/28/83 Tr. 14691-2: Landsman's "trust" of Applicant.
- If lack of trust suggests dishonesty or deception, K. disagrees. If trust means confidence, K. agrees with Landsman.
- 15122 Re: putting cost and schedule ahead of quality: there is no final NRC consensus why there are still problems implementing QA. Do know there are problems. Staff is therefore insisting on certain verification programs.
- 15123-4 Paton refers to Tr. 14731-2: doing job right first time vs. inspecting quality in. At 8/26/82 meeting K. and Eisenhut emphasized to CPCo that CPCo was not instilling right attitude.
- 15124-5 CPCo and BPCo management were not effectively assuring attention to detail. CPCo and BPCo management have met with workers. We will wait and see.
- 15125-6 When CCP is approved, there will probably be some sort of confirmatory order. Will have to see final program and decide how best to formalize commitments.
- 15126-8 K. has seen news article on K's "conditions" for reasonable assurance. There was no "deal" with CPCo/BPCo. K. and Eisenhut met with Cook and Selby 8/26/82 and 10/2/82. K. expressed concern with QA and Staff's analyses. Said CPCo/BPCo would have to deal with these problems. Discussed 3rd party inspection and need to verify quality of completed work.

15128 Since Summer of '81 K. has considered shut down.
Immediate shutdown demands that Staff demonstrate immediate hazard to public, or that construction might cover up defective work.

15129-30 Have been only two total shutdowns of safety-related work - Marble Hill and Zimmer. With Midland, K. didn't really consider an immediate shutdown, rather a show cause order.

Since company stopped work themselves, to solve problem K. et al. thought it better to require programs to confirm quality of past work and improve confidence in current and future work. Once programs are approved (probably?) will be a confirmatory order.

15131 Without work authorization procedure and 3rd party review, K. would not have "reasonable assurance". CPCo's improvements may result in better implementation of QA, but K. would be foolish to trust QA program without further assurances. Would not let work continue without 3rd party review. Prudence requires verification of quality of completed work because of past QA lapses. From all this, will know great deal about plant when it is finished. Any problems at site will have to be corrected.

15131-2 There are nonconformances at site today. Verification of completed work should analyze significance of nonconformances. If necessary, construction problems will be remedied. If problems are more procedural, perhaps they can be "dispositioned from an engineering point of view".

All nonconformances must be dealt with, in some manner.

151323 QA program/implementation did not meet expectations K. expressed in 1981 hearings - as evidenced by problems of '82 and, partly, of '81.

In April of '82 K. suggested he might have to modify his '81 testimony.

15134-5 K's present opinion on CPCo's implementation of QA: cannot rely on CPCo's QA program by itself. Need to supplement it with 3rd party review, which will continue till K's convinced CPCo's QA is working as it should.

Will let work go on so long as all details of 3rd party programs are satisfactory.

Emphasizes that past QA problems require construction verification program.

The various programs - 3rd party etc. - will, we hope, provide confidence that past and current work is properly done and that where there are problems they will be corrected.

15135-6 Bechhoefer refers to news article and asks if CPCo still trying to blame others (NRC) for delay rather than facing problems.

Examination of James G. Keppler
May 2, 1983
Vol. II

<u>Page</u>	<u>Text</u>
15137	Re: Selby comment on delay - CPCo committed the errors which brought on the 4/30/82 Order and Work Authorization program. If news quote is accurate, suggests CPCo is not facing the real problems.
15138	CX by Marshall.
15139	Ron Cook is a very good inspector.
15140	Ross Landsman is equally a highly competent, well-trained inspector.
15141	Thinks Midland Section would have recommended shut down after DGB IR if CPCo hadn't taken certain actions.
15142-6	Unclear.
15147	Responsibility for Midland is CPCo's.
15148-52	Unclear.
15152	NRC trying to take "responsible action" by requiring 3rd party review in addition to improvements CPCo is attempting in QA. Will not rely on CPCo QA without demonstration that it is working properly. Such NRC action should provide confidence.
15152-3	No question that there have been QA problems. Various review/verification programs and the other proposed programs will be in effect before we authorize work, to assure plant will be completed properly. Else cannot license the plant.
15154-5	Haven't considered a 3rd party review over operation if CPCo gets OL. CPCo's operation at other plants has complied with regulations. Did think about shutting Palisades down in 81 or 82. But Palisades has improved commendably.

- 15155 If ask "if can't build it right, how can they operate it right", K. doesn't have a good answer. Will see if changes CPCo makes are effective and invite confidence. But if plant finally is built under 3rd party review, then must consider question of confidence in CPCo operation vs. CPCo construction.
- 15155-9 Unclear.
- 15160 Inspectors in Midland section are honest and reliable.
- 15161 CX by Bernabei
- SALP for 7/80 - 6/81 was issued 4/82. CPCo then rated Category 3 in soils, electrical, and piping.
- 15162 Reference to 4/82 SALP meeting. Ron Cook said soils area hadn't improved since SALP period. K. was concerned that he might need to modify testimony which testimony in part concerned "reasonable assurance".
- 15162-3 At a 2nd SALP meeting 6/26/82 K. said he was troubled at continuing problems with QA. Didn't understand why implementation of QA did not work. Said "I have to wonder if CPCo can do the job". Said was uneasy about prior testimony and might need to clarify it.
- 15164 Announced Office of Special Cases at or near time of 6/26/82 meeting. Said would have 3 to 5 exclusively Midland inspectors.
- Said would reconsider testimony after talking with Staff.
- Said CPCo should be less defensive in reaction to SALP.
- 15164-6 Prior to 6/26/82 meeting, there was Norelius/Spessard memo on suggested changes for Midland.
- 7/26/82 was a meeting with NRR, included list of recommendations: get results of recent audit by CMC(?MAC); get certain CPCo commitments at public meeting. These recommended commitments were: independent design review and independent 3rd party to monitor QA implementation. These were recommendations agreed on by Staff, K, and NRR at 7/26/82 meeting.

- 15166-7 Warnick and OSC felt the recommendations were too specific because we didn't know real causes of the problems. Warnick and OSC were concerned that NRR recommendations were not sufficiently conclusive.
- 15167-9 Bernabei refers to Att. D to 10/29/82 testimony, memo Warnick to Keppler 8/18/82.
- Memo says Warnick on 7/31/82 expressed opposition to recommendations reached at meeting with NRR.
- Midland section met after 7/31/82 to generate own recommendation. Midland section met with K. on 8/3/82 to discuss opposition to NRR's suggestions.
- Bernabei refers to Adensam's notes (telecon/meeting log) [Stamiris 68].
- 15169-70 Discussion about Bernabei's not providing documents.
- 15171-3 More objections.
- 15174-5 K. not clear whether/when he discussed testimony with Adensam. Had a number of calls with Eisenhut, Adensam, Novak about Midland in July -August.
- 15175-6 In July - August may have very generally discussed testimony, that "something would have to be done".
- 15176 Midland Section produced recommendations different from NRR's (in Attachment D, enclosure 4 of K's 10/29/82 testimony).
- 15177 Midland Sections recommendation included increased inspection, "independent look at vertical slice" of a safety-related system, QC report only to CPCo, exit meetings with construction manager, etc. (These are all in attachment D encl. 4)
- 15178 Eisenhut not completely happy with Midland Section's recommendations. So K. told Selby 8/26/82 all the Midland Section and NRR's recommendations, not verbatim. K didn't "per se" adopt recommendations as his own. Didn't know what the problem was. Told CPCo to come up with a program for Staff to consider.

- 15179 8/26/82 meeting first time this subject [CPCo program?] was approached.
- 15179 Bernabei refers to pg. 31 of Adensam Notes - [Stamiris 68] "Keppler's List". Refers to conversation on or about 8/16/82 with Adensam.
- 15180 "Keppler's List" matches up to most of Midland Section's recommendations.
- 15181 Also on list: Marguglio/Bird must go, and K. to tell BPCo president to "shape up".
- 15182 K. was conveying Midland Section's recommendations with this list. K. agreed with most of these recommendations. Expulsion of Marguglio and Bird was dropped from list because NRC didn't know root cause of the QA problems.
- 15183 Clearly a communication problem from first line supervisors on site on up to J. Cook: issues not getting to top. Not sure if that was at Bird, Marguglio, or Cook's level, or all three.
- 15184-5 K. was conveying his Staff's (Midland Section's) preliminary recommendation.
- 15186-8 K. states his position at that time (July - August 82) on each of Midland Section's recommendations: Did not agree with augmented inspections - didn't have staff for it; more in agreement with 3rd party overview; completely agreed with 3rd party look at vertical slice; agreed with BPCo () reporting to MPQAD; with "Marguglio/Bird must go," that question asked and answered; agreed with exit meetings with both construction and QA; supported putting commitments in writing; about telling BPCo to shape up, K. met with CPCo first, and BPCo was present at 9/2/82 meeting.
- 15189 Agreed in principle with augmented inspection, but was a question of who did it.
- Re Marguglio/Bird must go, K. didn't know enough to take a position.
- 15190 In meetings with CPCo, K. passed along most of the recommendations. Said CPCo should come up with a program at their initiative. Didn't talk about expelling Marguglio and Bird.

- 15191 This meeting with CPCo was 8/26/82 in K.'s office: J. Cook, Selby, Eisenhut, Novak were present.
- K. said that he had reviewed his past testimony and CPCo's implementation of QA did not meet expectation.
- 15191-5 Objections.
- 15195 At 8/26/82 meeting, was stated that CPCo had new soils organization.
- 15196 K. et al. stated at 8/26/82 meeting that Curland (who is not at the top of QA program) was doing a good job. But did not know what problem was from Curland on up to J. Cook.
- 15197 Was discussed at 8/26/82 meeting how CPCo had turned Palisades around and would do same for Midland.
- Selby may have said graph of NRC nonconformance reports is getting better.
- Main purpose of meeting was to tell Selby what concerns were.
- K. told CPCo that CPCo had one week to produce a "get-well plan".
- 15198 CPCo produced draft get-well plan at 9/2/82 meeting and submitted it 9/7/82 (79/177).
- 15200 Draft plans for soils and for remainder of safety-related work presented at 9/2/82 meeting. K. said CPCo should submit those plans for record.
- 15201 At 8/26/82 meeting discussed in general way what issues were and what needed to be done. Did not specifically discuss Staff's recommendations. At 9/2/82 meeting CPCo presented draft plan.
- 15202 CPCo's draft plans included some of NRC's recommendations, but was vague. Were questions about what CPCo proposed.
- 15203 CPCo plan did reflect some Staff recommendations.

NRC before 9/2/82 did not communicate any of Staff's recommendations to CPCo.

- 15204-5 K. was aware of 9/8/82 working level meeting (CPCo-Staff). Doesn't know much about it.
- 15205-7 At 8/26/82 and 9/2/82 meetings K. et al. told CPCo they weren't satisfied with QA implementation, that CPCo should produce get well program addressing Staff's concerns. Whether K. told CPCo to submit 3rd party overview plan? K's response vague: basically CPCo could develop alternatives.
- 15207 CPCo 9/17/82 letters did propose plan in response to 8/26 and 9/2/82 meetings.
- 15208-11 Objections.
- 15212 Questions of "initiative", "pressure", "involvement" at 8/26 and 9/2 meetings: NRC told CPCo to submit get well plan. If NRC had not told them to produce plan, CPCo probably would not have at that time. But K doesn't know.
- K. would have been concerned if CPCo had not responded to recommendations of August meetings.
- 15213 Staff reviewed draft plan submitted at 9/2/82 meetings.
- Staff suggested changes, felt draft lacked much detail.
- 15214 Bernabei refers to Keppler to Warnick 9/24/82. [Stamiris 65; memo in fact is Warnick to K.]
- 15215-6 Objections.
- 15217 K. says first sentence of 2nd paragraph says this (CPCo draft plans) was submitted in response to K.'s meetings of CPCo and to some issues Staff recommended earlier.
- 15218-9 To the extent the Staff recommendations were generally discussed at 8/26/82 meeting, CPCo draft letters were intended in part to address Staff concerns raised in 8/19/82 [8/18? Att. 4 to Encl. D, K's 10/29/82 testimony] memo.

- 15220-1 [In Stamiris 65]. Staff expressed 4 concerns prior to resumption of soils remedial work.
- There were 7 recommendations from Warnick to K. The 7 recommendations were not, to K's knowledge, communicated to CPCo prior to submission of 9/17/82 CPCo letters [asked and answered].
- 15221 [As K said before] K et al. told CPCo at 8/26/82 meeting about Staff's general concerns about QA implementation and steps necessary for a get well program. Talked about some features that ought to be considered as part of such a plan. K et al. generalized the concerns of Norelius/ Spessard memo and the 2 Warnick memos [Att. D of K's 10/29/82 testimony].
- 15222 Stamiris 65 is Midland Section's comments on CPCo draft letter [get well program] to NRC.
- K. told Warnick to review CPCo's draft commitments, from CPCo get well program, which resulted from 8/26 and 9/2 meetings.
- 15223-6 Objections.
- 15226-7 K. had no contact with CPCo 9/2 - 9/17 and did not communicate to CPCo Staff's comments on draft letters (get well plan). Does not know if Staff did.
- 15228 Doubts that specific recommendations from Warnick memo (comments on CPCo draft letters) would have been told to CPCo, but does not know.
- 15231 Bernabei refers to Stamiris 69 and 70, 2 draft CPCo letters, 9/10/82.
- 15232 K. has never seen the 2 draft 9/10/82 letters before. K. not aware whether Staff saw the 2 draft letters prior to 9/17/82.
- 15233 Objections.
- 15234 9/10/82 draft letters appear to be drafts of the 9/17/82 CPCo letters.
- 15235 K. doesn't know if drafts differ from final.

- K. generally familiar with the two 9/17/82 letters.
- 15236 Objections.
- 15237 9/17/82 CPCo letters were in response to 8/26/82 and 9/2/82 meetings. K. can't say to what degree they reflect the (Staff) recommendations.
- K. didn't get intimately involved with 9/17/82 letters. K. knows Staff had problems with the letters.
- 15238-40 Objections.
- 15241 Staff reviewed CPCo's 9/17/82 letters and 10/5/82 letter (Att. G. to K's 10/29/82 testimony).
- 15242 K. read but didn't review the 9/17/82 and 10/5/82 letters.
- K. met with Staff to discuss problems with 9/17/82 CPCo proposals.
- 15243 To K's knowledge he and staff did not reach a final position on the 9/17/82 CPCo proposals during 10/82. DGB inspection intervened.
- 15244 Bernabei refers to Stamiris 71, a draft of letter from K. to CPCo.
- K. has not seen this draft before.
- 15245 K. thinks it is a memo drafted by Staff but not concurred with by NRR.
- 15246-7 K. knew staff had concerns about 9/17/82 CPCo letters. Had to coordinate response with Denton. But NRR did not approve letter.
- 15248-9 Draft letter (Stamiris 71) seems to be proposed acceptance of ("concepts" of) 9/17/82 CPCo letter.
- 15249 NRR opposed sending out Stamiris 71 at that time. Not sure why.
- 15249 NRR opposed sending out Stamiris 71 (Draft letter). Keppler not sure why.

- 15249 Bernabei shows Stamiris 72, handwritten comments by Hernan on Stamiris 71, draft letter proposing acceptance of CPCo 9/17/82 letters.
- Keppler has never seen Stamiris 72, nor does he know what NRR said about Stamiris 71.
- 15250 Keppler does not know what was NRR's disagreement with Stamiris 71.
- 15251-2 Objections
- 15252 Staff felt need to respond to CPCo 9/17/82 letters. NRR did not agree with the response. Mr. Warnick handled drafting response and told Keppler of NRR's disagreement.
- 15252-3 Started to become aware of problems from DGB inspection in October and early November. Doesn't know if early findings of DGB Inspection influenced NRC's position or CPCo's 9/17/82 letters. The letters were not high priority items at that time. Keppler aware of 10/25/82 meeting between Region III and I&E. Keppler did not attend; thinks Warnick and others attended.
- 15253 Keppler believes adequacy of CPCo (9/17/82) proposals was discussed at 10/25/82 meeting.
- 15254-5 Was mentioned at 10/25/82 meeting that perhaps vertical slice review was not broad enough. Discussed that 3rd party overview should be expanded to balance of plant. Stone and Webster was not specified for this task. Was discussed that INPO examination, suggested by CPCo, should be expanded, and that MAC lacked it. Was suggested that NRC should review 3rd party reports at the same time as CPCo.
- Keppler not specifically aware of CPCo asking NRR for direction or concurrence for 9/17/82 letters and 10/5/82 letter. Keppler not surprised CPCo asked for feedback but is not aware of specific questions. Objections.
- 15256 Keppler's recollection that around 10/25/82 staff was far from satisfied with information CPCo presented (9/17/82) with respect to balance of plant (QA implementation)

- 15257-8 In October 25 meeting, CPCo was told that the system for the vertical slice construction and design review was inadequate and that NRC wanted a second system, to be chosen by the staff from nominations by CPCo. Had been no official approval, but staff (around October 25) was reasonably satisfied with soils part of proposals. Some areas may have needed attention, but soils proposals were much closer to acceptance. At that time (10/25) Staff had not "taken a position on the acceptability" of balance of plant or soils proposals.
- 15260 10/29/82 testimony written in response to (perceived) deadline imposed by Board, written on basis of what we knew then, specifically on NRC position on continuation of soils work at time. Left balance of plant hanging there were programs, then under review, responding to NRC concerns.
- 15261 Keppler in 10/29 testimony was modifying his earlier view that there was reasonable assurance QA would be implemented satisfactorily.
- "These matters" were under review. Recognized he would have to provide additional testimony.
- 15262 In October Keppler left "in limbo" whether he could give reasonable assurance.
- 15262 Keppler and staff met with legal staff in Region III 10/7/82. Testimony written between 10/7/82 and 10/25/82.
- 15263 Bernabei shows Stamiris 73, last page of draft of 10/29/82 testimony.
- 152645 Second paragraph of Stamiris 73 talks of "performance orientation" (?) in last 12 months in DGB, SWPS, and other saftey buildings.
- 15265-6 Stamiris 73 says DGB inspection begun in 10/82 (10/12/82) and that it should provide information on how well work is being done at Midland.
- 15266 Bernabei quotes Stamiris 73: if intensive inspections require revision of Keppler's position, he will do whatever's necessary to ensure plant so constructed as to provide reasonable assurance of health and safety.

- 15267 Quoted portion was deleted from final draft of 10/29/82 testimony. Keppler not sure why.
- 15268-9 Stamiris 73 (draft of 10/29/82 testimony) indicates Keppler's conclusions on reasonable assurance might be different depending on DGB findings. Keppler is familiar with inspection findings.
- Findings have precipitated many actions necessary to provide assurance plant will be completed properly. These actions include construction verification activities and third party overview. Construction verification program not discussed in 9/82.
- Of proposals in CCP, third party overview was discussed in 9/17/82 letters, but not construction verification program.
- 15270 Vertical slice of independent verification program was discussed prior to DGB inspection, but not the program that required verification of all completed work. Overview of soils work was discussed in 9/17/82 letters.
- 15271 9/17/82 CPCo response on both soils work and remainder of safety-related work did focus on third party overview for the continuation of work, focused on an IDVP and independent construction verification for one or two safety-related systems.
- After DGB inspection, CCP added a complete review of all completed safety-related work - independent of the vertical slice.
- 15272 After DGB inspection NRC asked CPCo to take CCP, tie together overview programs from 9/17/82 proposals, and put it all together into one complete package (for NRC review). This package submitted on 1/10/83 and discussed at public meeting on 2/8/83.
- Keppler does not recall if horizontal review of past construction was part of 9/17/82 and 10/5/82 letters. Maybe.
- 15273 Bernabei refers to p. 12, first paragraph, 9/17/82 letter (QA program implementation, Att. E of Keppler's 10/29/82 testimony). That sentence does not refer to backward looking construction verification. It is a horizontal review of current operations at a given point in time. That was what INPO assessment was, not a complete review of completed work.

- 15274 The referenced 9/17/82 letter (Att. E to Keppler's 10/29/82) is not on soils work; it is on remainder of project.
- 15274-5 Probably was some discussion of review of as-built condition of plant prior to discussion of DGB inspection, but not in the detail of later discussions.
- 15276 CCP currently includes a backward looking construction verification program. Backward look was included in 1/10/83 CPCo submission. Staff told CPCo, probably in 12/82, that they expected some kind of verification of completed construction.
- 15277 NRC told CPCo during December, 1982, holidays, they would require more both of verification of past construction and more on the IDVP (more than what?).
- 15278 Was a 12/7/82 meeting between Region III staff and NRR Division of Licensing to discuss DGB inspection. NRC did request CPCo to consolidate their various proposals into one letter - to consolidate construction completion proposals with proposals submitted previously, the third party overviews and IDVPs.
- 15279 This consolidation included a construction verification program.
- When CPCo stopped work they presented a CCP orally at the site with the staff. CPCo was asked to submit that program in writing and to consolidate it with previous proposals for third party overviews and IDVP's.
- The submittal came 1/10/83.
- 15280 Not sure when discussion on consolidation of proposals was. Maybe later in December 82.
- 15280-1 Bernabei refers to Stamiris 74, 12/21/82 letter about 12/7/82 meeting between Region III and NRR.
- 15282 Stamiris 74 a summary of general agreements at 12/7/82 meeting. Item 5 says that NRC would not send draft letter by Region III and NRR in response to CPCo letter 18845, QA Implementation for Soils Remedial Work.
- 15283 Bernabei and Keppler disagree which draft letter is referred to in Stamiris 74. Keppler thinks that is letter drafted by Keppler's staff, which letter Bernabei showed Keppler earlier (Stamiris 71?)

- 15284 As a result of 12/7/82 meeting NRC did not send draft letter (Stamiris 71?).
- Item 3 of Stamiris 74 says NRC will request CPCo consolidate its various proposals on QA implementation and independent reviews.
- Item 6 - DOE will choose which of three systems proposed in CPCo's 12/3/82 letter will be added to TERA's independent design verification.
- 15285 Stamiris 74 (12/21/82 NRC meeting summary) does say TERA will do design verification, although staff had not yet approved TERA. TERA has not yet been approved.
- So Item 6 of Stamiris 74 is incorrect because NRR staff has not yet finally approved TERA.
- Page 3 of Stamiris 74 indicates that Region III would in future issue a letter authorizing start of work on Pier 12.
- 15286 Decision to issue authorization was discussed and agreed to at that (12/7/82) meeting between Region III and NRR.
- The decision to authorize work on Pier 12 came after Region III and NRR had received findings from DGB inspection.
- 15287 3/25/83 Testimony says work on Piers W-12 and E-12 was authorized 12/9/82. 12/13/82 in Activities log is an error.
- 15288 Keppler aware of DGB finding on IPINs. Keppler not familiar with "similar findings" in soils area.
- 15289-90 Objections.
- 15291 Conditions, if any, for authorization of Pier 12 work would be in the 12/9/82 NRC letter. Keppler not aware of any conditions. Not aware whether Landsman imposed conditions.
- 15292 Bernabei shows Stamiris 75 [].
- Last paragraph sets out three conditions to be met prior to release of soils work.
- First two conditions are satisfactory completion of technical review and approved MPQP-1 and MPQP-2.

- 15293 Third condition is resolution of matters "having to do with" QA implementation.
- DGB inspection showed problems with implementation of QA program. NRC characterized it as a breakdown. Keppler does not agree that therefore CPCo didn't meet third condition of 12/9/82 NRC authorization letter. Landsman and S&W had reviewed soils QA. Both satisfied there was no problem with proceeding with Pier 12.
- 15294 Licensee had done work on some nonsafety areas. "A very small authorization" to see how they did was appropriate.
- 15295 Hood testifies.
- 15295 Condition three of 12/9/82 letter refers to implementation of soils QA. Staff is satisfied in part because of S&W review.
- S&W was not approved at that time (12/9/82 release of Pier 12). NRC took account of lack of approval, but still used S&W's information.
- 15296 Staff had been continuously looking at QA for soils.
- There was no specific review to see if there were problems in soils QA similar to DGB findings.
- NRC did not view release of Pier W12 and E12 as a major release of work.
- 15297 Had reviewed a number of soils activities and wanted to see the effectiveness of the program as they proceeded in this small area.
- Keppler does not know if Landsman testified that Staff has lacked time to take a good look at training of QC inspectors for soils. Keppler not aware of findings of IPIN problems in soils area.
- 15299 Bernabei marks Stamiris 76, QAR189, 7/21/82.
- QAR189 indicates that IPINs are used in soils to identify multiple deficiencies.
- 153004 Objections.

- 15301 Keppler not aware of IPIN problems in soil area. Staff did not inform Keppler of such problems. Keppler doesn't know if Staff is aware of such problems.
- 15301-2 At time of release of Pier 12, Keppler aware of ongoing investigation into Landsman's allegation of violation of 4/30/82 Board Order.
- 15302-3 Keppler also aware at that time of investigation into Spessard memo [ALPO incident?]
- In 12/82 Keppler aware of 8/82 stopwork; 9/82 stopwork; 5/19/82 stopwork.
- 15303-4 In 12/82, Keppler aware that in 5/82 applicant had drilled through Q electrical duct bank.
- 15304 Keppler aware (in 12/82?) that there were significant findings on DGB inspection and that Staff felt some action necessary.
- Keppler not aware of any formal recommendation for stopping work after DGB inspection. But if CPCo hadn't taken "meaningful action", Midland group would have recommended a stop work.
- 15305 Keppler aware of DGB findings when NRC decided to release Pier 12 work. Staff was satisfied with CPCo's work stoppage.
- 15306 Keppler is aware of an 11/23/82 meeting between staff and applicant discussing DGB findings.
- At time of Pier 12 release, Keppler aware that staff told CPCo that if CPCo didn't do something about the problem, staff would recommend tough enforcement action.
- 15307 Keppler not aware if DGB inspection documented problems in soils area.
- 15308-09 DGB Inspection report Items 22 through 24 list concerns in soils area. Item 25 is a noncompliance in soils area.
- 15310 [Bernabei sums up last 1012 transcript pages and asks how Keppler could release Pier 12 work] Because staff recommended that he release it.

- 15310 Basis of staff's decision was Landsman and Midland section's recommendations.
- NRC did not see release of Pier 12 as a major release but was looking at whether CPCo improvements (reviewed by Landsman) would be implemented properly.
- 15311 At time of release, S&W had not yet been approved as third party overseer. But NRC was aware of and "took comfort in" S&W's observation of preparations for Pier 12 work. Keppler not aware of specific problems in soils subsequent to release of work.
- 15312 Keppler knows that Landsman testified that on 9/13/82 applicant hit concrete fill in excavating for Pier 12. Keppler was never informed of that.
- 15313 Bernabie: Staff has testified to a series of soils and other problems; so why did K. approve release of soils work? K: have relied "almost fully" on Landsman's judgement to proceed with soils (Pier 12). If Landsman felt work should be stopped he would say so. Warnick 9/24/82 memo [Stamiris 65] recommended conditions prior to release of soils work. Would have to ask staff if conditions were satisfied prior to release. Assumes they were or Staff wouldn't have recommended release.
- 15314 Stamiris 65 (Warnick to K. 9/24/82), recommends that License provide a computer listing of commitments.
- 15315 Stamiris 65 also recommends that soils QA and QC be integrated into MPQAD. K. cannot say which if any recommendations were implemented prior to soils release.
- 15316 Stamiris 65 deals with CPCo 9/17/82 effort to generate a soils program. Bernabei: on page 2 of Stamiris 65, Midland Section strongly recommends against blanket authorization for soils work. Keppler: release of Pier 12 is hardly blanket authorization.
- 15316-7 Items 1-4 of Stamiris 65 are recommendations to be implemented prior to release of soils. Keppler does not know if they were implemented prior to release of soils.

- 15318 Soils work is continuing. Keppler does not know specifics of problems in soils work since its release in 12/82. Did have a phone call on FIVP cracking. Doesn't know if CPCo or NRC knows root cause.
- 15319 Knows CPCo drilled into Q electrical duct bank during shallow probing around SWPS; Keppler doesn't know reason for incident; didn't ask if Staff knows.
- 15320-1 Keppler hasn't discussed with Staff the cause of drilling in Q duct bank.
- Keppler read in transcript that Landsman said duct bank incident indicated lack of attention to detail and a problem with upper CPCo and BPCo management. Such is typical of what K's heard in past from Landsman and other members of staff.
- Keppler was informed of problems with pier load test for Pier W-11. Not aware whether Staff or CPCo knows root cause of problem (load not reaching bottom).
- 15321 K. not informed of results of inspections unless there is a serious problem.
- 15322 Not fair to say Keppler is informed of most problems in soils area. Keppler had heard of Q duct bank and pier load test problems because of hearing is going on right now. Normally Keppler does not hear of routine problems.
- Based on overview program and continued very controlled release of work, soils work may go forward.
- 15323 In making decisions (on work release) Keppler places confidence in what Staff believes, weighs their considerations. NRC has released token soils effort at site. Must be satisfied that effort proceeds properly before release of next step. Keppler assumes if Landsman had serious problems with work at site, he would tell Keppler, and "we'd do something about it". Landsman has not done so. Keppler does not know of Landsman's testimony that inspectors don't have enough time to do all the work they'd wish to.

- 15324 Objections.
- 15325-6 Keppler can't recall Warnick proposal in 8/82 for 5-6 more people to aid inspection effort.
- Bernabei refers to attachment D to K's 10/29/82 testimony, Enclosure 4.
- 15327 Referenced document indicates Midland section wants 5 more inspectors. This request arose from Staff recommendation of augmented NRC inspection effort. Keppler did not agree that NRC should conduct the augmented inspection effort. Considered 3rd party overviews as an appropriate alternative.
- Would have loved to supply that manpower, but did not have it. 3rd parties will overview activities of QA programs.
- 15328 (NRC?) Inspectors look at everything, implementation of QA, "completed as-built work". If QA program is properly implemented, we should have confidence in as-built plant.
- 15329 [Testimony here unclear] One aspect (of what?), is review of ongoing work, other aspect is construction verification of what's already completed. "And certainly there will be a 3rd party overiewing that".
- Att. D, encl. 4 to Keppler's 10/29/82 testimony has been overtaken by events. In IDVP and ICVP 3rd party will do inspections of the as-built condition of the plant.
- 15330 3rd party will not do inspections in all 10 areas (1-10) suggested by RIII inspectors in Item 1-A of Att. D, encl. 4. Around time of Att. D memo (8/82), NRC considered use of licensee inspectors to help at Midland. Commission rejected that idea. Commission did not want to experiment with that FAA concept at this time (summer '82).
- 15331 FAA concept was suggested to Commission as part of Staff initiatives resulting from QA problems throughout the industry, including Midland.

15332-3 Was a period of 2 months after DGB inspection in which severity level and fine were discussed.

Keppler not heard suggestion of million dollar fine which Landsman heard at an enforcement meeting. Didn't hear any mention of \$1 million.

15333 On 1/10/83, draft enforcement package assigned to Klinger in I&E headquarters.

Keppler not really familiar with Klinger's comments on enforcement package. Klinger attended enforcement conference. Keppler did not personally discuss enforcement package with Klinger prior to the enforcement conference. Keppler talked with Sniezek, Klinger's boss, about package.

15334 Bernabei shows Stamiris 77, "Midland Enforcement Package, General Comments. Refers to Paragraph 2-A.

Keppler has not seen it before. It appears to be Klinger's comments on enforcement package. Keppler agrees with Bernabei's paraphrase of paragraph 2-A, cases (wilfullness ... breakdown in management controls) in which NRC intends to apply fines up to statutory limit -- \$100,000/violation/day.

15335 [Transcript appears here to be missing something] This (? enforcement package, Klinger's comment on fines?) was basically our position going into enforcement conference with Licensee. Envisioned that IPIN issue would itself be a \$100,000 fine.

At enforcement meeting Keppler et al. received some information that caused Keppler et al. to do further inspection to determine extent of problem, and that (further inspection or information at meeting ?) caused Keppler et al. to modify position.

Klinger's position that full fine of \$100,000 should be applied because problem may involve wilfullness was position prior to meeting with licensee. This meeting was 1/18/83 enforcement conference. Present were Sniezek, Klinger, number of member's of K's staff. Doesn't recall if any NRR people were present. Believes Lieberman of OELD was present. Number of CPCo and BPCo people were present.

15336 At 1/18/83 meeting Keppler indicated CPCo couldn't identify problems in past and DGB inspection indicated CPCo couldn't identify problems now. This indicates poor conduct or performance by CPCo in 1/83 as in the past (? Transcript unclear).

IPINs, and what kind of documents they are, discussed at 1/18/83 conference. Was discussed how much inspection of plant is done once deficiencies are identified, using IPIN system (to identify deficiencies, or after identification of deficiencies?).

15337 Was a twofold concern at 1/18/83 conference: if all deficiencies not identified, subsequent close-out inspections might miss deficiencies not identified, might not do full reinspection. Abuse of IPIN system might impair tracking of root and other causes.

Subsequently found out that concern for tracking root causes was valid concern. Had interviewed QC inspectors at site: some interpreted IPIN "issue" (procedure?) to require full reinspection, some did not. So there was a potential for missing problem areas during reinspections.

15338 Making this problem a severity Level II was discussed at 1/18/83 meeting. Subsequently it was reduced to Severity Level III, partly because do not believe violation was wilfull and became NRC believes "it wasn't as widespread as it was".

15338-9 Doesn't think IPIN issue is particularly related to soils. NRC required that all work covered by IPINs must be reinspected.

Doesn't know how concerned he'd be if IPINs were used in soils. It would depend on discussions with Staff, on whether they were aware of it and considered it a problem.

Normally all reports are drafted and reviewed by supervision. Keppler doesn't see them. Assumes Shafer or Warnick did final review of DGB inspection report.

- 15340 Keppler doesn't know if any changes from draft to final report which (final or deleted draft material?) characterized QA implementation problems not as "significant breakdown" but as "breakdown". Warnick or Shafer would make such changes. QA breakdown at Midland is a significant breakdown.
- Keppler is familiar with 6/18/82 ACRS interim report on Midland. (An Exhibit by virtue of inclusion in SER App. G).
- 15341 Bernabei refers to p. 2, paragraph 4.
- 15342 Passage in letter indicates ACRS wants NRC Staff to arrange for broader assessment of design adequacy and construction quality.
- Discussions with CPCo about 3rd party reviews after 6/8/82 ACRS letter were intended to deal with Keppler's concerns more than with ACRS's. NRC put together a report on design and construction problems and on what NRC was doing about them. Sent this to ACRS. Not sure when. Sent it to Eisenhut. Report titled "Report on Design and Construction Problems for Period from Start of Construction through 6/30/82". The reporter is a compilation of problems without a lot of "contexting put on these problems as solutions to where we are going from here". So report not very responsive to ACRS request.
- 15343 We owe ACRS more than that. Report didn't "get the review". Haven't told ACRS that we'd like to talk with them more about it.
- 15344 Believe NRC owes ACRS more in response to request for broader assessment of construction quality.
- 15345 Believes independent reviews to be conducted as set out in CCP will satisfy ACRS.
- 15346 (Testimony confused) Keppler believes 11/19/82 NRC Report on Design and Construction Problems should be fleshed out.
- 15347 Objections.

- 15348 3rd party overviews and construction verification will be required to satisfy NRC's concerns.
- 15348 As for ACRS, Staff prepared 11/19/82 report which was not totally responsive to their request. No one - Eisenhut, Denton, nor Keppler - ever really specifically discussed how to satisfy ACRS request. If get all that expert to from CCP - 3rd party overviews, we will satisfy ACRS concerns.
- 15349 Keppler has not talked to Adensam or others from NRR about ACRS "requirements"; doesn't recall any discussions [by others] with Adensam about ACRS requirements.
- 15350 Keppler believes 3rd party reviews initiated to satisfy NRC's concerns. Not aware they were directed to ACRS requests.
- NRC Staff's concerns for 3rd party review are in no sense motivated by the ACRS.
- 15351 One basis for Keppler's continued "reasonable assurance" is continued staff inspection and monitoring.
- 1535-2 With 3rd party overview and construction verification program, we have enough staff to oversee Midland. We have more Staff on Midland than on any construction site, excepting Zimmer.
- By the time these various programs are implemented we will know more about Midland than we do about most projects.
- Present staff adequate for inspection and monitoring. 3rd party reviews will help staff in that effort. Keppler is aware of ongoing investigation into Zack allegations.
- 15353 Objections.
- 15354 Region III is still investigating Zack allegations.

- 15355 For many reasons, Zack allegations did not receive priority attention. There was some confusion caused by formation of OI and by the division of the workload. Zack investigation has been taken from Warnick and given to DOE. Warnick's section (Midland) did not have time.
- 15356 Objections.
- 15357 GAP submitted 6 affidavits to NRC on 6/29/82. Investigation of all 6 was referred to Region III, sometime in 3/83 - 10 months after they were originally submitted to NRC.
- 15358 There was some confusion between Region III and OI about who had responsibility for investigating the allegations. Region III was instructed to leave investigations to OI. OI would decide what to investigate and what to leave to the Regions. Because of staffing problems in OI this confusion not cleared up until March, when Region III's investigation began.
- 15359 Believe we have enough staff on the investigation. Keppler is familiar with Boos investigation. Region III had some responsibility for that investigation because it occurred before formation of OI.
- 15360 Boos investigation was done by investigators now part of OI. No secret we've been short of investigators in OI.
- 15361-2 Region III investigators are responsible for two of the GAP affidavits. Midland section is not responsible for part of Zack investigation. DOE is doing Zack investigation, at Midland and at Clinton.
- 15363 To some degree, duties involved in investigations will have an adverse impact on Region III's inspectors' performance of duties relating to Midland.

All Regional Administrators and Office Directors would like to have more people.

- 15363-4 Given constraints imposed by Congress, Keppler feels Region III has its fair share of personnel. Keppler feels they can carry out their programs, to a large extent, if not 100%.
- 15364 Certainly are not skimping on man-power for Midland. If there's a problem its that resources are diverted because of Midland and Zimmer.
- Allegations and additional problems creates problem of diverting resources. Job will get done; if people are overworked, it takes longer. One problem is that you may not identify problems as quickly.
- 15365 One problem at Midland is that problems were not identified earlier. Bernabei refers to Att. B to 10/29/82 testimony, Cook to Warnick, Indicators of Questionable Licensee Performance. See last paragraph on p-7 cont'd on p. 8.
- R. Cook indicates that NRC inspection from 7/23/81 to 7/23/82 has been "purely reactive". Cook wonders what would happen if there were vigorous routine inspection and audit program at Midland.
- Could infer from Cook memo that Staff has too much work. Could infer that Staff, despite best efforts, may not be finding all the problems. That is one reason for construction verification program.
- 15367-70 Objections.
- 15370-1 One reason for reducing severity level in enforcement package was that NRC believed IPIN problem was unintentional and wasn't as widespread as previously thought. If learned that it was both intentional and more widespread, Keppler would consider raising the severity level.
- 15372 Keppler not aware of Staff findings subsequent to DGB inspection that showed IPIN problem to be more widespread than believed at that time (what time?).
- Keppler believes use of IPINs stopped after DGB inspection.

NRC talked to QC inspectors about IPINs.

15373 Keppler not aware of inspections (subsequent to DGB inspection and enforcement package) showing use of IPINs to be more widespread than originally believed.

15373 More examples of the same IPIN problem probably would not make any difference to Keppler. But discovery that IPINs had in fact not been discontinued, when CPCo said they had,...[would make a difference].

15374 Objections.

15375 Keppler has heard from Staff that because of lack of confidence in licensee they want hold points where they can review work prior to authorization of certain further work.

Keppler not aware of Staff testimony that Staff did not shut Midland down on 9/29/82 because of CPCo's promise to reinspect work of inspectors not properly qualified. Keppler has heard since he's been up at hearings that staff considered shutdown on 9/29/82.

15376 Keppler testified before that he knew Staff told CPCo on 11/23/82 that they wanted construction to stop.

15376 Keppler agrees with Staff that CPCo does not have adequate control over BPCo.

CPCo will manage construction verification program. CPCo will have first line responsibility to identify problems at Midland. Keppler believes CPCo will put identification of problems before concern for cost and schedule. Basis for that opinion: is vital for verifying plant, so NRC will exert intense effort; there will also be 3rd party oversight.

15378 It is important that CPCo have responsibility for identification and correction of problems. CPCo will ultimately have to run the plant and determine quality issues.

- 15379 [Unclear: more on trust and confidence. Keppler is not simply "trusting" CPCo -- there's third party overview].
- Keppler has not considered alternatives --such as independent review at Zimmer -- to putting confidence in CPCo to resolve problems. To Keppler's knowledge no one on Staff has considered an independent review such as Zimmer's.
- 15380 Keppler has heard from Staff that part of problem is CPCo's putting cost and schedule ahead of quality. But Keppler has no basis for that conclusion: NRC really doesn't know root cause why QA program is not being effectively implemented.
- 15381 Keppler spoke at 2/8/83 at public meeting in Midland. Keppler said at meeting that comprehensive programs would provide assurance that completed construction at Midland was sound.
- 15382 Keppler has spoken about construction verification program, in which CPCo will be identifying problems. Basis for Keppler's statement that comprehensive programs will provide confidence in completed construction is the construction verification program plus 3rd party overview plus IDVP and ICVP programs.
- 15383 Construction verification program will be vertical slice of 2 systems plus part of 3rd that will include construction as well as design.
- 15383 3/28/83 Keppler sent J. Cook letter (Att. 4 to J. Cook's testimony). Letter requested additional details on CCP.
- 15384 In that letter Keppler suggested consideration of 100% reinspection of accessible safety-related systems. NRC has not reviewed CPCo reply. NRC position is that 100% reinspection will be required. CPCo will have to justify doing less than 100%.
- 15385 Keppler heard that CPCo started doing 100% then doing sampling. Keppler doesn't now have details.

Abstract

Examination of James G. Keppler
May 3, 1983

<u>Page</u>	<u>Text</u>
15398	CX by Bernabei, continued.
15398-9	<p>Around 4/1/83 Keppler requested of DeYoung, Director I&E, cancellation of SALP for Midland and Zimmer, because management, QA and construction problems there were already well recognized. Request on Midland SALP partly turned down. Tambling requested a "modified SALP", on areas where work is now [not?] stopped, soils QA and any primary safety-related system where work was going on. Keppler has proposed SALP on primary system, Zack work and soils work. Will do QA SALP as it relates to those areas, but not on QA as an area of itself. We already know what the problems are there.</p> <p>SALP is used to decide how to allocate resources of Licensee and NRC. It's obvious at Midland and Zimmer where problems are, so Keppler asked to delay SALP for those plants.</p>
15400	SALP in these 3 areas satisfies Tambling's request for SALP on QA.
15401-7	Objections.
15407	K. reads Stamiris 58 (R. Cook; notes on SALP Response), p.5, paragraph 2. As Keppler understands it, paragraph says that the inspector believes that CPCo's threshold of noncompliance is much too high, and that that statement would support removal of license until CPCo management is completely purged and attitude has been "realigned".
15408	Staff has never communicated to Keppler such a statement or feeling.

We have had a number of discussions about CPCo over the years. Staff was very unhappy with SALP response. They felt it was defensive and did not face the issues in many cases.

Keppler felt the same as the Staff about SALP response.

Warnick and Staff then met with CPCo to seek a more responsive reply to SALP issues.

15409 At public meetings in Summer of '82 Keppler expressed his unhappiness with SALP response. At those public meetings Keppler said he'd seek Staff's advice on how to handle the inappropriate response.

In seeking Staff's advice on SALP, Keppler never received their comments (formal or not) on the SALP response.

R. Cook's comments (Stamiris 58) were never given to Keppler. Keppler can't say whether Staff considered proposal in Cook's comments (to remove license until CPCo management purged and attitude changed). Keppler sure it was discussed in preparation for subsequent meeting with CPCo on SALP and response.

15410 Keppler "had no information" that proposal to remove license was a suggested resolution to QA problems. R. Cook had the opportunity to, and surely did, contribute to Warnick's recommendations to Keppler.

15410 CX by Sinclair.

15410-1 Statement had been made that putting cost and schedule ahead of quality was a cause of QA problems, but Keppler and Staff could not firmly conclude what root cause of difficulty in implementing QA program. Sinclair reads from last page of Att. D to 10/29/82 Keppler testimony - BPCo's foremost consideration is cost and schedule.

Keppler has no reason to concur or not concur with that statement. The statement is the view of Warnick and his staff. Proving that statement is something else.

- 15413 Keppler doubts that Dircks, Director of Operations, saw or responded to CPCo's 9/17/82 letter(s).
- 15414-5 Keppler said that operation at Big Rock and Palisades was unsatisfactory (? satisfactory ?) from a regulatory point of view. There was a lot of improvement at Palisades.
- Keppler's confidence in CPCo at Midland has eroded. That's one reason why NRC is insisting on these, some unprecedented, programs to assure quality.
- 15415-6 At Palisades and Big Rock CPCo has shown they can take on a problem and correct it. Palisades was clearly the worst plant in Region III 3 or 4 years ago. Now it is clearly one of the better plants.
- In same period Keppler's confidence in Midland QA has eroded because of continuing problems.
- 15416 NRC decided sometime in 8/82 that some type of 3rd party overview would be essential for both soils and remainder of project for the project to continue. Did not at that time decide "it had to be that way".
- 15416-7 Decided on 3rd party overview because of all the problems [no, really]. Stone and Webster has responsibility for 3rd party review of soils work. S&W was nominated 9/17/82, was approved 2/24/83, and probably came onsite shortly after they were nominated.
- 15418 90 Day Report says they began 9/20/82. Keppler's Staff was involved in review of S&W. Keppler acquainted with all that went into decision. Selection of S&W was very similar to approach to selection of other 3rd party organizations.
- Not Keppler, but his staff, were at 10/25/82 meeting mentioned in Adensam's Log (Stamiris 68).
- 15419-20 CPCo brought S&W in on assumption they would be approved. That happens typically. Staff could well have approved S&W before 2/82, but Staff was tied up in other work.

- 15421 (Responding to Adensam notes) Keppler believes expansion of role of S&W -- or whoever got the job -- to balance of plant was considered (in 10/82). We knew overview would be required for everything. CPCo initially just approved S&W for Soils.
- 15421 There are "very definite criteria" for 3rd party reviews.
- 15422-7 Objections.
- 15427 Keppler not aware of discussions between NRR and CPCo on role of S&W, but would not be surprised if they took place.
- 15428 Adensam notes (p. 43, points 4 & 5) appear to indicate some discussion on "protocol between CPCo and S&W.
- 15429 Re 2nd line p. 45 Adensam's notes - which says meeting will address programs to be executed by S&W.
- 15430 These notes do not indicate S&W had been approved despite fact there was no evidence S&W had met acceptance criteria. They indicate staff was well on way to approving S&W. The meeting was to complete the review.
- Keppler wasn't at the meeting and these are someone else's notes.
- 15432 Objections.
- 15433-4 For 3rd party reviewer, you look for organization reasonably free from ties to the utility, look for technical competence. Look for independence and competence not only in the organization but in the individuals as well. We don't require acceptance criteria that specifically articulate how the choice is made. Assume organization is competent and will do the job.
- 15435 Choice of 3rd party is not casual. You look for competence and independence.

If NRC had determined after S&W was onsite that S&W did not meet standards, a new 3rd party would be brought in. Any credit given to work of first 3rd party would be abandoned.

15436 This happened in case of work at Zimmer by BPCo. Work done by S&W (prior to approval?) was done at CPCo's risk.

This process is analgous to what happened with MAC (? were rejected, or worked before approval?) "It doesn't mean work is useless, but the NRC gave minimal credit for it".

Presence of S&W was a consideration in release of soils work when they did. Keppler not sure he'd use the words "a very significant role".

15437 Keppler said in 8/82 that NRC decided on 3rd party review because were so concerned about soil problems at Midland.

15438 Getting S&W or some organization with proper qualifications was an essential consideration in going ahead with soils work.

15439 Reference to Att. 2 to March testimony (Palladino to Dingell, criteria for 3rd party). Question 1 is a definition of terms.

Keppler has reviewed to his satisfaction the acceptance criteria in the Palladino letter; it was used at Zimmer.

15440-2 Objections, etc.

15443 Staff had not completed review before S&W began at Midland. Keppler cannot say whether before S&W began work on soils review CPCo reviewed S&W's qualifications according to the acceptance criteria (Palladiro letter). But CPCo knew NRC Staff would use those acceptance criteria in evaluating the 3rd party.

There may have been letters.

15444 Staff asked for evaluations of S&W's independence.

Keppler explains genesis of Palladino letter and acceptance criteria for 3rd party: Diablo Canyon Saga.

Pacific Gas employed consultant, "Cloud", for seismic design review (independent review?). Cloud, going to do independent review, had made 75% of its money the previous year on Pacific Gas contracts.

Concerns for independence resulted in Staff's generating some criteria.

15445 In case of S&W for QA overview, Staff didn't consider (independence or competence?) to be a major issue, since S&W has been involved with many nuclear plants and their reputation in QA and engineering is recognized and accepted by NRC.

The serious issue came up with completing review of independence both of organization and the particular individuals.

Also wanted to see that the individuals named had been involved in good work at other plants. Looked at whether the individuals had contributed at other plants to problems in QA or other areas.

15446 Keppler and Staff looked at S&W's work at other plants. Competence and integrity are key criteria in Palladiro letter. S&W has been architect/engineer at Shoreham.

15447 Shoreham is not in Region III. Keppler not that familiar with it. Keppler knows there have been QA problems at Shoreham. Keppler wasn't aware that S&W had been removed from Shoreham ("but if you say so...").

S&W has been involved in a number of projects, some they've handled well and some not well. That is why we look at participating individuals to make sure "they're the first team", not "the third team".

15448 No, the dismissal of an architect/engineer from management position is not a reflection on their competence.

15449 Yes, it is a reflection on their competence, but organizations are not pure. Some jobs they do well, others not. For example, BPCo's work at Midland is not as good as their work at other facilities.

But if NRC felt S&W was incompetent, NRC should shutdown all the plants S&W has built.

15450 NRC accepted S&W's position in industry as indicating they can do the job, on basis that NRC has trusted S&W to be A/E and constructor of number of plants. Reviewed specifically S&W in NRC staff review of Diablo Canyon case.

There's a formal, published acceptance of that effort. We looked at individuals -- where they worked, what their past experience had been. Consulted NRC inspectors and various licensee's about their performance.

15451 Nine Mile is not in Region III.

15452-7 Keppler may have seen a 10/2/82 GAP letter.

Objections.

15457-8 NRC accepted S&W based on broad experience within nuclear industry, and based on evaluations at Diablo Canyon.

Every engineering organization in the world is the subject of such diatribes (GAP letter), based on nonconformance with regulations, stop work orders. Keppler could write the same thing about EBASCO(?), BPCo, Sargent and Lundy. These organizations are generally accepted as competent construction and engineering firms, but they don't always do a good job.

When they don't do a good job, it is up to NRC and the industry to get it turned around. So long as it is a recognized firm, we don't concentrate on the organization as much as on the individuals - to see they've not been involved in unacceptable work.

- 15458-9 After receiving GAP letter (10/2/82) Keppler did not follow up on S&W work described in letter at at Shoreham and Nine Mile Point. Looked at North Anna to see if the S&W individuals at Midland had been involved at North Anna. Doesn't remember if they were.
- Keppler did not personally review S&W construction at any other nuclear plants.
- Staff talked to other Regions to determine whether S&W (or NRC?) had any difficulty from a regulatory standpoint.
- A number of S&W people at Midland may have been connected with Shoreham at one time or another.
- 15460 Performance at Shoreham of individuals selected for QA work at Midland could be a reflection on their competence. Keppler would like to think -- Keppler's sure -- that Staff concluded that the people selected did not contribute to Shoreham's problems. For example, NRC excluded certain BPCo people from a 3rd party review team.
- Same screening process was used for S&W. Keppler doesn't know if anyone was excluded because they had worked at Shoreham.
- Keppler knows of individuals screened out of 3rd party for Zimmer because Staff told him.
- 15461 Can only assume that Staff didn't tell him who was dropped at Midland because Staff accepted the team.
- Keppler can't give specifics of Staff discussions with other Regions. Believes Staff contacted both NRC and utilities in other Regions.
- 15462 Keppler believes NRC provided an evaluation attached to letter authorizing S&W. (Att. 1 to March testimony).
- 15463 Jim Miller of Keppler's Staff, who contacted other Regions, might have personal notes.
- The authorization letter states staff has considered both organization and individuals.
- 15464 [one more time] We assume the organizations are competent; we screen individuals to make sure they have relevant experience at nuclear plants. Make sure they've not been involved ---or caused -- major QA problems.

- 15465 Objections.
- 15466 No effort made to supply governor or intervenors with the acceptance criteria for S&W team. Staff intentionally didn't use whole Diablo procedure at Midland and Zimmer. Each case done on own merits. Evaluated competence and independence.
- 15467 Commission is aware that staff is not using whole Diablo package of criteria at Midland and Zimmer.
- Commission has copies of plan of action (for selection of 3rd party?) at Zimmer. It is a public document. Don't have a similar document yet on Midland. Maybe eventually.
- Each case has unique problems. At one point considered different standards of independence for all 3 places (Diablo, Midland, Zimmer). Need to be flexible.
- 15468 Keppler believes that problems at Midland are unique and without precedent in the country.
- 15469 Process (selection of 3rd party review?) at Diablo became very bogged down. State, intervenors, NRC, and utility could not agree.
- Keppler believes these processes for selection of third party must be reviewed. Advocates 3rd party review at Midland. Doesn't take selection of 3rd party lightly. Believes in getting public comments on decisions, but will not share the decision process.
- 15472 Supply of evaluation documents to intervenors and governor in Diablo case was part of response to Palladino letter(?). That was done, Keppler thinks because of Jerry Brown's heavy involvement in the case.
- NRC chose to involve the State of California the way they did. Staff had major problems in involving multiple groups. Staff ultimately appointed a 3rd party, but that didn't really "evolve from everybody trying to get together."
- 15473 NRC held public meeting at Midland on 3rd party review.
- NRC has given Midland 3rd party "that kind of review" [Diablo kind of review?] Keppler hasn't considered going to the State and getting them that involved.

- 15474 Acceptance criteria must be considered as rigorously in every respect (as rigorously as what?) before letting 3rd party on site.
- 15475 Region III consulted with NRR and Region V (Diablo) about selection process. Staff in Bethesda though Region III invoked harsher criteria at Zimmer than Diablo - Followed basically the same practice at Midland as at Zimmer.
- 15475 Commission overruled Keppler's recommendations for BPCo at Zimmer.
- 15476 Keppler has been shown a QAR of 7/21/82 on concern for number of IPINS in soils.
- Keppler not aware whether S&W has expressed concern about use of IPINS in soils.
- IPINS were dropped after DGB inspection.
- Keppler doesn't know how long it took Staff to recognize IPIN problem during DGB inspection.
- DGB team was onsite several weeks.
- 15477 By time DGB report issued, S&W had been onsite considerably longer than several weeks.
- Use of IPINS, not IPINS, was deficient. Keppler believes S&W did not identify deficient use of IPINS. Keppler does not know if IPINS were used in the same manner wherever they were used.
- 15478 IPIN is a BPCo system.
- 15479 IPIN system applies site wide. Believes IPIN system was halted site wide.
- 15481 Same scrutiny to possible problems with IPINS will be applied to soils as to rest of the plant.
- 15482 CPCo has committed to reinspection of all areas where IPINS were used. Keppler doesn't know the schedule for reinspection.
- 15485 Additional DX by Paton - Keppler clarifies: Shafer not Miller of Staff did credential checks of S&W team. Check is documented in memo Shafer to Warnick, 2/18/83. That memo plus some telephone logs from S&W(?) were supplied to intervenors in discovery.

- 15486 Keppler's chronology may have some error in it as
 it was taken from daily reports.
- 15437 Keppler personally prepared the chronology, not
 Landsman.
- 15487 Staff Exhibit 21 (Keppler's chronology) recieved
 into evidence.
- 15489 CX by Sinclair resumed.

- 15489 Staff did not know specifically S&W's methodology for their overview. Believed that S&W was suitably qualified in QA and had people familiar with geotechnical work. Did not believe we had to approve their methodology.
- 15490 Nobody says that problems cannot be missed. S&W provides another layer of review of top of NRC and CPG's review. We cannot guarantee 100% perfection in any job. We believe 3rd party review is a good step. If it doesn't produce desired result we'll regroup.
- If Staff found significant problems that S&W missed that would affect Keppler's judgement of S&W's competence.
- 15491 It is too early to know if Staff has found problems S&W has missed because so little work has been authorized in soils.
- 15493 IPIN process went unnoticed during 12 years of NRC inspection.
- The use of IPIN was improper. NRC didn't realize it until Staff happened into a certain area.
- 15494 Keppler does not know if S&W found the 3 concerns and one nonconformance identified in DGB inspection report. Keppler does not know if the concerns and nonconformance happened before S&W started.
- Staff did not express concern that NRC found these but S&W had not.
- Staff recommended that work on pier be done.
- 15495 Keppler doesn't know why HVAC not stopped although DGB inspection found site wide breakdown in QA. It was discussed: ask the Staff.
- One reason not concerned about HVAC is that it all has to be re-evaluated because of problems at LaSalle and the ongoing investigations of allegations.
- Might argue that because of allegations the HVAC should be stopped. But Keppler had no problem with it because it will have to be reinspected anyway.

- 15496 Didn't stop NSSS work because QA there is under B&W, not CPCo or BPCo. Have no reason to believe that concerns in DGB inspection apply to NSSS.
- NRC plans to do special inspection of B&W work. Will deal with any problems separately.
- Sure the Staff reviewed B&W QA. Doesn't know specifically. NRC inspection program would call for a review of B&W QA methods at some time.
- 15497 B&W has a generic QA plan accepted by NRC. We've been discussing implementation.
- Can't say should be 100% reinspection of HVAC until investigation is complete.
- 15498 NRC felt that CPCo's QA for soil was separate so did not need to shut down soil work [?Transcript unclear].
- There is no provision for a backward look at soils as for balance of plant, because so little soils work has been done and done under close scrutiny.
- 15499 [Transcript unclear]. There have been numerous corrections and stop work orders in place for soils, Staff doesn't believe such a [backward] review was necessary.
- 15499 Keppler did say at public SALP meeting that he had expected a 1 or 2 rating in soils, because of all the extra attention on soils.
- 15500-1 That is, extra attention on soils by Board, NRC, public, and CPCo.
- Had key NRC Staff from NRR and Region III following soils work.
- Keppler was disappointed with results and initiated further action.
- 15502 Because of soils problems and DGB inspection, NRC is requiring programs about as comprehensive as possible for a plant under construction.
- 15503 Between time Keppler testified in '81 and SALP report NRC expectations for QA in soils were not met. So Keppler initiated series of actions for more review of the site.

- 15504 Board put strict restrictions on what work could be done (from 4/82 to present) and required NRC overview and step by step NRC approval. Given that sort of "hand-holding" program, it is very difficult to say what CPCo performance is, because NRC doesn't let them get very far off line before they halt work.
- Considering the stop work orders, things have gone wrong that shouldn't, but the process caught it.
- 15505 Increased NRC inspection may not provide necessary guarantees for soils. Keppler doesn't know. But if it doesn't, then we'll have to deal with that. That's why Landsman is on this job [MS referred to allegation of violation of 4/30/82 order]. Landsman "calls the shots very tough," yet Landsman urged release of work on pier, to see how they worked.
- The controls on the work is as tight as can be.
- Keppler believes 2 or 3 piers have been released.
- 15507 Keppler's job not to shut down the nuclear industry but to assure that regulatory requirements are met. If they are not, you take steps.
- 15508 When there's an immediate safety problem, you shut down and deal with the problem.
- Logical step at Midland was to require construction verification and review of activity in progress.
- If doesn't work, Keppler's not sure what's next. Keppler considered very tough regulator.
- 15509-10 NRC oversight coupled with other "areas" (programs) gives confidence for going ahead at site.
- 15514 Scope of S&W's work was by NRC initiative.
- 15515 83-03 (Staff exh. 18) point 2. Notice of violation. Keppler does not know if S&W as well as Staff identified point 2. S&W's weekly reports were in public document room. Staff uses S&W's weekly reports. Keppler cannot say but would think Staff does compare NRC reports with S&W's. Such comparison would be an important measure of S&W's effectiveness.

- 15516 Keppler does not know if soils concerns on p. 6 of 83-03 (underpinning pier concrete) were identified by S&W. [Ron Cook says they were.]
- 15518 S&W will remain on site as 3rd party overview until NRC has confidence in CPCo's QA. Can't speak for CPCo's plans for S&W.
- 15519 If S&W leaves, someone else will be brought in. CPCo is on record that S&W will remain until both CPCo and NRC are satisfied.
- Should be some kind of (comparative) assessment of S&W's effectiveness (competence). Keppler will think about it.
- 15520 Keppler cannot say if one basis for NRC acceptance of S&W was comparison of S&W's and NRC's inspections.
- 15521 NRC looked at competence of organization and individuals. Assumes but doesn't know if there has been comparative assessment of S&W's work since they've been on site.
- 15523 Sinclair identifies Keppler to GAP, 4/5/83. Letters says that NRC judged adequacy of S&W's work by whether NRC found problems that S&W should have found.
- Keppler says letter is consistent with his testimony. Keppler did not see letter. Keppler did say he thought comparative assessment would be done.
- 15529 Sinclair 2 (Keppler to GAP 4/5/83) into evidence.
- 15529 CX by MIM.
- 15530 IPINs used for 12 years; NRC didn't catch IPIN problem. Keppler doesn't know why use of IPIN began at Midland.
- 15531 Reference to CPCo response to DGB inspection, page A1-2.
- 15532-3 [DGB response says IPINs began 6/1/81]. Keppler doesn't know when they began. CPCo has committed to reinspect all work covered by IPIN. NRC will review that and go back as far as IPINs do.

- 15533 Midland Section: J. Harrison (formerly W. Shafer), section head; Cook; Gardner; Landsman; Bruce Burgess; Mrs. Crosby, secretary.
- 15534 Cook and Burgess are residents at Midland. Landsman's primary focus is remedial soils.
- 15535 Gardner is "project inspector," who sees to it that all activities in connection with inspection receive proper attention. Also does some inspections, in electrical and other areas. Burgess and Cook do the routine inspections and "reactive matters" as assigned first by Shafer now by Harrison. NRC encourages resident inspectors to look into any area they wish.
- 15536 Shafer then Harrison also give Landsman and Gardner specific assignments. Landman and Gardner also have time allotted to inspect as they wish. For most part they set their own inspection plans. The plans are subject to review by their supervisor. They have free time to pursue concerns.
- Midland section were all part of DGB inspection team.
- 15537 May have been additional inspectors on DGB team. Inspection Report identifies inspectors in team.
- 15537 Keppler doesn't recall meeting with all members of Midland Section when formed to discuss their responsibilities. Did meet with Warnick and Shafer.
- Warnick is Harrison's, formerly Shafer's, immediate supervisor. Warnick reports directly to Keppler.
- 15538 Keppler met with Warnick and Shafer shortly after the formed Midland Section. Keppler doesn't recall exactly what he told them. Purpose of meeting would have been to express Keppler's interest that Midland and Zimmer received "priority attention" and that Keppler wanted to know about any significant problems.
- 15539-40 Members of Midland Section had no other responsibilities than Midland. Their activities include things other than inspections.
- Keppler did not discuss with Warnick or Shafer how recommendation of Sections should be arrived at. Keppler doesn't know whether they vote. Believes that Warnick polls opinions, elicits concerns.

- 15541 There are multiple means by which an inspector can express disagreement with agency position on an issue: memo to file could be one way; inspector evaluation form; a written dissenting opinion (a formal procedure); presentation of public testimony. Commission has open-door policy.
- 15542 Keppler would be disappointed if inspector used testimony as means to register disagreement, but that is one way. All the other mechanisms require the preparation of a written document by person expressing disagreement.
- 15543 Warnick told Keppler that at end of DGB inspection Midland section wanted to stop work.
- No stop-work issued by NRC (based on position CPCo was going to take revealed in meeting about DGB findings).
- 15545 Keppler has never seen any written memo from any member of his staff saying NRC was wrong not to issue stop-work order.
- Keppler would like to think that such memos would come to him in normal course of business. But Keppler has seen in last couple of days some memos which astonished him.
- 15546 Keppler is referring to Adensam notes and others.
- Warnick kept Keppler informed about Staff's views about DGB inspection and told Keppler that Staff was satisfied with CPCo's proposed action.
- 15547 Keppler assumes Warnick would have told him of dissenting views.
- 15547 Midland section is not inhibited about expressing its dissenting opinions, if it has any.
- Another NRC decision was the severity level for DGB noncompliances. It was once level 2, eventually level 3.
- 15548 Were no written memos dissenting from severity level. Warnick's memo disagreed with the amount of money.
- When CPCo announced CCP they also said some work not in scope of CCP and would continue.

- 15549 Continuing work included remedial soils; Zack HVAC, B&W's NSSS; and preoperational testing.
- To Keppler's knowledge, no one in Midland section wrote memo dissenting from NRC's acceptance of continuation of those four items.
- 15550 By dissent, Keppler means written memos of dissent.
- 15551-2 There is a process by which knowledgeable members of staff review Keppler's testimony. Keppler believes members of Midland section reviewed his 3/25/83 testimony.
- In 3/25/83 testimony Keppler purports to represent position of NRC Staff or questions asked.
- Following final draft of the testimony no members of Midland section wrote memos of dissent to positions taken in Keppler's testimony, to Keppler's knowledge. Nor did any member of Midland section orally express disagreement.
- 15553 NRC's responsibility is defined by 10 CFR, Appendix B.
- 15554 Word "shoddy" does not appear in Code of Federal Regulations.
- 15554-5 Regulatory responsibilities of NRC with respect to QA are to assure that plant is built in accordance with the Atomic Energy Act and regulations implemented in that Act.
- 15555-7 Objections.
- 15557-8 If regulatory requirements were met, Keppler cannot see the NRC finding the work "shoddy."
- 15559 In response to Paton's question on direct about "shoddy," Keppler said that noncompliance with regulatory requirements was the key issue.
- 15560 If plant does meet regulatory requirements, Keppler cannot see inspectors' being concerned with shoddy workmanship.
- NRC will not issue OL until Staff is convinced that plant is built properly and in accordance with requirements specified in FSAR.

15561 By "built properly," Keppler basically means "in accordance with regulatory requirements." You may ultimately have a nonconformance, but sometimes they are evaluated from an engineering point of view and the plant is therefore licensed.

By accepted as "all right," Keppler means the nonconformance is not an undue risk to public health and safety.

That the plant not present an undue risk to public health and safety is the ultimate regulatory requirement.

15561 Properly functioning QC program is expected to identify problems in a timely fashion. [Answer not really responsive to intent of question, hence vague.]

15562 If something not constructed properly, NRC would expect that QC in first instance is the level of organization to catch problem.

QA is next level which, by series of audits and inspections, determines whether QC functions properly performed. If there are problems with QC, NRC expects QA to identify them.

Keppler would view as suspect a QA program that identified zero discrepancies in a year [though that QA program could be effective].

Would view such a QA program as suspect because in a project this size mistakes are going to be made. QC provides means to identify such problems.

15563 Keppler thinks an effective [QA] program would find problems.

15563 NRC conducts routine and special inspections at all nuclear power plants, and inspectors identify nonconformances.

Keppler would call wonderful an NRC inspection program which cannot disclose one nonconformance over a year.

It has never happened.

15564 Keppler not aware of any QC program of any CP holder that functioned effectively and found no noncon-

formances in a year. Likewise aware of no such QA program.

Every plant, to Keppler's knowledge, has in last 12 months in Region III had QC findings of deficient construction. Likewise every QA program has identified "inspection deficiencies." Likewise the NRC has found nonconformances at every power plant in the last 12 months in Region III, in varying degrees.

15565 Keppler said on direct that management at CPCo and BPCo was ineffective in assuring attention to detail.

Refer to Att. A to Keppler's 10/82 testimony, memo to Keppler from Norelius and Spessard, prepared at Keppler's request.

Refer to page 4 of Att. A (J. Cook too involved in details. At times appears that working level is ready to agree and act, but J. Cook argues details).

15566 Objections.

15567 In preparing the memo, Norelius and Spessard contacted people in Keppler's office familiar with Midland, including people who did special inspection in 1981 and other inspectors who have been there since. The memo is an account of these contacts.

15568 Keppler believes the particular comment [Cook's involvement in detail] was made by Cordell Williams; others may also have contributed.

Williams was Section Chief, comparable to Harrison, in June 1982.

Since memo written, Keppler has heard no comment that Cook has changed his approach -- that he is now too little involved in detail.

15568 Refer to Keppler's 10/82 Att. D, enclosure 4, last page.

15569 Keppler received this memo on or about the time his staff prepared it. [Referring to last page of Att. D.]

By "senior management" in subparagraph B, Keppler understood Cook and Selby.

15570 [Recognizing contradiction between this appraisal of management and Williams' appraisal re involvement in detail,] Keppler says this is one of reasons we concluded we did not know what source of the problem was.

15571 With all the "input" from his staff, Keppler could not determine conclusively the source of problems in implementation of QA. That was why NRC began "encompassing approach" to gain further confidence in QA program.

15572 Refer to Keppler's 10/29/82 Att. B, page 7, Ron Cook's comment on nature of inspections by Region III staff.

Keppler does not regard inspection of DGB 10-11/82 as purely reactive.

Refer to Keppler's 10/29/82 Att. D, enclosure 4, on third party review as (adequate) substitute for NRC inspections of areas set out on page 1 to enclosure 4, Att. D.

15573 One of activities in CCP is quality verification, which involves a complete backward look at installed components and materials in safety-related portions.

15574 NRC never does a complete backward look such as contemplated in quality verification part of CCP. NRC does not have sufficient staff for such an effort.

15575 An "augmented inspection effort," as referred to on page 1 of enclosure 4, Att. D, did not mean there should be a complete backward look at each of the ten specified areas.

15576-7 [Series of questions on certain events in relation to QA activities at site -- whether Keppler regards them as positive or negative indication that there is reasonable assurance that construction QA program will be implemented in accordance with regulatory requirements.]

Roy Wells was appointed full-time CPCo Executive Manager of QA at site.

- 15578-9 Appointment of Wells is a positive addition.
Staff views assignment of QC both for soils and balance of plant to CPCo as a positive "effect."
- 15580 Removal of Marguglio from direct responsibility for site QA is a positive change.
Retention of S&W for third party overview of soils work was in response to "NRC's request that that be considered or followed."
That third parties were considered and implemented for CCP and soils work, NRC views as a positive step.
- 15581 Staff believes that the satisfactory performance of work on Pier 12 is a positive [indication, influence . . .].
Staff viewed CPCo proposal of CCP as positive.
S&W 90-Day Report marked as CPCo 33.
- 15582 Keppler has not seen it before today.
Keppler not aware that by contract with CPCo S&W obliged to prepare a report after 90 days. Staff may have been aware.
- 15583-4 [Something may be missing from transcript.]
- 15584 MIM quotes Landsman, at Tr. p. 14524: every time he criticizes QA organization, they make changes.
- 15585 Keppler: There haven't been that many big QA reorganizations. Generally, reorganizations in response to NRC concerns are not in response to findings of one inspector. If NRC deems reorganization necessary, the request usually comes from Keppler's level or higher. The requests and the changes are usually documented.
It may not take a documented request to effect an organizational change.
- 15586 Keppler may meet with the utility president to bring about change in organization.
Keppler met with Selby 8/26/82 and 9/2/82 to express disappointment with implementation of QA, but did not make any changes.

- 15587 NRC did formally request integration of QC into MPQAD.
- Kepler has made requests that an individual be moved out of a specific job and another individual moved in.
- Any such requests should come from Kepler, in his judgment.
- Landsman has expressed to Kepler that Meisenheimer is not qualified for his position.
- 15588 Landsman's concerns have been dealt with at Staff level, but they were not raised with Kepler personally.
- If Staff felt someone in Soils QA should be replaced, Kepler "suspects" that would be brought to his attention. That has not happened.
- 15589 Meisenheimer resume marked for identification as CPCo 34.
- 15589-95 Objections.
- 15595-6 Original concern of Staff about qualifications for QA personnel for soils remedial was that they had limited technical experience and were unqualified for complex nature of soils remedial actions in underpinning.
- 15597 That concern for technical qualifications still expressed as late as 9/2/82, date of Stamiris 47 [Warnick to CPCo], last paragraph, first page.
- 15598 Kepler not able by looking at Meisenheimer's resume to evaluate Meisenheimer's technical competence for his job.
- Kepler not sure whether Landsman complains about Meisenheimer's technical qualifications or QA qualifications.
- NRC generally has responsibility for assessing adequacy of design. But because of complexity of the work at Midland, Kepler has urged inspectors to "stick their noses into design areas."
- 15599 Kepler doesn't recall any of his staff ever expressing to him that there are obvious inadequacies in the design of the control tower and EPA of Aux Building, nor in SWPS, nor in spread footings of DGB.

Landsman has never observed to Keppler that these are obvious deficiencies in design.

15600 Before granting of an OL, Staff must decide plant presents no undue risk to public health and safety.

15601 MIM refers to Landsman, at Tr. p. 14433, 4/27/83: plant is liable to jeopardize public health and safety. Keppler understood that to mean if nothing were done, which is why NRC is interested in reverification.

15602 Keppler said on direct that NRC had to find that plant was satisfactorily completed before it received an OL.

15603 Any problems must be corrected before OL. Keppler is thinking of CCP programs and remedial soils work, which are being evaluated with the goal of correcting problems in mind.

Landsman one of those evaluating those programs [and the plant?].

Landsman a very capable inspector.

15604 Landsman is a tough regulator, which is the kind of person Keppler wants at Midland right now.

15605 Landsman is certainly more outspoken sometimes than most other inspectors. Keppler has no knowledge of his overstating a finding in inspections.

15606 Keppler would not use some of the words some inspectors use ("shoddy," "trust"), but Keppler won't stop them from using those words.

Keppler does "put a factor" on Landsman's statements.

15607 Refer to Keppler's 3/25/83 testimony, answer to Question 11. Assuming that the three steps in the numbered paragraphs are satisfactorily implemented, Keppler has reasonable assurance that plant can be completed in accordance with regulatory requirements.

15608 Board Examination by Bechhoefer.

Keppler aware of recommendation in Norelius/Spessard memo, 6/21/82, Att. A to 10/29/82 testimony, that work be confined to one unit plus remedial soils.

- 15608 Recommendation was made because complexity and scope of soils work is so great that it is almost like building another plant.
- 15609 Staff felt workload was like having 3 reactors.
- Keppler thought recommendation had some merit. But didn't feel he could tell CPCo to stop work on one unit, because he wasn't sure that workload the real cause (of their problems).
- Keppler doesn't know what root cause of problems is, whether CPCo is spreading its resources too thin.
- Such a reduction in scope of work might be a possible solution if programs presently contemplated and recommended by Staff do not work.
- 15610 Generally, Staff does look beyond requirements spelled out in Atomic Energy Act and 10CFR Part 50 to applicable Reg. Guides, codes and standards.
- Licensing people go through SRP review in evaluating plant for OL.
- In looking at QA and construction related problems, NRC looks at any applicable Reg Guides for particular areas.
- 15611 If Licensee has committed to follow a Reg Guide, it must justify not meeting the Reg Guide. If licensee has not committed to Reg Guide, NRC may still enquire to what extent Licensee will or won't follow the Reg Guide. But NRC has no regulatory basis to require Licensee to follow a Reg Guide.
- If NRC believes strongly about a point, NRC usually will try to get it incorporated as a requirement for construction.
- 15612 NRC looks at commitments in FSAR. NRC looks at particular plans or guidelines put out by CPCo or BPCo for construction of particular structures.

Inspectors would record deviations [from committed Reg Guides, FSAR, construction plans and guidelines?]

Keppler believes that review of deviations from such guides, commitments, etc. in consideration of finding of reasonable assurance is encompassed in Appendix B.

15613 MPQAD rather unusual because it combines both BPCo and CPCo people in positions of authority.

There are still BPCo people in positions of authority today, but of lesser authority (than formerly).

Keppler testified on MPQAD in 1981. MPQAD organization not the usual approach. But NRC continues to believe that the program as it was laid out by CPCo was sound, if it had been implemented (properly). Program itself was sound, but it did not work the way NRC thought it should.

As a result, some of changes in MPAQD have been to put CPCo itself more in control and give BPCo people at higher levels less authority.

15614 It is more of a CPCo-run program now, but there still are BPCo people in areas of control.

QC is an example. NRC told Wells they were concerned that some BPCo people should not be in QC role. But Wells felt they were best people for the job, and he wanted a chance to see how that arrangement worked. If it did not work to Well's satisfaction, he'd remove those people.

15614 Keppler aware of view expressed by at least one inspector that BPCo QC inspectors should not report to BPCo employees.

15615 That view (recommendation) has been followed through, except for some existing BPCo QC supervisors, as Keppler recollects. He may be wrong. Keppler thinks there are some BPCo QC inspectors now reporting to BPCo QC supervisors.

- 15616 Wells has acknowledged NRC concern, but feels that these BPCo QC supervisors are the best people for the job. He'd like to continue that approach under his overview, to see if he can't straighten things out. If it doesn't work, Wells is willing to make the (recommended) change. NRC at this time accepts that position.
- The inspectors support that NRC position.
- 15616-7 Inspectors voice different opinions in the hearings, but all final decisions are supported by the entire team.
- Cowan Question.
- Keppler not aware of such a consolidation of QA and QC -- the MPQAD approach -- any where but Midland. But there are a number of variations in the industry "on how to do this".
- A number of different organizations may be successful if implementation is correct.
- Problems with both QA and QC not just with QC contributed to problems at Midland.
- 15618 Keppler believes idea of consolidation of QC and QA really matured after Midland section formed. It was one of their early findings.
- 15619 Refer to Att. 1 to 4/83 testimony, 2/24/82 letter re: S&W refers to an attachment to letter Weil to Shaw 11/9/82 listing S&W's work for CPCo.
- Keppler doesn't know if the description under date 9/82 is the contract with S&W before it was expanded at request of Staff.
- 15620 Shafer testifies: description refers to original soils contract of 9/20/82. Staff didn't ask for expansion until around 2/14/83. This is contract on S&W when CPCo assumed they would be approved.
- 15621 [Bechhoefer resumes questions].

Keppler not familiar with Landsman recommendation that work permit system expand to include underpinning.

If an inspector has a recommendation, it can be considered and implemented or not implemented at Staff level. There is a process by which "things" can be brought to K's level. Presumably if Staff feels strongly about something, and it was not acted on "at that time" [at Staff level?] "it would do so" [refer it to K?]

15622-3 Keppler doesn't know if recommendation to expand permit system was acted on or rejected after discussion on its merits.

Staff panel testimony sets out the difference of opinion [on this recommendation?] Keppler not aware of the recommendation.

Problem of CPCo control of BPCo, specifically CPCo's difficulty getting certain documents, has surfaced previously. It was major topic in 8/26 and 9/2/82 discussions with CPCo, and at public meeting in Midland when BPCo president met with Keppler. Keppler made it clear that "this matter" [control over BPCo: getting documents] was a major concern of NRC inspectors. Keppler urged BPCo's cooperation in clearing up the problem. Have to allow time to see if this problem resolved satisfactorily. If not, Keppler doesn't now have recommended solution, but he'll not let problem persist.

15624 CPCo should be able to get documents from BPCo. Keppler doesn't understand why they have a problem.

Refer to page 4 of Keppler's testimony [which?], Question 8, list of 7 exceptions [to work halt] accepted by NRC. Keppler is satisfied with the 7 items so excepted.

NRC already aware that all HVAC must be looked at again, so NRC did not insist that that work stop.

For B&W, NSSS work under a different QA program, and NRC had no reason to believe there were problems there.

15625 NRC will do special inspection of B&W work in near future. If there are problems there, NRC will have to take certain actions.

15625 "Post systems turnover work" [?] is turnover of completed systems from BPCo to CPCo. Excepted item is for "those completed systems or subsystems". It is mainly a paperwork exercise.

[Bechhoefer again]

15626 Regardless of staffing considerations, Keppler would not like a work authorization procedure for balance of plant.

By time of '81 testimony, NRC had put great effort into evaluating QA program for continuing work. In '81 Keppler gave best judgement he could on confidence of Region III with respect to continuing "that work".

Position Keppler took in '81 was wrong. But NRC, at Keppler's initiative, did try to determine what the problems were and to find solutions.

15626-7 Steps Staff is seeking at Midland are not minor: all ongoing work in soils and balance of plant to be reviewed by 3rd party. Keppler not aware of such step at another plant of this magnitude, in terms of continuing construction.

There will be major reverification program by CPCo overviewed by 3rd party. Plus, there is the Midland Section following those activities.

This effort should be sufficient to provide to NRC, Board, and public confidence that plant will be completed properly.

If that doesn't work, Keppler doesn't know what will. If NRC were to do work authorization for balance of plant, NRC might as well build it themselves.

K. thinks NRC should judge progress at arm's length. If that doesn't work, maybe NRC will have to take even more stringent action.

15628 It is presently a major NRC effort. K. doesn't recommend releasing Board's 4/30/82 Order right now, but NRC is getting too close to doing the soils work itself.

You lose some "regulatory flavor" by being that close. K. want's to get out of that role as soon as he has some confidence that QA and third party review are working. At that time K. will ask for relief from Board's 4/30/82 Order. K. really wants NRC staff in true regulatory posture at Midland.

15629 If K. had to go as far as work authorization for balance of plant, K. would probably recommend the job be stopped.

For QA performance, SALP ratings are not intended for comparison with other plants, but comparison is inevitable. Intended to avoid a sequential list of plants by performance. But within a Region, SALP ratings do invite comparisons.

K. has in own mind compared Midland to other plants in Region III.

15630 K. would rate CPCo's implementation of QA as one of lower ones in Region III. That is one of reasons for K's various recommendations.

15631 K. has voiced his thoughts to the extent he wants to: no supplementation required (right now).

K. would recommend that Board require Region III to provide at appropriate time more current observations on how the proposed plan is working. K. himself would come back if necessary.

15632 That update could be in OL proceeding. K. recommends this because Staff is here assessing concepts not yet realized. Actual experience should be valuable to Board. Supplemental testimony would not be needed before Board issues first decision "in this matter".

- 15633 Commission said (re BPCo at Zimmer) that CG&E could use BPCo for management overview or for co-manager but not both. Utility chose not to use BPCo for management review.
- The criterion invoked by Commission was thus not competence but independence.
- Staff thought BPCo would be acceptable for both roles. Commission disagreed.
- K. not aware of any particular labor problems -- bad labor - management relations, bad morale, etc. -- that may have contributed to problems in QA or QC implementaiton.
- 15634 RCX by Sinclair.
- Denton will grant the OL, if one is granted.
- NRR reviews application to determine if plant's design meets requirements. Denton does not issue OL until K. finds that plant completed properly and CPCo is ready to operate it. Board has a role. And there is an OL hearing as well.
- 15636 Since TMI, Commission votes on OLs.
- 15639 RCX by Bernabei.
- Objections.
- 15645 K. not sure if some of the ZACK allegations, in 7/82, were that MPQAD didn't work properly. Shafer might know. K. didn't read the allegations.
- 15645-6 Refers to Att. A to 10/82 testimony, page 4. 2-B. recommendation for separate management structure for soils and for construction of reactor.
- 15047-8 K. doesn't know if that recommendation was communicated to CPCo. K. met with CPCo 8/20/82 and generalized all recommendations he had, the two recommendations from Warnick and one from Norelius and Spessard.
- 15648 In general way NRR's recommendations and those of K's staff (Att. C) were communicated to CPCo in those two meetings. [8/26/82, 9/2/82]

- 15649 K. testified that he had not recommended specific personnel changes at CPCo.
- 15651 Adensam's notes, p. 31, "Marguglio/Bird must go." K. did not advise CPCo of this recommendation. Doesn't know whether staff did, but doubts it very much.
- Marguglio is no longer in "that position."
- 15652 Assumption of QC under CPCo QA is a positive influence.
- 15653 This integration was one of K's Staff's recommendations in August-September '82.
- 15656 K. aware of contentions that CPCo has poor management attitude.
- 15657 [In reference to 8 "positive factors" elicited from K. by MIM] That NRC has to prescribe certain actions CPCo should take is a negative factor. To the extent CPCo "picks up the ball and corrects the problem in a broader sense" that is a positive factor.
- Staff thought CPCo 9/17/82 proposals on soils and balance of plant we're deficient in detail; the proposals required "input" from Staff to get done what Staff thought necessary.
- After DGB inspection and stop work, NRC reviewed CPCo's proposed action and found it encompassing and positive.
- 15658 Prior to DGB inspection and the stop work, K. would rate CPCo initiative negatively: Staff had to exert much influence on CPCo's proposed actions. Subsequent to that, K. views them [CPCo initiative] more positively.
- 15660 Wells' appointment was at CPCo's initiative.
- QC integration in MPQAD was at CPCo's initiative [? Transcript a little unclear]
- Marguglio's removal was at CPCo's initiative.
- S&W was chosen by CPCo. NRC requested third party overview.
- 15660 Part of CCP came from NRC, part from CPCo.

- 15662 At meeting (early December, 1982) NRC told CPCo they expected CPCo to take appropriate action and that the action should be decisive or Staff would recommend shut down. "If CPCo didn't shut plant down, NRC would," was conveyed at meeting, though K. was not there.
- 15663 Refers to Att. 9 to testimony, memo from Midland Section, 10/9/82 (?). Document shows three concerns of Gallagher for QA personnel: technical ability, QA department and personnel ability (?).
- 15664 K. not aware of any Region III or NRR inspectors talking to Commission about construction going on in spring of '82 [speaking in dissent?].
- 15665 K. has no reason to doubt Landsman's "findings" of three design deficiencies.
- That Landsman did not communicate his findings of three design deficiencies is an indication that question is below the level K. needs to know about, or that K. will hear about it through the system. If Landsman's findings were inaccurate they would be retracted in subsequent documents.
- 15666 [Confusion, K. thought he was talking about an inspection report, maybe.]
- 15667 Licensee can challenge a finding. If Staff not convinced, issue can be taken to a higher level.
- 15670 K. has no reason to doubt Landsman's findings (re design deficiencies?).
- K. would deal with disagreement between CPCo and inspector on merits of the case.
- 15671 Procedure of challenging a finding and taking issue to higher level is typical in inspection process.
- 15672 [Re letting work proceed without work authorization permit procedure in balance of plant] K's answer doesn't change in light of Landsman's "I don't trust them."

- 15673 If CCP, overview programs etc. had been in place, Board's 4/30/82 Order for work authorization might not have been necessary. Order and procedure were for a specific problem.
- Board Order approach puts NRC into decision making. As a regulator, K. doesn't like that. K. would not want to expand work authorization into balance of plant; he'd sooner see the job stopped.
- 15674 We should six months from now be able to see the effectiveness of the program outlined in K's current testimony as basis for reasonable assurance.
- 15675 Some programs have not yet begun. But Staff is near to approving IDVP-ICVP. Depending on CPCo's response to NRC questions, NRC should be able to approve the CCP in three weeks or so. That will give five months or so to see an indication of how things are going.
- K. not proposing to stop any overview program at this time.
- 15676 K. has no idea how long it will take to identify "the problems" at Midland [which problems?]
- Can't estimate based on comparison to Zimmer: that is a comparison of apples and oranges. Staff has not thought about how long it will take to identify the problems at Midland.
- 15677 K. said Midland ranked as one of lower plants in Region III in QA.
- K. familiar with Commission meeting in Summer '82 to examine QA questions and problems in industry with Staff.
- In testimony by NRC to Udall 18 months ago, five plants were singled out as having major QA difficulties. Midland was one of those plants.
- 15678 CCP and overview program are two major factors in K's "reasonable assurance." Intervenors have criticized construction verification plan because CPCo is managing it.
- 15682 RCX by MIM.

Between NRR and Region III, NRR has responsibility for assessing design of SWPS, Aux. Bldg., and DGB. But because NRR did not review many design details specifically, K. encouraged Landsman to consider design.

An SER has been issued for Midland. K. doesn't know if SER addresses specific design issues (of SWPS, DGB and Aux. Bldg).

- 15683 K. encourages Landsman to "freelance" in any area of remedial soils.
- 15685 NRC indirectly had some initiative, through 4/30/82 Board Order, in successful completion of Pier 12 work.

- 15686 K. believes use of Pier 12 as a test of underpinning QA program was proposed by CPCo.

CPCo did perform the work properly. Board Order is strong incentive to do it right.

- 15687 By "looking at construction plans and guidelines" in assessing construction, K. was referring to specifications, drawings, procedures, and all the various documents [used in construction].

K. doesn't know if Landsman would be more effective if stationed permanently at site. CPCo has requested that. K. concerned when inspector gets too involved in details that he loses objectivity and becomes embroiled in approval process, especially for so complex a job. That's another reason K. doesn't like Board Order approach for a long period of time.

- 15688 Loss of objectivity could mean seeing more problems than there are or missing problems. Inspectors could get too close and become almost a designer or constructor.

K. thus distinguishes between Landsman's role as soils specialist and Cook and Burgess' more wide-ranging roles.

- 15688 Board Exam.

There is a place for resident inspector, but also ought to be outside people inspecting various activities.

15689 Landsman has been Region III's primary inspector in remedial soils. Ideally, would like more soils inspectors. NRC is considering adding another if Landsman were sole soils inspector, K. would be more concerned if Landsman were on site full time.

That doesn't mean they would never put the soils inspector on site full time, but K. is cautious when only have the one soils inspector.

15690 Cook and resident inspectors cover wide area of work. Also regional inspectors and resident inspectors keep check on each other, and thereby get a feel for whether resident is losing objectivity.

But when you have one man inspecting and handling all of one area, K. inclined to keep him in Region rather than onsite full time.

15691 Would be appropriate to see how and whether NRC findings are covered in S&W's 90 days report.

NRC Hearing May 4, 1983

15695-759 Preliminary Matters

Cross Examination of Ross Landsman, Ronald Cook,
Wayne Shafer and Ronald Gardner

(by Ms. Stamiris)

- 15759-66 Shafer agreed with Stamiris' statement that the purpose of the DGB inspection was to look at adequacy of the as-built condition of the plant. Shafer and Cook agreed that just about every area of the Diesel Generator Building inspected contained problems. The DGB inspection report issued 2/8/82 lists only 4 areas inspected that had no problems.
- 15767-76 In order to respond to the NRC's identified concerns Consumers is now expected to determine the adequacy of the as-built construction of certain portions of the site. Cook stated that as long as the NRC thinks Consumers is adequately comparing design to as-built they will not change their assessment. Beginning in the spring of '82 Cook began identifying QA deficiencies in the remedial soils area.
- 15777-79 Numerous discrepancies were discovered between the design drawings of the structural steel at the FIVP and the as built. Landsman stated that lean concrete backfill found beneath the FIVP also indicated a discrepancy between the design and the as built conditions.
- 15780-90 Landsman cited cases where workmen have drilled through electrical duct banks, sewer pipe and grounding cables because they did not have accurate design drawings. Discrepancies between the design and as built condition in the soils area would lead Cook to believe that that area should be included in the CCP. The reasons for the DGB inspection were to compare the drawings to the as built and to check quality control.
- 15791-93 If non-Q procedures are followed when Q procedures should be followed the resultant structure or component does not conform to the specifications.

15794 On several occasions Consumers and the NRC staff have disagreed as to whether something should be Q or not - such as the C-45 drawing, certain cable installations and certain underpinning work.

Afternoon Session

15799-811 The licensee has not taken any exception to the NRC's definition of Q. Stamiris Exhibit 78, a 12/17/82 draft of a white paper, was shown to Shafer who stated that Region III asked the NRR to give them their view as to whether they should allow an exception to Reg. Guide 1.29. Stamiris Exhibit 49 is apparently a letter from Warnick to the NRR asking the NRR to review the Reg. Guide 1.29 question. There has been no reply yet.

15812-19 Gardner explained that inspection report 83-03 (Staff Exhibit 18), paragraph No. 2-C, indicated that the licensee has been performing certain Q activities utilizing non-Q procedures. All instances where Gardner identified that the licensee was doing this were licensee identified Q items. The findings identified in 83-03 did not result from DGB inspection findings (82-22). Although both address Q and non-Q problems 88-03 refers to the classification of procedures that control work components and 82-22 refers only to the classification of components themselves. Cook added that different procedures are identified in 83-03 and 82-22.

15821-25 Landsman believes his intervention was the only thing that stopped consumers from placing Armor Stone around the perimeter dike of the cooling pond. This was mentioned on the last page of the DGB inspection report. He thinks the dike's integrity might have been impaired and the ultimate heat sinkages affected had that stone been used. He believes the use of non-Q procedures in placing the stone actually used was a violation of the Board's order.

15826 Landsman was asked to discuss problems with the licensee's application of the C-45 drawing after the Board's 4/30/82 order. Section 22 on page 27 of the DGB inspection report describes concerns identified in C-45. They are the same concerns Landsman testified to in question nine of his prepared testimony. These were labeled "concerns" so as to avoid confusing the DGB report with examples of non-compliance in the soils area.

- 15828 Drawing C-45 requirements in Section 22A of the DGB report resulted from the discovery of non-compliance in the Perimeter Dike Armor Stone. Item 22B was added to the Board's order because Consumers hadn't stated in writing that there were no utilities extending beyond the Q bounds. 22C, concerning misunderstanding about the tunnel under the Turbine Building and the installation of
- 15831 the instrumentation for the underpinning work, will be covered by Mr. Boos.
- 15833-34 Miller and Wilcone stipulated that from a quality assurance point of view Consumers' corrective actions must include an identification of and correction of past generic implications of identified deficiencies.
- 15837 Gardner was shown Consumers' 3/10/83 response to the DGB inspection report. (It is attached to the testimony of both Peck and Keppler) He identified No. 3 on page A2-6 as an individual instance of non-conformance not yet identified as a generic problem.
- 15845 Gardner agreed that the NRC has on many occasions attributed Midland's problems to QA implementation.
- 15847-57 Discussion about meeting that took place between Stamiris and the Staff during the break.
- 15857 Consumers' IPIN documenting deficiencies in the cable tray supports did not identify the deficiencies Gardner noticed himself. Therefore, he began to question QC and QA. Since Bechtel QC used IPINS site wide he began to see it as a generic problem.
- 15861 Gardner could not explain the difference between a deficiency report and an IPIN. Gene Smith or Dale Pressler told Gardner that the licensee switched from DRS to IPINS to streamline the instruction process and to make QC's job easier. When told of the IPIN usage Gardner's concerns
- 15864 about the inspection process were "amplified" since not all deficiencies were being documented when a QC inspector decided to exercise the return option.

- 15869 Consumers' 3/10 response to Item A, Notice of Violation regarding IPIN usage, was prepared because Consumers has an obligation to answer items of non-compliance and to determine root causes problems. The admission by Consumers that their QC management failed to recognize the importance of complete reporting of deficiencies indicates a lack of ability to "extrapolate on a management decision as to the ramifications of that decision." QC management should have known that giving the inspectors the option of documenting all deficiencies or documenting only some and turning the component back to construction would create inconsistencies among the inspectors. Gardner did not know why consumers did not recognize the inadequacies of the process but did note that there have been some subsequent personnel changes. NRC has required the licensee to transfer the control of QC from Bechtel to Consumers.
- 15875 Gardner and Landsman interviewed the QC manager and 13 inspectors and did not recall anyone saying they had been instructed to use the return option in order to circumvent required QC procedures. Neither Gardner nor Landsman ever considered having an investigation made into the deliberateness of the IPIN misuse. Landsman did not favor having an investigation because he considered it impossible to prove one way or the other. QC management did not have a firm grasp of QA/QC principles.
- 15881
- 15882 Landsman thinks the lack of full understanding among the QCE's about the necessity to close all IR line activities prior to conducting a followup inspection indicates a similar lack of understanding of basic QA/QC principles.
- 15883 Consumers' Part 1B and Part 2 reply to item A Notice of Violation does not indicate to Landsman that proper communication of specifics of return options would have resulted in acceptable IPINS. He does not think QC inspectors should ever have been told to stop documenting deficiencies.
- 15884 Neither Landsman nor Gardner remembered asking Consumers whether there were any written directives concerning the instructions to limit the documentation of deficiencies.

- 15885-88 In his review of the IPIN problem Gardner looked at Consumers' written training procedures which included those associated with identifying and controlling non-conforming conditions. He did not recall seeing the return option in any written document.
- 15888-91 After his IPIN problem inspection Gardner saw an NCR written by QA which allowed the licensee to correct non-conforming conditions during the shift they occurred without documenting them. The licensee informed him they intended to eliminate that procedure. He had not been aware of this practice during the DGB inspection. Landsman believes the licensee discovered this practice while reviewing Bechtel's implementing procedures and determined it had to be stopped as part of the resolution of the IPIN issue.
- 15891-93 Gardner agreed that Consumers' IPIN review was generated in response to concerns identified by the NRC. Landsman's main concern was that the licensee was misusing acceptable procedures. Had they followed IPIN procedures adequately, i.e. documented all deficiencies on the IPIN, the NRC would have had no problem. Gardner does not think IPIN procedures were inadequate but wondered whether an IPIN has as broad a scope in regards to non-conforming conditions as an NCR.
- 15894 Under the licensee's procedures completed items found to be nonconforming resulted in NCR's and noncompleted non-conforming items which could be corrected during the fabrication period resulted in IPINs. Even though the NRC's definition of "completed" differed from the licensee's there was no conflict because the licensee did away with the IPIN process.
- 15895 Landsman noted that before the IPIN process was abandoned some Consumers people used IPINs as final inspection reports to document deficiencies on completed work. This did not become a problem because IPINs were abandoned.
- 15898-904 Cook agreed that the IPIN process had been misused and consequently some deficiencies were not reported. The licensee's proposed CCP, which has not been accepted yet, includes reinspection of items formerly covered by IPINs.

- 15905-12 Gardner did not think there was confusion among the QC people, only the Staff was unsure when an IPIN was being used in lieu of an NCR. Cook stated that he did not think the IPIN system was used as a screening system to determine whether construction was good enough for a QC inspection. Any "preinspection process" would reflect favorably on management as it would be seen as adequate supervision. The problem was that the building was not being built in a quality fashion and the builders were relying on QC.
- 15917 Landsman summarized the NRC's position on the IPINs by saying that IPINs are no longer a problem since the licensee agreed to stop using them and to reinspect everything previously noted on them. The NRC's identification of the IPIN problem made Consumers aware of its misuse.
- 15918 Cook stated that Consumers abused the IPIN system. NRC did not investigate whether the abuse was intentional. The NRC is insisting on 3rd party coverage for the CCP to avoid similar abuse

CPCo/MIDLAND
5/5/83 HEARING ABSTRACT

STAFF WITNESSES:

LANDSMAN
SHAFFER
GARDNER
COOK, R.

Page

15923-44 Preliminary matters.

BY STAMIRIS

15944-45 Gardner does not recall a "trending problem" with IPINs in the soils area; however, there may have been some IPINs associated with the NCRs.

15946-47 Landsman was not informed of an adverse trend in quality in the soils area, but he would want to know of such a trend. CPCo is not obligated to report adverse trends in soils to NRC, but Landsman would expect CPCo Management to take some action to correct problems revealed by the trending program.

15947-48 Landsman says that where a trend is adverse enough to come under 10 C.F.R. 50.55(e) requirements for reportability, a licensee would have to inform NRC.

15948 Cook states that a failure by a licensee to take appropriate corrective action against an adverse trend is a violation of Appendix B.

15949 Landsman would not expect NRC, through a work authorization procedure, to have been aware of an adverse trend in soils at the time Stone & Webster was on site.

15950 Stamiris Ex. 78 (for ID): Quality Action Request #F-197, received by CPCo Legal Dept. 10/19/82, re: a Quality Indicator Graph for period 6/16-7/15/82.

Page

- 15951 Landsman agrees that Ex. 78 indicates an adverse trend in the soils area.
- 15952-53 Shafer agrees that IR 83-03 (Staff Ex. 13) says that "Attachment 10" forms were being used in place of the IPINs. Problems identified on the Att. 10 form did not get a proper review such as the "routine trading system" would have provided.
- 15954-55 The difference between IPIN problems and Attachment 10 problems, says Shafer, is that the Att. 10 forms simply identified problems and had no follow-up; whereas the IPINs were not identifying all the problems that existed. In both cases, deficiencies were being reported, but not to the right people. After identifying the problem with the Att. 10 forms in 8/82, CPCo prevented their further use but failed to resolve problems identified on the Att. 10 forms.
- 15955 Cook states that the Att. 10 form is not a Q document and is thus not subject to rigorous controls that apply to Q documents.
- 15956 The procedure associated with the Att. 10 form, says Cook, was itself inadequate.
- 15956-58 Shafer says CPCo received an item of noncompliance for CPCo's failure to present in the Final Audit Report the issues discussed in the Attachment 10 forms. (This noncompliance noted in 83-03 at p.3). Shafer talked with Curland to determine why the issues discussed in the Att. 10 form weren't presented in the audit report as they should have been. Curland did not know who was responsible for the omission, but he did stop the use of the [Att. 10] forms.
- 15959-60 Did NRC attempt to see whether the Att. 10 issue [i.e., use of Att. 10 forms] was an intentional violation of NRC regs? [Not a clear answer].
- 15961-62 Shafer: Item C of IR 83-03 had to do with someone changing the quality trend graph information. Shafer's group, with the assistance of the Office of Investigation, investigated the issue. They decided there was no "attempt by QA [to deliberately change?] the quality record" because the original graph, in addition to its revisions, were part of the record.

Page

- 15962-63 Shafer says the Midland Section did not ask the Office of Investigation to look at any other related issues (discussed in Part B of IR 83-03).
- 15963-64 Landsman: No similarity between the finding in 83-03, Part A, Item 2, regarding an out-of-date diag., and the finding in the DGB inspection report regarding soils problems, because drawing control was not an issue in the DGB inspection.
- 15964 Landsman says the problem identified in 83-03, Part A, Item 2 was a violation of 10 C.F.R. 50, Criteria 2. There were also violations of the same in the DGB inspec. report.
- 15966 BY BERNABEI
- 15969 Referring to Stam. Ex. 58 (Cook's handwritten comments on CPCo's response to the SALP report), Cook says he wrote these comments in preparation for a meeting w/CPCo re difference of opinion over SALP.
- 15969-71 CPCo's 5/17/82 Response to SALP Report (Stam. Ex. 56) reflected negatively on CPCo's QA and management attitude because it rebutted in an argumentative way findings which NRC feels were a fair assessment of CPCo's performance.
- 15972-74 At the time he wrote his comments on CPCo's SALP response, Cook believed that CPCo had made a false statement in its response, and that that false statement reflected poorly on CPCo management's attitude. (See Stam. Ex. 58, p. 1 at ¶4).
- 15974-76 Referring to comment 6 in ¶D, p. 1-2 of Ex. 58, Cook can't fairly say whether CPCo management is unable today to pay attention to communications between NRC & CPCo at the detail level. Such an evaluation will be forthcoming.

Page

- 15976-77 Cook agrees that his comment at p. 3, ¶2 of Ex. 58 indicates CPCo did not listen well to the NRC. [Comment refers to CPCo receiving a category 2 rating in the Preservice Inspection area due to lack of rigor in technique].
- He still believes today that CPCo responds only to strong enforcement action.
- 15977-79 Cook agrees that his comment at p. 4, ¶B.2 of Ex. 58 indicates CPCo's inability to listen to the NRC. [Comment refers to Cook stating opinion at 4/26/82 meeting that piping would, as of that time, merit a category 2 rating. It would have remained a category 3 had the Staff known of the results of I. Yin's inspection, however].
- Cook also agrees that the comment indicates his belief that in its response to SALP, CPCo misinterpreted his remark at the 4/26 mtg.
- 15979-81 Cook's comment in Ex. 58 at p. 4 (re: ¶C.1) indicates his belief that CPCo was aware of the quantity of QA personnel needed for particular tasks. Cook proceeds to testify that CPCo did not appreciate the quantity or quality of QA/QC personnel that were needed for "pulling operations". Nor did CPCo appreciate the quality of QA/QC personnel needed in other areas.
- 15981-83 Cook's comment re: ¶C.2 at p. 5 of Ex. 58 suggested that CPCo's management attitude toward noncompliance might warrant removal of the license until CPCo management was completely "purged".
- 15983 Stamiris Ex. [5]8 admitted.
- 15983-84 Landsman states that in 8/82 or 9/82, NRC & CPCo discussed conditions under which soils work would be released.
- 15984-85 Shafer met with Adensam, Hood and other NRR personnel in 9/82 to clarify the Midland section's responsibility regarding soils work review.

Page

- 15985-88 Shafer doesn't know whether he was part of the 9/7 Telecon w/Reg. III, noted in Stamiris Ex. 68 at p. 35. He denies that these notes state that Region III's main concern was with overall QA at Midland.
- Assuming the document said "overall QA", that term would mean an "overall" as opposed to a "piecemeal" addressing of QA concerns.
- 15989-92 Gardner doesn't recall any conversations w/ Adensam or other NRR personnel re: prerequisite conditions for release of soils work. Reference to 9/16/82 Telecon (in Stamiris Ex. p. 36) does not refresh his recollection.
- 15992-93 Shafer doesn't recall Keppler stating that the reasonable assurance as to proper QA was a condition to the release of the soils work.
- 15993 Shafer says Reg. III had an input into the decision to release the soils work.
- 15993-94 Gardner: Reg. III had not finished making its finding on the DGB inspection at the time the soils work was released (in 12/82). The DGB inspection continued in 1/83; the findings were issued 2/83. However, most of the findings had already been made available to CPCo at the 11/23/82 exit meeting.
- 15995-99 Objections to question of why, if there was a significant breakdown in QA, NRC released the soils work. Board, in essence, asks that the question be rephrased.
- 15999 Shafer states that because the NRC was paying such close attention to the soils work, it was not necessary to shut down that work.
- 16000-01 Cover letter to the DGB inspection report noted a loss of management control, says Shaker. The "management" associated w/DGB is not same as that associated w/soils. However, "senior management" -- i.e., Cook & Selby -- have responsibility in both soils & DGB. Thus the DGB inspection report is critical of "senior management."

Page

- 16001-002 In the period after the DGB findings, Landsman never urged Keppler to go ahead with the soils underpinning work.
- 16003-004 Shafer agrees that Peck's 11/23/82 exit meeting notes (Stam. Ex. 66) are a fair representation of Warnick's statement that CPCo should propose a plan for looking backward as well as forward.
- CPCo complied w/an NRC request that such a plan be presented prior to a meeting on 12/7/82 between Reg. III and NRR.
- 16004-006 Shafer: Was present at 12/7/82 meeting, along w/Keppler and others. They discussed the DGB inspection and the history of QA problems. [See Stamiris Ex. 74 at #1].
- 16006-011 Shafer does not recall JGK or anyone else saying at the mtg. that, after NRC met w/CPCo and expressed concern about the DGB results, CPCo had noted "Zimmer issued CCP." [See Stam. Ex. 79 (handwritten notes of 12/7 mtg) at p.3].
- 16011-012 Shafer believes he may have commented at the 12/7/82 meeting that MAC had taken a look at the Midland Project two years before and found nothing. He recalls a discussion of the proposed third-party review by Stone & Webster.
- 16012-019 [Objection to examination w/o providing documents to counsel.]
- 16019-020 Shafer says there was probably a discussion at the 12/7 mtg. re: need for a complete forward-looking program. He does not recall whether they discussed a need for a greater overview of work in soils than in the balance of plant.
- 16021 The sentence "why more overview in soils" at page 3 of Stam. Ex. 79 does not refresh Shafer's recollection of such a discussion.
- 16022 It is possible, says Shafer, that the last line on last page of Stam. Ex. 79 could represent GAP's position.
- 16022-23 Shafer recalls discussing 100% reinspection of work in the balance of plant, not soils work.

16023-26

CPCo submitted the CCP -- a proposal as to both the backward and forward look -- on 1/10/83.

The CPCo commitment to satisfy the ACRS request for a 3d party review is not part of CCP, but rather the Construction Implementation Overview (CIO).

16027-35

Referring to Fig. 1-1 foll. Tr. 1603 (which is also an attachment to JGK's 3/83 testimony), Gardner explains what is meant by the CCP's "forward look" and "backward look":

CCP includes the following parts:

- Preparation of plant (i.e., clean up scaffolding, etc., to facilitate future inspections);
- QA/QC (relates to integration of Bechtel QC into MPQAD);
- Phase 1 Planning (note: currently under revision). CPCo to take parallel paths in Phase 1, with a management review in each path.

One path is a verification of completed inspecs. (backward look or review of past installation to determine acceptability of previously completed inspections).

Anothe path is the "installation of inspection status", in which CPCo will identify components that are improperly installed or are necessary for a particular system.

- Phase 2 (i.e., system completion work)
- Quality Program Review.
- 3d Party Reviews (refers to IDV and ICV review; the scope of those reviews is still under consideration)
- System Layup Continuing Work Activities (ie., activities not affected by the CCP; e.g., maintenance, HVAC, B&W.

Gardner notes that Fig. 1-1 does not refer to CID (the overview of total CCP, encompassing both Phases 1 and 2).

"Quality Verification Program (QVP) is associated with the completed inspection; that is, Phase 1 or "backward look."

- 16036-40 Scope of CCP reinspections proposed by CPCo.
- 16040-45 "Average Quality Level" (AQL) = level of deficiency which is acceptable in a defined population. FSAR is the guide used by NRC staff for the level of quality required at Midland; the FSAR does not use the AQL terminology.
- Shafer not aware of any position taken by NRC on the permissible level of deficiency or acceptable quality level which may exist in a sample after a reinspection at Midland (or for plants generally) has been done.
- 16046 Gardner says CPCo has proposed reviews of documentation for inaccessible systems.
- 16047-49 Gardner, Shafer & Landsman state that the NRC has found problems with documentation of QA, traceability of materials, welding procedures (Zack), nonconforming conditions re IPIN and Attachment 10 forms.
- NRC has also encountered problems with documentation verifying the quality of items whose quality the NRC finds unacceptable.
- 16049-50 Gardner can't yet testify as to adequacy of CPCo's proposed review of documentation to verify the quality of inaccessible systems.
- 16051-69 [Objections to examination regarding NRC's review of CCP (re: documentation to establish quality of inaccessible systems) because this review is still pending.]
- 16069-72 Gardner, Shafer & Cook state that the Quality Improvement Program is intended to instill an attitude that quality should be built into the job.
- It recognizes contributions made by employees but it is not a "bonus" option. Staff hopes the QIP will have positive effect, but only time will tell.
- 16072-75 Gardner & Shafer indicate that the "team" concept proposed in CCP refers to teams that may include engineering personnel, QA and QC personnel.

Staff has discussed w/CPCo the question whether inclusion of QA or QC people in the team violates 10 CFR pt. 50, App. B, but Gardner personally does not believe CPCo's approach will violate the regulation.

- 16075 Shafer says the QA person's role in the team is not yet defined.
- Purpose of team, says Gardner, is not to identify problems in already-constructed portions of the plant (that is, the verification inspection), but to monitor installation.
- 16076 Gardner says the engineers on the team would be field engineers or technicians.
- Shafer knows of no requirement that engineers cannot be on the team.
- 16077-78 The requirement of an evaluation by an engineer for any design change recommended by the team, says Shafer, would be satisfied because such an evaluation would take place independently of the work of the team.
- 16079 Shafer does not recall a commitment by CPCo or Bechtel to NRC on 12/2/82 re: independent evaluation by an engineer.
- 16079 Referring to a document described as a Bechtel "Engineering Master Markup" for 1/12/83 (an early version of the system completion team draft), Shafer says the handwritten comments on p. 3 relate to reinspections by the team: there is no requirement for engineers' independence as long as they're not doing reinspections.
- 16080-82 Gardner says the team will perform the status of equipment work; a group of (recertified) inspectors will perform the verification of previously inspected components.
- This independence of the two functions was made clear in CPCo's 1/10/83 proposal.
- 16082 Cook had voiced concern about the independence of QC inspectors during CPCo's 12/2/82 proposal re CCP.
- 16083-85 According to Shafer there is no written "protocol" re: communications between CPCo, NRC and S&W con-

cerning Construction Implementation Overview (CIO), but NRC has established weekly communications with S&W which will [probably] be followed under the CIO. Staff does not know whether it will require adoption of a "protocol".

- 16085-87 Currently accessible systems will not become inaccessible (i.e., such that they cannot be inspected) because CPCo will not start work until reinspection occurs.
- 16087-89 NRC will be evaluating the coordination between phase 1 and phase 2 work prior to its approval, and by using hold points, it will be able to ensure that CPCo is proceeding according to plan.
- 16090-91 Gardner does not know who will be responsible for implementation of the QIP; Cook says CPCo has already hired new personnel to handle it.
- 16091-92 Shafer and Gardner don't know whether CPCo's current management or new personnel will manage the CCP. CPCo has never communicated to NRC any concerns about adequacy of personnel to maintain the CCP.
- 16092-95 Panel agrees that the DGB inspection documents the fact that in the past CPCo has not identified all the problems in the as-built condition of the Midland plant.
- Although CPCo has provided answers with respect to each individual noncompliance, Shafer doesn't know whether CPCo has determined the root cause of [the alleged] QA breakdown in general.
- Landsman notes that CPCo may not even admit that there was a "QA breakdown", in which case it would not have looked for a "root cause".
- 16098 If the staff does not think CPCo could carry out the proposed program, it would not approve it.
- 16099-101 [Brief discussion of complaint about the amount of time taken by Stamiris and Bernabei to examine the witnesses].

CROSS BY SINCLAIR

- 16102 Landsman testifies that Keppler has stated his agreement with Gallagher's evaluation that the Midland plant remedial soils problem is without precedent.

- 16103-04 Panel is asked whether they understood that Ms. Sinclair wants the 3d party review panel (Stone and Webster) to be carefully scrutinized for their competence. Response: Stone and Webster has already been approved. See 2/24 letter in JGK testimony.
- 16105 Shafer says Keppler said Stone & Webster's performance in the nuclear industry was part of the company's qualifications.
- Shafer did not "review the performance of Stone & Webster", but one of the qualifications that he considered was Stone & Webster's "perform[ance] in the nuclear industry."
- 16105-11 Referring to Attachments 1 and 2 to JGK 3/29 testimony, Shafer says that competence of the individuals or companies was the most important factor in selecting an auditor for the independent design verification program.
- In determining Stone & Webster's competence, Shafer investigated whether employees of this company owned significant amounts of CPCo stock and inquired into such employees' performance credentials.
- All these individuals were found to be competent and hence acceptable.
- 16113-15 Shafer screened all of the key supervisory personnel involved in the Stone & Webster audit to see whether they had done any substantial work at other utilities.
- Shafer also investigated whether these personnel were involved in any of the allegations made by GAP.
- [Reference is made to an (October '82?) letter from GAP, not identified, which discusses GAP's independent assessment of Stone & Webster].
- 16115-16 Sinclair Exh. 3 (for ID): 2/18/___ Memo from Shafer to Warnick re credentials check on Stone & Webster.
- 16116-21 Shafer screened Stone & Webster individuals who worked at the Shoreham facility. Gardner testifies that performance of those individuals

at the Shoreham facility would be an essential factor in determining Stone & Webster's competence.

16122-23

Elements of Shafer's investigation:

1. Obtained sworn Statements from Stone & Webster re independence of the individuals under review, w/resumes attached;
2. Checked any similar seismic design work done for CPCo;
3. Previously or presently employed by CPCo;
4. Ownership of CPCo stock;
5. Relatives employed by CPCo as management personnel;
6. Made phone calls to people who supervised the individuals' work at other plants.

16123-26

Shafer knows nothing about QC problems at Shoreham,, Nine Mile Point 2, or North Anna. Members of the Stone & Webster team who had experience at those facilities include Kilker & Rowan (at Shoreham), Hosinger (at Nine Mile 2) and Lutz (at Shoreham and North Anna).

16127-28

Shafer considered the allegations presented in the 10/22 letter from GAP to NRC and investigated the work of Stone and Webster individuals at Shoreham and Nine Mile 2 to see whether their performance was questionable.

16128

Shafer not aware of State of NY consultants looking at problems at Shoreham.

16129-31

Shafer reiterates that the point of his investigation was not to examine a utility (such as Shoreham) but to examine the competence of certain individuals involved in the work at a given utility.

16132-34

Gardner discovered a potential problem w/IPINs a week after the DGB inspection began (10/12/82). Shafer does not believe the use of IPINs was a site-wide procedure.

16135-36

Cook says Staff has not established that there were IPIN problems in the soils area. The problem with IPINs was that people were using them to mask the trending ability, with the result that management paid less attention to deficiencies. CPCo has recently been giving more attention to such deficiencies.

16137-44

Referring to JGK supplm. test., Att. D to Att. 1, Landman says that regardless of whether a super-plasticizer is added to the concrete mix, the concrete must be consolidated.

He discussed this problem in IR 83-03, p. 5 (Staff Ex. 18). Stone & Webster did not make a similar finding.

Referring to CPCo Ex. 33, Tab entitled "90-day Report" at page 61 (Stone & Webster Conclusion No. 4), Landman says his item of noncompliance in IR 83-03 has nothing to do with the Stone & Webster conclusion that the MPQAD inspec. plans are adequate.

16144-49

In response to a question about whether Stone & Webster should have found the violation noted in IR 83-03, App. item A-2, Landsman says Stone & Webster does not look at everything in the plant having to do with remedial soils.

[It is noted that Stone & Webster's responsibility changed sometime during the time period in question; there is not a clear answer as to whether the NOV (A-2) was something for which Stone and Webster was responsible.]

Landsman agrees that it is for the NRC and not CPCo to identify the proper scope of Stone & Webster's work.

16150-52

[Referring to JGK 3/83 testimony, Att. 4, p. 27 at ¶ 22 ("Drawing C-45"), Sinclair asks whether Stone & Webster should have identified the same soils problems the Staff did in its DGB inspection.]

Landsman says S&W's responsibilities did not cover review of all areas. He also says everybody on site should have identified the aux. bldg. underpinning problem. That problem arose prior to Stone & Webster's arrival on 12/20.

16153-57

[Comments on usefulness of the Stone & Webster weekly reports.]

16157-59

Landsman has not reviewed the Stone & Webster 90-day report sufficiently to evaluate Stone & Webster's opinion of the MPQAD; however, his own opinion of MPQAD is given in his 3/83 prepared testimony (Q. 7).

BY MILLER

- 16161 Shafer says there has been communication among the witnesses in response to questions so far on cross-examination.
- 16162-63 Cook, Landsman & Gardner participated in a meeting with Intervenors and their counsel the previous evening, at which they informed Intervenors and their counsel that the panel didn't wish to discuss the CCP.
- 16163-72 In the last 90 days, Shafer has had 3 to 4 phone conversations (totalling about 7 hrs.) with Intervenors or their counsel, at which the subject matter of the last 2 weeks of hearings was discussed.
- However, he doesn't believe they discussed the proposed CCP, or anything of significance re: preparation of the SALP report.
- He was not asked in these conversations to express an opinion about the effectiveness of CPCO's QA implementation re: remedial soils work; they primarily discussed the DGB inspection and inspector evaluations. He kept no notes of these conversations.
- 16172-75 In one conversation Shafer was asked whether any inspector evaluation forms existed. In fact, Gardner prepared one such form within the last 2 months.
- Gardner does not recall whether he prepared the form in connection with IR 83-03. The inspector evaluation form allows an inspector to describe his relationship with the licensee, and to address any items that might not otherwise have been included in the report.
- 16177-78 Gardner says inspector evaluation forms should be filled out as a matter of routine following each construction at Midland. The form [the particular one that Gardner says he filled out?] does not contain any adverse comments regarding either the licensee, Staff members on the Midland team or anything else associated with the inspection.
- 16179-80 The inspector evaluation form allows an inspector to raise issues that are not allowed by his supervisors.

- 16180-81 Neither Landsman nor Cook disagreed with the way Gardner had checked the boxes on the inspector evaluation form [associated with IR 83-03]. [Nor did Burgess (?) disagree]. Cook says their disagreement was simply over having to use the form in the first place.
- 16182 The form is directed to Shafer, who then comments and forwards it to Warnick.
- 16182-87 In his conversation with Stamiris, Shafer did not discuss qualifications of specific CPCo personnel associated with Midland.
- Nor did he discuss whether Midland was a public health threat or whether there were design deficiencies in the SWPS, AUX, elec. penetration area or DGB.
- He believes he stated, however, that the Midland Section did not trust CPCo.
- It is a lack of confidence in CPCo that led Shafer to ask for sworn statements from time to time.
- 16188 Shafer did not use the term "shoddy workmanship" or "slipshod workmanship" in his conversations with Intervenors.
- 16188-90 Gardner recalls discussing only technical matters (underpinning, cable pulling, etc.) in his conversations with BS and Garde.
- He does not recall discussing the truthfulness of CPCo's representations or whether Midland was a public health and safety threat; he may have discussed Bechtel & CPCo management attitude in reference to the QC certification problem.
- 16190 Cook has not had any phone conversations with Intervenors or their attorneys. The only conversation Shafer had where an attorney was present was the one with GAP.
- 16194 Cook had one conversation with Garde, following a recent hearing session. He told her that her demands for paperwork were "distracting the inspection staff" in its job of helping the citizens of Midland. They also discussed cracks in the DGB and containment.

16194-97

Landsman has had one phone conversation with Stamiris and one with Garde in the last 90 days. He recalls nothing of his conversation with Garde.

Gardner also participated in the Garde conversation, as did Shafer. Shafer has had other conversations with Garde as well, regarding the DGE.

16198-99

Landsman says that when CPCo encountered lean concrete (which he believes they clearly anticipated), they threw up their hands and then broke it up.

Landsman was informed of the problem, he visited the site, and discussed with CPCo the procedures it was going to use to excavate the lean concrete. He found the procedures satisfactory.

The concrete has been removed. Landsman does not know whether the procedure was properly followed, but has no reason to think it wasn't.

15199-16203

Referring to Stamiris Exh. 51 (cracks in feedwater isolation valve pit), Landsman says a crack of .01" is visible to the eye.

After the cracking at the Feedwater isolation valve pit was reported, Shafer went to the site to observe the .01" crack (the one that exceeded the alert level).

In order to measure a crack of this width, says Shafer, it is necessary to use a 30 power magnifying microscope. (See p. 2 of St. Ex. 51).

16204-207

Referring to Stam. Ex. 67 (Midland team activity log), entry for 11/8-11/10/82, Shafer says the line "Team is uptight" meant the Midland team was concerned about the numbers of findings that were beginning to build up.

As of 11/10, the inspection by four Midland team members had been going on for 25 working days. Not all 4 members were on site each of those days.

16207-208

[Question about whether the team wanted "to recommend shutdown", as reported in St. Ex. 67, 11/10 entry, is objected to and withdrawn].

- 16208-209 The term "CP", as used in the phrase "We'll probably go for CP" in Stamiris Ex. 67 (entry for 11/10/82), means Civil Penalty. Shafer thinks he prepared this entry on 11/10/82.
- 16209-11 Shafer explains that the team wanted to recommend shutdown, and also wanted to go for a civil penalty -- although a more precise term than civil penalty might be "escalated enforcement".
- 16212 Cook agrees that in earlier testimony he characterized the workmanship at Midland as "slipshod".
- 16213 Cook's responsibilities as an NRC resident inspector include monitoring management attitudes and public attitudes, and determining whether the plant is built in accordance with all regulatory requirements or other acceptable industrial practices.
- 16214-16 For example, Cook adjudged during the DGB inspection that the workmanship regarding the control panel did not meet reg. requirements.
- Given a hypothetical situation where the paint on the Turbine generator is applied in a slipshod way, resulting in bubbles, Cook says he probably would not be concerned unless the poor paint job somehow affected the public health and safety (which is his ultimate responsibility as NRC inspector).
- 16216-18 Referring to Attachment B to Keppler's 10/82 testimony (Memo from Cook to Warnick re Indicators of Questionable License Performance - Midland Site), Cook says that in Item 7 he used the word "slipshod" in the sense of "carelessness": certain anchors had not been dropped to the proper depth, and when NRC inspectors asked CPCo about it, CPCo indicated that the finding was not valid because QC had not inspected the item.
- The Staff felt that CPCo's reliance on QC to ensure proper installation indicates CPCo's tolerance of slipshod workmanship.
- Cook says the preceding example most likely had to do with a safety (vs. non-safety) related matter, since the NRC is concerned primarily with safety related aspects of the plant. He adds that the Staff is concerned, of course, with the impact of non-safety related aspects on the safety-related ones.

Midland Hearings
May 6th, 1983

- | <u>Page</u> | <u>Text</u> |
|-------------|--|
| 16223-26 | Cross Exam of Wayne Shafer (Resumed)

Shafer feels that building quality in is preferable to inspecting quality in, but inspections are still necessary: Appendix B, 10CFR 50 is the law requiring inspections. The quality control function inspects work, quality assurance above QC audits and should survey all work. |
| 16227-32 | In the real world a QA program that didn't generate a single NCR would be suspect. Linda Sucharski is employed by Region III Management Information Bureau. Miller shows Shaffer CPCo. Exhibit 45 re: statistics on inspection activities for plants under construction in Region III from 1980 to the present. The variables in the number of NCR a plant under construction receives are hours of inspection, quality of work performed by the licensee, experience of the inspectors, and inspection effort intensified during start-ups. |
| 16233-39 | Exhibit 35 doesn't rate the significance of any of the NCRs. The Zimmer plant has less NCRs but, according to Keppler, has more significant construction problems than Midland. But comparisons cannot be drawn from Ex. 35. Inspectors decide on a case by case basis how to write up NCRs and how many to write. They use their discretion to characterize NCRs in a certain way to get the licensee's attention. Witness Cook is shown Stamiris Exhibit 58, his comments on CPCo's SALP response. |
| 16240-42 | Cook had the SALP draft in May and formulated his comments to it sometime after the 6/21 meeting with CPCo. in Jackson. Exhibit 58 is a compilation of the data Cook prepared for a meeting in August. CPCo didn't challenge the NRC staff & their SALP conclusions in the August meeting. |

- 16243-47 Paragraph D on page 1-2 of Stamiris Exhibit 56 refers to "timely feedback" and Consumers believes that CCo and the NRC have "fallen short in this area". Cook states in Ex. 58 that this is a "false statement". Many of the comments in Ex. 58 are "Cookisms" that were originally intended as notes. The reference to "Purge of CCo" refers to Cook's belief that management should be pinged to make it more responsible to the NRC's item of noncompliance.
- 16248-52 Jim Cook remains head of the Midland project. Cook believes that the attitude realignment that he refers to in the document is occurring. He also refers to the NRC not having a tolerance for mediocrity. In Stamiris Exhibit 66 (11/23/82) there is a reference to the NRC telling CCo that their attitude had been improving. Cook doesn't recall saying this. The licensee had been cooperating with the NRC in the intensive DGB inspection.
- 16253-57 Don Miller was CCo's site manager at this time. Miller instructed Bechtel to be more cooperative with the NRC. Shafer doesn't think CCo's attitude remained as good as the NRC perceived on 11/23/82. Shafer states that his communication with Miller hasn't changed but with Wells it has diminished due to 2 incidents. Wells was involved in changing the quality trend graph which Shafer describes as a poor management decision. Gardner thinks CCo's attitude might have declined too because Wells hurried along a QC inspection. CCo determined that QC training should be suspended until the recertification and requalification program was more adequate.
- 16258-63 Gardner had partial responsibility for electrical and instrumentation input into the SALP evaluation of the QA functional area. Gardner states that in Stamiris Ex. 55 an 'average reading' in Category 2 is equivalent to an 'average reading' in Exhibit 60. Comments on the front of Stamiris Ex. 60 relate to QA functional area. In the April 1982 SALP report a Category 2 or average rating was assigned to the QA functional area. Gardner probably gave his input and average rating to the SALP Coordinator in the summer of 1981.

- 16264-68 The IPIN form is a Bechtel form discontinued formally on 1/18/83. In Peek's notes of 11/23/82 it states IPINs were a big problem. Shafer thinks Meisenheimer discontinued IPINs at Midland for Soils prior to January. Subsequent to this Wells sent a letter directing everyone else not to use them. Gardner doesn't know when CPCo took steps to eliminate the use of the "return option" prior to 1/83. Gardner is shown CPCo Ex. 36, a memo from Bechtel to all QCCE's from E. Smith on 11/9/82. Smith was PFQC engineer. No one can recall if the return option with respect to the IPIN form was discontinued prior to 1/83. Neither Cook or Shafer has seen CPCo Ex. 36 before today.
- 16269-71 "Return Option" is a procedure described in CPCo's Exh. 36, used to address concerns expressed by Gardner re the abuse of the IPIN process uncovered during the DGB inspection. The IPINs didn't identify each deficiency found by a QC inspector.
- 16272-77 Gardner and Landsman went onsite on 1/19/83 and interviewed QC inspectors to determine the use of IPINs. This indicated that the inspectors had no understanding from management of return option or the use of IPINs. Gardner is shown CPCo, Ex. 37a, a letter from Curland (site QA Super of Bechtel) to Smith (Bechtel) dated 12/2/82.
- 16278-81 Shafer thinks he might have seen Ex. 37 before. It appears to indicate that Applicant was taking steps to eliminate the IPIN form as early as 12/2/82. 12/2 was the meeting where all Bechtel work activity was stopped. Curland was site QA super and had authority to recommend discontinuance of the IPINs. No one at CPCo was opposed to this, Shafer has seen CPCo. Ex. 38 before, a memo from Wells to Rutgers dated 1/26/83. No one recalls whether IPINs were used in the remedial soils work after 12/1/82.
- 16282-87 They didn't interview quality control inspectors in the soils area. Cook, Gardner Landsman and Shafer have heard of a directive from Meisenheimer to QC inspectors in the soils area not to use the IPIN form. Miller moves into evidence CPCo. exhibits 35-38. Ms. Bernabei states she never received Ex. 35 during document production. Ms. Bernabei objects to Exhibit 36, 37 & 38 for lack of relevance & sponsorship. Miller withdraws exhibits 37 & 38.

- 16289-93 Landsman believes the excavation permit procedure should be applied to the underpinning work. CPCo has submitted to Landsman their case why the excavation permit procedure needn't be applied to the underpinning work. He has discussed it with other Midland people, and informed the Board last week that it should be applied. CPCo's April 4 response states they don't want to include the underpinning work in the excavation permit system. Landsman, rather than respond to CPCo, has notified the Board to intervene. On Staff Ex. 18, inspection report 8303 the application of the excavation permit system to underpinning is discussed on page 5 as an open item.
- 16294 Applicant agrees to commit itself to apply the excavation permit system to the underpinning work. Landsman accepts this commitment.
- 16295-302 Shafer was concerned about Bechtel employees being QC inspectors under the revised quality control organization at the Midland plant. Stamiris Ex. 48 is Shafer's telephone log. He recalls having conversations with Wells. He recalls Wells saying he was going to use Bechtel QC inspectors reporting to Bechtel QC supervisors. Wells stated he wanted to get this issue out on the table to see if the NRC had any objections. Wells wanted to put dependable qualified people in those QC supervisory positions that Bechtel already had. Shafer's position was that QC inspectors from Bechtel shouldn't report to Bechtel QC supervisors. Cook lists problems he observed with Bechtel QC supervisors.
- 16303-06 Cook isn't identifying individual Bechtel QC supervisors, but looking at it as a generic problem. Shafer thinks Wells tried to look at individual Bechtel employees qualifications. Shafer doesn't recall if he told Wells the practice was acceptable. He is shown Stamiris Exhibit 48 and recalls his position was he told Wells he was lifting the hold point re the QA organization. Wells did ask for Shafer's concurrence in using Bechtel employees for QC inspection & supervisors. A cantilever is a structure hanging from another bldg. portion that is basically unsupported. The electrical penetration area of the Aux. Bldg. area is resting on berths.

- 16307-12 Landsman describes this area of the Aux. Bldg. as a design deficiency because one side of the structure is rigidly supported (the electrical penetration areas on the control tower side) and the other side is inadequately supported on control compacted fill. The design is in the 5/28/69 PSAR, so Landsman agrees the NRC has known from the beginning that the EP area of the Aux. Bldg. was going to be supported on compacted fill. The SER should have been issued by the NRC Staff prior to the construction permit for Midland. Landsman has never seen the SER. He came to Midland in 1980.
- 16313-14 Landsman isn't sure when he learned that a portion of the Aux. Bldg. was founded on till and another portion on fill material. Landsman did discuss the design deficiencies of Midland on other occasions. The NRC approved the design on the PSAR chart that shows some of the Aux. Bldg. on compacted fill and some on natural fill.
- 16315-20 The fact that the fill is controlled doesn't make a difference. Landsman states that a cantilever is only supported on one side so using fill, even if it conforms to PSAR requirements, is not good soil engineering practice and is a design deficiency. He has discussed this with others associated with Midland. He states he and the others have laughed about the design of the cantilevers. He hasn't communicated this exact opinion to the NRC. Landsman didn't help prepare or comment on the SER. Neither Cook, Shafer or Gardner have the technical knowledge to express their opinions in this area.
- 16321-28 Preliminary Matters
- 16329-33 Ms. Bernabei wants to enter Stamiris Exhibit 72, "NRR comments on proposed letter from J. Keppler to CPCo on Midland QA Program" entered into evidence. Mr. Miller objects because the minutes to that meeting are already in evidence. The Board accepts it into evidence.
- 16334-61 Ms. Stamiris states her request for production of documents is not being met.
- 16362-63 Sinclair Exhibit 3, a memo from Shafer dated 2/8/83 is entered into evidence.
- 16364-66 Matters re: Zack depositions to be taken.

NRC Hearing
June 1, 1983

<u>Page</u>	<u>Text</u>
16370-92	<u>Preliminary Matters</u> <u>Cross Examination of Ronald Gardner, Ross Landsman, Ronald Cook, Wayne Shafer, (by Mr. Miller)</u>
16392	None of the witnesses knew of any other nuclear power plant, with a Category I structure, founded partially on natural soil and materials and partially on compacted fill.
16392	None of witnesses are familiar with Palo Verde Nuclear Power Station or its FSAR (Consumers Exhibit 39). Looking at the exhibit, Landsman agreed that the DGB at the Palo Verde plant appears to be founded partially on natural material and partially on compacted fill. He believes the Palo Verde sketch exhibits obvious design deficiencies. The other panel members had no opinion on the design.
16399	
16399-401	Landsman at one time worked for Sargent and Lundy Engineers. He had no responsibility with respect to CECO's Braidwood facility and is not familiar with how its auxiliary building is supported. None of the witnesses was familiar with an excerpt from an FSAR for the Byron and Braidwood stations. (Consumers Exhibit 40) Landsman could not tell what material the fuel-handling building was founded on.
16402-4	Excerpts from an FSAR for Bechtel's South Texas Project, i.e. 4 pages entitled Unit 1 and 2 Power Layout, Figure 1.3-1, were shown to the witnesses. Only Landsman has had professional responsibility with respect to that project. As a special investigator of quality assurance Landsman reviewed construction practices in the soils area in 1979-1980. The fuel handling building is shown in the exhibit as resting partially on natural material and partially on backfill. Landsman believes the South Texas fuel handling building design is obviously defective.

- 16404-6 Landsman raised generic concerns about the South Texas buildings settling unevenly. The design engineer, Brown & Root, was replaced by Bechtel. Landsman was not sure whether the uneven settlement was due to the design of the foundations or to compacted fill. He never specifically told anyone that there was an obvious design deficiency in the design of the fuel handling building because it rests partially on natural material and partially on uncompacted fill.
- 16406-10 Discussion re admissibility of Exhibits 39-41.
- 16410 With respect to page 15060 from Landsman's 4/30/83 testimony, Landsman corrected the testimony to read that having the DGB sit on compacted fill is a deficiency. None of the witnesses knew of any other DGB with spread footings rather than a continuous mat for the building's foundation. Landsman believes spread footings are an obvious defect because one must anticipate some differential settlement between the various portions of the building and between the diesels themselves, due to the different intensities of load under each.
- 16413-7 Consumers Exhibit 42 (also part of Stamiris Exhibit 3), answers one and 23 from Consumers responses to 50.54(f) questions, were identified by Landsman as discussing the change from a mat foundation to a spread footing foundation. Landsman is basically only familiar with the 50.54(f) answers dealing with quality assurance. Cook had seen these answers before but hadn't reviewed them in detail. Shafer and Gardner had never seen these 50.54(f) responses before.
- 16417-20 The NRC staff was fully aware of the fact that there was a spread footing foundation for the DGB. None of the witnesses participated in Bechtel's structural design audit last year. The use of a spread footing foundation for the DGB was probably not raised as a design deficiency because Consumers had already surcharged the area to get rid of most of the differential settlement. The remedial measures were to compact the fill under the DGB. Landsman believes the DGB "was a bad design from the start".

16421-3 Darl Hood joins panel

Hood recalled that the NRR first became aware of the spread footing design when they learned of the settlement problem. The PSAR was ambiguous in identifying the DGB as having a spread-footing foundation. Hood was pretty sure that at the time the DGB was constructed the staff had not reviewed the adequacy of spread footing for that structure.

16424-5 Hood recalled no discussion of the use of spread footings as a design deficiency during the 7/27-7/31/82 Ann Arbor structural audit. He does not think the NRR characterizes the use of spread footings as a design deficiency per se. What is important to the NRR is that a conservative prediction of differential settlement be recognized at the outset of the design. No regulatory requirement is violated by the use of a spread footing for the DGB, however, Hood added that regulatory requirements do not usually address specific design.

16425-8 Hood noted that had the soil beneath the DGB been properly compacted a structural engineer could have accommodated both types of differential settlements. "I think a reasonable acceptable structure should have been barred from such a design". If using spread footings were an obvious design deficiency the NRR would have been aware of it and would have said so in several places, including the SER.

16428-9 Landsman never told Hood that he thought the design of the DGB's foundation contained an obvious deficiency. The reason Landsman never communicated his concern to anyone was because the NRR reviewer said that the cracks that have already occurred are okay.

16429-30 Hood understands Landsman's position to be that it's best not to design a structure for differential settlement when it could just as easily be placed on a uniform foundation. Hood believes a structure can be properly and sensibly designed for nonuniform soil. Hood agrees that the cracking in the DGB occurred because the soil under the building was not properly compacted originally.

- 16430-5 Hood was shown portions of the Midland Safety Evaluation Report Supplement 2 and agreed that they refer to the DGB foundation design. Had an obvious design deficiency been present one would expect it to be discussed in those sections. On the contrary, the DGB as modified by the surcharge and subsequent analysis of stresses was found to be acceptable. Shafer, Gardner and Cook had no comment. Landsman disagreed with Hood but prepared no written statement of his opinion because he thought the issue had already been brought to the Licensing Board's attention. Hood supplemented his answer by saying that acceptance of the seismic margin earthquake is still pending.
- 16435-9 None of the witnesses knew of any nuclear power plants with a DGB with a spread footing foundation resting on compacted raw material. Landsman agreed however that Consumers Exhibit 43, an excerpt from a 1969 FSAR for the Monticello facility, describes such a plant. The NRC was not in existence at that time and Landsman believes that the AEC was more concerned with reactor protection systems than soil mechanics. He was not an AEC employee but has looked at old FSARS. Shafer added that the AEC's requirements in 1969 were significantly less rigorous than they are today.
- 16439-42 None of the witnesses knew of any reports that there has been unacceptable differential settlement in Monticello's DGB. No one knew whether Monticello is currently subject to the SEP review. (Systematic Evaluation Program)
- 16443-4 Clarification of Landsman's testimony on page 14433. He had told Marshall that shoddy work at the Midland plant is liable to jeopardize the public health and safety of the people of Midland.
- 16445-50 With respect to question 8 on page 5 of his 3/25/83 prepared testimony, Shafer stated that the "positions" he referred to were any supervisory positions. He knew of no regulatory requirements that dictate the experience level or qualifications of the supervisors for QA organizations. With respect to lower level individuals there are ANSI standards. When he prepared answer 8 Shafer was trying to address Landsman's concerns. His answer includes reference to the selection of any management personnel. The NRC has been observing organizational changes and

watching supervisors' performances at Consumers. Shafer believes Wells, the Executive Manager of MPQAD, is qualified. Cook feels that as long as Wells is surrounded by more experienced people he can hold his position. Curland, Wells' technical assistance, has an extensive background in QA work and is the type of person Cook likes to see around Wells. Cook would actually prefer having Curland replace Wells. Gardner believes Wells is qualified for his job if he performs in an adequate manner.

- 16450 Shafer has no reason to think Meisenheimer is not qualified to hold the position of superintendent of QA for soils. Cook thinks Meisenheimer has technical credentials but lacks in QA experience. Gardner believes Meisenheimer is qualified if he performs adequately.
- 16451-3 Concerning Leonard, General Superintendent of QA, Shafer has no opinion, Gardner does not know him and Cook thinks he's qualified. Shafer thinks Fredrick is qualified for his position as superintendent of the Quality Control operation at MPQAD. Cook and Gardner think Friedrich should be watched for awhile before evaluating his performance, although his resume looks good. His ties to Mack Corporation, which has contracts with Bechtel and Consumers, may affect his independence.
- 16453-4 Shafer and Gardner have no opinion on Don Horn, Assistant Superintendent of Soils and also Section Head for Quality services in the soils area. Cook thinks he is qualified since he has quite a bit of QA experience.
- 16455 Shafer and Gardner do not remember DeWitt but Cook identified him as the head QC person of soils in MPQAD. Cook thinks DeWitt is highly qualified for the position.
- 16456 None of the witnesses know R.L. Oliver, head of QA engineering, well enough to have an opinion on him.

Afternoon Session

- 16458-63 Preliminary Matters

- 16463-5 Landsman stated that Gallagher prepared paragraph (6) on the first page of Attachment 9 to the 10/29/82 Staff testimony. Landsman agreed with the observations set forth in that paragraph ie that the QA Civil Staff has very limited technical soils mechanics experience. Attachment 8 also contains the NRC Staff observation concerning the competence of the QA Staff that was going to be assigned to Soil Remedial Work.
- 16465-70 Prior to Meisenheimer's appointment as Superintendent Landsman told Bird (apparently in a 7/82 phone conversation) that he had no comment one way or the other on Meisenheimer's qualifications. Landsman did not remember making a determination about his qualifications were after receiving his resume. He received a second copy of Meisenheimer's resume and a copy of Blendy's and Oliver's on 12/21/82. Landsman does not know what Meisenheimer's degree is in.
- 16470-4 Consumers Exhibit 34, Meisenheimer's resume, was shown to Landsman. None of the panel had any problem with Meisenheimer's technical expertise in the soils area. Landsman was concerned about his QA qualifications. Landsman would not characterize Meisenheimer's Wolf Creek experience as that of a soils engineer but rather as a project engineer/project manager. He could not recall whether Meisenheimer ever had responsibility for a soils lab at any nuclear power plant.
- 16474-5 It might be hard but not impossible to find someone with both the technical experience and the QA background needed for the remedial soils work at Midland even though the underpinning work at Midland is unique in the industry. Landsman was not aware of Consumers deliberately passing over any highly qualified people with extensive quality and technical backgrounds.
- 16475-7 Landsman does not think experience as a quality control engineer is applicable to quality assurance efforts. Quality control re earth work involves running soil tests while quality assurance deals with making sure people are qualified and documenting things properly. At Wolf Creek Meisenheimer just verified that people were performing tests and wrote daily reports to keep the owner informed as to what was going on at the site. None of the witnesses ever spoke with Meisenheimer about his quality background.

- 16478-9 Cook believes Meisenheimer is now familiar with quality assurance concepts and principals. Gardner does not question his technical ability as a quality assurance manager but might question is ability to function in the engineering organization Wheeler is in charge of.
- 16480-1 Landsman used Attachment 10 of NRC Inspection Report 83-03 (Staff Exhibit 18) to illustrate Well's lack of understanding of QA principals. Shafer agreed however that the use of Attachment 10's was discontinued before Wells took his present position.
- 16481-2 Shafer noted that Wells made the decision to change the quality trend graph. Report 83-03 Section 1 reports details of the change. After Attachment 10 forms were discontinued IPINs were used. IP Performance Forms are used now.
- 16483 Shafer corrected a previous statement re training requirements for QC inspectors by saying they are ANSI 45,.2-6.
- 16483-7 Per Landsman, items of noncompliance identified by I&E Staff can concern something done incorrectly or something not done at all. The Applicant's philosophy seems to be that if something is not done correctly the first time they will catch it during an inspection. Landsman is not sure whether the applicant has the same attitude about quality assurance reports. He does not think that items of noncompliance where work has not been done in accordance with regulatory requirements reflect poor management on the part of Consumers and Bechtel.
- 16487-91 All of the witnesses reviewed Keppler's prepared testimony before it was filed in 3/83. Shafer agreed with Keppler's oral testimony on page 15607 i.e. assuming that the 3 steps set out on page 6 of his 3/83 testimony are met that there would be reasonable assurance that Midland can be completed in accordance with regulatory requirements. Cook was reluctant to agree without reading Keppler's entire statement and did not want to be limited to the 3 steps mentioned since there is also CCP involvement.

16491-2 Landsman agreed with Keppler's conclusion that there's reasonable assurance that the plant can be built. However, since Consumers has had unqualified people running their remedial soils work Landsman has not seen any improvement and has reservations about the future.

16493 Landsman will decide after meeting with the Staff tonight whether he still agrees with Keppler that further underpinning work may proceed.

16493 Gardner agreed with Keppler's reasonable assurance statement as long as it included satisfactory implementation of the CCP.

Examination By The Board

16495 Shafer indicated that some reassignments of responsibilities, such as Leonard being made superintendent, may be what Wells meant in his testimony when he hinted about further improvements in the MPQAD organization.

16496-7 With respect to Inspection Report 83-05 and the fact that the inspectors were critical of QC training and the status of PQCI's Gardner stated that effective 3/7/83 the licensee suspended training to PQCI's until they are reviewed and revised.

16498-9 Stone and Webster's 90 day report probably referred to the MPQAD Remedial Soils Group when it okayed the quality and training of MPQAD. There are 2 QC organizations in the MPQAD, the soils people under Mark Dewitt and all other people under Frederick.

16500 Cook stated that Bechtel has programs to promote worker safety and quality of work. Bechtel is committed to improving quality at the grass roots level through quality control people. The present QIP program at the site is a continuation of the program proposed over a year ago.

16502-5 Cook indicated that no work has to be actually going on in order to identify items of noncompliance. The NRC prefers to increase its inspection efforts to be commensurate with the amount of construction activities going on at a site.

- 16505-8 Landsman indicated that the amount of overhang of the auxiliary building is about 150 feet. With respect to Consumers Exhibit 41, the South Texas plant drawing. Landsman estimated that the overhang of the fuel handling building was about 100 feet. He did not think it is good construction practice to have that much of an overhang supported by compacted fill. Design deficiency means an inadequate design...it might work but they are asking for trouble.
- 16508-9 Lean concrete and filled concrete are the same thing. The random use of concrete backfill at Midland in the '70s is causing a differential settlement of the buildings. If lean concrete had been used everywhere there would be no settlement problems. Improper soil compaction and lean concrete both cause problems.
- 16509-12 None of the witnesses knew of academic courses concerning quality assurance. Quality assurance is learned through corporate training programs and on the job training. All agreed there seems to be a shortage of experienced quality assurance engineers. Consumers has had extensive recruiting programs. It's hard to know how good they are. Consumers has used organizations like SAI and PAC to procure experienced quality assurance personnel.
- 16512-4 Shafer indicated that ANSI N45 2-6 requires Level 1-3 Quality Control inspectors to have a high school education or the equivalent. A person with a Masters in geotechnical engineering would be over educated for such jobs. Per Landsman a geotechnical engineer is a soils engineer.
- 16515-6 Consumers told Landsman that they have complied with their commitment to extend the excavation work permit system to underpinning but he has not reviewed the new procedures yet. So far Consumers has done no additional underpinning.
- 16517-9 Hood expects any information given to him by the applicant to be correct. And after the loose sands meeting he discovered that Budzik had obtained his information from unreliable people. It would be overreacting on the NRC's part, however, to create a formalized mechanism by which Consumers would report information.

- 16519-20 Landsman indicated that there have been numerous misunderstandings in the remedial soils area. He has tried to tell Consumers to make sure they have all necessary information before relaying it. Shafer thinks the CCP shows the licensee is trying to improve.
- 16521-4 Per Shafer the NRC Staff has seen a difference in the information available to it since a meeting with Bechtel and Consumers where Cook told them their communications with the NRC were unacceptable. Currently Gardner finds no reluctance on the part of Consumers personnel to discuss matters with NRC inspectors. The inspectors tend to speak to those seen as highly credible. Landsman now personally receives daily phone calls about what's happening at the site.
- 16525-6 Gardner thinks QA/QC control would be better if only one building were built at a time. Before the CCP he actually recommended that that be done. Now probably the best thing to do is go forward on one unit while the other is being reinspected.
- 16526-9 Landsman and Cook think there would be better quality control if one unit were built at a time. If no rework were necessary it would be feasible to construct both plants simultaneously. Shafer is not so sure that constructing 2 plants at the same time is any harder than constructing one.
- 16529-33 Gardner has no particular people in mind that he would like to see removed. Landsman said Wells, Oliver and Meisenheimer should be removed because their resumes show they are unqualified. Cook is more worried about qualified experienced people being put in positions of lesser effectiveness than having individuals removed. Cook named Mike Shafer, Danny Corcoran, Ed Jones and Joe Petrasini as being such people. If Wells keeps the most effective people in positions to benefit the licensee Cook has no objection to Wells being there but apparently he doesn't. He was not sure whether the recent transfer of Curland was a good move although he did think Curland was good in his former area.
- 16534-6 Shafer has never formally requested that anyone be removed from a key position. He had reservations about Jim Cook, Wells and Don Miller.

- 16536 Cook thinks Don Miller and Curland could successfully build a plant by themselves that could ultimately be licensed.
- 16539-41 Landsman has had numerous misunderstandings with Mooney, Shapp and Fisher and thinks the work would be "a lot easier if we didn't have them there". Costs and scheduling are probably the common thread running through all the misunderstandings. They seem to come before quality. The problem with the individuals mentioned is that they tell the staff one thing one week and something else the next. Landsman never knows whether he has been told false information or whether circumstances have changed.
- 16542 Shafer noted that the individual with single point accountability is in the Jackson Office and must rely on people at the site to tell him what is going on. An example of how this causes problems is the lack of communication last fall over when a training program would be ready.
- 16543-5 Gardner thinks that the people who determined that the pipe support problem (mentioned on pages 5 and 6 of Rutgers' testimony) had no impact on safety were wrong to suggest that if such conditions occurred elsewhere in the plant that they too would not impact safety. Specifications must be conformed to and nonconformances must be given case by case evaluations.
- 16545-6 Shafer fully expects the licensee to meet their program requirements. QC inspectors fill out nonconformance reports and the management system then is supposed to insure proper review and evaluation.
- 16547-8 Cook stated that the NRC reaches its "threshold" (and therefore presumably would request a work stop) if the licensee is told by its QA people that there is a problem and the licensee doesn't stop work itself.
- 16550 Shafer clarified Landsman's October testimony (page 5) by saying that no problems with the CCP's performance of actual underpinning activities has been so significant as to warrant an actual recommendation to halt work.
- 16551-2 None of the witnesses could think of anything not already talked about that they would like to see put into effect at the Midland plant.

CPCO MIDLAND HEARINGS
June 2, 1983

16556-63 Testimony of Gardner, Landsman, Cook, Shafer, and Hood. Preliminary matters re: CPCo's audit of U.S. Testing.

16563-78 Redirect Exam by Mr. Wilcove

Landsman thinks that Board should look carefully at the DGB cracked structure. Cook discusses certain things that Warnick decided would be essential in 8/18/82 memo to construct Midland safely. Hood clarifies his response from yesterday re: the 12/10/82 testimony on the DGB. Gardner explains that a programmatic exam (possibly administered by licensee) is to ensure the inspector has adequate knowledge of QC practices for inspectors. A PQCI exam would be different for different inspectors, depending on their specialty and area they work in. It is a technical exam.

16579-88 At the last hearing it was discussed that 2 out of 19 QC inspectors had failed the general programmatic exam. They couldn't have been involved in major underpinning work because they failed in the Fall of 1982. Underpinning of safety related structures began in 2/83. They might have inspected soils work done within the boundary of C-45. If there was work inspected by those who failed the programmatic exam it would be up to the licensee to determine how to reinspect the work. Landsman reviews March supplemental testimony, pg. 4. He meant to include the whole first section of (E), and Items A-F on his attachment 1C. As head of Special Cases Shafer thinks CPCo spends too much time trying to rationalize the difficulties they run into. Hood states that SER supplement 2 reflects the view of NRR and the Region.

16589-93 Landsman named three buildings he had design concerns about in previous testimony. He also thinks the BWST has an inadequate design. A 50.55 report was filed on this. The SWST deficiency is in the design of the valve bit monolithically collective with the ring beam. The BWST cracked and is being repaired. Landsman wants the record to show that the BSWT, SWPS, DGB and Aux Bldg all have inadequate original designs. Gardner has not seen CPCo's exhibits 36 and 37 (not yet admitted). He has already stated he doesn't think the QC inspectors understood the steps taken to eliminate the return option, reflected in these exhibits.

16594-600 Recross Exam by Mr. Marshall

Cook has been doing a survey, at regular intervals, of the work at Midland. He has stated he thought the work he saw was "slipshod." He hasn't changed his mind. Cook would have no qualms about living in Midland with his family if the plant were operating.

16601-06 Landsman is aware of work going on. They are pouring piers under a building and putting hydraulic jacks on the concrete forms to lift the building. The pier where the bottom dropped was the low-test pier W-11, used to verify silo parameters used in the reanalysis of the building. It is the smallest pier which they loaded with the highest load. It was expected to go down more than the other ones. It isn't causing the building to shift further. There are 57 temporary underpinning piers to be put in there. CPCo has put 6 in. The low test pier did not respond the way it was intended to. The NRC ran the load tests at their request after this problem occurred to verify soil parameters. NRC gave the applicant two choices -- to run a new load test or accept their estimate that the soil parameters were half of the assumption in the design. He has been verbally informed that the Applicant will reanalyze the whole building, so they don't know if the permanent underpinning wall is feasible. They are trying to increase the bearing area on the bottom to reduce the load under the piers. There are no underground water currents at this site. The bearing strata the piers are on is hard clay silt.

16609-12 Recross Exam by Ms. Bernabei

The panel of witnesses is familiar with the goals for integration of QC organization into MPQAD. This was included in a meeting in March. Shafer doesn't think it was an in depth discussion. Stamiris Exh. 80 is marked, but doesn't refresh Shafer's memory. No one on the panel knows if Exh. 80 represents the licensee's proposal for the integration of the QC organization. Gardner states that NRC asked CPCo to assume management control of QC and later asked them to recertify QC inspectors. He thinks Exh. 80 is internal directions taken by licensee to fulfill this commitment. The original request for CPCo to integrate the QC function took place on 9/29 in a public meeting. CPCo said integration and recertification would be completed by 4/83.

16613-20 The witnesses don't know if the administrative controls discussed on page 3, Exh. 80 have been done. Gardner doesn't think NRC staff placed specific controls on CPCo other than the separation of QC personnel from Bechtel management. The NRC has a concern about Bechtel inspectors reporting to Bechtel QC supervisors, though there is no regulatory requirement against it. It is not going to be a condition to approval of the CCP. In May 1981 the NRC requested CPCo's position on Regulatory Guide 1.58 (NRC position of ANSI N45-26) and Revision 1 addressing regulations of minimum experience and education. In generic letter 81-01 NRR asked all construction permit holders to explain their compliance with Reg. Guide 1.58 on a case by case basis. Then in 10/82 the NRC asked additional requirements re CPCo's first response. No one on panel knows the licensee's latest position on commitment to the Reg. Guide. Gardner is shown Stamiris Exh. 81, a letter from CPCo to Denton dated 12/3/82, answers to Questions 2 and 3.

16621-29 The document states new employees must meet the minimum education and experience requirements. Gardner doesn't think it clearly states what old employees must do. You could assume they will be recertified. There have been concerns in the past whether the certification process is a satisfactory substitute for the education/experience requirements. These concerns are documented in audits. Shafer states the certification process is used to measure experience and training. ANSI 45-26 stipulates requirements for QC inspectors, but states these aren't absolute. It allows someone to determine the acceptability of a person to perform inspection tasks based on other things. CPCo doesn't state in their response if they will require certified inspectors to meet minimum requirements for education. People without adequate training or experience had to be recertified. Even a person who had previously been an inspector at another site would have to go through CPCo/Bechtel training procedures and be recertified.

16630-35 A performance demonstration at QC training is an in the field demonstration given by the trainee to show that he can perform an inspection. The NRC was concerned about changes in scheduling performance demonstrations, which makes it hard for Region 3 to review them. One of the reasons for frequent changes is because employees must work at construction. The individual going out to perform construction inspections may already be certified to a given PQCl.

16636-40 Afternoon Session, Recross Exam by Ms. Bernabei

Hood states the Applicant has identified the BWST ring foundation as a design deficiency. Hood previously testified that its important to recognize the differential settlement that can be expected and determine it in a conservative manner. The structural design must accomodate that amount of settlement to avoid design deficiencies. At the PSAR stage they are reviewing design concept as opposed to detail design.

16641-44 Cook is shown Stamiris Exh. 82 re: a 2/24/83 meeting where the NRC expressed concern re changes to the performance schedule. Cook remembers being there. The major reason given for the changes was construction activities. Either the reviewer or the candidate would have to do construction activities. The licensee hasn't made changes to ensure these problems don't reoccur, in fact, it might have gotten worse. Landsman can't recall if he reviewed the PQCI for soil stabilization in Fall, 1982. Cook doesn't recall if he's seen Exh. 82 before (accepted into evidence p. 16644).

16645-52 Landsman is shown Stamiris Exh. 82, a letter to Turnbull (Bechtel) dated 8/19/82, with attached PQCI Inspection Record 7220-UP-C-1.013, Rev. O. He has seen it before. He reviewed it after the date and had criticisms of the PQCI. This copy from QA records vault didn't agree with the copies used in the field. He documented this criticism in his inspection report. He hadn't reviewed any other PQCI's for the soils area. They have reviewed procedures B-3M and B-3M-1 for training MPQAD personnel. Cook reviews Stamiris Exh. 84 to refresh his memory. It appears that Revision 1 is the same as Rev. O with some NRC recommended changes. It supplies to QC inspectors in the soils area.

16653-58 There are two procedures B-3M-1. One is revision O, the other revision 1. Both were written on 10/22/82. There are two deviation requests, #17 addressing B-3M, Rev. O and #21 addressing B-3M, Rev. 2 and subsequent revisions. On deviation request #21 it states B-3M applies to MPQAD personnel who perform inspections/overinspections. The corresponding procedure for NDE personnel is B-4M. B-3M doesn't apply to firms engaged in subcontract work. On 9/29 at the public meeting the licensee committed to certify all Bechtel QC inspectors

in accordance with their program. Shafer states that the Exhibit shows B3M-1 is limited to the QC personnel for soils work. At the 9/29 meeting CPCo agreed to integrate QC into MPQAD but everyone wouldn't be under MPQAD until 4/83. Not all QC inspections are certified to that procedure yet.

16659-63 Stamiris Exh. 84 accepted into evidence. In Spring 1983 Gardner had discussions with CPCo re independent 3rd party reviews proposed for Midland. He is shown Exh. 85. He isn't sure if its a schedule for the IDV that is the TERA review in the C10 or if it's on outline. The document has dates when certain work commenced or meetings occurred. Under item D, p. 3 it indicates Stone & Webster have been on site since 4/20/83, apparently in connection with the C10. No one on the panel knows if they have approval to do the Construction Implementation Overview. The notations on Exh. 85 are Gardner's. There is a notation of "six months....report...evaluation." Gardner isn't sure what it means.

16664-71 Gardner understood that in 6 months a report would be issued. He is shown Stamiris Exhibit 86 which is a handout presented to the caseload forecast panel about 3 weeks ago. The markings on it are Gardner's notations. The second page is the licensee's characterization of all closed inspection reports. One of the assumptions is that the schedule will be completed in a week with 5 inspector hours per day. Gardner's notation says that the 5 hour figure is too high. Exhibit 86 was prepared by CPCo for presentation and to estimate completion of Units 1 and 2. It is Gardner's personal opinion that 5 inspector hours seems high because set up time per day would make it unrealistic. He can't think of any specific instances where CPCo made other overly optimistic estimates. Cook recalls that the previous CPCo forecast to the NRC panel was optimistic and didn't agree with the actual results.

16672-84 Shafer states that the licensee is optimistic about their structure completion program. The witnesses have characterized these overly optimistic assumptions as a lack of understanding of the reinspection process. The cable reinspection also took longer than anticipated. Ms. Bernabei moves Exhibits 85 and 86 into evidence. Mr. Miller objects. The Board admits them. Brown and

Root designed the S. Texas plant. Landsman has identified design deficiencies at S. Texas re: differential settlement of the buildings. He doesn't know if he mentioned them in the investigation unit report. Landsman doesn't know if anyone ever did a design review at Brown and Root.

16685-91 Landsman states Mr. Blendy has been removed from the position in soils that he held. He isn't sure what position Mr. Horn holds. Landsman previously stated that Wells was "ultimately" responsible for hurrying the QC inspections. He expected Wells to utilize his authority to correct the problem. Gardner states that Shafer characterized this incident as an indicator of lack of qualification by Wells. Gardner has no opinion on this. He thinks Well's changing of the quality graphs indicates a poor management decision.

16692-93 Landsman referred to an incident re: bypassing hold points in the underpinning and the licensee stopped work for 16 hours. CPCo never mentioned the incident.

CPCo/MIDLAND
6/3/83 HEARING ABSTRACT

STAFF WITNESSES:

GARDNER
LANDSMAN
COOK
SHAFER
HOOD

HARRISON

GILRAY
LANDSMAN
SHAFER

- | <u>Page</u> | <u>Text</u> |
|-------------|---|
| 16769-87 | Preliminary matters. N.B.: Correction to Tr. 16479, line 6, which should read: "But, again, I cannot say". |
| 16787-89 | <u>RE CROSS BY MILLER</u> (cont'd)

Shafer doesn't think there is an undue emphasis on completion of the project on schedule at the expense of quality in <u>Stamiris Ex. 88</u> (transcript of the videotape prepared by Selby & Wall regarding QIP program). And, to the extent that the document expresses concern about doing it right the first time, Shafer agrees that it is in accordance with the regulatory philosophy he has expressed. Landsman and Cook also agree. |
| 16789-91 | Shafer states that Selby, as highest officer at CPCo, has responsibility for completing Midland on schedule. He also has responsibility for QA in the sense that all others -- including QA personnel -- report to him and that the CFR requires him to set policy according to Appendix B. As long as cost and scheduling functions are not done at the expense of quality, it is not a violation of Appendix B for Selby to have responsibility both for quality and for cost & scheduling. |
| 16791-92 | Landsman says CPCo did not inform him promptly with respect to the results of the audit of U.S. Testing. Cook and Gardner take the position, though, that the communication regarding this audit was adequate. |

- 16792-94 As for a separate incident involving the Carlson meters load test at pier 11, Landsman says he learned about the problem from a CPCo site employee. He describes this communication as "unofficial". Although three CPCo people were in Landsman's office at the time Landsman was informed of the problem, Landsman didn't inquire of them as to the incident: he used the situation as a test to see whether the CPCo employees would be forthcoming with information.
- 16794-95 Gardner states that under the CCP, PQCI's will be reviewed and revised as necessary, after which they will be used as part of the training session for QC inspectors. Landsman adds that where a PQCI is revised after the training session, the Level 3 QC inspector in charge of the particular area will determine whether retraining and recertification is required. Gardner says this aspect -- as well as all other aspects -- of the CCP is currently under review by the Staff.
- 16796-97 Shafer states that there is no present need to implement the commitment by CPCo that QC instructors who were not recertified by 4/83 would be precluded from acting as QC inspectors after that date. The reason there is no need, according to Cook, is that CPCo -- at the NRC's urging -- agreed to a less ambitious requalification program.
- 16798-800 Referring to Stamiris Ex. 82, an oral communications record by Mr. Ewert, Cook says that at a meeting they indicated to Ewert that the reason many performance demonstrations had to be rescheduled was that either the trainee or the person conducting the training had to perform ongoing inspection activities.
- 16800-801 Landsman says that acceptable corrective action was taken when the individual who encountered the loose sands (which washed into a pier) performed an emergency grouting operation. Cook agrees, and notes that the NRC was aware of CPCo's actions. He also notes that for such emergency situations it is not necessary for CPCo to first obtain a full work authorization.

- 16801 Shafer testifies that CPCo's current commitment in the CCP with respect to installed components and areas is to do a 100% reinspection. This position, he says is, the same one Don Miller took on 12/2/82.
- 16802-3 There is no formal process by which a Staff member may request that the licensee remove someone from a position, says Shafer.
- For example, in 8/82, when they had only recently assumed responsibility for the Midland project, Shafer and Warnick discussed whether Marguglio ought to be removed.
- They did not take a position in the issue, but the discussion was transmitted -- as would all similar discussions be transmitted -- to Keppler. Shafer then states that Marguglio is the only person who has been the subject of discussion between the Midland Section and Keppler.
- 16803-5 However, there have been other discussions among the Midland Section members as to whether other CPCo employees who should be removed. [Gardner, in earlier testimony, described the decision-making process within the Midland Section as a "consensus".]
- Shafer is not sure that in any of these discussions the group has gone so far as to decide on making a recommendation to management. Cook agrees with Shafer's characterization of this decision-making process; Landsman is not sure what Shafer said.
- 16805-6 Shafer believes the decision to reassign Marguglio was made solely by CPCo. He does not know whether the Midland Section's consensus opinion about Marguglio was communicated to CPCo.
- 16807 Referring to earlier testimony (in response to a question by Bechhoefer) where he said he never formally requested removal of anyone, Shafer insists that it is not his testimony that Jim Cook and Wells ought to be removed.
- 16807-17 [Attempt to clear up confusion about the meaning of "design deficiency" in Landsman's testimony at Tr. 16319 and 16507: Is an obvious design defi-

ciency one that results in a structure that cannot be operated with due regard for public health & safety, or is it one that is not optimum, but acceptable?]

Landsman appears to take the latter position: a design deficiency, he says, means a design that is not adequate, but that "adequate" is a matter of opinion. For example, if the SWPS and Aux. Bldg. (which has the cantilevered overhang design deficiency) had been built on properly compacted soil and as originally designed, they would have been licensable.

Landsman believes, however, that they would have experienced settlement problems sometime during the plant's 40 year life, causing cracks, and resulting in possible shutdown by the NRC.

16817

BY BOARD

There is no NRC regulation that says having an unqualified individual in QA is grounds for issuance of a noncompliance. There is, however, such a regulation with respect to auditors.

16818-19

Gardner states that if instead of adopting the ANSI N45-26 standard for qualifications of QC personnel a licensee adopts the waiver that is permitted under that standard, the NRC should, at the start of construction or soon thereafter, examine the licensee's program to check for any abuse of the waiver.

Gardner sees much improvement in CPCo's recertification process: CPCo has stipulated that for new hires it will use the full ANSI requirements.

16820

BY BERNABEI

Under the new recertification program, says Gardner, QC personnel will be recertified as category 1, 2 or 3.

Not all QC inspectors are being recertified: e.g., B&W and HVAC inspectors are not. Gardner doesn't know what date CPCo has set for completion of the recertification.

16821-25 Gardner says that in at least once instance of reviewing PQCI's he observed that some of the PQCI's still had references to IPIN's. CPCo was informed, and agreed to delete the reference.

Cook notes that CPCo is currently updating its PQCI's, and that the Staff has been reminding CPCo that it must use only currently revised PQCI's to train personnel.

Landsman says that schedule pressures have led to problems with PQCI's; e.g., if any questions arose during the training period, they would be answered before the inspectors were certified. He doesn't think this will happen again, though.

16825-26 Cook doesn't know whether CPCo's current revision of PQCI's has affected the schedule for recertification of inspectors.

16826-27 BY BOARD

Referring to the "three concerns" (including the "low threshold" matter) that he previously testified about, Landsman says he would have added them to his 2/15/83 memo had he known of them.

As with the other concerns noted in the memo, he would have recommended that they be resolved before allowing CPCo to proceed with the underpinning.

16827-31 [Board asks whether Quality Improvement Program (QIP) documents recently produced shed any light on adequacy of CPCo's underpinning work]. Landsman says that under the QIP, CPCo rewards its site engineers for good work; it has nothing to do with the work itself.

The Staff has asked CPCo to extend QIP to Mergentine and Spencer, White & Prentis, but Landsman doesn't know whether they've done so.

Shafer states that, based only on the documents he has seen, CPCo's record in 1980-81 indicates that QIP was not working -- at least in that period.

BY BERNABEI

16832-33 Referring to the incident where he was informed of the load test problem at pier 11, and then waited for CPCo to initiate any discussion of it, Landsman says the Staff later confronted CPCo about the problem [see Tr. 16792-94]: Landsman, along with Warnick & Cook, called Mooney. He doesn't recall Mooney's response.

Cook states that Mooney informed them -- shortly after the phone call -- that the instrumentation and other concerns associated with the pier had been properly tested. Consequently, the Staff signed a work authorization allowing CPCo to test the pier.

[Landsman is sure that if CPCo had ever acknowledged that it should have provided the information in a more timely fashion, it would have called it a "misunderstanding".]

16833-40 Shafer says there was never a "majority view" -- as opposed to a consensus -- among members of the Midland Section as to whether certain CPCo employees other than Marguglio should be removed.

However, if any individual or group of individuals in the Section were to recommend removal, that information would be transmitted to Keppler regardless of whether the view was shared by the entire group.

Landsman indicates that they never made formal recommendations to Keppler on a consensus or majority basis because to do so would be futile. They often informally discussed CPCo individuals whom they wanted to remove, though.

Cook, citing the Marguglio example, says that the Midland Section generally hoped that CPCo would recognize and resolve the problems with personnel on its own.

16841-43 According to Cook, the individuals whom the Midland Section felt should be removed include Mooney, Schaub, Fisher, and Jim Cook (from time to time). Shafer and Landsman agree.

16843-48 Shafer says CPCo presently has a commitment to do a 100% reinspection.

John Harrison, current Section Chief of the Midland Section, states that while the NRC position currently requires a 100% reinspection it is reviewing proposals to reinspect on a sampling basis. The NRC is not yet ready to discuss it.

BY MILLER

16848-50 Landsman says the Midland Section received the advice about not mentioning names (of those individuals whom they wanted to remove) from Mr. Davis, NRC Assistant Regional Director.

[Panel Excused]

16851 NRC STAFF PANEL: GILRAY, SHAFER & LANDSMAN

BY PATON

[Corrections to testimony, which follows Tr. 16854 and Tr. 16859]

16860-61 BY BERNABEI

MPQP was the result of a meeting between CPCo and NRC in about 3/82 where they discussed underpinning. [But see Tr. 16921-24]. The NRC wanted a QA plan outlining a skeleton of CPCo's program.

The current revision of MPQP 1 P1 and P2 was CPCo's attempt to ensure that they were up-to-date, as required by the 4/30 court order.

16863-65 Shafer says the integration of QC into MPQAD is identified in Revision 4 of the MPQP-1.

CPCo made this and other revisions to the MPQP in order to update its procedures to current commitments.

16867-70 Landsman and Shafer agree that ¶2 p. 2 of MPQP 1 (Rev. 5) is a management instruction for reviewing and approving major decisions for the underpinning work. They have no opinion about the adequacy of this instruction; however, Gilray says it is "acceptable".

- 16871 Landsman states that the three incidents to which he testified earlier indicate that CPCo is not implementing MPQP 1 and MPQP 2 properly.
- 16871-72 Landsman says MPQP 1, Rev. 5, p. 6 indicates that Bechtel is responsible for coordinating the activity of the underpinning subcontractors. Shafer adds that Bechtel performs over-all-on site management of all construction activities, including coordination.
- 16873 CPCo QA engineers are responsible for reviewing and approving the PQCI's. Landsman thinks their evaluation of PQCI's is adequate; they just aren't implementing them properly.
- 16873-74 CPCo's recent audit of U.S. Testing was not done pursuant to either MPQP 1 or 2, says Landsman. Rather, it was done by the balance of plant personnel as part of their normal audit function.
- 16875-76 Landsman agrees that pp. 16-17 of MPQP 1 (Rev. 5) indicates that subcontractors are responsible for implementing training for their QA activities.

Principle subcontractors include Mergentine (who is doing most of the underpinning of the aux bldg), Spencer, White & Prentis, and Wiss Janey Assoc. MPQP 1 addresses the procedures, subcontractors' procedures, but not in detail.

- 16876-77 Because CPCo has ultimate responsibility for its contractors and subcontractors, it must review the subcontractors' training. MPQP 1 sets forth standards by which CPCo must conduct such reviews. Shafer notes that MPQAD does in fact provide QA training to people who do soils work.
- 16877-80 Gilray summarizes his 1981 testimony on the effects of the MAC evaluation, the Crosby program and QA program updates on the QA program at Midland. He has no comment on whether these efforts resulted in any improvement in implementation of the QA program, though, because his area of responsibility doesn't include implementation.

Shafer says that the Staff is unhappy with implementation [and not the QA program itself].

16881-82 Because of the soils remedial work, say Shafer and Landsman, a separate quality plan -- such as MPQP 1 and 2 -- would have been required even if everything else had worked out as expected.

16883-89 In his 1981 testimony, Gilray felt that the addition of Cook and Rutgers to the CPCo management would create a new management attitude toward QA, and bring integrity and credibility to the QA program. [See Tr. 3714-15 and 3713.]

Landsman reiterates that Cook and Rutgers are not implementing the QA program properly.

BY SINCLAIR

16889-91 Landsman doesn't know whether plans such as MPQP 1 and 2 exist at other facilities.

16892-94 [Board allows testimony on any incidents not already described on the record which reflect a failure to implement the MPQP 1 and 2].

Referring to the MPQP 1 (p. 8) requirement that design documents be "checked for compliance to design requirements," Landsman states that "50 work packages" were not adequately reviewed. This incident is the subject of an IR, but he doesn't recall which one.

16894 The reason CPCo did not receive a noncompliance for this incident, says Shafer, was that the work had not yet begun, and so an issue of NC did not arise.

16895-96 Referring to MPQP 1, Rev. 5, p. 5 (breakdown of management and the purposes of each part of the plan), Landsman says most of the organizations -- e.g., CPCo site management, Bechtel Project Management, Bechtel Engineering, Bechtel Geotechnical Engineering -- have at some time been responsible for inadequate implementation of the plan.

There is no way to pinpoint which organization is responsible for individual incidents.

Shafer feels that if CPCo were to concentrate on the weakest link in the chain, there might be an improvement.

16897-98 Landsman expects that if CPCo is doing its job it should be able to "get a handle on past mistakes." The excavation permit procedure is one way in which CPCo could perhaps improve its performance.

Because such permits require signatures of approval, there is more accountability for decisions that are made.

16898-902 Referring to Byrd's prepared testimony at Q.6, p. 7, re: the reason for creating MPQP 1, Landsman says an additional reason is that the complexity of the work required a quality plan that would "tie everything down."

He agrees that the contractors' technical qualifications were excellent in the kind of work that had to be done. He goes on to say that their work at Midland has been merely "acceptable."

16903-05 Landsman thinks Mergentine is doing a good job, but that CPCo and Bechtel personnel are causing trouble; i.e., they place cost and schedule before quality.

16905-10 Referring to his 1981 testimony at Tr. 3717, Gilray says that the enhancements that have been instituted would "probably create a proper implementation of the QA program."

Partly as a result of information gained through discussions with CPCo and Region III, he thought at the time that the QA program could be properly implemented. He has no opinion as to whether MPQP can be properly implemented.

BY WILLIAMS

16911 Purpose of the CPCo and Bechtel Topical Reports (referenced in MPQP 1, Rev. 5, p. 2), according to Gilray & Landsman, is to set forth QA programmatic controls.

16912-13 Shafer says that detailed commitments as to the implementation of the QA program are contained in the Topical Reports, and that MPQP 1 shows in part how the commitments are to be implemented with respect to underpinning.

- 16913-14 Shafer states that CPCo made a commitment on 9/24/82 to certify QC inspectors with respect to soils work, and made a similar commitment on 9/29/82 with respect to the balance of the plant. The use of 1978 ANSI standards was part of the 9/24 commitment.
- 16914-15 CPCo has submitted a Revision 6 of MPQP 1 to Region III, but Landsman has not yet reviewed it in detail. The plan will not be implemented until the Staff reviews and approves it.

BY BOARD

- 16915-17 Even though QC inspectors are Bechtel employees, says Shafer, their connection with Bechtel has to do with administrative bookwork only. See Staff's 3/83 testimony at Q. 8, re MPQAD's responsibility for hiring, training and certifying QC inspectors.

MPQAD has an overview function whereby it "over-inspects" Bechtel's supervision of QC inspectors who are not directly hired, fired and trained by MPQAD.

This function is necessary in order for MPQAD to have full responsibility for QC. Landsman has no indication yet that the overview function is proceeding satisfactorily.

- 16918 [Response to the question of why the U.S. Testing Audit was not performed under MPQP 1 -- even though their work was related to underpinning -- is unclear].

- 16918-20 Even without the 4/30 order, says Landsman, Mergentime would have had to have its own QA plan, as required by the "general plans" that say a subcontractor must have such a plan. In his testimony at Tr. 16904-05, Landsman says he did not mean to imply that the underpinning subcontractors could do a better job without the QA controls that have been placed on them. He meant that Mergentime and QC are doing their job; but upper management personnel (including QA, CCP and Bechtel Site Construction upper management) are more concerned about cost and scheduling than about quality.

16921-4 When the subject of subcontractor Mergentime was discussed at these hearings in 1981, it was known that Mergentime had no QA plan of its own; thus it would be required to follow an "overall plan" provided by Bechtel or CPCo.

However, Bechtel's and CPCo's overall plans (i.e., Topical Reports) were not a sufficient guide for subcontractors, and, as a result of meetings between NRR, IE and CPCo in 1/82 or 2/82, the MPQP was created to provide such guidance.

16925-6 Shafer says the fact that Bechtel retains some administrative control over QC inspectors has not adversely affected MPQAD's ability to carry out its inspection duties.

16927-8 Landsman says the panel has no problem with the use of the term "overview" in MPQP 1 (Rev. 5) at p. 1 as a description of the activity and relationship of CPCo upper level management with respect to QA.

Shafer, referring to organization charts attached to Wells' testimony which show dotted lines of authority, says he interprets "overview" to mean acting in an advisory capacity.

16928-33 The last full paragraph on p. 3 of MPQP 1 (Rev. 5) reflects the agreement between Staff and CPCo that certain items or activities may be excluded from the QA program.

The Staff, says Landsman, reviews all items that are to be excluded: CPCo does not do any work without authorization by the Staff.

[To make it clear that items might fall under the "general" exclusions (referred to in the document) do not escape review by the Staff, CPCo agrees to delete the term "general" from the MPQP]

16934-7 Gilray states that his 1981 recommendation (Tr. 3847) that there be adequate documentation of a QC inspector's ability where the waiver provisions of ANSI have been invoked is now a regulatory requirement.

Gardner has indicated to Gilray that the documentation is in fact adequate. Landsman has not reviewed it and has no comment.

16935-6 In addition to the suggestion made in 1981 by EJG that Selby should become more involved in the project (See Tr. 3852), Gilray would suggest that the person who is "responsible" talk with top management at the NRC about CPCo's commitments and the time frame for the commitments.

BY BERNABEI

16938-41 In contrast to EJG's view that a QC inspector's education should be the primary concern in deciding whether to approve a waiver of the ANSI standard, Gilray thinks that ability, as shown through proficiency tests, is most important.

Landsman feels that there are inspectors at Midland who have neither proper education nor adequate experience to do the job, and that CPCo and other licensees have not always followed the intent of the ANSI standard in their attempts to waive the standard. The Midland team has begun the review CPCo's interpretation of the ANSI standard.

16942 The fact that Bechtel retains some administrative control over QC inspectors has not adversely affected the inspectors' performance, but Shafer says the Staff is monitoring the situation. [Repeat of Tr. 16915-17]

16943-44 Shafer says the NRC could, by the use "escalated enforcement", require CPCo to remove Bechtel personnel from any supervisory authority over QC inspectors if a safety issue were involved.

Although the Midland section has recommended that QC inspectors not report to Bechtel QC supervisors, it has not recommended an enforcement action in that regard because no safety problems have arisen.

16944-46 MPQP 1 provides for periodic audits of underpinning work. Landsman would expect a periodic audit conducted under MPQP 1 to find problems similar to those found by the U.S. Testing audit (which was not done under the MPQP 1).

Shafer doesn't recall whether the MPQP 1 audits he has reviewed uncovered the same problems that were found by the U.S. Testing audit.

BY SINCLAIR

- 1694-47 Landsman says U.S. Testing has inspected some concrete, but he doesn't know whether they have inspected concrete in the underpinning piers.
- 16947-50 Landsman thought [but is not sure?] that U.S. Testing was covered by MPQP, but he's sure the concrete work was covered.
- [Shafer notes that under the Board's Order, an "acceptable quality plan" -- which every sub-contractor must have -- is not necessarily limited to MPQP 1 and MPQP 2. Board says that is correct.]
- 16951 In response to a question about whether the Staff's investigation into the U.S. Testing audit included an evaluation of the quality of concrete already in place, Landman says, "Only if we can determine from the U.S. Testing records that the concrete is acceptable." If concrete were not acceptable, "there would be a lot of jackhammers on site."
- 16952-53 Landman says the Staff will be investigating whether U.S. Testing's compaction records are reliable, but that right now it is not an issue.
- 16956 Sinclair Exh. 4 (for ID).
- 16957-58 Shafer says there is nothing in the MPQP that would improve communications between QA site management and top management. In a 9/17/82 letter, though, CPCo made a commitment to get the Chief Executive Officer involved in periodic meetings regarding remedial soils work. [See attachments to JGK and JWC testimony].
- Landsman and Shafer do not know whether top management has in fact carried through with that commitment.
- 16960 Gilray has no suggestions on how to make management more knowledgeable about and relate more directly to what is happening at the Midland plant.

BY WILLIAMS

- 16960-61 In his testimony at Tr. 16915-17 about Bechtel QC supervisory personnel, Shafer was referring to the actual function of such personnel as supervisors, not to any new function.
- 16961 Landsman's testimony at Tr. 16938-41 about QC inspectors who were certified without enough education or experience had reference to an earlier inspection [5/81]. He doesn't know whether it is currently a problem.
- 16961-62 Landsman doesn't recall what he meant when he used the term "on the lab", in connection with three instances of problems with soils work that [allegedly] illustrated how people weren't adequately doing their jobs.
- 16964-67 Shafer clarifies earlier testimony regarding who told the Staff to avoid naming those individuals whom it wanted removed from CPCo management: he states that he informed Davis of the "rumor" about Marguglio threatening to sue anyone who sought to remove him, but he can't recall where he received that information.

Abstract
6/4/83

Beginring on Tr. 17016, Examination of James Mooney. Examination of Walter Bird on 6/4/83 is not included here.

17016-7 DX of Mooney. Prepared testimony accepted into the record.

17018 Supplemental DX by FCW.

Specification for response to cracking in FIVPs: an alert level requires notification of consultant, Construction Technology Labs. CPCo must bring consultant on site to investigate cracks.

17019 There are 2 alert levels: any new crack greater than 10 mils and any existing crack which exceeds 30 mils.

On site, consultant must immediately observe cracks. He must then give a verbal report within 2 hours and follow with written report.

Procedure requires consultant to recommend action.

17020 CPCo then evaluates recommendation and implements it.

Crack in west FIVP (Unit 1) did reach alert level during proof-load. Cracks were mapped after proof-load test: one crack measured ten mils.

CPCo implement procedure: notified consultant. Consultant evaluated crack and said probable cause was pipe hanger at roof of FIVP.

Consultant's recommendations for proof-load of Unit 2: disconnect pipe-hanger on Unit 2 prior to test; install additional gauges; proceed with jacking; and then provide consultant with crack map and data from instruments.

CPCo implemented the recommendations.

- 17021 Consultant provided required written report on Unit 1 cracks. Initial report did not have benefit of data from Unit 2 jacking. CPCo provided Unit 2 results and consultant amended report. There were some minor cracks in Unit 2: none reached alert, and they were in different locations from those on Unit 1.
- Based on information from Units 1 and 2, consultant concluded the principal cause of Unit 1 cracks was load of pipe (hanger). Residual stress may have opened up some of smaller cracks. Consultant did not officially report on Unit 2 cracks (did not reach alert) but thought probable cause was residual stress.
- 17022 CX by Bernabei. Mooney is electrical engineer by training.
- Prior to present position Mooney was Project Manager for Farley Nuclear Plant and had responsibilities for all aspects of completion and start-up of those 2 units. Before that, Mooney was Manager of Construction Services for Alabama Power Co.
- 17022-3 In that position, he had direct responsibility for soils group and the concrete section. Thus far he has some knowledge about soils.
- 17024 Mooney has no soils engineering training, nor geotechnical training, nor training or experience in geology.
- 17025 The remedial soils work is unique in nuclear industry but it is not necessarily complex.
- The work requires some experience in geotechnical engineering.
- Mooney is located in Jackson. Not located on site on daily basis.
- Mooney is single point of accountability for the soils program.

17027 Mooney not specifically aware of any criticism (from NRC) that single point of accountability should be onsite.

Do not think it is necessary that single point of accountability for remedial soils be onsite daily. There is much more to Mooney's job than implementing construction: must see that engineering is done right, and that function is in Ann Arbor.

Mooney also interfaces with NRC on technical matters - i.e. with NRR.

17028 Other than Chair of Quality Improvement Council for Midland, Mooney has no responsibilities beyond single point accountability for soils.

Mooney is concerned with any NRC concerns.

17029 If NRC was concerned that single point accountability should be onsite, Mooney would also be concerned and would want to know basis of NRC concern.

Does not recall being informed of any such NRC concern.

Mooney would be concerned if NRC felt he was not qualified for his job.

Mooney would be concerned if NRC inspectors at Midland felt he'd not been honest and forthright with them.

17030 Mooney would be concerned if Landsman said Mooney had not been forthcoming with certain information. Mooney heard Landsman's testimony of such failure to be forthcoming.

Mooney thinks he has been very forthcoming.

17031 Bernabei refers to Tr. 16791-2.

Meeting in Chicago described by Landsman included Bob Wheeler but not Mooney.

Mooney is advised of all meetings between CPCo and NRC.

17032 Mooney aware of indications of problems with Carlson Meters. Not sure if he knew of the problems at time of Chicago meeting.

In normal course of business Mooney would be notified of such problems, in a timely fashion. So Mooney was probably aware of problem with Carlson meters within hours after it occurred.

17033 Mooney does not personally notify Landsman. Landsman normally communicates with Wheeler.

Mooney has no knowledge of the Chicago meeting. Mooney has no reason to believe Landsman's testimony (that Wheeler did not notify Landsman about Carlson meters) was not accurate.

Landsman should have been informed as soon as CPCo determined there indeed was a problem. Mooney does not know what the state of knowledge was at time of Chicago meeting.

17034 By "assessment" prior to notifying NRC, Mooney means determination of facts of the potential problem. "Assessment" could be a simple 5-minute review. Mooney not referring to extensive review for reportability: you just assess whether it is significant enough to report.

17036 Given assessment of significance of Carlson meter problem, either Mooney or Wheeler should have informed Landsman at or near time of occurrence. Mooney became aware of problem around noon, reviewed situation, and NRC was informed in afternoon. Mooney is speaking from vague recollection.

Mooney doesn't know date of problem.

17037 [Manifest confusion: which specific problem are we addressing?] Talking about meters' not working or about problems with QC inspection?

Problem occurred during construction of Pier 11 west. Problem with records didn't surface until sometime during the load transfer itself.

17038 Mooney was notified with couple of hours after it [which?] was identified.

There is normally a meeting with Region III every couple weeks in Chicago. All the meetings deal with work procedures.

So Mooney doesn't know date of meeting. Cannot recall date he notified NRC of problem.

17038-9 Landsman testified that we bypassed some hold tags on Pier 11. James Mooney not aware of hold tags bypassed on Pier 11.

Mooney is aware of a hold tag problem on a different pier.

17040 Stamiris 89 marked for identification. [Novak to Board, 5/24/83]

17041 Stamiris 89 refers to drifts for access to piers, not to installation of pier itself. Mooney is aware of this hold tag problem. But it is not the problem he mentioned earlier.

Stamiris 89 5/24/83, Board Notification on Violation of Hold Tag During Remedial Underpinning Construction, contains memo Eisenhut to Warnick [?]

17043 Mooney heard Landsman testify about incident in Stamiris 89.

Mooney believes Landsman spoke of 3 incidents.

17044 Mooney has called Landsman regularly over last few months. "Courtesy calls" have been going on for quite some time. They have been intensified in recent weeks.

17047 Bernabei refers to Tr. 16702-3, starting at Line 21 (6/2/83). Landsman testifies that courtesy calls began after the "three incidents".

For quite some time it has been practice to call Landsman regularly and update him. That effort has intensified in recent weeks.

- 17049 Courtesy calls began prior to the incidents described by Landsman.
- 17049 Bernabei refers to Tr. 16539 lines 5-24: Landsman describes relationship with Mooney since 3/82.
- Landsman says he has had nothing but misunderstandings with Mooney since 3/82.
- Mooney does not agree with that characterization.
- We have had many meetings and discussions.
- 17050 Certainly understandable that we don't always fully understand each other.
- Our relationship has been very professional. Mooney has always tried to be truthful and forthright. He has never intentionally misled Landsman.
- Landsman apparently disagrees with that evaluation.
- Stamiris 89 accepted into evidence.
- 17051 Bernabei refers to bottom of pg. 2 of Mooney's testimony: technical difference relating to quality requirements for underpinning.
- CPCo felt temporary underpinning facilities should not be deemed safety-related. NRC said they should be.
- CPCo and Staff stated their positions on 3/10/82. Within 20 days we agreed on course of action.
- 17052 CPCo accepted Staff position. There were many discussions about specific items, especially instrumentation system, in the 20 day period. Weren't really any further discussions on general concept presented at 3/10/82 meeting.
- 17053 There were less than 1/2 dozen such discussions on specific items.

CPCo met with NRC Region III in 4/82 about SALP Report. CPCo indicated then that SALP ratings were incorrect. Mooney not aware if CPCo discussed whether soils rating specifically was not correct. Mooney attended 4/82 meeting but not aware of details of follow-up meetings. Mooney has read CPCo's original response to SALP but did not have any direct responsibilities for preparing it.

17054 Mooney knows Region III was disturbed by initial response to SALP.

There were discussions (in public meetings) about possibility of Keppler's changing his "reasonable assurance testimony".

Mooney participated in 8/26/82 meeting with Selby and J. Cook in Keppler's office. Keppler reviewed some of his Staff's concerns.

17055-6 Keppler presented some general recommendations from his staff. To best of his recollection, there was discussion about requiring an independent 3rd party look at vertical slice of [a?] safety-related system. Also discussed recommendation that QC inspectors be independent of BPCo and report to CPCo. Also discussed increased involvement in QA by CPCo senior management. All these topics were discussed as concerns about QA implementation, not as direct requirements. But Keppler did present recommendations, not orders.

17057 Mooney believes Keppler also said NRC was considering increased inspection.

Keppler also said CPCo should review his concerns and get back in following week to discuss appropriate action.

Keppler did not at 8/26/82 meeting suggest CPCo provide written get well plan.

Bernabei refers to 15178-9 (5/2/83 exam of Keppler), lines 12 and following.

17058 At 8/26/82 meeting, NRC went over Staff concerns/recommendations and asked CPCo to think about them and come back to discuss CPCo proposals. NRC did not then ask for a written program.

Bernabei refers to 15207. In testimony Keppler refers to a get well program, but it was not called get well program at that time.

17508-9 At 8/26/82 NRC informed CPCo of details of concerns. 9/2/82 CPCo presented recommendations. As result of 9/2/82 meeting, CPCo was asked to document CPCo program.

17059 CPCo was asked to come up with a program. They felt obligated to do so and did do so. In that sense there was an NRC mandate to produce a program.

9/2/82 CPCo presented recommendations, but it was not at that point a draft of what became 9/17/82 letters.

17060 Presentation was in form of written one-liners and a handout. Discussed that handout at 9/2/82 meeting between Region III and CPCo.

There were not significant changes made in concepts presented. Material used at 9/2/82 meeting was series of one liners. Based on 9/2/82 discussions, Mooney proceeded to develop a written program, eventually submitted as 9/17/82 letter.

9/17/82 letters were a development of concepts listed in handout of 9/2/82 meeting.

Mooney drafted 9/17/82 letters.

17062 Bernabei refers to appendix 2 to Mooney's testimony. Reference there to favorable ACRS comment on soils review is from late April 82 meeting of ACRS subcommittee. ACRS issued report on meeting.

In form report was typical ACRS letter.

17063 Bernabei refers to 6/8/82 ACRS letter in SSER #1. ACRS meeting Mooney referred to was, he believes, 4/29/82. ACRS subsequently issued a letter. Mooney not sure if the 6/8/82 letter is that letter.

17064 6/8/82 letter does cover 4/29/82 meeting, and appears to be the letter Mooney was referring to in his testimony. Subcommittee's favorable comment on thoroughness and conservatism of approach to remedial measures is on page 2. Mooney reads it.

ACRS letter says ACRS Staff is generally satisfied with CPCo's approach (to soils work).

17066 Mooney construes ACRS comment to be favorable; if there were significant problems a letter would have indicated them in great detail. Such is the usual ACRS approach.

6/8/82 ACRS does call for broader assessment of design quality and adequacy and construction quality (pg. 2, 3rd paragraph). ACRS call is directed to NRC.

17067 Therefore, CPCo letter would not mention that "call". CPCo 9/17/82 letter does not mention it.

On page 3 [of 9/17/82 letter, in appendix to his testimony] Mooney refers to work authorization procedure and work permit system. Work authorization procedure is procedure signed by Shafer and Mooney and specifies how NRC will release work.

In general NRC only releases work (with written release) in response to written request from CPCo. Procedure allows for other methods of approval.

17068 Work permit system was instituted in summer of 82.

Work permit system is an internal system controlling release of work to people onsite. NRC authorization does not do that.

Work permit system involves request to Wheeler's group to review proposed work to NRC procedures and to verify that approval [from NRC] has been obtained. Wheeler's group then signs release for the work. The authorization procedure wouldn't do that.

Authorization procedure was established after an alleged violation of Board Order.

"That was after a stop work was ordered in the soils area".

17069 In Work Authorization Procedure, NRC releases work; in Work Permit System CPCo release contractor to do the work. Together procedures require CPCo and NRC specifically authorize work.

- 17062 Sentence in 9/17/82 letter (p.3, 3rd sentence, first full paragraph) accurately reflects way Work Authorization and Work Permit Systems operate.
- 17072 NRC authorizes work and CPCo then authorizes work. It is a 2-step process.
- 17073 Referenced sentence does not suggest who was responsible for (initiated) work authorization procedure; it merely states how work is controlled.
- 17074 Bernabei refers to pgs. 3 - 4 of 9/17/82 letter (soils).

Paragraph refers to 3-hour QA indoctrination session. Indoctrination program only goes down to level of foreman. Letter does not address QA indoctrination for workers on site.
- 17075 Federal regulation of nuclear industry is one of 4 parts of indoctrination session.
- 17076 NRC portion of indoctrination discusses NRC organization, the inspection process, what CPCo obligations are, and how CPCo "interfaces" with NRC. NRC portion doesn't deal with federal regulations.

It is appropriate that people understand CPCo's obligation to ensure that work complies with federal regulations.
- 17077 The four items do not receive equal time or emphasis.

Section on federal requirements and NRC inspection is a brief introduction. Then there is specific discussion of procedures in place as a result of following regulations. Then there is detailed discussion of soils remedial quality plans -- MPQP-1 and 2. That consumes most of the time.

Mooney doesn't think the 9/17/82 (soils) letter addresses background of personnel teaching indoctrination session.

This [procedures, MPQP?] particular segment is taught by MPQAD. Other parts are taught by other people.

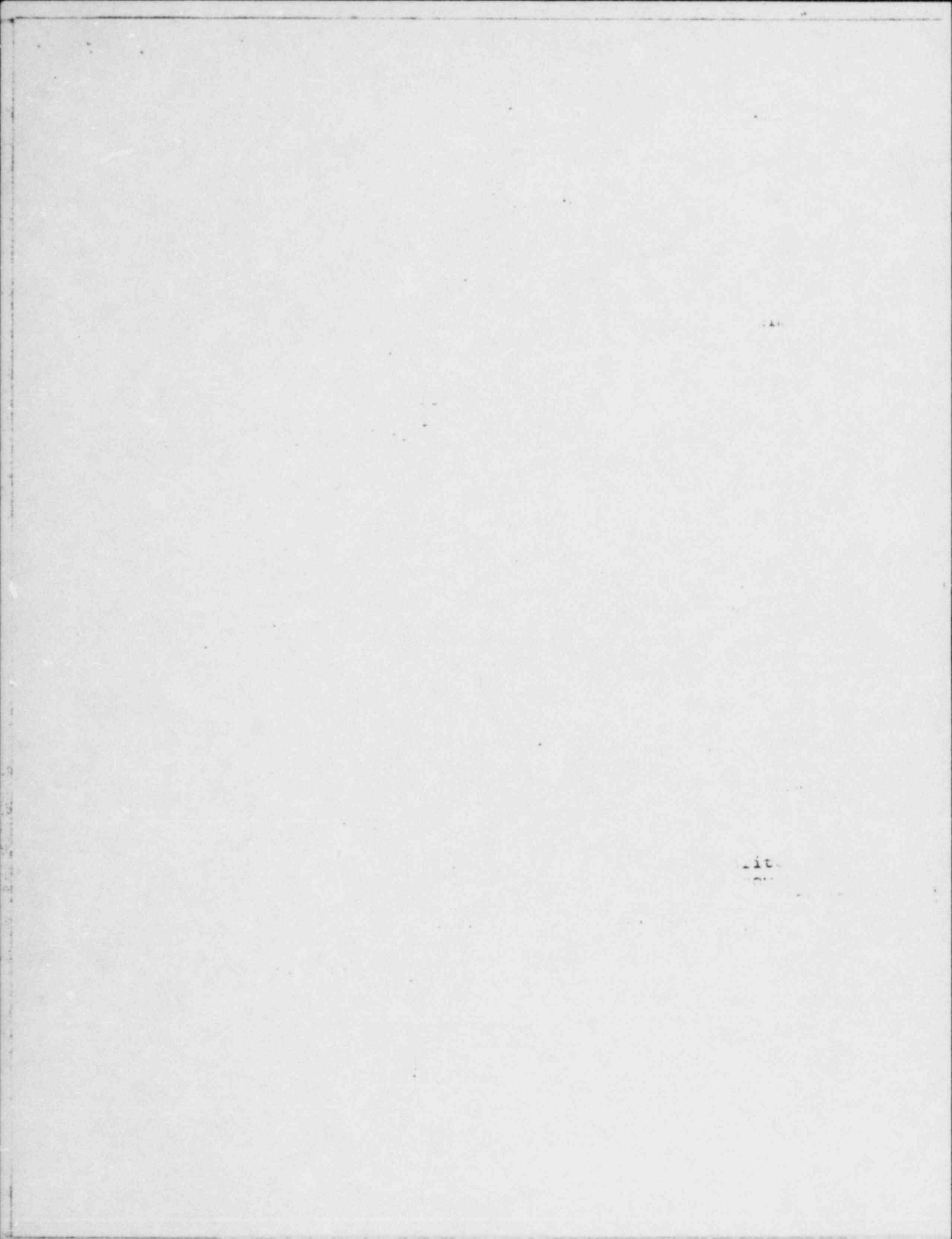
A given segment is usually taught by organization responsible for the given procedure or activity.

12-

12/11/87

87

Bill
m ar



Abstract
6/6/83
Continued Examination of James Mooney

<u>Page</u>	<u>Text</u>
	CX by Bernabei, continued
17112-3	<p>Bernabei refers to pg. 2 of Mooney's testimony.</p> <p>The technical difference between CPCo and NRC was whether or not temporary underpinnings would be Q and whether MPQP-1 would apply to that work.</p> <p>Prior to 3/10/82 meeting Mooney was not aware what Staff's position was. After 3/10/82 CPCo presentation Staff stated that all construction activities in the underpinning areas should come under Q program. CPCo didn't agree at that time with that position and wanted more time to consider.</p>
17114	<p>CPCo position was that temporary supports should not be covered by Q program. Did point out that certain temporary piers were certainly of significance to CPCo and agreed to apply an identical type of program to certain piers. But they (these piers) were non-Q.</p> <p>Also CPCo position that support of non-Q structures (e.g. Turbine Bldg.) was non-Q.</p> <p>Mooney would have to see 5/10/82 (?) letter to see if CPCo position was that non-Q buildings and supports which could effect Q structures would not be Q.</p>
17115	<p>Marks Stamiris 90 for identification: Hood's summary of 3/10/82 meeting.</p> <p>Mooney: Stamiris 90 is not complete; there were a number of other attachments. Does include MPQP-1.</p>
17116	<p>Hood summary says CPCo position is that non-Q buildings and supports which can affect Q structures are non-Q. However, evaluation of the effect of such non-Q structures on Q structures is Q. This was CPCo position.</p>

CPCo position was that temporary support of EPA, which support does not become part of final support, is non-Q.

17117 CPCo came up with a "QA" ["Qa"?] category for items CPCo did not wish to apply Q classification. Such "Q" items although not safety-related are of significance to CPCo and, thus CPCo would apply a "Qa" program to them. This program was same as MPQP-1, but without reporting to NRC.

Staff decided not to accept this second classification. Sometime later CPCo accepted Staff's definition of Q-related structures and components, after a series of discussions.

17118 CPCo accepted Staff's position on 3/30/82.

Pg. 4 of Mooney's testimony refers to Work Authorization Procedure. That was entered into after a stop-work in soils area.

J. Cook reviewed and commented on final draft of Work Authorization Procedure.

17119 At time of J. Cook's review of Procedure, CPCo and NRC were working from draft. Mooney reviewed that draft over the phone with J. Cook. It was not at the time of J. Cook's review signed or agreed-to-be-signed.

Draft prior to J. Cook's review was substantially as it is today: CPCo must get prior written approval from NRC.

17120 Mooney does not recall a comment by J. Cook on draft that CPCo should be able to proceed with soils work at own risk.

17120 Mooney remembers telling Shafer that Cook would like to make some suggestions, but does not recall what those suggestions were.

Mooney knows Shafer said Cook did suggest such a change (proceed at own risk). Mooney does not recall, but Shafer may be right.

Mooney believes there has been improvement in soils work in period since summer 1982 --considerable improvement since September '82.

17121 Sometime prior to mid-September we were having significant problems in several areas.

At that time Mooney did not normally receive the trends. Would not have been familiar with whether there was an adverse trend in quality in soils at that time.

Mooney assumed position, essentially, in 12/81, and would have had overview of soils area since then. Should have received some quality trend graphs.

17121 Stamiris 91 marked for identification - includes a quality trend graph.

17123 Bernabei refers to page 5 of Stamiris 91, which shows a quality-trend graph with adverse trend during June and July.

Mooney was on distribution for Stamiris 91, but does not recall seeing it. Graph shows an erratic trend. Document says the adverse trend was from June 16 to July 15, 1982.

IPINs were used in soils in that period.

17125 Mooney is familiar with IPINs findings in balance of plant -- that some inspectors did not record all nonconformances.

Does not know whether there has been such a problem in soils area.

"These particular IPINs" (?), "electrical IPINs" were generated during installation of instrument testing system. Mooney investigated to extent that this entire system was extensively overinspected by MPQAD.

17126 Mooney has not investigated whether QC inspectors were instructed not to document all deficiencies on IPINs. Doesn't exactly know what has been done.

Mooney not familiar with upgrading of IPINs to NCRs in summer and early fall of 82. Does recall that near end of 82 did upgrade some IPINs relating to temporary backfill. Recalls no others. These IPINs were upgraded around November-December '82.

17127 In soils, we decided not to use IPINs and to close out some IPINs, but could not close out IPINs by replacing the backfill. Therefore the IPINs were upgraded to NCRs in order to clean slate of all IPINs.

An IPIN upgraded to NCR would be closed out as an NCR. IPIN would be closed out by issuance of NCR. The IPIN would still exist as a closed out document.

Mooney doesn't know if IPINs upgraded to NCRs would be included in reinspection committed to by CPCo of everything covered by IPINs.

17127 Mark Stamiris 92 for identification -- an IPIN log.

17128 IPIN log, Stamiris 92, indicates certain IPINs upgraded to NCRs in Spring-Summer 1982.

17129 These IPINs are for backfill. Doesn't know if they are the upgraded IPINs he referred to earlier.

Mooney does not know what would be included in CPCo's reinspection program.

Stamiris 91 indicates that construction does not think there is an adverse trend in quality, because the facts around each IPIN in the graph are different.

17130 Mooney thinks that any trend of this type should be addressed in more detail than this one page of Stamiris 91.

QA has been criticized for not determining generic causes of deficiencies.

17131 Construction's response on Stamiris 91 would be input to QA.

Mooney does not know if QA accepted construction's response in Stamiris 91. Mooney not familiar with the document even though he's on distribution.

17132 Stamiris 78 indicates that Construction's response in Stamiris 91 is satisfactory to QA.

Mooney would like to see more information before he judged construction's response to be satisfactory. He's sure person accepting the response did get more information, perhaps.

17133 QA identified a number of IPINs and NCRs indicating an adverse trend in quality. Construction took exception to inclusion of some items in the trend, and QA agreed. So there is not an adverse trend in the excepted items, but that does not deal with the remaining issue.

That document (Stamiris 91) is somewhat incomplete because not all items are addressed.

17134 CPCo ran into concrete fill in excavation for pier 12, in 12/82. Pier 12 was the first pier.

17135 Concrete fill hit was unexpected in that did not expect it at that particular location; but we anticipated a large amount of concrete backfill in that area.

Mooney knows that Landsman testified that encountering concrete backfill at that location was unexpected. Landsman also said that procedures were in place to deal with anticipated large amount of concrete backfill.

17136 Mooney does not agree that concrete backfill was dumped in an uncontrolled manner.

17136 Bernabei refers to Landsman's testimony Tr. 14628 (uncontrolled dumping of concrete backfill)

17136 Tr. 14628 does not show Landsman saying "dumped in uncontrolled manner".

17137 In case of pier 12, CPCo encountered concrete fill because of an intentional overpour of a sump inside Turbine Bldg. There was a hole much larger than the pit. Rather than fill in a portion of the hole and "pour them up to the sump, they simply poured the entire area." (?)

That same concrete was encountered on both sides.

17138 As for Landsman's (supposed) testimony that concrete fill at Pier 12 was unexpected, if it was a Q area Mooney thinks it would have been a controlled pour.

Mooney disagrees with "unexpected" because in this case it was an intentional overpour.

Mooney would have to know what other instances are referred to to say if the encounters of concrete fill were unexpected.

To Mooney's knowledge there are no instances of uncontrolled pours of concrete in Q areas.

17139 There was some discussion between Region III and CPCo about (soils) craft training. Region wanted additional training for craftspeople. CPCo agreed and provided additional training.

If individual was to perform "specialized task", e.g. welding, then he was trained in welding. concern of NRC was that craftspeople should have more general knowledge of what the underpinning work was and that CPCo should give such general training, not specifically "specialized in task".

17140 Training was specialized to remedial soils work.

17140 Bernabei refers to 2/22/8? memo from Landsman (attached to Landsman testimony) re use of superplasticizer in concrete.

17141 James Mooney does not equate use of plasticizer to good [or bad] construction practice. It's used to make concrete more flowable. Landsman referred to vibration or lack of it.

- 17142 CPCo proposed to mix superplasticizer, pour the piers, and not vibrate them. CPCo felt that was acceptable, in accordance with code. Landsman did not agree, and CPCo changed its position.
- 17142 Mooney does not think today that use of plasticizer is poor practice. CPCo changed position to "please" Landsman, not because it was a poor practice.
- 17143 CPCo and NRC disagreed about load to be applied in 4-point jack of FIVP. Landsman wanted higher load during test. Mooney doesn't know that disagreement lasted a year, though Landsman so testified.

Disagreement lasted around a couple months. There were a number of changes associated with support system of FIVP. CPCo proposed a more conservative design in June, 1982. Then discussed whether to do load test; then started discussion of how much load for test. FIVP was checked sometime before December.

- 17144 So that is several months of discussion.

Discussion was about Landsman's concern that load should be increased to include load of mudmat (Landsman believed would be) attached to grill.

Mudmat was lean concrete fill, but it is broken off during excavation, so that ultimately support system will not experience load of mudmat.

Landsman said that load of mudmat would be a 100 tons, or 100 kips. Mooney doesn't know which figure Landsman was talking about -- either 50 or 100 tons.

CPCo eventually accepted NRC position.

- 17145 Mooney recalls but disagrees with Landsman's statement that CPCo's original position was motivated by concern for schedule. [Transcript here unclear] CPCo's position was that FIVP should not be (or would not be?) jacked off (?).

The more conservative design adopted installation of additional rock bolts and rods into support system. Load for individual rods was calculated and applied to individual bolts. System was "tuned" so that each bolt carried its specified load.

CPCo was concerned that lifting FIVP might detune the system. NRC did not accept CPCo's position. CPCo accepted NRC position and did test load.

17146 FIVP cracked in roof slab during jacking. Crack reached alert level in Unit 1. Unit 2 also cracked, but did not reach alert level.

Spring hanger for feedwater pipe in Unit 1 was locked during jacking. Originally CPCo believed locked hanger caused cracking. Spring hanger was unlocked in Unit 2. Unit 2 also cracked but to lesser degree and at different location.

17148 Report of Construction Technologies Labs, the consultant, stated that primary cause of crack in Unit 1 was increased load associated with hanger and that there might have been some residual stresses.

Consultant made this evaluation after cracking in Unit 2 -- i.e. in full knowledge of cracking in Unit 2. They also had readings from instruments placed in Unit 2 prior to jacking.

[Landsman said NRC does not know what caused cracking] Landsman has the consultant's report. If he's reviewed it, he knows consultant's conclusions.

Mooney does not know what Landsman believes (about cause of cracking).

17149 Mooney does not recall Landsman's testimony about NRC and CPCo's knowledge of cause of cracking. Mooney believes Landsman stated what CPCo thinks after reading consultant's report.

CPCo does not intend to investigate the matter further.

(Re timing of taking data in jacking FIVP) Data was taken within the time specified in the requirement. Data was to be taken within an hour (after release of jacking); it was taken in 5 minutes, Mooney believes.

17150 . Mooney familiar with NRC position that data should be taken an hour after release of jacking. Mooney has not fully evaluated the situation (NRC position), but he believes procedures were complied with: Data was taken within specified time.

17151 If procedure stated data should be taken within 1 hour, concern then is that data should not be taken later than an hour after release. Therefore, the sooner data is taken, the better. Taking data within 5 minutes certainly met the intent of the requirement.

As far as Mooney knows, procedure specifies data be taken within 1 hour. Mooney hasn't reviewed it in detail, but that indicates to Mooney that you should not wait more than 1 hour.

Data was taken within 5 minutes, and also later at R. Cook's request.

17152 From what Mooney has seen, he thinks NRC position was that data should be taken at 1 hour after release, not within 1 hour.

Mooney thinks Wiss, Janey took data. Mooney believes R. Cook said he wanted Wiss, Janey to take data an hour after release, but Wiss, Janey would not do so without direction from BPCo.

17153 Mooney has no independent knowledge of the incident.

Mooney imagines that people had been working at jacking for several hours, completed test, and took reading. R. Cook, Mooney imagines, did not approach individual in authority. Thinks R. Cook said that. Once Cook talked to individual in authority, they rejaacked in accordance with R. Cook's request.

Mooney has no independent knowledge of incident, other than R. Cook's testimony.

To Mooney's knowledge, CPCo has since done no investigation or evaluation, nor taken any action as result of incident.

Mooney is familiar with cracks in SWPS.

17154 Mooney not aware of any cracks opening up recently in SWPS.

Bernabei refers to Tr. 14659, Landsman's testimony on 4/28/83.

Mooney has very general knowledge of the incident described.

Periodically required to map cracks in SWPS. At recent mapping, about a month ago, was indication that some cracks had grown from previous mapping, over 30-millimeter (?) limit for SWPS. In accordance with other procedures, CPCo brought Construction Tech. Labs onsite. They evaluated cracks.

17155 Mooney has reviewed report of Construction Tech. visit, but not in great detail. Mooney recalls that consultant remeasured cracks and determined they were same cracks as previously evaluated and that they had not in fact increased in width.

17156 Landsman has copy of CTL report; Mooney would have to check when report was sent to Landsman.

CTL is Construction Technology Laboratories, consultant to CPCo.

Mooney's current knowledge is that cracks in SWPS have not increased (in size).

17157 Landsman had a concern about rising of wings of EPA, instead of sinking. There is very sophisticated instrumentation on the EPA: it is being measured perhaps more than any building ever has been.

17158 EPA did appear to be moving in several different ways, not just rising. It seemed to be sloping in the middle, causing the wings to rise, and several other "things". CPCo did not at the time have a position on what all these measurements meant.

17159 Landsman was provided the information. He, as were we all, was concerned about what all this information meant.

Mooney believes we (CPCo/BPCo) had reviewed the information at the time [Landsman said no one at CPCo had reviewed it]. We did not then know what it meant exactly. We had provided the information to Landsman.

CPCo is responsible for reviewing the data. They collected and plotted it daily.

It is Mooney's understanding that we gave Landsman the information and pointed out that the EP was acting erratically.

17160 We did notice a trend; it was then very erratic.

Mooney not aware that Landsman stated he originally observed the trend.

Bernabei refers to Tr. 14671-2, 4/28/83.

Landsman there says he identified trend. Landsman says he told CPCo at an exit meeting that someone should be looking at the data.

Our procedures require that CPCo resident engineer plot and review data.

Mooney does not recall specific exit meeting Landsman referred to. There have been many discussions about what the data meant.

17161 Mooney does not specifically remember Landsman telling CPCo they should be looking at this data.

Mooney is saying we looked at the data, because procedures require that we review and plot it. Doesn't mean CPCo reached same conclusion Landsman reached at that time.

Mooney assumes BPCo looked at data in accordance with procedure, or else there would have been an NCR.

Mooney does not have independent knowledge that BPCo followed those procedures in this instance. It would concern Mooney if BPCo had not followed procedures.

17162 In Pier 11 West load test there was a problem transferring full load to bottom of pier. CPCo believes cause was that antifriction system did not work properly.

CPCo has chosen to reanalyze the building using differential settlement of 1/2 inch between main Aux. Bldg. and control tower -- twice the original figure of 1/4 inch.

17163 CPCo had 4 options or combinations of possible actions. CPCo did a parametric study using the 1/2 inch figures for differential settlement -- it came out to about 47 or 44 (.47 or .44?). Appeared to be no structurally distressed elements, and therefore building would have no trouble with that differential settlement. [17164 is missing]

17165 Re: hitting the duct bank.

In attempting to remove lean concrete backfill from around duct bank, man held jackhammer at angle instead of straight down, and thus nicked the bottom of duct bank. Did not damage any conduit or cable. Did nick concrete off bottom of duct bank. There was a lack of attention to detail in holding jack hammer.

Worker did not realize he had hit duct bank until it (concrete fill?) was broken off. Did hit it around 14 times.

17166 Mooney is not familiar with a problem with reference criteria in PQCI not lining up with items trainees were to inspect (re batch plant inspections)

Bernabei refers to Tr. 16824-5. Mooney still not familiar with this specific incident.

Mooney is familiar with incident of an improper signature on a soils PQCI.

[Reprise of preceding testimony:]

- 17167 Cracking in FIVP did not surprise Mooney.
- 17168 We did not specifically anticipate cracking in both Units of FIVP, but it is not surprising that there would be some cracking in moving a big concrete structure.
- SWPS cracks were there before and have not grown.
- Re EPA data: with such sensitive instrumentation, we did not know what to expect.
- 17169 We were all interested to see what building's response would be.
- 17169 That is why there is a period of baselining to know how instruments would perform.
- Did not know what to expect. Wings did rise for a short period. That trend has long since been reversed. Rise was early in data collection. Building is stabilized and performing predictably.
- In early days Mooney would not have expected wings to rise but to sink.
- 17170 Did not anticipate problem in transferring full load to bottom of Pier 11 West during load test.
- Subsequent reanalysis of building was to ensure that even if soils were as poor as tests indicated building would still perform satisfactorily over life of plant. Certainly expected the load test to work, and not saying it didn't: did collect a significant amount of data, presented it to NRC, and they did not [?] agree with our conclusion.
- Did not anticipate hitting the duct bank in probing around SWPS.
- 17171 Did not anticipate the 2 problems with soils PQCI's mentioned earlier (batch plant and improper signature).
- There have been problems in underpinning which CPCo has not anticipated. Mooney as single point of accountability for CPCo is ultimately responsible (for soils).

[Q: what have you done to ensure that these problems will not occur again in this fashion.] We have taken a quite a number of actions best summarized in the 9/17/82 soils letter. James Mooney thinks that these actions have been very effective.

17172 Most of problems just listed were relatively recent.

Mooney has worked with QA recently to develop trending based on nonconformances. Since beginning of soils work in 12/82 we have around 200 (nonconformances = data points?).

17173 Have been doing this trending on an annual basis. Get some information/idea from the trends (?). We have intensified awareness of nonconformances. We are constantly stressing to people the need to conform to requirements. This emphasis extends to craft level. Certainly on weekly basis, and every time we start a new procedure, we stress need to conform to requirements. E.g., we talk about what hold tags are, why you should be aware of them.

Worker did not know he was hitting duct bank. Mooney does not know if he was terminated. He was certainly given instruction. In similar cases there have been some very "stern discussions."

17174 [Harbour asks some questions about hitting the duct bank] Duct was almost completely buried in back fill concrete. Worker stood on top of concrete to separate backfill from duct bank. He put hammer on top of backfill concrete, but by drilling at an angle he nicked the bottom of duct bank.

Water tightness of duct bank was not violated. Individual wires would be encased in conduit which would be surrounded by concrete duct bank. Conduit was not damaged.

17175-6 You would not notice any difference between duct bank and concrete backfill. It (?) is simply exposed raw concrete.

Duct is full of conduit embedded in concrete. Conduits are routed in a bundle, and entire bundle is encased in concrete. There is air space inside conduit but not between conduit and concrete.

Conduit itself was not exposed during drilling.

- 17177 [Bernabei resumes] Mooney has already listed actions that came to mind (in response to or against the "unanticipated problems in underpinning thus far").
- 17178 Discussion of making craftspeople aware of non-conformances took place within the last week. Not sure if it has yet been implemented. It will be an item to discuss with crafts people which hasn't been in past. Would discuss (specific non-conformances) with craftspeople during the weekly quality awareness meetings, or at time the specific nonconformance is identified.
- Mooney doesn't believe that there were any similarities between the various problems mentioned (FIVP cracking, EPA data, etc.). There is no generic cause or problem in these instances.
- 17179 Mooney aware of conversation between R. Cook, Landsman, Warnick and Mooney himself about going ahead to do load test on a pier. R. Cook said Mooney was overeager to do load test on pier. Mooney certainly wanted to proceed with work. Felt they had met the prerequisites and thus should be allowed to proceed. Thinks conversation took place a few days before 4/25/83.
- 17180 In conversation Warnick asked if Mooney was absolutely sure that all QA and QC problems had been resolved. Warnick asked if all instrumentation was properly tested.

Mooney replied "yes" to both questions: to best of his knowledge at time there were no problems.

Following conversation, Mooney did not immediately begin load test; rather Mooney requested top-to-bottom review of all documentation associated with Pier 11. After this review, Mooney was told no problems were identified. Started load test and later some problems were identified. Problems were with properly filling out a PQCI.

17181 There two PQCI's, one relating to pouring the pier and one to the Carlson meters. The 2 PQCI's each required the close out of the other before each could be closed itself. So one had to be changed. PQCI for Carlson meters was modified: a new PQCI or inspection report (?) had to be issued and the previous one closed out. In closing out the old PQCI the inspector did not properly transfer data from revised PQCI to new PQCI. Did not on Level-2 review pick up the improper transfer.

Certification for those (inspectors) involved was revoked, and inspectors were retrained.

17181-2 [Transcript unclear:] "Problem was closed out, because the items which were not properly transferred had been over-inspected by QA, and they were closed out in that fashion".

17183 There was an over-inspection of those items.

James Mooney thought that all QA and QC problems were resolved (until they found this PQCI problem). That was basis for telling Warnick all problems were resolved.

Level 2 had signed off. Therefore Mooney assumed it was a good record, which it was not.

Problems were identified only after work had gone on at Pier 11.

17184 Mooney just said he held up load test until he could do a re-review of records [in response to: schedule was cause of beginning while there were problems].

Re-review did not find the problems. Work did go ahead prior to finding the problems.

Mooney's concern with quality did have impact on schedule.

Abstract
6/7/83
Examination of James Mooney, cont.

<u>Page</u>	<u>Text</u>
17202	Stamiris 92 admitted into evidence [IPIN Log].
17204	<p>CX by Bernabei, continued. Mooney to some extent familiar with audit of U.S. Testing. MPQAD Balance of Plant crew conducted audit. It was a routine audit, conducted in advance of schedule. Audit found problems with U.S. Testing organization, but not with underpinning work.</p> <p>U.S. Testing does testing for concrete, dry pack, etc. for the underpinning.</p>
17205	<p>Audit not yet in final form: not concluded whether there were problems in testing concrete. Draft audit identifies problems with certification of inspectors, testing methods, and some calibration techniques traceable to U.S. standards. Cannot say audit identified problem with any concrete. Did show problems in gradation of concrete material, not concrete itself. Calibration problem was that calibration of equipment used to verify calibration of jack was not in itself traceable to U.S standards.</p>
17206	<p>Those are the jacks on top of the piers used to jack Turbine Building.</p> <p>Audit of U.S. testing had about 20 findings. What Mooney just said was a general summary of his recollection of the present state of the audit.</p> <p>After audit CPCo did not implement stopwork. Mooney directed that excavation of Pier 8 bell not begin until QA had evaluated audit and determined there would be no problems with concrete later on. [Transcript unclear] Pier 8 bell would need concrete 2 or 3 weeks downstream.</p>

At the time, Mooney was ready to place concrete. QA confirmed that the findings were not so significant that U.S. Testing could not continue to function. So Mooney allowed start of bell.

17207 Mooney received preliminary audit Friday, 5/20/83. Mooney made aware then there were a significant number of preliminary findings. Mooney did not then review the audit. Mooney was only made aware of number of findings and possible situation.

Audit continued through weekend. Monday QA group had meeting, including audit team and QA management. Late Monday afternoon Mooney let work begin on Pier 8, 3 days (over weekend) after receiving notice of the preliminary findings.

17208 Mooney relied on judgement of QA department. Many people participated in Monday meeting: Curland, Meisenheimer, Leonard, and audit team. They did not make decision on work; they decided unanimously about "the situation of the audit". Assured by reviewers of audit that there were no significant problems, Mooney made decision to proceed with work.

Mooney didn't personally inform NRC of preliminary audit findings. Believes NRC was informed Monday, prior to release of work.

17209 Informing NRC and releasing work did not "tie together". Informing NRC was not necessary precondition for releasing work.

CPCo responsibility was to handle matter appropriately and advise NRC of decisions.

17210 Mooney aware some NRC people believe(d?) work should be stopped because of audit. Not sure they made an assessment.

Mooney aware another NRC inspector believes CPCo should have stopped work themselves. Believes Landsman and Cook are the inspectors with these opinions about stopping work.

- 17211 Paton makes Board Notification: Landsman and Gardner began yesterday review of U.S. Testing audit, and will continue today. They have determined at least for time being that stop work is not appropriate. Mooney: CPCo will require final report by 6/16.
- 17212 Target date for final report is 6/16. Hope to be in advance of that date.
- 17213 Mooney prepared draft of 9/17/82 letter, attached to his testimony.
- CPCo met with NRC 9/2/82 and agreed in concept on what letter should be. Mooney started preparation of letter, which took several weeks. Don't believe a specific date was mentioned for issuance of letter.
- Doesn't recall NRC giving specific due date for letter. Mooney prepared several drafts and discussed one with NRC.
- Mooney met with NRC 9/8/82. Bernabei shows Mooney Stamiris, 68 (for identification), Adensam's log, entry of 9/7/82.
- 17215 Entry does not refresh Mooney's recollection.
- Agreed on 9/2/82 that Mooney would prepare draft and get back to NRC. Talked to Hood and Novak about status of preparation of that draft. Not sure he made an appointment with them on 8th. To his knowledge Adensam was not involved. She wasn't involved in any discussion with Mooney. Entry would indicate Novak told her he was bringing the letter in.
- 17218 Log for 9/7/82 does say "Draft letter due today". There also is some illegible writing.
- 17219 Mooney did prepare a draft dated 9/7/82, attached to Hood's summary of that meeting (Stamiris 64). This is the draft Mooney discussed with Novak, Hood, and Shafer. Draft was not officially submitted. It was a talking document, discussed in very general terms.
- 17220 Mooney apparently left some unsigned copies with them. It was not submitted as an official document. In Hood's handwriting is written at top of Stamiris 64 "Received during meeting of 9/8/82".

17221 NRC did receive unsigned copy of draft letter at 9/8/82 meeting.

Midland section did make general comments on letter. Mooney did not receive any comments in writing. Had a brief conversation with Shafer, whose comments were very general. Had a call either from Hood or Novak saying they had no comments and Mooney should issue letter.

Shafer told Mooney independent assessment team should be in place prior to Pier 12. Doesn't believe that statement was in connection with this letter.

17222 Draft of 9/2/82 proposed independent appraisal program be in place prior to removal of soil for piers 8 East and West, which is not even started yet. Also says independent appraisal team will be in place prior to starting Phase 3. (Piers 8 E and W are installed as part of Phase 2.)

17223 9/7/82 letter does not say independent appraisal will begin "no earlier" than Phase 3 but rather "prior to". Does not say when prior.

At sometime Shafer told Mooney independent appraisal should be in place prior to Pier 12 (Phase 2). Not sure if that statement was in connection with this letter.

As a result of Shafer's request, CPCo agreed to have independent appraiser in place before work on Pier 12.

17224 S&W's target date for completion of review was in 2 parts: would be onsite a minimum of 3 months or until the team was satisfied that the program was being properly implemented.

17225 There was always a 2-part target: team had to be fully satisfied program was properly implemented before they left site.

Stamiris 93 marked for identification. Bernabei directs Mooney to last paragraph on pg. 1.

Mooney: last paragraph says what Mooney just said: target is 90 days but duration of S&W review will be determined by team.

- 17227 Original specification issued to S&W around 9/20/82 says under "Schedule" assessment team will determine duration of assessment. That specification is also in S&W's report.
- 17228 Goal was to complete assessment in 90 days. Obviously that did not happen.
- To Mooney's knowledge question of increasing S&W's scope (to balance of plant?) did not come up until 2/83.
- Bernabei refers to p. 39, 10/25/82 entry in Adensam's log, Stamiris 68.
- 17229 Entry appears to address balance of plant, the CCP assessment [?]. Appears there was some discussion of asking S&W then to expand soils scope to include this CCP assessment [?]. But that was not done. The 2 S&W teams are independent of each other.
- Mooney knows of no such discussions with NRC at that time.
- 17230 S&W did not receive firm approval from NRC until Keppler's 2/83 letter.
- NRC (in October 82) offered no specific objection, if you want to call that tentative approval.
- Mooney attended 11/5/82 public meeting re S&W. Doesn't think J. Cook was present. S&W's scope of review discussed at meeting.
- 17231 Last slide (in Stamiris 93) used in 11/5/82 presentation shows S&W scope. Ten items are listed.
- 17233 (1) Review that construction implemented intent of design, (2) review that construction was consistent with industry standards, and (3) review that QA program properly implemented are all 3 included in S&W's scope.
- Scope is as listed in specifications.
- 17234 Specifications also indicate other items, e.g. how S&W submits reports.

Three items listed are in 9/17/82 (soils?) letter. To implement these CPCo issued specifications.

17236 On 11/5/82 the substantive scope of S&W's review was the 3 items listed.

S&W has never expressed concern to Mooney about scope of their review. S&W review was (11/5/82) limited to underpinning of Aux. Bldg.

17237 Was some discussion at 11/5/82 public meeting of whether review of technical adequacy would be in S&W's scope. Lucks of S&W said S&W would not review adequacy of technical fixes.

17238 There is misunderstanding about what technical adequacy is. S&W was directed not to review design features, which have been reviewed by CPCo and their consultants and by NRC and their consultants. The parameters are agreed on.

Technical adequacy defined as whether all necessary technical requirements, codes, etc. are called out in the drawing has always been within S&W's review.

So Lucks' statement meant S&W is not reviewing design parameters, features, but S&W does review, e.g., whether specifications for concrete are called out in the drawings, whether procedures are in place, etc.

17240 S&W has never expressed any concern about scope of review to Mooney.

S&W has never made a finding that craftspeople are not receiving required amount of training. Required amount of training is not defined.

2/83 NRC observed they wanted craft training increased.

17241 S&W agreed with CPCo's position on use of superplasticizer.

17246 S&W made no finding that craftspeople were not receiving the required amount of specialized training in underpinning.

S&W would have reviewed training and certification of people involved in Aux. Bldg. underpinning. Such review was not a specific line item in their scope until late 2/83.

17247 Reviewing use of superplasticizer was within S&W's contract.

It was certainly implied that S&W should look at qualification of QC inspectors and other people: otherwise S&W would not know whether the QA program was being implemented.

17248 That was in their scope prior to 3/1/83.

To Mooney's knowledge, S&W did not prior to 3/1/83 find any problems with the recertification of QC inspectors.

NRC's finding on QC recertification either predated or was very close to the time S&W came onsite, mid-September.

Mooney recalls no specific finding [by NRC] made while S&W was onsite.

Review of load for FIVP load test was within S&W's scope. S&W found no problem with CPCo's proposal load. NRC asked CPCo to increase load.

17249 2/24/83 Mooney wrote to Lucks of S&W increasing scope. Contract change was effective as of date of Mooney's letter. Contract was expanded in accordance with Section 2.1(j) of existing specifications.

17250 Region III requested CPCo expand S&W's scope in 2/24/83 letter to CPCo. Keppler conditioned his approval of S&W on expansion of their scope.

17251 Mooney not sure why Region III made the request. Landsman had expressed concerns about scope of S&W prior to 2/3/82. One concern was that S&W was not reviewing design documents for technical adequacy.

From beginning of their assessment S&W has reviewed design to ensure appropriate codes were called out and would be followed. S&W did not, for example, look at adequacy of size of piers.

- 17253 S&W (now?) reviews work packages to ensure adequacy and accuracy -- any type of adequacy, including technical adequacy.
- S&W's scope was expanded to ensure adequacy and accuracy (of work packages).
- 17254 Review includes technical adequacy as Mooney has defined it -- excluding basic concepts but including codes and assurance that work could technically be implemented.
- Previously S&W reviewed drawings in general. After expansion S&W reviews each work package prior to submission to S&W.
- 17255 Scope was expanded to include review specifically of pages put together in work packages submitted to NRC for authorization to proceed.
- Previously S&W would review drawings for technical adequacy in audit fashion.
- 17256 Previously S&W would not necessarily review each and every drawing. Now S&W reviews all documents associated with work for which CPCo is asking NRC authorization.
- Bernabei refers to 2/15/83 memo from Landsman, an attachment to Keppler's March testimony.
- 17259 Paragraph referenced does not mention work packages per se. Does say S&W not reviewing design documents for technical adequacy. Facts do not support last statement: S&W has reported NIRs on technical aspects of work.
- Mooney believes his statement of S&W scope is correct. Mooney disagrees with Landsman's memo. But Mooney would agree S&W was not reviewing work packages.

- 17260 Mooney is familiar with NRC request (in NRC & review of S&W) for certain letters from S&W and with fact that Shafer called various utilities to ask about individuals on S&W's Midland team.
- Believes Shafer testified that he checked whether S&W individuals contributed to QA problems at other plants.
- Mooney reviewed resume's of individuals assigned to S&W team before they were permanently assigned.
- 17261 M. didn't make phone calls (to see if individuals had contributed to QA problems elsewhere). M. reviewed their qualifications, technical competence to perform their assigned job.
- M. did discuss with Lucks involvement at other plants of 2 individuals, Larry Rouen and Barry Holsinger.
- Lucks is from S&W.
- 17262 If Mr. Lucks told M. that these 2 had contributed to any problems, QA or not, M. would have been very concerned, and they would not have been on team at Midland.
- Holsinger was a QA engineer at Nine Mile Point Plant, Unit 2, from 3/81 until assignment to Midland.
- 17267 M. did not specifically ask Lucks if Holsinger contributed to QA problems at Nine Mile Point Plant. Lucks did not indicate that Holsinger was or was not such a contributor.
- Holsinger was in civil area. If there were problems outside civil, he wouldn't have been involved.
- 17270 Holsinger's activities are limited only by S&W's scope of review. His activities would include identification of civil problems. Most of underpinning is a civil effort.

- 17273 Bechhoefer: Nine Mile N.O.V. does involve civil structural. Inspection Report is 81-13, docket 50-410. Harbour: for the record, severity levels in N.O.V. are 4 and 5.
- 17276 Bernabei resumes. M. is familiar with S&W's weekly reports. NIRs are separate from Weekly Reports. When NIRs are identified, they are written up, and copies go to NRC and CPCo. May be some attached to weekly reports, but M. doesn't recall any.
- S&W's Findings are documented in NIRs; finding is not official unless so documented.
- S&W may well make observations in daily and weekly reports.
- 17277 Weekly reports contain status summary of NIRs, including whether they are open or closed.
- 17278 Weekly Report documents NIRs by giving specific numbers and a cryptic description. You would have to go to the NIR itself to see the problem, cause, date of opening and closing, and reason for closing the NIR.
- NRC receives copy of S&W's weekly reports before CPCo.
- 17279 NRC does receive NIRs, separately from weekly reports, as they are issued. R. Cook testified to that.
- Field Soils organization has day-to-day control over operation of soils work. Field Soils is a BPCo organization.
- BPCo has no responsibilities for reviewing S&W weekly reports.
- CPCo (QA), BPCo and S&W do discuss site activities, status of problems at daily meetings onsite.
- 17280 At daily meetings BPCo receives S&W's status reports and analyses of particular problems.
- There is no requirement that BPCo accept any analysis by S&W.

In daily meetings, BPCo does not have to accept a S&W analysis or recommendation. But if S&W has a problem, they issue an NIR, and then it is CPCo's responsibility to respond to the NIR. CPCo (M) must close out NIR in a manner acceptable to S&W.

17281 S&W has never required a specific action. However, there are examples of an unsatisfactory initial response by CPCo and consequent refusal by S&W to close NIR until M. acted appropriately.

CPCo has authority for action; however, S&W has authority to open or close NIRs.

Bernabei refers to S&W weekly report number 23, also attached to inspection report 83-05.

17282 Bernabei refers to daily meeting of 2/21/83.

17283 Report indicates Cvicl of BPCo is coordinating site response for project engineering to concern about requirements for washers and plates.

Report indicates Cvicl will respond to S&W concern about concrete sampling; that Fisher of BPCo will respond to S&W's questions about acceptance criteria.

(Further: BPCo personnel are involved in responding to S&W).

17285 Item 5 on 2/23/83.

17287 "Take under advisement" means Cvicl would [consider and] provide his conclusions in normal course of daily meetings. If S&W disagreed, they would issue an NIR, which is then CPCo's responsibility.

These are highly competent technical people discussing daily a lot of problems: there will be many discussions about, e.g., what is adequate, what to do, etc.

17288 Problems found in audit of U.S. Testing are now in scope of S&W. S&W had already expressed some concern in some of the areas cited in audit. S&W did not themselves document any specific findings; audit team did. S&W was aware of problems especially with some equipment.

- 17289 In S&W Report #35, S&W expressed concern about incorrect concrete specimen curing temperatures. I think there are several other related items.
- 17290 Report 35 is 5/27/83. M. could go through each report and pull out items similar to those found in audit of U.S. Testing. E.g. 2/23/83 item 5 - correlation sampling...
- 17291 These findings are not in NIRs because S&W felt quality organizations were properly handling the situation.
- Another example of S&W concern within scope of audit of U.S. Testing: No. 8 of 2/22/83 report.
- 17292 One NIR dealt with concrete mix certification, but did not involve U.S. Testing. That is in NIR No. 5. The mix approval is a BPCo process.
- 17293 Stamiris 93 into evidence, memo from Darl Hood, Sum of 11/5/82 meeting on independent assessment of Aux. Bldg. memo dated 11/22/82.
- 17295 CX by Paton.
- M. joined CPCo in mid-August, 1981. Initially M. had overview responsibilities for site construction organization and the cost and scheduling organization.
- Gil Keeley was then in charge of licensing aspects of soils work. He was leaving CPCo, so in December M. began assuming Keeley's role. So, M. responsible for NRR interface and technical aspect of soils remedial work.
- 17296 M. assumed additional responsibilities through Winter and Spring. As the result of formulation of soils project team, M. emerged as head of that organization. That appointment was officially announced to NRC at 9/2/82 meeting.
- M. had many conversations with J. Cook about M's responsibility for soils remedial work.
- M. had assumed major responsibility for soils work by end of 1/82.

- 17297 M. has not specifically discussed his responsibilities with Selby.
- M. has had many conversations with Selby about progress of M's job and about soils organization, in particular in preparation for CPCo proposals in August - September '82 meetings.
- M's position obviously important to CPCo.
- 17298 Doesn't think Selby ever specifically told M. his was an important job, though they discussed the organization, M's position and the people who would work with M. in effort to get most competent people. M. sought Selby's concurrence or some key issues. Such discussions indicate to M. that Selby thinks M's job is important.
- Selby would probably not tell M. he's doing a good job; he would tell him if he was doing a bad job.
- 17299 M. can't recall any specific comment by Selby about M's job.
- M's job is one of several very important jobs.
- 17300 Before assuming taking job at CPCo, M. did talk with J. Cook several times, as early as 4/81. Toured site, met with J. Cook and Don Miller, and later visited Jackson.
- 17301 J. Cook said he was trying to strengthen Midland project office. He was looking for someone with broad background in nuclear construction. Cook was thinking of 2 positions then, because he knew Keeley would be leaving. Wanted M. to take one of the key jobs, responsible for construction and cost and scheduling. M. accepted that job.
- 17302 At time M. joined CPCo, doesn't think plant was behind the then current schedule.
- In December 81 M. began assuming some of Keeley's job resolving technical issues with NRR, which Cook thought an important job. Cook asked M. to conclude those technical discussions with NRR.

17303 That is all M. recalls Cook saying about M's job prior to his getting involved in soils work in 12/81.

From 12/81 to present, initial direction M. had from Cook was to bring technical discussions with NRR to successful close.

Some work began onsite. Some problems began in interface with NRR and with implementing work. Cook asked M. to become more involved in implementing work.

M. and Cook had number of discussions relative to QA.

17304 Both felt QA needed someone technically competent and with quality experience.

Agreed should be some organizational changes in quality group. Agreed on Meisenheimer for soils QA. Talked at length about BPCo organization and function.

As a result of discussions and changes, Cook asked M. in early July to take complete charge of soils work, and relieved M. of other responsibilities.

Cook never said anything to or about effect on M's career of success or failure in this job. Doesn't think Cook said anything about affect on CPCo.

17305 Cook and M. have discussed schedule many times, the sequence of events and how we intend to accomplish the work. Cook has never to M. set a date for completion. M. gave Cook his best information and Cook drew his own conclusions.

Possible impact on CPCo of M's success or failure in soils remedial job is obvious without being specifically mentioned. Cook has never specifically discussed the impact on CPCo.

17306 Never discussed because obvious.

There was some discussion about having top level management in quality onsite.

M's location is not that significant. M. is in Midland when he is needed, on average 2 to 3 days a week. Likewise, he is in Ann Arbor when needed, and in D.C.

17308 Prior to taking a job with CPCo, M's personal preference was to live in Midland. He's now in Jackson and has no preference.

17309 Can more effectively do his job in Jackson. Jackson is corporate headquarters, and it is easier there to communicate with Cook and Selby, and with major departments -- licensing and design production -- and with BPCo project organization in Ann Arbor.

Anyone in management position, M included, always has cost and schedule pressures in addition to pressure of quality.

Quality pressures are now increasing more than cost and schedule pressures.

17310 Cost and schedule pressures are not increasing.

Never discussed with Cook or Selby the cost of financing; that is not M's responsibility. Knows CPCo recently stated financing costs will probably increase.

M. still believes cost and schedule pressures are decreasing. Just senses that: thinks there is more emphasis on quality than on cost and schedule. As examples, M's already mentioned couple of cases where he has stopped or not started work because of concern for quality, e.g. Pier 11 W.

17311-12 Also, e.g., bell on Pier 8.

Assumes cost of delay at Midland is as at any comparable project, approximately \$1 million/day.

17313 Selby's policy is to be onsite every other week. He usually make it. M. usually participates in those meetings. The visits are a more important item on Selby's agenda.

At meetings, Selby is updated on progress of job, problems encountered, status, quality concerns, whatever is significant at time of visit.

17314 Selby is onsite from 10:00 until 2:00 or 3:00.

Selby does respond to information he receives at Midland. He is quite an engineer and has strong opinions. He makes his disagreements known.

We have talked on a number of occasions about quality. He wants to know how M. let something happen. That it merely happened doesn't satisfy Selby.

17315 M. attempted to explain QA problems on Pier 11 to Selby, during major portion of one meeting. Selby had some suggestions.

M. thinks Selby felt M. and company were taking appropriate action.

On 4/22/83 M. told NRC that all quality problems and other problems were resolved.

M. then told his people to go back and check. They said there were no problems.

But there were problems.

17318 M. doesn't know what Keppler was addressing (specifically) in saying he didn't know why there were so many problems at site.

Re Pier 11 problems: M. was very upset. But looking at details he can see how it happened. It was an honest mistake.

17321 M. recalls Keppler said he didn't know what the cause of the problem was.

17322 Paton refers to p. 5 of Keppler's 3/25/83 testimony, Question and Answer 11.

17323 M. believes this question and answer refers to balance of plant (3rd party necessary for reasonable assurance).

M. won't say right now that CPCo could successfully complete soils work without S&W's overview. M. has asked S&W for further assessment of CPCo work following installation of grillage beams at Pier 8.

At that time M. might be able, based on S&W's conclusions after reviewing further work, to conclude that CPCo could successfully proceed without S&W.

17324 Paton refers again to Keppler's 3/25/83 Question and answer 11 on 3rd party "assistance" for entire plant (balance of plant). M. has not participated in any discussions on CCP; so he would have no basis to agree or disagree with Keppler's statement.

Board Examination

(Harbour)

Any time you delay a plant or impose more stringent requirements you increase cost.

17325 Quality affects both cost and schedule. Improper work will certainly increase both cost and schedule.

[Transcript slightly unclear] It is possible both to under and over emphasize quality, in relation to cost.

Midland is very close to point of overemphasizing quality. E.g., S&W has pointed out several times that we're not underpinned as fast as would be good construction because of emphasis on quality.

17326 Code M. referred to in saying use of superplasticizer was good practice is ACI 336.3R.

17327 M. believes use of superplasticizer without vibration for pier was permitted by code. Had a concern about honeycombing, segregation of material, and other aspects of concrete placement. CPCo built a full-scale mock-up of the pier onsite and placed concrete in that using techniques we expected to use on the real piers. Pier was stripped and examined. Took some core samples. So we were very confident that proposed techniques using superplasticizer were acceptable.

Doesn't know if there was a formal report on the mock-up, because we did not eventually use the methods tested.

17328 In addition, we contacted former chairman and a present member of ACI 366 committee, and we have written letters of opinion that the code is applicable.

NRC chose not to review the information on strength tests of core samples, comments from ACI 366 committeemen, etc. They were informed what we had done, but don't believe they reviewed that work. S&W did review that work with us.

Does not know specifically whether the information was offered to NRC or not.

17329 The mock-up is in S&W's weekly report No. 11.

Harbour refers to Stamiris 91 [92?], IPIN Log. M. does not know if the deficiencies noted in IPIN Log have been reinspected or not. Stamiris 92 is a complete listing of all IPINs in soils area.

17330 There are some civil and some electrical IPINs. In November or December, M. directed that all open IPINs be converted to NCRs so we could better track them and ensure they were closed out.

Notation on Stamiris 92[?] refers to NCR FS0-038, which picks up all the open IPINs on Stamiris 92[?], except one which is picked up on 4258.

17331 The IPINs were opened in Spring and Summer of '82. M. directed they be closed by upgrading to NCR, referenced on Stamiris 92 as FS0-038, which is dated 1/28/83. So it took some time for M's direction to be acted on.

There has not been reinspection as result of upgrading.

- 17331 Open IPINs were upgraded. There are currently discussions whether it is necessary to reinspect all the closed IPINs.
- 17332 [Exam by Cowan]
- There have been about 200 NCRs opened since soils work began in 12/82. About 50 are currently open.
- The list of M referred to earlier [in reference to trending in soils?] also includes QARS, etc. -- all quality documents.
- 17333 The report [list of all quality documents in soils] attempts to analyze types of problems that come up and to determine they are adequately dealt with. Report also ensures that we are reviewing outstanding problems/quality documents and that we are determining what are the more critical problems to resolve.
- We are working on developing a program to define trends. But in present report/tabulation the emphasis is more on finding which problems are more important to resolve.
- 200 non-conformance (NCRs) are certainly within reason for a project this size.
- We are about at the appropriate emphasis on safety and quality, possibly a little on the high side.
- 17334 M is not satisfied with rate open items are being resolved. Within the last month we've taken some effective steps to ensure open items are closed out in a more timely fashion.
- There are two buildings [being underpinned and whose IPINs are being assessed by S&W as stated in Item 4 of 2/24/83 expursion of contract?]: Aux Bldg, which includes Control Tower, EPA, and and FIVP, and SWPS. BWST is getting new ring beam.
- 17335 DGB was surcharged.
- 17336 [Bechhoefer Exam]
- S&W's review [particularly of IPINs] is specifically limited to [underpinning] work of Mergentime and Spencer, White, although S&W was doing some shallow probing around SWPS to expose underground utilities.

17337 Violation of Hold Tag referred to in Stamiris 89 was in scope of S&W. Bechhoefer: Stamiris 89 says NPC was informed by S&W.

Mooney: Problem was discovered by MPQAD.

Doesn't know of MPQAD or CPCo notified NRC apart from the S&W notification mentioned in paragraph 4 (of Stamiris 89, attachment 5/13/83 memo). Wheeler would know. It would have been his responsibility to notify NRC.

Doesn't know if S&W found hold tag problem independently of MPQAD.

17338 Hold Tag placed on Saturday afternoon; Monday problem was identified and work stopped until it was resolved. Not sure who other than S&W notified NRC.

17338 M thinks that Staff was referring specifically to balance of plant and conversations with Don Miller in speaking of difficulty getting documents from BPCo.

17339 M's own opinion is that it is understandable that a person not in a responsible position who is asked for documents would be reluctant to provide them. But it is not M's experience nor is he aware of any BPCo person in responsible position not providing information on request.

M would be very disturbed if he thought there was such a problem setting information from BPCo. He would not tolerate it.

17340 RDX by FCW.

The underpinning is unique but not complex. We have a know design for the Aux Bldg and SWPS. We can calculate the stresses which can or will develop during underpinning and we have very sophisticated instrumentation to monitor and evaluate the response of buildings. So we have good grasp of how things will work as opposed to underpinning older buildings.

- 17341 Basis of M's good opinion of Meisenheimer and Oliver is his personal knowledge and discussion with others about their performance. Also S&W's report about the quality organization, in summary section page 2. M quotes it.
- 17344 CPCo 33, S&W 90 day Report, into evidence.
- 17345-50 There has been testimony relating to certain portions of the Aux. bldg. rising. No underpinning operations were going on at that time. The instrumentation was installed and they were trying to obtain a base line to compare how the instruments were performing prior to underpinning. During this base line period certain data indicated that the electrical penetration area of the Aux. bldg. was rising. Mooney didn't draw any conclusions from this. The results were reviewed by NRC Staff and adjustments were made. Mooney reviews pps. 16792 and 16832 of the 6/3/83 hearings. The incident on 16832 refers to the meeting re: load test. Mooney testified he was not present at the meeting but was generally aware of meetings like this which took place under his area of responsibility. Mooney believes this meeting took place on 4/20 in Chicago.
- 17351-56 The 4/20 date also refers to the date the two PQCI problems were identified. There was a PQCI related to the Carlson meters and one related to the Pier 8 bell. The problem was resolved by revising the PQCI. On 4/22 Mooney received a call from Warnick and Landsman re the Pier 11 Load test, which was started on 4/25. On 5/5 Harrison requested all documentation for the Pier 11 Load test and they then noticed the non-conforming condition relative to the transfer of information from one Carlson PQCI to the other Carlson PQCI.
- 17357-61 Mooney was employed by the Alabama Power Co. and was project manager for the Farley Nuclear Project for 5 years. He had responsibility for all QC and was the only executive in charge of the project. He was site project contact for the NRC inspection force. He had many meetins with them. None of the I&E people ever indicated to Mooney or Alabama Power that they were not forthcoming with information. Since he has worked for CPCo, Mooney hasn't made any study of QA problems prior to his coming on the job. He has not been directly involved in the balance of plant QA.

He hasn't studied QA problems or problems of QA implementation with respect to the balance of plant work. He has analyzed QA incidents re remedial soils implementation/construction work.

17362-63 Mooney hasn't been able to discover any generic causes for the soils problem at Midland. He has been able to identify specific causes for specific problems.

17364-71 Recross Exam by Ms. Bernabei

Mooney doesn't recall any specific NRC criticism of CPCo's inability to determine generic causes for problems at Midland. Region III inspectors at Midland have made statements re: Mooney's not being truthful with them. Mooney doesn't feel he has had problems communicating with Region III inspectors, though Landsman's testimony indicates he did. Mooney states there have been more noncompliances during his time at Midland than at Farley.

17372-76 Mooney doesn't know of any QA breakdown the NRC found at the Midland site. He doesn't view his relationship with the NRC at Midland any different than that at Farley. He has heard that Region III is a tough regulator. O'Reilly, regional administrator of Region II, which Farley was in, was a tough regulator while Mooney was there. He doesn't think there's any difference between Region's II and III administrators. Mooney isn't aware of whether or not CPCo can pass the cost of constructing Midland on to its customer's before its in operation.

17377-85 The IPIN system was a site wide Bechtel system used in the Soils area and in the balance of plant. Mooney upgraded some IPINs in the soils area in November/December 1982. The nonconformance item occurred in January 1983. Meisenheimer had some concerns about the use of IPINs so they agreed not to use them in the soils work. He doesn't know when the NRC told Consumers of the IPIN problem. Mooney doesn't know why Meisenheimer recommended to stop using IPINs. If an IPIN is upgraded to a non-conformance report the deficiencies noted on the IPIN are dispositioned on the NRC.

17386-91 Examination by Mr. Paton

Pier 12 was started around 12/9 or 12/10/82. There had been preparatory work prior to this. The instrumentation installation was Q work, done during mid summer. Mooney thinks the work they were permitted to do in 12/82 could have been done sooner. They had requested release for various activities prior to that time but some problems needed correction. Mooney thought they were ready to work in August. They had to get an independent assessment team on site. The actual work request to do Pier 12 would have been sometime after August 12. Prior to the 8/26 discussions with Keppler, Mooney didn't think a third party assessment was necessary until after her talked to Keppler.

17392-96 Mooney thought it appropriate to have the third party review but hadn't considered it prior to Keppler's suggestion. Mooney thinks CPCo requested permission to proceed with the underpinning work prior to August of 1982. He believes that at that time they were ready to proceed. He felt they were ready in late June/early July.

17397-04 Mooney isn't sure if the work authorization procedure, which set the work back, would have affected the physical work. He believes they could have constructed the underpinning in a safe manner in July, 1982. He doesn't think they would have been able to start around 4/29. Mooney is in charge of interface with the NRC for soils. He is shown Stamiris Exhibit 89. On 4/9/83 53 Mergentime employees were sent home because of hold tag violations. Mooney doesn't know if anyone under his direct supervision ever acquainted the Mergentime people with the Midland quality problems. There are drifts which permit excavation of material and movement in tunnels under the turbine bldg in the FIVP. The turbine mud slab bolted to the tops of the drift are removed by use of air hammers, so the surface isn't smooth. The plates are installed according to in-plant multibolt applications which shouldn't be applicable to underground work. Because the surface isn't smooth there is more than the allowed 1/16 inch between plate and concrete. QC personnel had done an inspection and attached hold tags to plates.

The drifts may have been in for days and weeks, but suddenly had a tag on them. The night shift came on Saturday, walked through the drifts and started working. On Monday it was questioned if they had worked through the hold tag because the drifts had been used for access. By walking through the tunnel they had used a drift which had a non-conformance on it. Mooney would like to talk to Landsman about their communication problems.

17405 Examination by the Board

Mooney isn't aware of any problems/misunderstandings he's had with NRC Staff. There are no restrictions on Mooney's activities.

17406 Redirect Exam by Mr. Williams

Mooney is shown Attachment 3 to the 3/25/83 testimony of Keppler, a notice of violation and inspection re diesel generator building inspections. He has seen it. He wasn't aware the 2/8 letter re a breakdown in implementation of the QA program. Mooney knows of no way to schedule work which would say that work would either be charged to the rate payers or the stockholders.

17409 Recross Exam by Ms. Bernabei

Mooney believes Mr. Selby may have made general comments re CPCo may go bankrupt if the Midland Plant isn't completed. Mr. Paton stipulates that completion of the 4.43 billion plant is important to CPCo. Mooney feels the importance of finishing Midland doesn't adversely affect the quality of the plants.

NRC HEARING

JUNE 8, 1983

Page

17416-17419 Preliminary matters.

Direct Examination of Charles Weil, Ronald Cook, Ross Landsman and Ron Gardner (by Mr. Wilcove)

17419-17421 Weil is a criminal investigator for NRC, Cook is Senior Resident Inspector at Midland, Landsman is with Region III and Gardner is a Reactor Inspector with Region III. Weil has been with the NRC for three years and is stationed at Region III's Commission office. Prior to that office's inception in July, 1982, Weil spent two years as a staff investigator for Region III.

17422 In April, 1982 Keppler, the Regional Administrator, and Warnick, Weil's immediate supervisor, asked him to investigate possible misleading information concerning the instrumentation program for the underpinning work.

17422 Staff Exhibit 22, a 1/18/83 cover letter from Keppler and investigation report 82-13, was identified by Weil as his report. The report did not reach any conclusion as to the accuracy of the information presented to the Staff because Warnick and Weil decided to use a new format that excluded conclusions.

17424 The underpinning work instrumentation is designed to measure auxiliary building movement. Gardner described the steps taken to install the instrumentation.

17425-17427 Boos was at the 3/10/82 meeting where report 82-13 was discussed. Hood presented the Staff's position with respect to Q'ness of underpinning, i.e. that from that day forward all remedial soils work was to be covered by the quality assurance program.

Page

- 17427-17428 Landsman stated that Boos started to run out of the room after Hood made his announcement saying he had to stop some work on the site. The NRC indicated to Boos that work on the main access shafts, which was ongoing, could continue to elevation 609 (where it still sits today) and that since Boos indicated that the instrumentation was almost complete the NRC would not make Consumers backfit all of it to Q requirements. Landsman did not remember Boos' exact words but had the impression the instrumentation was complete. Cook agreed with Landsman's characterization of Boos' reaction.
- 17429 Most of the people Weil interviewed concerning the 3/10/82 meeting did not recall any discussion of instrumentation at all.
- 17430-17431 Landsman stated that had he known at the 3/10/82 meeting that one week later (i.e., 3/17/82 when he and Gardner made an inspection) only part of the raceway would be installed and only 8 to 11 of the 160 some odd cables would be in place that he would have insisted that Consumers "go back and make everything fall under the quality umbrella to ensure that the instrumentation would work." What bothered him was not so much that the cable pulling did not start until 3/11/82 but that he and Cook got the impression on 3/10/82 that the instrumentation was almost complete. During a 3/12/82 phone call Boos stated that the instruments were "essentially well underway," the raceway had been installed and the cables pulled.
- 17432 Landsman's interpretation of "instrumentation" includes the whole system, i.e., raceway, cables, terminations and calibration. Conduit and cable trays are normally characterized as raceway. Landsman also characterized "instrumentation" as the auxiliary building, underpinning, monitoring system and "an instrument" such as one LVDT or one dial gauge.

Page

Cross-Examination (by Ms. Bernabei)

- 17434 Landsman indicated that there was no discussion about the difference between phase 1 and phase 2 at the 3/10/82 meeting. The meeting centered on quality assurance requirements for the underpinning. The Staff position at the end of the 3/10/82 meeting was that all underpinning activities from 3/10 forward, except the 2 items previously mentioned, would be covered by the quality plan.
- 17436 The Washington meeting was called specifically to inform the licensee that everything would be covered by the quality assurance program. No formal mechanism was set up at the meeting which would permit Consumers to do underpinning work not under the quality plan. Later the work authorization procedure was developed.
- 17438-17441 According to Landsman the licensee initiated the 3/12/82 phone call to discuss the status of work under the Q program. Cook added that the licensee wanted certain items to be excepted from the Q envelope. About 12 Bechtel or Consumers people were present during the phone call. Consumers and Bechtel used a secretary to transcribe the conversation since the NRC objected to the tape recording of it. Consumers wanted a transcript of the conversation so that any commitments made by the NRC would be recorded. Cook did not want to be tied to any verbal commitments concerning NRC enforcement policies.
- 17442-17447 Boos appeared to have a specific list of items he wished to discuss during the phone conversation in the hopes that the NRC would commit to a position. Boos was either Assistant Project Manager or Project Manager for Bechtel. Cook did not know his duties but thought he was informed about the status of the underpinning work and expected him to know now completed the instrumentation was. The NRC had been able to rely on Boos prior to 3/12/82 for such information.

Page

- 17447-17454 Exhibit 10 (Boos' matrix) was used during the phone conversation to indicate which items were to be Q and which weren't. Items marked with dotted lines indicated non-Q activities. Landsman agreed that Boos' reason for calling was to get the Staff to state that certain activities could proceed as non-Q. Landsman did not understand Boos' reference to the Q'ness of the instrumentation made during the 3/12/82 conversation either when he originally heard it or while looking at the transcript of the conversation. Cook agreed that the reference appears to be a request by Boos for clarification that the installation of the instrumentation would be non-Q.
- 17456 Landsman and Cook did not remember whether Phase 1 or Phase 2 were discussed during the phone call. Weil did not remember his report saying that Phase 1 and Phase 2 were not mentioned in the phone conversation.
- 17456 Weil investigated an allegation that Jim Cook had called Keppler to discuss the possibility of not writing citations for things Consumers thought should not be in the quality program even though they were important items. Keppler told Cook his staff would discuss it. Cook did not tell the NRC that there was such an agreement.
- 17458-17459 Landsman added that he, Gardner and Ron Cook were told around 3/17-3/19/82 by Marguglio that Jim Cook and Keppler had agreed that no noncompliances were to be written on any remedial soils work. They couldn't believe such an agreement had been made and questioned Region III management about it. Someone told them Keppler denied making such an agreement. Weil did not investigate the alleged agreement much since the main thrust of his investigation was statements made by Boos.
- 17461-17465 One 3/18/82 Gardner called the Region and told them what Marguglio had said about the alleged agreement. He also told them that the Staff had recommended to the licensee

Page

that cable installations be suspended. Region III supported whatever steps were necessary to ensure that the cablepulling operations were stopped. Ultimately, Nore-luis of the NRC decided that an NRC CAL would not issue and that a reverse CAL from Consumers would. Gardner, Landsman and Cook had previously informed the Licensee that the NRC would issue a CAL so they were embarrassed when it didn't.

- 17466 Cook recalled another reverse CAL issued in 1981.
- 17467-17471 Cook indicated to Weil during Weil's investigation that he and Keppler agreed that the NRC would not issue noncompliances in certain non-Q underpinning work.
- 17471-17474 No one from Consumers, except Marguglio, ever told Weil that Keppler had agreed with Cook's request. Weil believes Marguglio had drawn his own conclusions. Landsman believes a clear staff position, backed by Region III, was expressed at the end of the 3/12/82 meeting.
- 17474-17478 Consumers' management attitude was that they did not want any remedial soils noncompliances written against them. Landsman believes Cook's going to Keppler after the 3/10/82 meeting was an example of their attitude. Gardner and Cook agreed. Gardner added that Consumers attitude was to try to eliminate as many areas of remedial soils from coverage by the quality plan as possible.
- 17478-17480 Per Cook even after it was explained on 3/10/82 that all activities associated with the soils would be Q Consumers continued to worry that the Staff would nit-pick over slight violations in materials.
- 17480-17486 Landsman asked Hood to arrange the 3/10/82 meeting after he and Cook became fed up with arguing with Consumers over what was Q and what wasn't. The panel could not recall any instances where they believe they were misled by Boos other than with his 1/18/83 investigation report 82-13 (Staff Exhibit 22) where he spoke of work being "underway".

Page

- 17485-17489 A 1/18/83 cover letter from Keppler to Jim Cook states that several members of Keppler's staff believed they were misled by remarks made by Consumers and Bechtel employees. Keppler was referring to the episode with the instrumentation. The Staff's decision to exclude the installation of the instrumentation under the Q envelope was influenced by the remarks and would have been different if the remarks hadn't been made.
- 17489-17493 Landsman cited 2 other examples of when the staff was misled by information given to them by the licensee. One concerned a soil boring incident where they were assured quality assurance requirements were in place when they weren't and the other concerned the area of the dikes -- the staff assumed Consumers was following the Board's order to cover that area with the quality assurance program, but they had not. This work did not fall under any exception to the Board's order.
- 17495-17499 Two other examples of misleading information are the agreement not to dig below the deep Q-duct-bank and the denial that there were problems with the Carslon meters and inspection books connected with the load test on the pier. Mr. Mooney was the Senior Consumers representative in the 3/10 and 3/12/82 meeting.
- 17449-17505 Landsman agreed that the loose sands incident at the dewatering plant also falls in the category of incidents where misleading information was provided. Cook was not sure. Landsman heard of the incident from other staff members. Boos and Budzik told the staff things they should have known were untrue.
- 17506 The panel could not recall any incidents, besides the one concerning the alleged agreement on non-Q underpinning work between Keppler and Cook, where they were told by the licensee that certain agreements had been reached with Region III that were subsequently found to be nonexistent. Weil did not investigate other alleged misleading incidents.

Page

- 17508-17511 Weil's investigation ran from the end of March, 1982 to 6/17/82. The final report was issued in 1/83. Warnick, Weil's supervisor, decided that the report should reach no conclusion. Weil did not know the policy reason behind this but he knew before he finished interviewing that he would be reaching no conclusion.
- 17512-17515 The investigation report cover letter went through 3 drafts. Landsman refused to concur with the first draft because it merely stated that the results of the investigation were inconclusive and the NRC had no plans to do anything. Cook and Landsman disagreed with the official legal opinion of the Office of the Executive Legal Director, i.e., that there was no material false statement. They both wanted the licensee to receive a strongly worded letter denouncing the dissemination of misleading information. Cook, Landsman and Weil agreed that Boos had lied although Weil could not prove it. Keppler agreed with Landsman that he was right not to concur with the letter.
- 17516-17518 Keppler wrote his own strongly worded letter and told Selby at the DG Building enforcement meeting that Consumers had been "right on the fence" and might not be so lucky next time. The fact that Cook's and Landsman's names were not on the final Regional letter did not mean they disagreed with the NRC position -- they just did not think it appropriate for them to sign it.
- 17521 All meetings concerning the cover letter and statements to be made regarding the report on the Boos incident were held at the Region office. Landsman did not remember how many meetings there were. Consumers had no input into the investigation.

Page

Afternoon Session

- 17523-17528 Questions concerning the U.S. Testing matter will be held until the final audit report comes out.
- 17528 Stamiris Exhibit 95, the 3 draft cover letters and the final draft cover letter, were moved into evidence.
- 17530-17534 Landsman and Cook could not say whether Boos deliberately misled them during the 3/10/82 meeting and 3/12/82 phone call. Neither knew the motivation behind his remarks. Weil did not draw any conclusion as to whether Boos deliberately misled the NRC but did say that there were Consumers personnel present during the phone call who had to know what was going on at the site.
- 17535-17537 Decision to hold in camera session.
- 17541-17635 Separate volume.
- 17636 Cook and Landsman agreed that if the NRC legal counsel had said that they had a strong case that enforcement action should have been taken concerning the misleading information. As it was they settled for a strongly worded letter to the licensee.

ABSTRACT OF PROCEEDINGS PERTAINING
TO CONSUMERS POWER COMPANY
MIDLANT UNITS 1 AND 2
HEARINGS TAKING PLACE ON JUNE 9, 1983

Page

- 17641-17642 Stamiris Exhibit 94, a nine mile point inspection report with accompanying notice of violation, is being identified.
- CROSS-EXAMINATION OF NRC STAFF WITNESSES WEIL, COOK, LANDSMAN, AND GARDNER
- 17643-17647 (After objections by Miller) Gardner indicated that Norelius was the person within Region III who made the ultimate decision as to the issuance of a confirmatory action letter or, in the case of March, 1982, a reverse confirmatory action letter. At the time, he was the director of the division that Gardner and Landsman worked in.
- 17647 Gardner added that his opinion was that he had not been familiar with a reverse confirmatory action letter, and he was somewhat surprised; he said he might have even been disappointed, but the main point was to have the work stopped, and that had in fact been accomplished.
- 17648 Cook added that since the understanding concerning a confirmatory action letter had resulted from a kind of caucus, they were all a bit surprised.
- 17649 Landsman indicated that the caucus that Cook referred to was the phone call coming from his management stating that they would issue a confirmatory action letter that afternoon; the participants included Landsman, Gardner, Cook, Duane Boyd and Cordell Williams.
- 17650-17653 Gardner indicated that none of the members of the panel could speak for NRC management practice, but he didn't know of any other instances of sites outside of Midland where a reverse confirmatory action letter had been used.
- 17653-17654 Cook indicated that "it wasn't too long ago" that the NRC would issue an immediate action letter, and when the licensee wrote the letter, it was called a confirmatory action letter.

Page

17655

Gardner did not personally feel a reverse confirmatory action letter as a procedure eroded his effectiveness on site with the licensee. There were times he felt the NRC had to be very forthright and there was thus a need to issue an immediate action letter; in other instances there was not such a forthright need. Thus it would be difficult to say for a generic instance.

17655-17656

Dr. Landsman stated that the "embarrassment" mentioned previously referred to the fact that they had told the licensee something and it wasn't happening. This referred to the issuance of the confirmatory action letter. However, he didn't know if that had eroded their effectiveness on site.

17657

Cook added that it was simpler to be aggressive in enforcement actions, and thus they may have been disappointed at a confirmatory action letter; however, he did not think that eroded their effectiveness to inspect the licensee.

17657-17658

Gardner described the procedure of presenting differing interpretations of regulations or requirements to the NRR. Both the licensee's and the Region's interpretation would be submitted, and the NRR would decide that either Region III or the licensee seemed to be correct. Gardner indicated that if the NRR provided adequate justification for overruling the Region's position, they would accept it. He could only remember one instance in which they could not accept the NRR's position, and they had gone the route of "differing professional opinion."

17659

Gardner cited an instance in Midland in which a Region III position had not been verified as being correct by the NRR: this was the position that Gardner took on the marking of instrument sensing lines back in 1981. The NRR's latest letter had indicated that they were not sure, but this did not mean that the NRR had overruled his position.

Page

- 17660 Cook indicated (after objections by Wilcove) that he could not think of any instances pertaining to the Midland site where that had happened. Landsman could only recall an instance involving the diesel generator building.
- 17661-17666 (After some discussion Bechoffer ruled that Sinclair's question regarding the strong enforcement actions to be taken where material false statements were established, was objectionable.)
- 17667-17668 Weil stated that during his investigation he did not believe any questions were raised as to whether there was misleading information provided at any other time beside the instance in question.
- 17669 They were thus investigating a single incident. Weil did not believe however that the lack of conclusion drawn from this investigation reduced the effectiveness of these investigations.
- 17670 Weil indicated that the purposes of the investigation were the objective findings of facts which were provided to the NRC management for their action. Such action was spelled out in the enforcement policy. In regard to the discussion between Boos and Dr. Landsman at the March 10th meeting, Weil stated his belief that the report indicated the information Boos gave to Landsman had come from a member of his staff and he didn't remember which one.
- 17671 It was Weil's understanding that a group of people collected the information presented at the weekly status meeting. However no one put together an agenda.
- 17672 Weil thought that the name of the man who had given Boos the information was Simpson, but he wasn't sure.
- 17672-17673 Landsman indicated that at the March 10th meeting they were just trying to get Region III's position across. Even though the licensee brought in a lot of people to the meeting, they were not all invited to give their input. Though Bird said he was present, Landsman did not remember him being there, and in any case only a few of the people present were doing most of the talking. Had Bird come forward at the March 10th meeting indicating

Page

that he knew the instrumentation system was incomplete and the brackets had not been fabricated. Landsman said he would not have given them a pass on the instrumentation.

17674

The instrumentation being discussed were the instruments in the auxiliary building that monitored the movements of the building. Landsman indicated they had received readings from those instruments, and they were within the framework of the tolerance that had been set. (Miller objected to this question.) In his notes, Dr. Landsman indicated that everything after March 10th would be Q. However Schaffer had told them that the cable pulling was started on March 11th. Landsman said that he thought the investigation would determine who had made the decision to go forward with cable pulling on the 11th even though it was all to be Q beginning on that date. Schaffer did not have anything to do with the instrumentation at the time.

17676

Weil said that he had not tried to determine who had given the decision to go ahead with cable pulling on March 11th. He indicated that the cable pulling did not in fact begin on March 11th. When Weil had spoken to Schaffer, Schaffer did not recall making the statement.

17678

Schaffer was not aware, according to Weil, of when the cable pulling actually started. The investigation showed the cable pulling had started the end of February or the first part of March. Raceway installation had been started mid-February. Weil did not know exactly when the first cable pulling occurred, but he thought it was before March 11th.

17678-17679

Landsman indicated that the instrumentation installation proceeded on Q-A criteria only after March 19th. He thought the IPIN's process was probably accepted procedure and part of the Q-A for the instrumentations installation.

Page

- 17679-17680 (Beckhoffer sustained an objection to a question regarding the use of IPINs as irrelevant to the present testimony to the panel.)
- 17681 Landsman said that Boos wished to have instrumentation procurement and installation of instrumentation excluded from the quality assurance program because Landsman would not be able to inspect it and it also saved consumers a lot of money and time. Cook added that Boos also knew it took approximately two months after the March 19th meeting for the licensee to develop its QA program so it would be commensurate with Q installation of the instrumentation.
- 17681-17685 Landsman's notes of the meeting on March 10th apparently showed that Boos was attempting to point out that instrumentattion installation had begun, and if quality assurance were applied to the work, there would be an adverse impact on completion. Against objection, Weil stated that the adverse impact being discussed at the meeting was the "retrofit" that would ensue when work had begun under a non-Q program, and then quality assurance were applied.
- 17686 Weil said the future of the quality program was not part of an investigation, thus he did not ask what the adverse impact would be.
- 17686-17687 In response to Sinclair's question on the subject, Weil said he had talked the day before about a particular interviewee in the investigation who a requested a corporate attorney, and the difficulties of protecting his identity with a company employee present.
- 17688-17690 However, Weil saw no reason at the time to point out these difficulties to his superiors because there was no reason to, and also because the man was given an opportunity later on (outside of the earshot of the attorney from the company) to request another interview.

Page

17590

Weil said each witness was asked if he preferred to have an interview without the attorney present; however they were asked this when Mr. Brunner was in the room with them. Weil didn't see this as a real problem however; in any case the people that Weil thought probably had more information were asked separately, out of earshot from the Consumer's attorney.

17691-17694

Weil indicated (over numerous objections) that if there had been a conclusion reached that a material false statement had been made in connection with the investigation he conducted, the matter would have been referred to the Department of Justice for prosecution. He didn't know what enforcement action would have been taken by the NRC. Neither Gardner, Landsman or Cook knew either.

17694-17695

Weil added that the investigations were reviewed by the NRC's office of the Inspector and Auditor who had the liaison function with the Department of Justice. At the level a decision would be made for referral.

17696

Weil didn't know if this investigation report had been reviewed by the office of Inspector and Auditor, but it had been by the Executive Legal Director. Weil thought this was the routine procedure when the regional management had questions.

17696-17697

As to his personal opinion as to whether or not there was material false statement made in connection with the statements by Boos, Weil added that if one took lying as "just a statement or misstatement of fact" then he had lied. However, if one took the issue of "deliberateness", then he didn't think the facts of the situation bore that out. In regard to interviews of individuals, Weil said that it was up to the judgment of the investigator as to whether a written statement was taken for a certain individual.

17698

However, generally written statements were taken for those individuals who were deemed to have more significant information.

Page

- 17698 In compiling his report, Weil said he referred not only to the written statements that had been obtained, but also his notes on the subject. He didn't believe there were any instances in which his notes of the interview and the witnesses of written statement were inconsistent.
- 17699 After completing the first draft of the report, Weil would generally refer it to his immediate superior. It might also be sent further up the chain or even laterally for review. Weil thought Landsman had reviewed his report in a draft form before it was finally published.
- 17700 Landsman concurred that he had probably reviewed part of one of the drafts of this report, though he could not give an approximate date when that occurred; he recalled it was when he was reviewing the first draft of the cover letter.
- 17701 Following his review of the draft report, he recalled making comments to Mr. Wayne Shafer.
- 17702 He recalled telling Shafer that he concurred neither with the cover letter nor with the report underneath. However, it was the cover letter that had been the subject of his disagreement; there was no specific section of the report that he had made comments on. Weil did not recall anyone else having any objection to the substance of the report.
- 17703 Other than minor editorial changes, the final draft submitted was in fact the same as the first draft. Weil had not prepared the first page of Stamiris' Exhibit 95, titled the first draft; No one on the panel knew who had prepared that, though Weil thought it was a member of Region III. His informed guess was that it was his supervisor, Mr. Warnick.
- 17704 Weil thought he had seen this first draft on or about the time it was prepared. He had certainly reviewed it at some point. He didn't remember what his opinions were as to the accuracy of the statements in the cover letter, or whether or not he thought it was a satisfactory statement. (The panel was still not able to decide who had written the report, even after looking at the handwriting.)

Page

- 17704-17705 Landsman said he had expressed his opinion along with Cook "a few times" to Mr. Warnick.
- 17706 Gardner did not have anything to do with their discussions. The substance of Landsman's complaints however, was that he didn't think the cover letter adequately represented the facts in the case and he could not concur in them. Landsman thought that he and Mr. Cook then created their own draft and submitted it to Warnick; Warnick did not create a second draft himself.
- 17707 Landsman said that when he handed the report to Warnick he explained to them that the counselor for the Office of Executive Legal Director in his letter did not say it had not been a material false statement; he had said that they had a weak case. However, Cook and Landsman had wanted the cover letter to be a little stronger.
- 17708 The report finally ended in the Regional Director's Office since he had signed the cover letter. Afterwards Cook, Shafer, Weil and Warnick all had a meeting with Keppler about the thing.
- 17709 Landsman thought Gardner and Lewis were in the meeting as well. Landsman and Cook were not asked to concur in the fourth draft which Landsman believed Keppler had himself written. Landsman thought Keppler had shown him the letter before he signed it.
- 17710 Weil explained that at the time he thought it was improper for the allegers in this incident to be reviewing the cover letter.
- 17711 The reaction of Mr. Davis, the Deputy Regional Administrator to Weil's objection was to remove Landsman and Cook from the carboncopy list. As it turned out however, they continued to review drafts of cover letters. Dr. Landsman thought the statement "we are concerned that statements made by a member of your staff" etc., were written about Al Boos.

Page

- 17712 The fourth and final draft (written by Keppler) said "several members of my staff believe they were misled by remarks made by Consumers Power Company and Bechtel employees during the meeting in Washington, D.C. on March 10th, and the subsequent telephone call on March 12, 1982"; Landsman thought what Keppler meant by this statement was that every person who was at the March 10th meeting or everyone involved in the telephone call on March 12th. However Landsman could not recall any remark at the March 10th meeting that misled him.
- 17713 Landsman thought the statement about misleading remarks was referring to Ben Marguglio for telling the staff that there was an agreement between Keppler and Cook.
- 17714 Landsman also added that part of Mr. Weil's investigation report covered that statement. Such statement was supposedly made to Landsman and Gardner when they were on site on March 18 or 19.
- 17714 However, specifically referring to the meeting on March 10th or the phone call on March 12th, as far as Landsman can recall from the transcript he could not find any misleading made by Ben Marguglio. However, Landsman did not think that the statement in the letter concerning misleading remarks made by Consumers Power Company and Bechtel employees was in itself misleading, because he said that he had earlier stated that he couldn't remember any misleading statements from the March 10th meeting.
- 17715 To the best of his recollection when Landsman was interviewed by Weil he made every effort to disclose to him all facts and circumstances regarding the alleged misleading remarks. In fact Weil provided him with a draft of his statement which he revised.
- 17716 There was nothing in his statement regarding any misleading remarks. This statement is dated April 6, 1982.

Page

- 17716-17717 However, his statement reflects remarks made to Weil over the course of the period April 6 through April 19. [Consumers Power Company Exhibit No. 45, a handwritten document, was marked for identification].
- 17718 These were the handwritten notes of Weil taken during an interview with Dr. Landsman on April 6, and also subsequently. Weil said that more than likely most of these notes were created on April 6. Two additional pages were in Landsman's handwriting; however, Landsman couldn't tell whether these were prepared either on April 6 or during the March 10th meeting.
- 17719 The last two pages of the exhibit were the typed portions of those pages prepared by Dr. Landsman. When Weil conducted his interview of Dr. Landsman, it was his first exposure to the topic that he was going to be investigating other than the discussion with his supervisor assigning him to the case. At that time, his supervisor had told Weil that there was a problem at Midland in which two of the inspectors had thought they had been given misleading information by the applicant.
- 17720 The next step in the investigation was to talk to Dr. Landsman. He asked Landsman what the nature of the misleading statements was, and who had made them. At that point Landsman identified the person as Mr. Al Boos. Weil didn't recall whether Landsman was asked if there was anyone else who had made misleading statements to him.
- 17721 Weil believed that during the interview they were discussing Boos and Boos only. Weil commented that Landsman was certainly a cooperative interviewee, and thought if Landsman had any information with respect to alleged misleading statements made by Consumers Power employees at the meeting or during the telephone call, he certainly would have come forward. Landsman concurred in this.

Page

- 17721-17724 Taking his own earlier asserted assumption that lying was a misstatement of fact, Weil did not feel the cover letter, (insofar as it referred to misleading statements made by members of Consumer's or employees of Consumers during the meeting of March 10th and the subsequent telephone call) was in fact a lie; he thought the staff looked at the applicant and their subcontractors as one and the same.
- 17725 Weil agreed that he was quite precise in the body of his report (on page 2) as to the misleading statements that were the reason for the investigation. They precisely referred to statements of Mr. Boos who was an employee of Bechtel Power Company.
- 17725-17726 The first three drafts referred to Boos as "a member of your staff." Weil thought it was correctly assumed that Boos was considered to be a member of the staff of Consumers Power Company. However, Gardner did not know what the basis was for changing the wording of that sentence to include the words Consumers Power Company in the fourth draft.
- 17727 Landsman reiterated his feeling that Keppler was trying to include Marguglio's statement which had occurred on the site visit by Landsman and Gardner. Cook also agreed that the addition of the words "Consumers Power Company" resulted because of Keppler's desire to include the conversations that pertained to Marguglio.
- 17728 Although Weil did not believe the statement in the cover letter was a lie, he did believe it was misleading. Gardner's definition of instrumentation (brought out by Wilcove) included a conduit which was an enclosed raceway for cable.

Page

17729

"Raceway" was the generic title for any type of vehicle enclosing cable. So all conduit was raceway but not all raceway was conduit. The cable itself was part of the instrumentation system along with the instruments themselves. Gardner believed there were also terminal boards located in the data acquisition room at the top of the turbine building which were also part of the instrumentation system.

17730

Included as well was the data collection unit. Generally, cables ran from the instrument to the terminal board and then from the terminal board to the data collection unit.

17731

The number of cables running from each instrument depended on the type of instrument: Gardner indicated the thermocouple might have one cable and the LVDT might have two or three. Gardner believed that four or five or even six cables ran from the instruments to the terminal board for those instruments that were associated with the deep bench marks. The number of wires in each cable also depended on the type of cable. There were four or five different types of cables utilized for underpinning instrumentation. Some of the cables running to and from the deep seated bench mark instruments might have as many as four to six conductors, while others would have just two. Gardner thought there would be a number of LVDT's and strain gauges associated with each bench mark predicated upon which type of movement was being monitored.

17733

Landsman supplemented Gardner's explanation by speaking of the cables needed to monitor movement of the building in three different directions, including relative motion between the turbine building and the auxiliary building, and possibly an absolute vertical movement indicator.

Page

- 17734-17735 Miller referred to exhibit 13 to staff exhibit 22, enclosure 1 to the March 22, 1982 letter. In numbered paragraph 4 there was a reference to six deep seated bench marks with instruments installed and operational. Gardner speculated there would be 25 to 50 cables needed for the six deep seated bench marks discussed. Four other identified instruments were referred to in paragraph 4. Gardner said that the two of them were deep seated bench marks, and the other two (according to Judge Harbour) were differential movement detectors.
- 17736 Gardner speculated that four to six cables would be required for each of the relative movement indicators.
- 17737-17739 Gardner had from time to time inspected the instruments and had on occasion observed the number of cables going into them. Referring to paragraph 4 attached to Exhibit 13 of staff Exhibit 22, Gardner seemed to feel that instrumentation for eight deep seated bench marks in total was contemplated. However, neither Gardner, Landsman nor Cook knew how much conduit was installed as of March 10, 1982. Weil thought that a walk down of the systems by a Bechtel field engineer indicated that 2,651 feet of conduit had been installed as of March 19th.
- 17740 Weil's assumption was based on the work order.
- 17740-17741 Weil really didn't have any idea what the status of conduit installation was on March 10th as opposed to March 19. He had no idea how many man days it would take to install 2,651 feet of conduit. While Gardner felt it would not have taken a long time, he still indicated that it was difficult to tell and he would not be able to estimate in days or hours or even weeks. As for how many cables had been pulled as of March 10th, Gardner had been informed by a number of Consumers Powers staff that pulling didn't commence until the 11th of March.
- 17742 Both Landsman and Cook concurred in this. The only basis for Weil's earlier statement that cable pulling began at the end of February was the fourth paragraph on page 10 of the report.

Page

- 17743 The information Weil got indicated that pulling would start the third week of February; however, he could not give a percentage of either the amount of cables pulled or the amount of conduit installed prior to March 11th.
- 17744 Gardner agreed that once a particular conduit route was completed, cable could be pulled on that conduit while additional conduit installation was going for other cables. However, Gardner could give no definitive answer to how much conduit would be required for the eight deep seated bench marks and the two relative movement instruments specified in paragraph 4 of the enclosure 1 to Exhibit 13. How many would be needed for each instrument would depend on the sizing of the conduits.
- 17745 Gardner thought it was more time consuming to install conduit than to pull cable. Once the conduit was in place, there were various types of tools used to lead cable through conduit.
- 17747 Hood described the responsibilities the NRR branch had in connection with the review of the underpinning work during the first quarter of 1982: Their job was to establish an acceptable remedial action for the various areas affected by inadequate compacted soils. These included the auxiliary building, service water pumps structure, the borated storage tank and the diesel generator building. During this first quarter Consumers Power used the word "phase" in the context of the auxiliary building underpinning to identify different portions of work. Hood recalled there were four phases of that underpinning activity.
- 17748 Phase I was the implementation of a vertical access shaft. Phase II provided for horizontal drifting beneath the FIVP and beneath the turbine building. Phase III provided for the drifting beginning at pier 8 and going beneath the auxiliary building itself (electrical penetration area). Phase III also included the further drift of the control tower. Hood also believed Phase III included the construction of the permanent wall. Phase IV was the attachment of the permanent wall to the structures and the back filling of the excavated area beneath the structure.

Page

17749

Hood noted that for construction purposes, Phase II was divided in time into sub Phases IIA and IIB; he noted they were trying to determine the amount of acceptable settlement for the structure and the amount of stress that the structure could reasonably tolerate. These two sub phases resulted from a difference of view between the NRC and the applicant about what certain soil thermometer should be beneath the main part of the auxiliary building; whether or not it should be seventy KCF or thirty KCF. These engineering parameters, which put into the analysis of the structure, affected the amount of differential settlement to be involved.

17750-51

Hood agreed then that there was at least some discussion of beginning the horizontal drift prior to the time that the settlement values were arrived at, and that one could proceed to some degree with the drifts without the structure being at undue risk. Hood had not been a participant in the telephone conversation of March 8. However, he was informed shortly afterward that, in effect, Consumers had then indicated that sixty seated bench mark instruments would be in operation before beginning Phase II work.

17752

Hood could not recall whether the staff had a position as to whether that amount of instrumentation was adequate before beginning Phase IIA work. Tedesco's letter of March 22, 1982, with enclosures, represented the NRR's response to some of the items, including how much instrumentation had to be installed as per the telephone discussion of March 8.

17753

Hood thought that the Consumers Power commitment shown in numbered paragraph 4 of enclosure 12 exhibit 13 in fact referred to the record of the telephone conversation of March 8. Hood thought he recalled that Kane had told Consumers Power Company during the March 8 phone conversation that four additional instruments (in addition to the 16 seated bench mark instruments) were going to have to be installed.

Page

- 17755 Though the number sounded right Hood couldn't remember when this was conveyed to Consumers. All he could recall was that there was some effort to distinguish at this time the needs for a given phase and it seemed that not all of the instrumentation required had to be concerned with Phase IIA.
- 17756 Hood had attended the March 10 meeting but he didn't recall any of the discussion at that time about trying to distinguish instrumentation for some given phase.
- 17756 Hood did however recall making a statement in substance that from that point forward everything would have to be Q.
- 17757 Hood also indicated that he had clarified for Mooney and Boos that this position was not intended to apply to what the NRC had already approved. In other words Phase I (the vertical access shaft) had already been approved as non Q. Rather, it was intended to apply to Phase II.
- 17758 However for those instances which on a case by case basis could be justified as being non Q, Hood conditionally said that they should be worked out with Region III. Finally it was decided that Region III 3 should do a review of its position on things such as FIVP overhead settlement.
- 17659-60 Hood believed that all work underway in the site as of March 10, 1987 was Phase I work in the auxiliary building. The NRC also required that instrumentation was to be in place and operating prior to the start of Phase II. This was spelled out at the March 10 meeting, and was documented in the March 22 letter.
- 17761 Hood reiterated that Phase I was non Q and instrumentation was part of Phase II. It had been Hood's intent to convey that the instrumentation should in fact be installed as the initial phase of Phase II. However, what Hood had tried to convey apparently had not been received that way by Consumers. Or in other words Consumers construed that to mean that "since the requirement had to precede Phase II it was in fact Phase I and being Phase I it was non Q".

Page

17762

Hood couldn't exactly recall if anyone at the meeting made any representations to him about the status of instrumentation work as of March 10; the monitoring portion would then be Q; he just didn't remember specific statements attributed to Mr. Boos.

17762-17765

Had Hood been told at the meeting that Consumers had started installing instruments, Hood thinks he certainly would have reacted to it and certainly would have under those conditions clarified the staff position that instrumentation was included in the Q.

17766-67

In regard to the company's commitment with respect to the installation of underpinning instrumentation as Q, Hood recalled that applicant had made a sort of proposal during the meeting to the extent that the monitoring aspect itself would be Q. Hood recalls that Moody had some comments at the conclusion of the meeting in which he said he was going to generally discuss the matter with his men and get back to the Staff with the company position. Landsman didn't remember Mooney's comments at the conclusion.

17768

Landsman's impression was that the staff did not have to wait for the company to do anything; they had stated "how it was going to be" and they didn't have to wait for the company to say anything. There would be no negotiation. Landsman recalled two things the staff "let them off the hook on": one was the access shaft down elevation 609, and the other was the instrumentation system. Everything else would be Q.

17770

Instrumentation according to Landsman, included the strang gauges the extensive meters and the Carlson meters, and a whole range of instruments that had to be installed to monitor to auxiliary building.

CONSUMERS POWER

MIDLAND PLANT UNITS 1 & 2

<u>Page</u>	<u>Description</u>
17770	However, when he gave his statement to Mr. Weil, Hood said he believed instrumentation just meant settlement gauges and strain gauges.
17771	Hood however said that at the time he was just giving examples of instrumentation and that was not the complete list. Evidently Mr. Weil had understood the instrumentation and Hood's description of it in the same manner.
17772	Cook's understanding of the commitment of Consumers Power at the conclusion of the March 10 meeting was that everything associated with soils would be Q and that the staff would not require them to backfit those things which were already backfitted Q into those things that were already essentially installed. Based on the asserted representation of Mr. Boos, that was the case with respect to the instrumentation system. Cook says there was no regulatory basis for giving Consumers Power a "pass" on the instrumentation system assuming it had already been installed. Instrumentation, however, fell into the category of the backfitting of Q, meaning provided it could be demonstrated that even though it had been installed non-Q it could still perform its function, it would be passed.
17773-74	Essentially, then, on the premise that the instrumentation had been almost completed, the staff indicated that they would not require Consumer's to go back and backfit Q (i.e. tear it out and re-do it all to Q standards); nevertheless, completely inferior installation of the instrumentation be Not accepted either. "So it was up to the licensee to demonstrate that even though they were put in in a Non-Q fashion, the way they were put in would be adequate to give settlement data during the soils work."

1775

If instrumentation had been installed in a Non-Q fashion Cook said, the staff expected it to be of a good enough quality that it could take data on the building during the remedial soils work. The staff had indicated to the licensee (or at least Joe Kane's group) that the repairs in the soil settlement were based upon having data that could be reliable enough to make an evaluation as to what happened to the buildings.

1776

Cook felt the Staff knew that sometime later the instrumentation would have to be checked out and there would be an opportunity for inspectors to ascertain that even if they had been installed in a nonque fashion that they were of good enough quality to give good data during the remedial soils work. The NRC inspectors would ultimately have to check out the data on the instrumentation.

17776-77

Landsman indicated that he had wanted to bring out Ron Gardner to look at the instrumentation system functioning in place for several hours and thus get his opinion as to whether the whole thing was going to work. Landsman was personally not basing anything on what the licensee had said. Hood added that the NRC's intent in giving their position during the March 10th meeting was that those items that were not to be Q listed were to be justified by the applicant; the FIVP was a case in point in which the overhead temporary support had been installed Non-Q. Rather than going in and ripping it out the staff would work with the applicant to establish what reliance could be placed upon the system and to establish whether or not it was important to safety.

17778

The confuzion started when someone misunderstood the staff's position: Consumer's apparently construed it to mean that if something was installed Non-Q under normal situations the NRC did

not have any authority to go in there and tell them to tear it back out. The NRC staff's real position was that they did reserve the right to go in there and tell the applicant to tear out things installed nonque because they were considered essential for the operation.

17779-80

Hook said that at the time of the March 10th meeting their preference would have been that everything be installed Q, and they weren't aware that there had supposedly been instrumentation installed Non-Q to the extent that the staff was led to believe. Landsman said that at the conclusion of the meeting, both he and Cook were of opinion that the instrumentation was almost complete. Landsman then described the meeting of March 10th. It was in a small meeting room and only the major participants were seated around the table in the middle. Other people were off to the side. Around the table were seated Mooney, Boos, Hood, Landsman, Cook and others that Landsman couldn't remember.

17781-82

Hood recalled that the bulk of the presentation was given by Moody and Boos, and he thought Boos was probably the predominant speaker because he recalled that it was mainly "a Bechtel show," something to which Hood was quite adverse. Cook recalled that at the meeting from the NRC Hood had talked along with Eleanor Adensan, Landsman and Cook himself.

17783

Hood recalled that Mr. Bird was also quite involved in the discussion; others, who were at the meeting but had little to say, included Hirzel, Horn, Williams and Gilray. Mr. Rinaldi didn't say anything according to Landsman. Although Brunner was at the meeting he did not have a great deal to say. Hood didn't recall the involvement of Budzik.

17784

Hood recalled the caucus that the staff had had with Mr. Vollmer.

17784

This caucus took place because of the staff's position that everything was going to be required to be Q except as could be justified otherwise, and for Hood to develop a staff position involved the concurrence of his management. Vollmer agreed to the position he was putting forward on behalf of the staff. When they went back into the other room Hood was the main spokesperson for the staff.

17785

Hood had not had any discussions with any representative of Consumers Power Company regarding the substances of the statement prior to giving it to Mr. Weil.

17785-86

Hood indicated that his answers were given under oath and represented personal recollections of the events; he insisted that he was following no "party line."

17787-88

In the third paragraph of Cook's statement (Exhibit 6 to Staff Exhibit 22) Cook used the word "installed" to denote physical installation. To Cook that meant that the item was essentially complete: for the most part the raceway was installed, the wires were pulled, and the instruments and brackets were physically in place. However, this does not necessarily mean that the system had been checked out. He would have inferred that certain portions of the system had been checked out and were essentially close to the point where a few remaining terminations would transpire and then the intergrated testing and the instrumentation. "Essentially" completed meant to Cook to mean that it was almost completed.

17789-90

Farther down in the same paragraph Cook uses the word "completed" which in the ideal case for Cook would have meant that the item was all the way installed. Cook said he intermixed "essentially" completed and "nearly" completed. He said often times the staff got into

situations where they reviewed things that had been termed completed but were not absolutely so; they were not ready to operate, but "completed" meant the equipment had been installed, the circuitry was there, some of the rudimentary tests have been performed and so forth.

17790-91

Cook's felt was that when the NRC left the meeting they were not going to require a backfitting of QC if large portions of the work had been installed. "Installed" however, meant something very different to Cook than the word "begun".

17792

Weil indicated that when Cook used the word "begun" in his interview with him Weil understood the word to mean work started.

17793

So Cook had told Weil in his statement that it was not work that was begun before March 10 that would be excluded from the program, but work that was completed prior to March 10.

17794

Weil could not find the place in his notes of the interview with Cook wherein Cook made the statement. Cook, however, recalling the meeting of March 10, said it was his understanding that the agreement between the company and the NRC staff was that work that was completed (in as much as completed meant almost finished) would be excluded from quality.

17795

Referring to Doctor Landsman's statement concerning the meeting of March 10, Landsman indicated that the word "started" was used to mean begun. This Landsman said was different from complete. It was certainly different from "well under way" and was in a more preliminary stage. Looking at the sixth paragraph on that particular page of Landsman's statement, it was his understanding that

the instrumentation system would be excluded from the quality assurance program as work that had been begun before March 10. Begun in that instance meant the same thing as started.

17796

Landsman agreed to the conclusion that assuming that conduit was installed beginning in mid February and in April it had been pulled, then the instrumentation work had then been started. And if that had taken place beginning in Mid February and continued up to March 10 of 1982, then he would certainly agree that the work had been started or begun prior to March 10.

17797

In nautical terms (since Cook was in the the Naval Reserve) the word "underway" meant the start of a voyage.

17798

Cook was present when Boos made his statement that "our instrumentation is essentially underway". Cook understood that to mean that the instrumentation was nearly completed. Thus, when Boos used the word "essentially" Cook understood him to mean "nearly".

17799

So in this context Cook understood the word "underway" to be the same thing as complete. Cook could not find any words in the transcript of the telephone conversation which indicated to him that all or a portion of the instrumentation system had been checked out.

17800

However, the terms "essentially underway" gave Cook the connotation that installation was at the point of development where wire had been pulled and raceway had been installed.

17801

Nevertheless, there were no specific words or language in the transcript which represented that the instruments had been attached to the wire. After their conference on March 12, Cook recalled a conversation with Mr. Mooney out in the hall. He did not recall, however, what had been said. Mooney may

have told him in substance that the applicants still had a long way to go on instrumentation, but Cook did not recall.

17801-802

In the context of the March 10 meeting and the March 12 conference call, Cook would have interpreted Boos's assertions to indicate that checkout and perhaps terminations needed to be done, but certainly something other than only a few wires being installed.

17803

Landsman agreed that the word "essentially" meant almost or nearly. He also thought the words "well underway" meant the same thing as complete.

17803-804

Landsman indicated that to him the word begun did not mean the same thing as complete.

17805

For his part Weil said that when Doctor Landsman talked to him he did not use the word begun in the same way as he would use the word complete in the context of this investigation. Landsman said that only a small percentage of the installation instrumentation would have needed to be done to have met his criteria for work having been begun as of March 10, 1982. Less than ten percent, in fact, would do it.

17805-806

Landsman asserted that his reason for believing that Boos misrepresented the facts to him was not solely based on his recollection of the statement made by Mr. Shafer of Consumers Power Company, that installation had not begun until March 11, 1982; Landsman said he had heard Boos say something March 10, which he claimed was reinforced in the March 12 phone call by the same person.

17806

On the last page of a telephone transcript a possible meeting between Cook, Landsman, and Boyd was discussed following the telephone conference; Landsman did not recall any meeting of this nature, though Cook remembered having a telephone conference when they got back to the trailer amongst the NRC staff.

17807

On the preceding page, Boyd seemed to indicate that a telephone call would be placed to Consumers Power Company representative on Monday the 15 of March; neither Cook or Landsman recalled any telephone call of that sort, and Weil could not find any mention of it in reviewing Boyd's statement. Moreover, he personally did not ask Boyd about it in the course of his interview.

17808-810

Weil could not say, however, if he construed Boyd's promise to call back as a lie, given the fact that he did not do so; there was still the matter of "deliberatness", and since Boyd was not present at the hearing, no one could ask him about that.

17810-812

Given that the agreements between the NRC's staff and Consumer's Power was that any work begun (common meaning of the word "begun") prior to March 10 was not within the scope of quality insurance program, and assuming that work had in fact begun installing conduit and pulling cables as early as the third week in February, Weil could not describe how (if at all) a member of the NRC staff could be misled by what Mr. Boos had said on March 10 or March 12. However, Weil had more to say about the agreement between Consumers and the staff: the agreement did not imply that if an activity had been accomplished it would be written off by the staff as non Q, since this was not intended at the meeting and such an indication according to Weil was "indefensible". According to Weil the actual agreement was that "where such systems had been accomplished they would be looked at and they would either be justified or they would have to be done over".

17813

Weil did not think that this had been spelled out properly; the emphasis was on the justification. In the case of the vertical access shaft, the staff had done review of that activity and it had made a technical adjustment that it could be performed as a non Q system and would not impact safety.

17813-14

Cook explained that the incident that upset him the most when Dr. Landsman and Mr. Gardner appeared to conduct an inspection of the instrumentation system on the 17th of March was not that Mike Shafer did not have a quality plan, it was that he had limited knowledge of the instrumentation being associated with the remedial soils work. What upset Cook was that if Mike Schaeffer was indeed the lead quality assurance electrical engineer, how could the applicant keep him in the dark if instrumentation associated with the remedial soils was at some advanced state of installation? Cook added that he became more upset when he found out the actual status of the installation.

17815

Cook agreed that Schaeffer was assigned to MPQAD and as such had responsibility for the Q-A functions within his assigned area. Based on Cook's understanding at the time, the instrumentation system was completed and therefore was not within the scope of the quality program. Cook said it was the mere fact that the instrumentation was going on, even if it was in a non-Q state, and Schaeffer's limited knowledge of the instrumentation that he found so surprising; considering Cook's opinion of Schaeffer's capabilities, he would consider Schaeffer's nonawareness of instrumentation whether it was Q or non-Q to be very surprising indeed.

17816

What would have been even more surprising to Cook was that management would not have asked Schaeffer for his opinion as to what quality requirements might be needed, especially in the light that the data taken from the instrumentation would be Q. So to sum up, "to chat with a person of Mr. Schaeffer's capability and have him express that he was not knowledgeable with the requirements for instrumentation for the remedial soils was at best a little surprising if not shocking." Schaeffer did not make these comments to Cook while in Landsman's

presence. Landsman said that when they arrived on site, Gardner and Landsman did an inspection first and determined the status of the instrumentation and then went to talk to Schaeffer.

17817

It was at that time that Schaeffer informed him that the cable pulling was not considered to be within the scope of the quality assurance program. Landsman indicated that the questioning of Schaeffer about the absence of quality control/quality assurance for the instrumentation installation was their normal course of inspection; since it would be normal when one was working on a site for there to be some controls in place (not the complete Q-A controls) Landsman was surprised that there were none in place at all.

17818

Landsman said that MPQAD did not have responsibility for controls on non-Q work; he really didn't know if there was another organization on the Midland site that did have responsibility for such control.

17819

Landsman suddenly realized why they had gone to Schaeffer on site. There had evidently been some part of the instrumentation that had to be Q, and since he was the electrical instrumentation head, they went to him to find out what he knew about it.

17819-21

Gardner's explanation was a little bit different. They had gone on site, Gardner explained, expecting to take a half day or so to inspect the system that was fairly well complete. When they got on site and went out to the building, they discovered a lot of the cables were not installed; he thought 10% actually had been. Since it was Gardner's understanding that for that part of the instrumentation system which was not complete, a Q program was needed, they went to Mr. Schaeffer to find out what programs had been established to control the remaining installation that

had to be done to accomplish the complete installation of the system. At that time, Schaeffer told them that he was not aware the system was a Q system at all and that there had been no program or requirements established for cable pulling, termination or any other aspects of instrumentation.

17823-24

The previous day, (transcript of page 17490), Landsman had testified that the placing of riprap on the dike by the ultimate heat sink was directly specified in a board order to be covered by the quality assurance program. Landsman was unable to find any reference to this requirement and either the April 30th order, or the May 7th order. He denied he had deliberately given the wrong date the day before when he had said it was the April 30th order.

17824-25

Landsman wasn't sure it was in an order. Hood thought the board had said something to the effect that drawing C45 could be used to define structures "in and around" but it was subject to the staff comment on such drawings, and it was within the staff comment that one found the requirement that the boundaries be altered to encompass the dike. Hood didn't know if the first revision of C45 after the Board's order just listed the burn as Q and not the dike itself. However, he did know that the staff's comment in respect to its review of drawing C45 indicated that the dike should be included in the definition of Q areas.

17826

Hood didn't know when the staff comment came along; he thought it was in the May 25 letter. Hood didn't know if there was ever a point in time the previous summer when drawing C45 was revised by Consumers to indicate that the Q boundaries included the berm of the ultimate heat sink, but not the dike area adjacent to the berm.

17827

Landsman did not recall the exact date but it was a fact included in his testimony that drawing C45 had been revised again to include the entire dike area as Q. Landsman thought that during October or November there had been some communication from the staff to the applicant stating that the dike should be included.

17828

Landsman indicated that the dike had at one time been identified as a safety-related structure. He said it was not originally constructed as a seismic category one structure, however the staff had conducted a technical review based on the borings that were provided and they were able to determine from the engineering properties that the structure would not fail under an earthquake and therefore they were satisfied with the dike.

17829

However, said Hood, the question about the dike's consideration as a safety class structure did not have an easy answer. The staff had looked at after the fact and established its integrity by another means. (Other than design in seismic category one.) However he said, what was intended by the staff comment was that considering the activities that could go on in the dike in the future it should be controlled and should be under the control of the MPQAD program. One would want to control, for instance, any kind of activity involving excavation or construction which could possibly lead to a hydraulic fracture. Hood could not remember what had prompted the staff to review drawing C45 initially.

17830-32

Hood explained that what prompted the initial decision to review the dike as a category 1 structure were the concerns that the failure of the dike would impact the safety system (namely the reservoir). Hood indicated that the initial set of borings received from the applicant were probably before March of 1982.

17833

Hood was not positively sure of the date; he thought it would be in the SER.

17833-34

In response to a board question regarding the semantics of work started and work completed, Landsman indicated that when Mr. Boos had said instrumentation his impression was that instrumentation was complete or essentially complete; he took it as a whole system -- all the parts. For his part, Hood said it didn't make much sense to talk about whether it was started or completed -- to him, the relevant point was whatever the applicant had done that was not done as Q should be justified. This he later clarified as meaning phase 2 though apparently not everyone understood this; in effect he was saying "stop at this point, let's look at what you've done, let's see if there is justification for what you've done as non-Q, and then proceed forward with the rest of it as Q."

17835

It was Hood's intent that this would mean that work may have begun prior to March 10 and not be under the QA program, but that its completion would have to be under the QA program from then out. Hood thought when he clarified this comment to save phase 1 and phase 2 he was being consistent; all he had to prove for phase 1 was the vertical access shaft whether it was finished or not he had refuted and found it acceptable. But he didn't want anything beyond that going on non-Q unless it could be specifically justified.

17835-36

Landsman explained further. The access shaft and the instrumentation were both cases in point; the staff had actually stopped the access shaft at elevation 609 and had wanted Consumers to dig the

rest of it under Q. The same was true of the instrumentation. Had Landsman known all the conduit was in and perhaps all the wire was pulled, the staff would have stopped them on that and said from this day forward the termination, the installation of the instruments and the checkout would all be made as Q. He added they would have stopped the instrumentation at whatever stage it was, but they had been told it was complete. Cook added that had they known the instrumentation was not very far along chances they would have forced all of it underneath the Q umbrella.

17837

In other words the staff had to evaluate the significance of the impact: if it could have been justified then what had been done would not affect the readings later on, the staff would probably have let that go as non-Q. The same was true with the instrumentation: had they found the instrumentation to be to a large degree installed, they would not have required the licensee to backfit Q provided it could be shown that what was done would not adversely affect the taking of data for the period of time that it was needed.

17838-39

Cook explained that this did not mean that similar types of cables or instruments would be judged Q or non-Q simply on the basis of when they were installed; if for instance the wiring that was installed in the non-Q portion of the instrumentation was compatible with that which would be required under the Q envelope Cook said there would be no reason to throw away the wiring that had been initially installed. However, if this wiring turned out to be of an inferior quality then staff would require that it be removed. This is also true if the system had been completely installed:

had the staff made the determination that the wiring used was of an inferior quality and could not withstand the rigorous use of instrumentation then that too would have required them to insist on it being removed. That was part of the reason that Ron Gardner was asked to come on site initially. Hood believed that the basic decision as to justification of an item was made by the applicant and was reacted upon by the staff.

17839-40

Gardner said he was going to ascertain the status and the adequacy of a complete instrumentation system, whether it had been installed in their Q program or not. When they found out there was only a small percentage of the whole installed the determination became different: they needed to find out what kind of program Consumers should have since it turned out they had a lot more to do to complete the remainder, and the other determination was whether the system would have functioned properly if they continued with the remainder in the same manner as they had with the small part that was installed. Gardner had determined at the time that they previous manner of installation had been unacceptable.

17841

Landsman said that he had thought the system was in place and operating; they never thought of how to inspect parts of it. So in his mind it was not a question of work in progress to be looked at, it was one of items to be inspected as a whole entity.

17841-42

Starting with the second draft of the cover letter to the Inspection Report, there was reference to the fact that the cable pulling started on March 11. Landsman and Cook had been responsible for the second draft of the cover letter. The statement as to the date, March 11, was solely based on the report received

by Landsman and Cook from Mike Shafer. Landsman indicated that the question was asked Shafer during the inspection either Thursday or Friday as to when the cable pulling had begun. Cook said that the message they had intended to convey in the letter was the fact that the amount of work that was done, as small as it was, was actually started after the meeting when everything was supposed to be Q.

17842-44

Gardner didn't think anyone could break down the differences in types of wire to determine if there was any difference in that which was pulled before March 11 and that which was begun on March 11 or after. Landsman didn't think it had been proven on the record that any cable pulling had begun before March 11.

17845

Weil reiterated that he had testified that some cable pulling had occurred prior to March 11; however, he knew of no difference between that which was pulled before March 11 and that which was pulled after.

17845

Referring to the notes of Mr. Black, Weil said that the references on the very last page to benchmarks and dates complete pertained to conduit and cable. There was also a correlation between the particular numbers and letters appearing under benchmarks on the last page to the same letters on the previous page.

17845

Upon questioning, Black had indicated to Weil that the number of cables pulled prior to the stop work order on March 19 had been 32, and 16 had been removed. Weil didn't know how many had been pulled prior to March 11.

17847

Mathematically, Weil thought there were problems trying to add up the footage and determine what was pulled prior to March 11.

17847-49

The only basis for Weil making the statement that cable pulling had begun prior to March 11 was the statement by Mr. Black who apparently had time cards. Weil had reviewed some of the drafts of the cover letter other than the first; he did not have any problem with the statement occurring in all of the drafts that cable pulling did not begin until March 11 (a) because the cover letter was really out of his domain, and (b) his colleagues (who were honorable men) were told it was March 11 and he had no reason to doubt that.

17850

Weil didn't know if he had ever pointed out to anyone in the course of his review that March 11 might not be accurate.

17850

Hood said that the way the March 10 meeting was concluded was that where there were exceptions to be taken to the Q umbrella, the applicant would work those out with Region 3 and get their agreement to them and thus there were expected to be further contact between the applicant and the NRC pertaining to the Q requirement.

17851

Hood said that as far as the staff were concerned if the applicant did not plan to take any exception and they wanted to make everything Q there would be no need for any further contact on the matter. He added that the NRC's position on the matter was final and it was not something that was open to negotiation. That's why Hood met with Mr. Vollmer and his management beforehand so that he could take that position. Hood's understanding was that the meeting of March 10 and the phone call on March 12 came about because there were exceptions desired on the part of the applicant.

17852

Hood agreed that any work performed on March 11 or after which the staff regarded as phase 2 or beyond, which was being completed non-Q and for which an exception had not been sought would be regarded as at least inconsistent with regulatory requirements. Cook recalled that it was



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

MAR 12 1982

Docket Nos.: 50-329
and 50-330 OM, OL

J. Handley
Rec'd 3/22/82
1/B3

APPLICANT: Consumers Power Company
FACILITY: Midland Plant, Units 1 and 2
SUBJECT: SUMMARY OF FEBRUARY 23-26, 1982, MEETINGS ON REMEDIAL ACTIONS
FOR STRUCTURES ON PLANT FILL

On February 23-26, 1982, the NRC Staff and its consultants met in Bethesda, Maryland with Consumers Power Company (the applicant), Bechtel and their consultants to discuss (1) dewatering and recharge tests in progress at the site, (2) results of surcharging the Borated Water Storage Tank (BWST) valve pits, (3) the Diesel Generator Building, (4) Service Water Pump Structure and (5) monitoring criteria for underpinning the Auxiliary Building. Meeting attendees are listed in Enclosure 1A through 1D.

Dewatering and Recharge

Mr. W. Parris of Bechtel described the recharge test which began February 4, 1982 after the water table was lowered to elevation 595' or below. All but two of the observation wells indicated the water table had reached 595' or lower. At these two locations the water was only slightly above elevation 595' because of soil stratification conditions which appeared to indicate a perched water level overtop an impervious foundation layer near elevation 595'. The object of the test is to demonstrate that adequate reaction time exists in the event of loss of dewatering capability before liquefaction potential exists beneath critical structures or components (i.e., before the water table rises to elevation 610').

The Applicant provided a Bechtel drawing entitled "Ground Water Levels Prior to Start of Recharge Test (2-3-82)". This is a large size drawing and a copy is retained at the NRC Central Files, Bethesda, Maryland. Enclosure 2 shows the ground water measurements at twenty wells observed since early January 1982. Observation wells in the area of the Railroad Bay (i.e., the north part of the Auxiliary Building) have shown no response in water levels since the recharge test was initiated on February 4, 1982. Enclosure 3 is the Applicant's estimated repair times for various well failure mechanisms. Extrapolation of the present data base indicates that about 48 days or more is the shortest period of time that may be available after loss of wells before the ground water rises from elevation 595' to 610'. This 48 days is based on observations of well COE-13A which is located just south of the Diesel Generator Building. The applicant will have thirty days of data by March 4, 1982 and will meet with NRC March 3, 1982 to determine whether an adequate basis for extrapolation has been established before terminating

2040504/35
225 pp.

the recharge test. The March 3, 1982 meeting should also better define which structures and components are of liquefaction concern and their associated control level and monitoring details. The Applicant will also address failure of non-seismic piping, including the condensate storage tank lines and circulating water lines which are near or beneath the Diesel Generator Building.

BWST Valve Pits

Mr. J. Kane of the NRC geotechnical staff stated that on February 19, 1982 the Applicant had provided an informal information package of settlement results of the BWST ring walls and valve pits due to the surcharge. On the basis of that information, Mr. Kane concludes that the surcharge may now be removed from the BWST valve pits. The NRC will formally document its concurrence. The Applicant was asked to submit the following formally:

- See letter dated Mar. 18, 1982 from Cook to Denton*
1. A letter discussing the predicted maximum differential settlement between both valve pits and the new ring beam foundations following removal of the surcharge, and a comparison of this projection with the maximum differential settlement which was calculated in the structural analysis of the BWST.
 2. Time-settlement plots for both tank units. These plots should identify significant event dates (e.g., dates for filling tanks, raising cooling pond level, dewatering, placement of surcharge). The plots should also be marked to indicate the above identified maximum differential settlements.

The Applicant will also provide information on the placement of strain gauges for the new ring beam on March 16 and details of the procedure for re-leveling the Unit 1 tank on April 15, 1982.

The Applicant will provide information to establish that the load combination identified in its testimony for the February 16-19 hearing session is the controlling load combination for the design of the BWST ring foundation. The Applicant will also provide information to establish that 1.5 times the FSAR seismic spectra will envelope the Midland Site Specific Response Spectra for the evaluation of the BWSTs and their ring foundations.

Service Water Pump Structure (SWPS)

1. Structural Items

Mr. C. Dirnbauer of Bechtel reviewed the three-dimensional, finite-element models for the SWPS and the status of their use in analyzing the existing structure and underpinning design. The analyses for the various loading combinations will be completed in mid-March, 1982. Mr. Dirnbauer's presentation is given by Enclosure 4. The finite-element models are described by Appendix A (Enclosure 5) of the Applicant's report "Technical Report on Underpinning the Service Water Pump Structure," submitted under cover letter dated November 6, 1981.

In support of its discussion of jacking loads for the SWPS underpinning design, the Applicant also provided a draft copy of its proposed hearing testimony for the SWPS prepared December 31, 1981 (Enclosure 13). Section 5.2 of this draft testimony addresses jacking loads.

The Applicant stated that a report on the cracks in the SWPS will be submitted for Staff review about March 1, 1982.

The NRC has scheduled an audit of the SWPS underpinning design and associated design calculation for March 16-19, 1982 in Ann Arbor, Michigan. Mr. F. Rinaldi of the NRC identified the following areas of structural interest for this audit:

1. Details of the prestressing system and associated loads, including any effects on the structure.
2. Derivation of the jacking loads
3. Results of analyses for all load conditions and applicable load combinations.
4. Crack control and monitoring, including pressure grouting plans.
5. Limits for building movement and differential settlements during underpinning construction and during plant life, and an evaluation of effects on the structural components.

2. Geotechnical Items

Enclosure 6 lists 26 questions by Mr. H. Singh of the Corps of Engineers resulting from his review of the November 16, 1981 technical report on the SWPS. The response given at the meeting to each question follows:

- Q1. Procedures for attaching settlement indicators to benchmarks for the SWPS will be the same as those for the Auxiliary Building.
- Q2. This is addressed in paragraph 4.6.1 (page 24) of Enclosure 13. At least two deep benchmarks at the north end of SWPS are already installed. All deep benchmarks will be installed by March 15, 1982.
- Q3. Analysis to establish allowable building movements during underpinning are in progress. Response to this question is deferred to the March 16, 1982 audit meeting.
- Q4. This is addressed in section 8.2 (page 47) of Enclosure 13.
- Q5. Applicant's analyses are incomplete at present and results will be presented during March 16 audit. The approach being used is addressed in Section 7 of Enclosure 13.
- Q6. The reference in the design report will be corrected. Instrumentation details will be discussed during the March 16, 1982 audit.

- Q7. Text is unclear and will be clarified.
- Q8. This is discussed on page 49 of Enclosure 13.
- Q9. This is discussed in Section 5.2.1 of Enclosure 13.
- Q10. This is discussed in Enclosure 13.
- Q11. Applicant confirms that only 20 days has been allowed for primary consolidation but is committed to await achievement of a straight line to define secondary consolidation. Applicant states that it is not critical to the construction schedule if more than 20 days is needed.
- Q12. Applicant's testimony gives 0.01" in 10 days for settlement rate limit. Basis for this will be discussed at March 16 audit.
- Q13. This is addressed in Enclosure 13.
- Q14. Final plans for construction dewatering during underpinning construction will be provided to Applicant by contractor during May 1982. Only a preliminary plan is available to the Applicant at present and this will be submitted to the NRC Staff for review of the dewatering concept.
- Q15. NRC needs to review the soil spring constants which were provided by Consumers on February 23, 1982.
- Q16. The Applicant finds that the change due to the unsymmetric jack load procedure for piers 4 and 5 is small. This item is resolved.
- Q17. The Applicant's loading sequence will take this concern into account.
- Q18. This is addressed in Enclosure 13, Table SWP-2.
- Q19. This is addressed in Enclosure 13 at Section 8.1 and Tables SWP-3 & 4.
- Q20. This item was discussed during the structural presentation and has been resolved.
- Q21. This is clarified by substitution of "jacking load" for "dead load" and the issue is resolved.
- Q22. Applicant will respond by March 5, 1982.
- Q23. The loading combination presented was explained to be the most severe of the combinations considered.
- Q24. The Applicant committed to recheck the load equations and respond by telephone during the week of March 1, 1982.
- Q25. See Figure SWP-15 of Applicant's testimony. Applicant will respond by telephone during the week of March 1, 1982 showing how shear is developed.
- Q26. The NRC staff intends to discuss this question with its Structural Engineering Branch before pursuing the question with Applicant.

Enclosure 7 lists 28 questions by NRC consultant S. Poulos from his review of the Applicant's SWPS submittals including the Applicant's draft testimony dated December 31, 1981. The response to each question given at the meeting follows:

- Q1.1 The Applicant will respond later. In response to Applicant's request for staff concurrence of the soil spring values proposed for use in its finite-element model, Dr. Poulos addressed the six cases of Table 1 in Enclosure 5 accordingly:
- Case 1 and 2: Staff will respond March 16, 1982.
 - Case 3: These appear to be the correct values.
 - Case 4: Further Staff review of this case is needed.
 - Case 5: This is an open item to be discussed March 16, 1982.
 - Case 6: Not discussed.
- Q1.2 Addressed in Applicant's testimony (Enclosure 13).
- Q1.3 Applicant will compute the maximum differential to be allowed between adjacent piers.
- Q1.4 Applicant will provide pressure diagram of lateral earth, seismic and hydrostatic pressures used in design at the March 16, 1982 audit.
- Q1.5 This will be addressed during March 16, 1982 audit.
- Q1.6 This will also be provided at the March audit.
- Q1.7 Yes. The SWPS can span between corner piers without assuming any soil support. This is resolved.
- Q2.1 Applicant's conceptual plan will be provided March 8.
- Q2.2 This will be addressed March 16, 1982, to the extent known (coordinate with Singh's Q14).
- Q2.3 See H. Singh Q14 question. The bottom water elevation levels to be maintained during SWPS underpinning, monitoring details, and allowances for perched water will be submitted to the Staff in May 1982. The Applicant has committed to not excavate below the water level during SWPS underpinning construction.
- Q3.1 & 3.2 These will be addressed during the March 16, 1982 meeting.
- Q3.3 & 3.4 These were discussed in part during the meeting where similar to the Auxiliary Building situation and will be concluded during the March 16, 1982 meeting.
- Q3.5 No response from Consumers is needed to this statement.
- Q3.6 Applicant agrees and intends to comply.
- Q4.1 One of six Bechtel resident geotechnical engineers will accept the bearing stratum.
- Q4.2 Dr. Poulos finds that the foundation adequacy of the alluvium may not be appropriately verified by the calibration curve for proposed cone penetration method and that another method may

be needed. The Applicant will re-examine the proposed method and discuss with the Staff during the March 16 audit. Applicant will also establish a maximum thickness of lean concrete to be placed under piers.

- Q4.3 The Applicant will review boring information to establish a maximum elevation difference between foundations of adjacent piers. The Applicant will also develop procedures which could be followed in the event field conditions would require the established maximum elevation difference to be exceeded.
- Q4.4 The correct answer is 1/2". The drawing showing 3/4" needs correction.
- Q4.5 No, there is no significant amounts of gravel prevalent in the hard clay. Yes, the material is stratified.
- Q5.1 The drift is beneath the SWPS because there are several obstructions alongside, including SW pipes and electrical duct banks.
- Q5.2 Test loading up to 130% of design load is recommended for either pier 1 or pier 2. The Applicant will consider this and advise the Staff of its decision.
- Q5.3 This question is deleted.
- Q5.4 Piers 11 are built after removal of jacks so that shear is not introduced into rock bolts.
- Q5.5 The QC inspector will take readings of loads on pier jacks independently of construction crews. Only the QC inspector's reading is a Q-listed activity. The frequency of the reading will be provided at March 16 meeting.
- Q6.1 The contract for SWPS underpinning will be awarded about March 16, 1982. This includes dewatering. Construction start is anticipated about March 23, 1982.
- Q6.2 See Q 3.3
- Q6.3 This is provided in Applicant's testimony.

Mr. J. Kane requested that the adopted upper water surface resulting from permanent dewatering conditions be presented at the March 16, 1982 audit in conjunction with calculations that establish imposed loads for bearing capacity analysis.

3. Quality Assurance Items

Dr. R. Landsman of Region III continues to await receipt of the list of non-Q listed activities for both the Auxiliary Building and SWPS underpinning which he requested during the meeting of October 1, 1981 and again on January 12, 1982. Mr. J. Schaub will expedite this previous request. The NRR Staff noted that acceptance of the Q-list is necessary prior to staff concurrence of Phase II construction for the Auxiliary Building.

Dr. Landsman asked whether the Applicant planned to solicit staff approval of the six Bechtel resident geotechnical engineers. Bechtel replied that it considers such approval unnecessary. Dr. Landsman considers such approval to be advisable in view of past disagreements in this area.

Dr. Landsman asked whether monitoring of the water level during underpinning was a Q-listed activity. The Applicant replied that this is unnecessary since monitoring of the subgrade takes care of this and is Q-listed. The staff finds that control of water level has a direct effect on maintaining foundation stability and that water level during underpinning monitoring should be Q-listed.

Dr. Landsman also noted that excavation of the pits for pier footings was not Q-listed and indicated the need for further discussions on this matter.

A meeting will be scheduled in the near future to resolve NRC concerns regarding quality assurance aspects of the underpinning for the Auxiliary Building and SWPS.

Diesel Generator Building (DGB)

The principal document for this discussion was the Applicant's proposed hearing testimony for the DGB as provided to the NRC January 27, 1982 (Enclosure 14). Enclosure 8 shows the DGB settlement measured during surcharge, measured settlements since surcharge removal, and predicted settlements for plant life as presented on the blackboard by Dr. Afifi.

Enclosure 9 shows the DGB dewatering settlements which were observed from September 1, 1980 to February 4, 1982. Enclosure 10 shows settlement vs time during and after surcharge for several different DGB settlement markers and updated through February 4, 1982.

Dr. Afifi proposed a change to Figure DGB-8 in the Applicant's proposed testimony (Enclosure 14) with respect to the settlement values indicated for Surface D. The proposal was to substitute settlement values at the individual marker locations which was a sum of the settlements measured since surcharge removal plus the predicted settlements from December 31, 1981 to December 31, 2025 (See Encl. 8). The Staff and its Consultant agreed with this proposal since actual settlement records would then be used for the time period which has actually occurred since surcharge removal, rather than predicted values during this same time period.

The NRC Staff commented on the smoothing effect of the long term settlement profile (Surface C) which results in the Applicant's finite element analysis for determining stresses in the Diesel Generator Building due to settlements since surcharge removal. The Applicant's position is that this settlement

profile is the most likely surface because it allows for the Diesel Generator Building rigidity. The Staff and its Consultant do not agree with this position, contending that Surface D, as modified by Dr. Afifi's proposal, is the best estimate of the long term settlement profile at this time and is based on past observations of Diesel Generator Building behavior under field loading which would appropriately reflect the actual rigidity of the structure. In addition, the Staff pointed out past statements by the Applicant's consultants that these predicted settlements would be used in structural analysis in assessing the adequacy of the Diesel Generator Building. The Applicant was requested to perform additional analysis and vary the static soil spring constants, possibly as low as zero in areas to represent potential bridging to produce analytical results that more nearly approximate the predicted settlement profile as proposed by Dr. Afifi. The Staff noted that the major portion of settlement which the Diesel Generator Building has experienced occurred before surcharge removal and questioned the results of structural analysis during pre-surcharge removal period. The Applicant indicated the results of this analysis are now being completed and would be submitted to the NRC Staff by March 8, 1982. The Applicant indicated its intention to demonstrate to the Staff that settlements which occurred prior to surcharging the Diesel Generator Building (January 1979) need not be analyzed for inducing structural stresses.

With respect to long term monitoring, the Applicant proposes to monitor at 6 points on the DGB. The Staff find that a minimum number of 10-points should be monitored.

The Applicant considers that the seismic analysis for the DGB should be deferred for the OL review and these analyses have not been reviewed. Staff conclusions regarding the adequacy of the DGB surcharge must therefore be limited in the instant hearing, even though this remedial action is completed. Mr. Rinaldi also requested information showing that 1.5 times the FSAR seismic spectra envelopes the Midland Site Specific Response Spectra for the DGB.

Dr. M. Sozen reviewed the enclosure to the Applicant's letter of February 16, 1982 entitled "Evaluation of the Effect on Structural Strength of Cracks in the Walls of the Diesel Generator Building". The Applicant has not evaluated the diagonal cracks at the south-east corner of the east exterior wall of the DGB. The Staff questioned whether the diagonal cracks were due to distortion from settlement of the structure and whether the structure was behaving as a rigid body. The Staff requested a statistical analysis of the DGB settlement data and the basis for concluding that the structure is settling as a rigid body. This statistical analysis should consider expected errors in the surveyed data and is intended to see if changes in curvature in the structure are the result of survey tolerances or actual curved distortions.

The Staff also questioned what analysis has been performed along the south wall due to actually measured settlements. The Applicant's consultants indicated that they had not been requested to evaluate the effects of this

settlement and questioned the tolerances of the survey measurements which established these settlement records.

The Applicant has not yet determined whether cracks in the DGB will be repaired. Mr. Rinaldi of NRR stated that cracks affected by the fill or by other significant effects should be repaired prior to plant operation. The Applicant will advise the Staff of its decision during the third week of March, 1982.

Mr. Rinaldi of the NRC noted that spacing of cracks and the sum of crack widths should be considered in the Applicant's crack criteria. These criteria are significant with respect to the total elongation of rebar. In response to this concern, the Applicant stated that a stress criterion of 54 ksi would be used in the analysis, rather than yield stress.

Replacement of 36" Diameter Piping

The Applicant stated that its plans for the replacement of the 36" underground SWS headers will be submitted to the Staff on March 15, 1982. This submittal will also include piping profile information with boring data superimposed as previously requested by Mr. J. Kane and plans for settlement monitoring during plant operation. The transmittal letter will request Staff concurrence by April 15, 1982.

Monitoring Program for Auxiliary Building Underpinning

Viewgraph slides used for this presentation are shown by Enclosure 11.

The Applicant described an analysis of soil stiffness variations beneath the main Auxiliary Building during "stage 1" excavation beneath the east and west ends of the Electrical Penetration Areas. The purpose of this parametric study was to determine the effect of soil modulus variation on the inducement of stresses during Auxiliary Building underpinning. The Applicant has established allowable settlements based upon analyses using a soil modulus of 30 KCF beneath the main Auxiliary Building. The NRC Geotechnical Staff finds that the field information supporting selection of the soil modulus is quite limited and therefore a reasonable range of values should be examined. The Staff's concern is whether a moderate increase in soil stiffness value such as to 70 KCF, is significant and important in defining control movements during construction. For a value of 70 KCF, smaller allowable building movements than those proposed (see slide 10 of Enclosure 11) might result. The Applicant noted that controls are provided for since the high stressed areas (659' slabs and Control Tower shear walls) will be monitored during construction by strain gages on the steel. Since these areas are already cracked, the stress is probably redistributed and therefore should be lower in value. The NRC Staff will advise the Applicant by March 5, 1982 whether a determination of allowable movements based upon a modulus of 70 KCF is needed.

Mr. Rinaldi of NRR noted that cracks should be repaired prior to plant operation.

Mr. Rinaldi of NRR noted that during the February 2-5 audit meeting he had requested that the concrete modulus value not be reduced (the Applicant is using $E_c = 1.8$), and that the Applicant agreed to this request. However, in the evaluation of soil stiffness variations, the Applicant uses the same reduction term.

Mr. John Anderson of Bechtel discussed his parametric evaluation for construction spring constants. Results of this evaluation are shown in Enclosure 12. Mr. Anderson also addressed calculations for spring constants (normal and long term) during the last phase (Phase IV) of Auxiliary Building underpinning. Phase IV provides for construction of the permanent underpinning wall, load transfer and backfill of the excavation.

The Applicant also described the division of responsibilities between Bechtel and the several contractors during Auxiliary Building underpinning (see slides 11 and 12 of Enclosure 11), and the administrative plan for action for the monitoring of building settlement (slide 13, Enclosure 11) and cracks (slide 14, Enclosure 11).

The Staff requested additional information regarding the Applicant's decision not to activate the freezeway near the Turbine Building-SWPS duct bank crossing. Rather than the freezeway, dewatering wells will be used here.

Dr. R. Landsman of Region III advised the NRC Staff that several dewatering wells had been installed along the underground west plant dike near the Administration Building. The Staff requested further discussion of these wells during a March 3, 1982 meeting.

The Applicant will provide the Staff with its plans for the reading frequency and evaluation frequency for the strain gauges to be located at the Elevation 659 slab and at the Control Tower shear walls by March 15, 1982.

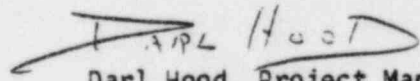
The Staff noted that several significant changes have occurred in the construction sequences diagram for the Auxiliary Building underpinning and requested an updated copy. The Applicant will provide this during the March 16-19, 1982 audit. One of these changes is that the grillage beams from pier W-8 to the Containment Building will be installed before the long drift beneath the Turbine Building to the Control Tower (previously included under Phase II construction) is made; both activities are now part of Phase III construction.

The Staff requested further discussions of the Applicant's backup plans in the event of unexpected or excessive building motions during underpinning construction.

Concluding Remarks of Staff Project Manager

Near the conclusion of this meeting, the NRC Staff Project Manager advised Mr. J. Schaub of Consumers Power Company that a surprisingly large amount of information still awaits the March 16-19, 1982 audit and beyond.

This date is inconsistent with the March 16, 1982 filing date for hearing testimony established for the March 30, 1982 hearing session. The Staff intends to re-evaluate its ability to provide substantive hearing testimony to the present schedule.

A handwritten signature in black ink, appearing to read "Darl Hood". The signature is stylized with a large, sweeping initial "D" and a long horizontal line extending to the right.

Darl Hood, Project Manager
Licensing Branch #4
Division of Licensing

Enclosures:
As stated

cc: See next page

DRAFT: 12/31/81

Midland Plant Units 1 and 2

SERVICE WATER PUMP STRUCTURE

TABLE OF CONTENTS

- 1.0 BACKGROUND
- 1.1 SCOPE OF TESTIMONY
- 1.2 STATUS OF DESIGN EFFORT FOR REMEDIAL MEASURE
- 1.3 FUNCTION AND DESCRIPTION OF BUILDING
- 1.4 IDENTIFICATION OF POSSIBLE UNSATISFACTORY FOUNDATION CONDITIONS
 - 1.4.1 Test Borings
 - 1.4.2 Measurement of Building Settlement
 - 1.4.3 Crack monitoring
- 2.0 CORRECTIVE ACTION
- 3.0 CONCEPTUAL DESCRIPTION OF CONTINUOUS PERIMETER UNDERPINNING
- 4.0 CONSTRUCTION OF THE UNDERPINNING WALL
 - 4.1 HISTORY AND APPLICATION OF UNDERPINNING CONCEPT
 - 4.2 CONSTRUCTION PROCEDURE FOR SWPS
 - 4.2.1 Post-Tensioning Ties
 - 4.2.2 Dewatering
 - 4.2.3 Access Shafts
 - 4.2.4 Underpinning Procedure
 - 4.3 COMPLETION OF THE UNDERPINNING WALL
 - 4.4 WALL CONTINUITY

- 4.5 INSTRUMENTATION OF UNDERPINNING PIERS
- 4.6 MONITORING OF MOVEMENT
 - 4.6.1 Existing Building Vertical Movement Monitoring
 - 4.6.2 Underpinning Pier Vertical Movement Monitoring
- 4.7 THEORY OF PIER DEFLECTION
- 4.8 ACCEPTANCE OF FINAL JACKING
- 5.0 STRUCTURAL DESIGN OF THE WALLS
 - 5.1 BASIC APPROACH TO DESIGNING NUCLEAR STRUCTURES
 - 5.2 COMPUTATION OF JACKING LOADS
 - 5.2.1 Preliminary Calculation of Jacking Loads for the Underpinning Wall
 - 5.2.2 Final Jacking Loads
 - 5.3 BEARING PRESSURES
 - 5.3.1 Preliminary Calculated Bearing Pressures
 - 5.3.2 Final Calculated Bearing Pressures
- 6.0 ACCEPTANCE CRITERIA
 - 6.1 BASIC CRITERIA
 - 6.2 ADDITIONAL DESIGN CRITERIA (ACI 349/RG 1.142)
 - 6.3 LOAD FACTOR
 - 6.4 SEISMIC LOADS
 - 6.5 ALLOWABLE STRESSES
- 7.0 STRUCTURAL REANALYSIS OF THE SERVICE WATER PUMP STRUCTURE WITH UNDERPINNING
 - 7.1 PRELIMINARY REANALYSIS
 - 7.2 CONSTRUCTION CONDITION REANALYSIS
 - 7.3 FINAL REANALYSIS

7.3.1 Schedule

7.3.2 Reanalysis Objectives

7.4 ANALYTICAL PROCEDURES

7.4.1 Determination of External Loads

7.4.1.1 Dead Loads

7.4.1.2 Live Loads

7.4.1.3 Wind and Tornado Loads

7.4.1.4 Buoyancy Load

7.4.1.5 Seismic Loads

7.4.1.6 Thermal Loads and Effects

7.4.1.7 Jacking Preload

7.4.1.8 Settlement Effect

7.4.1.9 Other Loads

7.4.2 Internal Force Distribution

7.4.3 Comparison to Allowables

8.0 GEOTECHNICAL CONSIDERATIONS

8.1 CHARACTERISTICS OF THE UNDERLYING SOILS

8.1.1 Stratum F, Fill

8.1.2 Stratum A, Alluvium

8.1.3 Stratum T, Undisturbed Glacial Till

8.2 BEARING CAPACITY OF UNDERPINNING PIERS

8.3 ESTIMATE OF SETTLEMENT OF THE UNDERPINNING
PIERS

8.4 DIFFERENTIAL SETTLEMENT BETWEEN UNDERPINNING
AND MAIN SWPS

8.4.1 Filling SWPS Reservoirs

8.4.2 Dewatering and Drawdown

8.4.3 Summary of Differential Settlement

9.0 CONCLUSION

REFERENCES

APPENDIX

A Significance of Service Water Pump Structure Cracks

TABLES

SWP-1	Load Equations for Service Water Pump Structure Modified to Include Jacking Load
SWP-2	Bearing Pressures and Safety Factors
SWP-3	Summary of Test Boring Series in Vicinity of Service Water Pump Structure Underpinning
SWP-4	Service Water Pump Structure Underpinning Properties of Fill and Sandy Clay Till
SWP-5	Ultimate Bearing Capacity of Foundation of Underpinning Wall

FIGURES

SWP-1	Site Plan of Midland Units 1 and 2 Power Plant
SWP-1	Plan of Service Water Pump Structure at Elevation 634'-6"
SWP-3	Typical Section of Service Water Pump Structure (Looking West)
SWP-4	Boring Location Plan
SWP-5	Service Water Structure Settlement Marker Locations
SWP-6	Service Water Pump Structure Settlement Marker Plots
SWP-7	Construction Dewatering Wells
SWP-8	Service Water Pump Structure Concrete Placement Sequence
SWP-9	Service Water Pump Structure Construction Survey Control Point Locations
SWP-10	Service Water Pump Structure Changes in Elevation

- SWP-11 Service Water Pump Structure Crack Locations - Plans and Elevations
- SWP-12 Service Water Pump Structure Crack Locations - Elevations
- SWP-13 Service Water Pump Structure Crack Locations - Roof Slab
- SWP-14 Service Water Pump Structure Underpinning Plan and Sections
- SWP-15 Service Water Pump Structure Underpinning Sections and Details
- SWP-16 Need for Underpinning
- SWP-17 Underpinning Pit Isometric
- SWP-18 Sections Through Underpinning Pit
- SWP-19 Underpinning Construction Details
- SWP-20 Service Water Pump Structure Tension Ties
- SWP-21 Section Through Instrumented Underpinning Pier
- SWP-22 Service Water Pump Structure Estimated Top of Pier Deflection Due to Creep of Concrete v. Time
- SWP-23 Service Water Pump Structure Estimated Top of Pier Deflection Due to Shrinkage of Concrete v. Time
- SWP-24 Service Water Pump Structure Estimated Top of Pier Deflection Due to Consolidation of Soil v. Time
- SWP-25 Service Water Pump Structure Estimated Top of Pier Deflection Due to Total Deformation v. Time
- SWP-26 Boring Location Plan and Geological Section

SERVICE WATER PUMP STRUCTURE

1.0 BACKGROUND

1.1 SCOPE OF TESTIMONY

This testimony presents evidence regarding the remedial measure to be undertaken at the north end of the service water pump structure (SWPS) as a result of the detection of certain areas of insufficiently compacted fill material which was placed for foundation support under the overhang section at the north end of the building.

1.2 STATUS OF DESIGN EFFORT FOR REMEDIAL MEASURE

The design and analysis procedures for the remedial measure for the SWPS are described in detail in Sections 5.0 through 7 below. The committed preliminary design (described in Section 5.1) for the underpinning walls will be completed in January 1982. It is anticipated that the final underpinning design and final structural reanalysis of the building will be completed in February, 1982. The information presented here, which is based on the partially completed committed preliminary design, does not represent final design information, which is usually not presented until Operating License proceedings. This testimony, however, provides considerably more detailed information than is normally required at the Preliminary Safety Analysis Report (PSAR)/Construction Permit (CP) licensing stage pursuant to 10 C.F.R. § 50.35. The information herein provides an adequate and reasonable basis for assurance that upon completion of the

proposed remedial action the SWPS will be fully capable of performing its intended safety function under all postulated conditions.

1.3 FUNCTION AND DESCRIPTION OF BUILDING

The SWPS is a reinforced concrete structure located approximately 500 feet east of the diesel generator building. (See Fig. SWP-1.) The structure contains three water-filled reservoirs and five pumps which together provide cooling water for various components during normal plant operation and which supply several safety-related cooling systems which are required to function during a design basis accident, such as a postulated safe shutdown earthquake (SSE). Because of the safety-related function of this equipment, the SWPS structure must maintain its structural integrity during and after a design basis accident. Consequently, the building is required to be designed as a Seismic Category I structure.

The SWPS is rectangular in plan, with upper and lower sections of different dimensions. The upper section is 106 feet long and 86 feet wide. The lower section is approximately 72 feet long and 86 feet wide. The upper section thus has an overhang section at the north end which is supported by a separate base slab. The lower section base slab is situated approximately 47 feet below grade level at the south wall. The upper section base slab is situated approximately 17 feet below grade level at the north wall. The structure measures about 69 feet in total height from the lower base slab to the roof, with approximately 22 feet of the

building extending above grade at the north wall (Figs. SWP-2 and SWP-3). The water-filled reservoirs are located in the deeper section of the structure. The south wall of the deeper section abuts the cooling pond.

The two reinforced concrete base slabs supporting the structure are located at elevations 587 and 617. The lower slab is 5 feet thick and is constructed on undisturbed glacial till. The upper slab is 3 feet thick and is constructed on a triangular wedge of backfill soil with a maximum depth of 30 feet. Both slabs are locally thickened near sumps.

All walls and slabs are of reinforced concrete. Exterior walls are 2 to 4 feet thick and the interior walls vary from 1 foot, 6 inches to 2 feet in thickness. The roof slab is 1 foot, 9 inches thick.

1.4 IDENTIFICATION OF POSSIBLE UNSATISFACTORY FOUNDATION CONDITIONS

As a result of settlement measurements on another building in August 1978 (see G. S. Keeley, prepared testimony following Tr. 1163). The Applicant undertook a subsurface soil investigation in the vicinity of the SWPS utilizing soil borings. On November 7, 1978, the Applicant submitted a 10 C.F.R. § 50.55(e) interim report that disclosed that soil borings had been made in plant fill areas in the vicinity of the SWPS.

1.4.1 Test Borings

Eleven soil borings were taken in the area of the SWPS. Two borings were taken inside the building and nine in the surrounding area. (See Fig. SWP-4.) These borings indicated that some localized areas of the heterogeneous backfill material underneath and adjacent to the overhang section of the structure had not been sufficiently compacted.

1.4.2 Measurement of Building Settlement

The Applicant established a Foundation Data Survey Program (FDSP) to monitor settlement of Seismic Category I buildings at the site in May 1977 in anticipation of a commitment to do so in the Midland Project Final Safety Analysis Report (FSAR). The FDSP began in May 1977 with the attachment of settlement markers to the containment buildings, one corner of the auxiliary building, and the turbine building and was extended to other locations as construction conditions permitted.

Pursuant to the FDSP, settlement markers were attached to the four corners of the SWPS by the summer of 1978. (See Fig. SWP-5.) Field personnel have surveyed the elevations of three of these markers bimonthly from about July 1978 to December 1980 and biweekly from January 1981 to the present. The initial reading for the fourth marker occurred in September 1978 but bimonthly resurvey did not commence until November, 1979. The accuracy of these measurements is approximately ± 0.005 foot (1/16 inch).

Fig. SWP-6 shows plots of observed settlement against time for the four SWPS settlement markers. As this figure indicates, the maximum movement since initiation of the FDSP occurred at marker SW-1 attached to the northwest corner of the building. This movement, about $3/8$ inch, was noted in the period between May 1980 and September 1981, which coincides with the period when the construction dewatering wells north of the SWPS were operating. (See Fig. SWP-7.) The $3/8$ -inch movement appears to be a composite of about $1/4$ -inch long-term settlement since FDSP initiation and $1/8$ -inch reversible settlement due to temporary loss of buoyancy forces. As noted in Fig. SWP-7, pumping of the construction wells has ceased. The net downward movement of marker SW-1 is presently about $1/4$ inch since program initiation.

In order to relate the net $1/4$ -inch settlement since program initiation to the total settlement experienced since essential building completion, additional measurements of markers other than those in the FDSP have been undertaken. Six construction survey control points were installed at elevation 639.5 a short time after concrete placement. (A complete history of the placing of concrete in the SWPS is shown in Fig. SWP-8.) These construction control points have been resurveyed in an effort to determine total changes in elevation.

The six control points were originally installed using bench mark PBM-1, which is a stable bench mark located

outside the dike area, as a reference. The locations of these points are depicted in Fig. SWP-9. Four of these points, numbers 1, 3, 4 and 6, lie on the inside faces of the concrete walls in the same general regions as the four permanent settlement markers which are located on the outside of the building walls. The six construction control points were resurveyed in October 1981, using PBM-1 as a reference control bench mark, after pumping of the construction wells ceased. The net changes in elevation as of October 1981 for the six construction control points are shown in Fig. SWP-10. The accuracy of these measurements is ± 0.01 foot (1/8 inch).

Several important observations can be made from examination of these data. First, the values from the six control points are, as expected, uniformly larger than the values from the four permanent markers, which were placed 2 to 6 months later than the control points. Second, within the tolerances associated with the readings, the two sets of data are closely correlated. For example, the maximum total measured settlement of 0.03 foot measured at the north building end at control points 1 and 6 is not statistically distinguishable from the 0.025-foot (5/16 inch) measurement at permanent settlement marker SW-1. Third, the north-south differential building settlement is minimal; as determined by the six control points, the maximum differential is 0.01 foot (1/8 inch); the maximum value from the four FDSP settlement markers is less than 0.025 foot (approximately 5/16

inch). These measurements indicate that the building is very stable by conventional standards.

1.4.3 Crack Monitoring

A crack mapping program for all Seismic Category I buildings founded in whole or in part on fill was instituted in December 1978. The initial crack mapping of the roof slab and walls in the overhang section of the SWPS, which is founded on fill, was completed in April 1979. Approximately 6 months later a second mapping was performed. In April of 1981, an abbreviated crack survey took place. In October and November of 1981, a third crack mapping was conducted. The third mapping included a mapping of the north wall of the overhang and a mapping of the roof and walls in the southern portion of the building, which is founded on undisturbed glacial till and which had not been previously mapped. (See Figs. SWP-11 through 13 for the results of crack mappings.)

The observed cracking in the overhang section of the building has been assessed as normal volume change cracking which is to be anticipated in structures of this type and size. The cracking in the southern section, shown in Fig. SWP-11, is indistinguishable on the basis of pattern or width from that in the overhang section of the building. For a fuller discussion of the assessment of cracking in the SWPS, see Appendix A to this testimony.

2.0 CORRECTIVE ACTION

The Applicant chose to undertake a remedial structural measure which would compensate for unsatisfactory

compaction of backfill material rather than to attempt to demonstrate satisfactory fill material under the overhang portion of the building. The Applicant selected a remedial measure involving supporting the overhang section with a continuous perimeter underpinning wall founded on undisturbed glacial till* soil as the best measure for assuring proper foundation conditions for the SWPS. After extensive study, this measure was selected as the most effective means of underpinning the SWPS to provide a foundation on undisturbed natural material with adequate design margin for postulated seismic effects.

3.0 CONCEPTUAL DESCRIPTION OF CONTINUOUS PERIMETER UNDERPINNING

In this concept, a continuous perimeter underpinning structure will be constructed under the north end of the

*As is more fully described in Sections 8.1 and 8.2, the underlying glacial till is typically located at and below Elevation 590. The underpinning piers will be founded at or below Elevation 587 and, therefore, it is anticipated that the foundation material for these piers will be the glacial till. However, it is possible that small pockets of sandy alluvium (see Section 8.1.2) will be encountered at that elevation. As described in Section 4.2.4, if sandy alluvium material is encountered in shallow layers, Applicant will remove the sand and replace it with concrete. If the layers are determined to be deep, Applicant will remove any disturbed sand, but will otherwise construct the pier footing on undisturbed alluvium. The sandy alluvium, as described in Section 8.1.2, is an acceptable foundation material and, in fact, has strength characteristics equal to or greater than those of the undisturbed glacial till. All references in this testimony which refer to the bearing material as undisturbed glacial till should be read to include the possibility of sandy alluvium.

existing structure. The underpinning will consist of three reinforced concrete walls which will be connected to one another and to the main building to form a box structure. The reinforced concrete underpinning wall will extend from the under side of the upper foundation slab to undisturbed glacial till (elevation 587). The underpinning walls will be 4 feet thick on the east and west walls. Because the largest fraction of the applied load is on the north wall, the base of the underpinning wall under the north wall will be enlarged to 6 feet to maintain bearing pressures within allowable limits.

When the underpinning structure is complete, pre-determined jacking forces will be applied at the interfaces between the overhang perimeter and the underpinning wall to provide for load transfer from the structure to the underpinning and thence to the undisturbed glacial till. Upon satisfaction of design settlement criteria, the spaces between the tops of the piers and the bottom of the base slab will be firmly wedged, welded, and grouted and the piers tied to the overhang structure and to the vertical north wall of the deeper section of the building. (See Section 4.7 below.) The completed underpinning wall structure will provide additional stiffness to the north wall, create complete north-south vertical plate elements, and assure firm structural foundation resting on undisturbed glacial till. (See Figs. SWP-14 and 15).

4.0 CONSTRUCTION OF THE UNDERPINNING WALL

4.1 HISTORY AND APPLICATION OF UNDERPINNING CONCEPT

The general rationale for and procedures used in the technique of underpinning is set forth in Section 4.1 of the prepared testimony on the Auxiliary Building (following Tr. 5509) and will not be repeated here. The concepts utilized are illustrated in Figs. SWP-16 through SWP-19.

4.2 CONSTRUCTION PROCEDURE FOR SWPS

4.2.1 Post-Tensioning Ties

As a preventive measure against possible building distress due to loss of buoyancy during construction, post-tensioning ties were installed along the tops of the north-south exterior walls of the SWPS in November 1981 (Fig. SWP-20). These ties, which consist of two tendon groups on each side of the building, apply a compressive force of about 1,000 kips to the upper portions of the building north-south exterior walls. This force is intended to compensate for additional loading of the overhang section resulting from the loss of buoyancy which will be caused by the temporary dewatering required to construct the underpinning.

4.2.2 Dewatering

An important consideration in constructing the underpinning wall is the necessity for dewatering the underpinning construction area. To lower the water table temporarily within the construction area, construction dewatering wells will be installed in the immediate area of the SWPS. The system will lower the groundwater table

approximately to the level of the top of the undisturbed glacial till. The dewatering results will be monitored at piezometers located adjacent to the underpinning wall. Underpinning wall construction will not begin until the groundwater level has been lowered to the required level.

4.2.3. Access Shafts

Access shafts will be constructed adjacent to the northeast and northwest corners of the SWPS, access shafts will be constructed to provide access for workers and equipment for the underpinning work. The locations of the access shafts are shown in Fig. SWP-14.

The shafts will be excavated in two phases. Initially, they will be excavated to elevation 617 to permit installation through approach pits of the initial underpinning piers No. 1 on the west side and Nos. 1 and 2 on the east side beneath the SWPS base mat. When this initial underpinning is completed, the access shafts will be lowered to elevation 609 to provide full access for excavation beneath SWPS.

The shafts will be constructed using standard methods. First, an auger hole about 2 feet in diameter will be excavated down to elevation 603 for installation of a soldier pile. The hole will then be filled with lean concrete, and a steel beam, called a soldier pile, will be inserted into the wet lean concrete. The soldier piles will be installed at about 5 feet on center around the access shaft perimeter. As excavation progresses downward, heavy horizontal timbers, called lagging, will be installed between

the flanges of the soldier piles. The trimming of soil, trimming of the lean concrete in the auger holes, placement of lagging, and backpacking behind them with soil will be done by manual labor. At predetermined intervals, horizontal beams, called wales, will be installed to support the soldier piles. Support for the adjacent earth around the perimeter is provided in this manner at the same pace as the excavation in the shafts progresses downward. The excavation progress will be coordinated with the groundwater removal so that the measured groundwater levels will always be below the permitted shaft excavation level.

4.2.4 Underpinning Procedure

Wall construction will begin from the access shafts at the northeast and northwest corners of the structure. Working simultaneously from each shaft, tunnels will be advanced to permit construction of three piers at each corner and five piers at the center of the wall. The piers will be constructed in the sequence indicated in Section A-A of Fig. SWP-14. In order to minimize disturbance to the support of the center of the structure due to tunnelling, the second tunnel will not be extended to the center piers until two of these piers are load bearing.

A typical pier is 5 feet long, 4 feet wide, and 30 feet deep. The pier areas will be excavated from the tunnel to undisturbed bearing material. The full depth of the pit excavation will be supported by precast concrete plank lagging which forms the sides of the pier (see detail in Fig. SWP-15).

It is anticipated that glacial till will be encountered at final subgrade. However, pockets of alluvial sand may be encountered. In such cases it is anticipated that the sand will be removed down to undisturbed glacial till, provided that the excavation of the sand will be relatively shallow. The shallow pockets will be filled with concrete. If deep alluvial sand is encountered, it will be accepted for foundation footing, provided it is undisturbed and of the quality described in section 8.2 below. The onsite geotechnical engineer will determine when suitable foundation material has been reached using a combination of visual inspection and penetrometer readings. (See Section 8.1.3.) After the bearing capacity of the soil under the wall base has been approved, reinforcing steel bars and couplers will be placed and concrete for the pier will be poured. The concrete will be cured at least 48 hours before the initial jacking load is applied. After jacking, the tunnel will be advanced to the area where the next pier is to be constructed. The sides of the tunnels will be supported by timber framing and precast concrete plank or steel lagging and bracing.

The principal consideration in the first stage of construction is to provide initial support to the north-end of the building. To compensate for the loss of support under the base slab caused by tunneling and to further counteract reduced buoyancy, the underpinning construction procedure requires jacking an initial load into each pier about 48 hours after its concrete is placed.

The groups of three piers on each end of the north wall have been assigned a total of 465 kips of load each when the tunnelling begins toward the center. The piers and underlying glacial till have the capacity to support 2,000 kips at each end, with a factor of safety of 2.0, should additional unplanned load be transferred to these piers. Based on preliminary calculations, it has been determined that the north structural wall above the underpinning is sufficiently rigid and strong to safely transfer these loads to the end groups of piers.

The underpinning scheme is designed so that the completed north wall and partially completed east and west walls will support about 3,130 kips of load from the overhang section of the building through stage 1 jacking. This load has been established as described below in Section 5.2.1.

The initial jacking load for each pier has been calculated so that most of the initial load will be distributed evenly along the north wall and the remaining load distributed to piers 2, 9, and 10. The loads will be monitored and adjusted for any shift of load caused by pier settlement. During the period that load is maintained on the piers, frequent checking of jacking load will be performed, and the wedges will be periodically retightened. In effect, the tight wedging will be a safeguard for the structure's support should a jack or its hydraulic line fail while loaded.

4.3 COMPLETION OF THE UNDERPINNING WALL

After Piers 1 through 10 (refer to Section A-A of Fig. SWP-14) have been jacked and the deflection of the piers is occurring at a satisfactory rate (i.e., when approximately 75 percent of the predicted pier deflection has taken place), the predetermined final stage jacking forces as specified in the jacking load table (Fig. SWP-14) are applied. It is anticipated that this condition will occur about 90 days after the Number 10 piers are placed and loaded. The final jacking loads will be applied by simultaneously jacking all piers and sustaining this load long enough to assure that pier deflections are occurring at a satisfactory rate. (See Section 8.3 for a description of the criteria for acceptance of final jacking.)

After the top-of-pier deflection rate on a semilog plot has stabilized (see Section 4.8 below), the wedges will be driven tight and welded in place (See Detail 2 of Fig. SWP-15). The jacks will then be removed and the space between the top of the piers and the underside of the SWPS base slab will be closed with concrete and grout to provide additional structural continuity.

The two pier areas at the interface with the main portion of the SWPS (Pier 11) are then excavated. Rock anchors will be drilled into the vertical face of the lower portion of the existing structure. (See Detail 5 of Fig. SWP-15.) The casting of the Number 11 piers will encase the

rock anchors to assure firm connection of tie the vertical face of the underpinning wall to the existing structure.

To tie the top of the underpinning wall to the existing structure, anchor bolts embedded in the concrete of the piers will extend through holes drilled through the upper foundation slab of the SWPS.

When pier interfaces are completed, the access tunnel will be filled with lean concrete. (Because the north end of the structure will be entirely supported by the underpinning, a nonstructural concrete can be used.) The tunnel will be filled and an exit made at the remaining piers (Pier 12) at each access shaft. After these last piers are constructed, the access shafts will be dismantled and filled with compacted backfill.

At this point, the top of the underpinning wall will be fastened to the existing structure by tightening and grouting the previously placed anchor bolts (see Detail 7 of Fig. SWP-15). Because tensioning of the rock anchors and anchor bolts does not occur until after the final jacking load is locked off, these connectors do not transfer dead loads or jacking loads at the interfaces at the time of lockoff.

The construction dewatering system will then be discontinued and removed.

4.4 WALL CONTINUITY

To stiffen the north end of the structure and provide full support, the underpinning wall is made continuous. The wall is constructed in pier segments and the

piers are jacked at different times. To obtain wall continuity, the piers must be tied together with continuous reinforcing steel and shear keys. Splicing the reinforcing steel with reinforcing bar couplers placed at the interface of adjoining piers will provide continuity in the reinforcing steel. (See Detail 1 of Fig. SWP-15.)

Shear keys lock the concrete of adjoining piers together to enable the piers to act as a structural unit. The keys are created by forming a void area at the face of the first of the two piers constructed. This void is filled by the concrete cast in the second pier. As a result of the use of shear keys and coupled reinforcement, the piers together form a continuous wall which will resist lateral and vertical forces in the same way that a continuously constructed wall resists those forces.

4.5 INSTRUMENTATION OF UNDERPINNING PIERS

During underpinning installation, each pier will be instrumented to monitor deflection of the pier tops and bottoms. Pier top movement is monitored by an extensometer dial gage with readings taken between the underside of the foundation slab and the pier top. Monitoring will begin the day after pier concrete is placed and will include measurements during and after initial jacking.

Pier bottom movement is monitored by devices called telltales to help differentiate between the deflection in the underlying soil and deflection of the top of the pier due to shrinkage and creep. The telltales consist of the following

instrumentation. A 3-inch square plate with an attached rod will be placed at the base of the pier (see Section D-D of Fig. SWP-15). The rod will be greased and enclosed in a small diameter pipe sleeve. The rod and sleeve which extend to the top of the pier before the pier, will be put in place concrete is poured. The top of the rod is connected to an extensometer dial gage which also indicates movement relative to the base slab. Rod movements will be recorded simultaneously with monitoring of the pier top. The arrangement of these instruments is illustrated in Fig. SWP-15.

These instruments produce measurements relative to the position of the base slab. Absolute pier top and bottom movement values can be obtained by adding the measurements of movement, if any, of the base slab obtained from the deep bench mark monitoring.

The instrument readings for the movement of the pier base and top will be compared to anticipated values for creep and shrinkage of concrete and for the soil settlement. Actual values will be compared to expected values to determine when the final jacking load may be applied.

As a precautionary measure, Carlson-type stress gages will be embedded in the concrete of the three piers in each corner. These gages will be monitored during tunnelling and installation of the five center piers in order to detect any sudden increase of load which might indicate that the tunnelling had removed a hard point in the existing fill. If a sudden increase of load is detected, tunnelling will be

halted and the procedure for installing piers modified so that piers are installed and loaded by jacks in 5-foot lengths as the tunnel is extended toward the center. These gases are also illustrated in Fig. SWP-21.

4.6 MONITORING OF MOVEMENT

4.6.1 Existing Building Vertical Movement Monitoring

For the past several years, level readings have been used to monitor settlement at various structures at the Midland Plant. (See Section 1.4.2.) In addition, the Applicant will establish additional settlement reading points at the mid-span of the north side of the building and on the east and west side at the mid-point of the deeper portion of the structure and at the location of the vertical interface with the main part of the structure. These points will be observed by means of optical level runs before and after significant events which may affect the settlement of the structure and, during the underpinning operation, on at least a weekly basis. Readings are made with an accuracy of approximately ± 0.005 foot.

In addition, two deep bench marks will be established near the northeast and northwest corners of the portion of the structure to be underpinned. These deep bench marks will extend to a depth of at least 100 feet below grade level (elevation 634) and will be grouted into the undisturbed glacial till. A steel bracket arrangement will be attached to the SWPS to position a permanent extensometer dial gage above the two deep bench marks. These extensometer dial gages will

read changes in level between the corner of the structure and the top of the bench mark to an accuracy of ± 0.001 inch.

For a period prior to underpinning work, the extensometer dial gages will be read twice weekly to provide a base for subsequent readings. After the underpinning contractor begins his work, the extensometer gages will be read daily to monitor effects of construction on the building displacement.

4.6.2 Underpinning Pier Vertical Movement Monitoring

The telltales embedded in the piers (see Section 4.5) will measure directly the deflections at the glacial till under the piers. Thus the soil settlement can be read separately from the total movement at the top of pier which is measured by a second extensometer between the pier and slab. (See Fig. SWP-21.) As noted in subsection 4.7, it is anticipated that the shrinkage of the concrete and the settlement of the underlying till will form the two major components of the deflection of the top of underpinning piers. Readings on the two extensometers at each pier will begin the day following the placing of the pier concrete. The two readings will be plotted on separate graphs for each underpinning pier. Combining these plots will allow an evaluation of the progress of soil and concrete deflection in response to the underpinning loads and will be an important aid in the decision as to final jacking load acceptance.

It must be recognized that independent pier movement due to jack loading on an individual pier will be possible

only before the reinforcing steel and shear keys of the adjacent piers are engaged and the two piers tied together. For example, Pier 1 will deflect under its own jacked load until Pier 3 is constructed and tied into Pier 1. Subsequently, the two piers will move as a unit. As the later-completed pier is jacked, the jacked loads will distribute laterally into the earlier pier and vertically into the just-completed pier, at which a new jacking load is imposed. Experience with other underpinning projects indicate that the necessary balance of loading can be maintained on the piers in groups by adjusting the jacking loads in adjacent piers as they are completed.

4.7 THEORY OF PIER DEFLECTION

The time dependent vertical deflections at the tops of the underpinning piers will result from the combination of movement due to several properties of the underlying soil and the pier concrete. The elastic and plastic deflections of the glacial till soil are discussed below in Section 8.0. The predicted concrete behavior has been estimated based on observations reported in recognized engineering standards, such as the journals of the American Concrete Institute (ACI). The attached Fig. SWP-22 depicts a plot of the top of pier deflection versus logarithm of time. The initial deflection will be due to elastic deflection of the concrete in compression and subsequent deflection to creep of the concrete under continued compressive load. As indicated, the total will amount only to about 0.03 inch. The attached Fig. SWP 23

shows another deflection property of the concrete, i.e., the top of pier deflection versus log time due to shrinkage of the concrete as it cures and dries. The 10,000 day line is equal to about 27 years of elapsed time after pier construction. As can be seen, the total shrinkage-caused pier deflection is estimated at about 0.2 inches with the deflection leveling off after about 90 days. By combining the curves of pier deflection due to concrete behavior, as shown on Figs. SWP-22 and 23, plus the soil deflection curve on Fig. SWP-24, a composite top of pier deflection versus log time curve can be drawn. (See Fig. SWP-25.)

The initial jacking of load into the pier several days after concrete placement will result in early rapid deflection, as is shown in Fig. SWP-25. After about 90 days of loading, the load will be increased to the final jacking level, which will result in another, but smaller, drop in the deflection curve. This increase in jacking load will combine with the shrinkage effect, which is greatest between 10 and 90 days. At about 110 days, the curve will flatten, so that on the semi-log plot it will appear as a straight line. (On a linear time scale the deflection rate continually diminishes.) As discussed in Section 8.0, this semi-log straight line prediction is a standard observation for soil reaction after an initial elastic reaction period and is based on numerous test observations in the laboratory, as well as on long-term field observations on in-place structures and buildings. The key decision in the process of final jacking and locking off

is the determination as to when this linear phase has begun. This determination will be made at the site by plotting deflection curves, both at the top and bottom of the piers, while maintaining the final jacked loadings. It is anticipated that the linear phase will occur soon after the final load level is jacked, assuming that all pier concrete is more than 90 days old.

4.8 ACCEPTANCE OF FINAL JACKING

The final jacking load (established as described below in Section 5.2.2) will total 4,600 kips and will be imposed on underpinning piers 1 through 10 and 12. At that time, all of these piers will be at least 90 days old. This load level will be maintained for a period of two to three weeks until the rate of settlement is within acceptable limits. The plottings of pier deflections under load over the previous periods of time will establish a performance record which will greatly influence the decision of final acceptance and locking off.

The present estimate is that top of pier deflections will total about 0.6 inch maximum at the time of acceptance and locking off with a residual deflection due to jacked loads thereafter over 40 years of 0.1 to 0.2 inch.

5.0 STRUCTURAL DESIGN OF THE WALLS

5.1 BASIC APPROACH TO DESIGNING NUCLEAR STRUCTURES

The design of Category I structures for the Midland plant takes place in four phases. The design of the underpinning wall for the SWPS follows this four-phase approach.

The first phase consists of conceptual design. There may be more than one conceptual design to solve a given design problem, but eventually one concept is selected as the preferred solution. The conceptual design involves simple feasibility calculations and gross member sizing. The conceptual design for the SWPS underpinning wall was completed in April 1981.

The second phase involves the development of a preliminary design. The purpose of this design is to ascertain reliably the feasibility of the concept with more sophisticated calculation methods and more detail than at the conceptual design level. The typical PSAR submittal is supported by preliminary designs.

In this stage, the structure is designed using some load combinations, including seismic loads, which are either factored loads from a previous seismic analysis for a similar structural configuration or loads developed from a preliminary dynamic model. In the preliminary design, engineers determine major member sizes and some, but not all, detail; for example the precise amount of reinforcing steel may not be specified. For simple structures, the design may be performed by hand calculations or a simplified computer model; for more complicated structures, a more detailed computer model may be necessary. Design calculations supporting licensing submittals require independent checking. The preliminary design phase for the SWPS underpinning wall was completed in June 1981.

The third phase of the design process is known as the committed preliminary design. It is not mandatory that the analyses supporting this design be computerized, but computer analysis is frequently used. The analytical method for this design is usually the same as that used later in the final design phase. However, because the SWPS is a very simple structure, the committed preliminary design for the SWPS is being performed using hand calculations, while the final design will utilize a computerized finite element model.

In the committed preliminary design, the engineer reviews the load combination table and selects, by a process of elimination, those load combinations which control the design of the structure. Full quality assurance requirements apply to this phase, including checking of calculations by a second design engineer who has qualifications at least equivalent to those of the originator and full review and approval by supervisory personnel. The committed preliminary design may serve as the basis for issuance of construction contracts and for the execution of the actual work. The committed preliminary design for the SWPS underpinning wall, including construction drawings, will be completed in January 1982.

The fourth phase of the process is called the final design. In this phase, the structure is analyzed using all FSAR load combinations and any supplemental load combinations which may be applicable due to commitments outside the FSAR. The analytical techniques to be used for the final design of the SWPS underpinning wall are discussed in Section 7.4. The

quality assurance provisions discussed in the preceding paragraph also apply to this design phase. The final design for the SWPS underpinning will be completed shortly after completion of the committed preliminary design.

5.2 COMPUTATION OF JACKING LOADS

In the case of the SWPS underpinning, the foregoing process is only part of the entire analytical procedure for effecting the selected remedial plan. Because the underpinning design requires consideration of jacking loads, a computation of appropriate jacking loads is required. This computation is performed in two stages. In the preliminary stage, simple engineering methods and hand calculations are used. For the final stage, a complete structural reanalysis of the jacked building is needed. (This reanalysis is conducted both to verify the adequacy of the preliminary jacking loads and to assure that the building itself, both during underpinning construction and after completion, continues to satisfy applicable structural requirements. For further discussion, see Sections 7.0 through 7.3 below.)

5.2.1 Preliminary Calculation of Jacking Loads for the Underpinning Wall

The preliminary design jacking load for application during construction has been set at about 3,130 kips, with about 2,500 kips allocated to the north wall and about 315 kips to each of the east and west walls. The preliminary design jacking load for permanent application to the underpinning wall (final jacking load) is about 4,600 kips,

with about 3,500 kips on the north wall and about 550 kips each to the east and west walls.

In determining a preliminary design approach to develop the jacking load for permanent application to the underpinning wall, the engineers first examined the existing structure to determine what loads would have to be compensated for under the assumption that no support was provided for the overhang by the backfill material. It was determined that the total weight of the overhang section was approximately 5,500 kips. However, it was also determined that the existing structural walls could continue to be relied on to carry a portion of this load, namely about 900 kips.

The design process for the loading of the underpinning wall was one of redistributing stresses from the remaining 4,600 kips load from the existing deeper section of the building to the underpinning walls. As a focus of design, the engineers sought to determine which structural member of the building would benefit most from stress relief which would be provided by overhang underpinning. The engineers ascertained that the elevation 587 base mat could benefit most from incorporation of this remedial measure.

Accordingly, the design engineers chose a preliminary design approach in which moments of forces in a vertical plane about the center of gravity of the lower base mat would be substantially compensated by the preliminary design final jacking loads. The engineers calculated the dead load overturning moment of the structure about the center of

gravity of the lower base slab with no vertical support given to the upper foundation slab from the fill material. The selected jacking force of 4,600 kips, with 3,500 kips acting on the north wall and 1,100 kips acting at the center of gravity of the overhang slab, substantially compensated for these moments. This jacking load results in a situation in which about 4,600 kips of the total 5,500 kips weight of the overhang section is borne by the underpinning wall and about 900 kips by the existing deeper section of the building.

The design process for determining the construction condition loads was much simpler than determining the design process for the loading of the underpinning wall. In this case, the designers assumed that the temporary underpinning piers would assume only the bearing loads previously supported by the existing fill as this material (width of 8 foot tunnel and pits) is removed and replaced by the concrete piers. This approach relies on remaining backfill for continued support of portions of the overhang section during construction. The assumption that the remaining backfill material will support about 1,500 kips of the eventual underpinning load during construction is a very conservative assumption.

5.2.2 Final Jacking Loads

The jacking loads produced by the preliminary method set forth in Subsection 5.2.1 will be used as input loads to the structural reanalysis, to be described below in Section 7.0. If these analyses indicate excessive stresses, the preliminary jacking loads will be adjusted. This procedure

will be repeated until a distribution of jacking loads that maintains building stresses within allowable limits is achieved. The computed adjusted jacking loads will be the final jacking loads used for construction. It is not anticipated that adjustments will amount to more than 20 percent, and the design of the underpinning structure is more than ample to accommodate increases of this magnitude.

5.3 BEARING PRESSURES

5.3.1 Preliminary Calculated Bearing Pressures

The maximum bearing pressure under the underpinning wall produced by final jacking load alone amounts to 6.8 ksf at the north underpinning wall. The analysis described in Section 3.2 below indicates that the safety factors against various load combinations which incorporate the bearing pressure for jacking loads exceed by large margins those safety factors committed to for foundation conditions in the PSAR. A summary of those results is as follows:

<u>Loading Conditions</u>	<u>Safety Factor for Ultimate Bearing Capacity of 48 ksf</u>
Temporary peak loading during jacking incl. maximum downdrag and no seismic load $6.8 + 0.5 + 4.7 = 12$ ksf	4.2
Long-term sustained loading, including eventual downdrag and no seismic load $6.8 + 0.5 + 2.0 = 9.3$ ksf	5.4
Long-term sustained loading, including eventual downdrag, plus seismic load $9.3 + 6.4 = 15.7$ ksf	3.2

5.3.2 Final Calculated Bearing Pressures

As loads are adjusted for the final design as described in Section 5.2.2, the bearing pressure on the foundation soil will be calculated to assure that the FSAR safety factors continue to be met for all required load combinations.

6.0 ACCEPTANCE CRITERIA

As outlined in Section 1.1, the SWPS is a safety-related Seismic Category I structure. The acceptance criteria to be applied to the SWPS and to modifications to it stem from its designation as a Seismic Category I structure.

6.1 BASIC CRITERIA

The design of the underpinning wall will be in accordance with the design criteria, applicable loads, and load combinations and acceptance criteria of FSAR Subsections 3.8.5 and 3.8.6, supplemented as indicated in Section 6.2. The load combinations for concrete structures reflected in FSAR Subsections 3.8.6.3.1 through 3.8.6.3.4, have, however, been modified to reflect the effects of the final jacking load (refer to load combinations 1 through 14 of Table SWP-1).

When the existing structure is tied to the underpinning wall, the load equivalent to the jacking load will become an internal reaction and will be transmitted downward, acting as a compressive reaction rather than as an external force on the piers. Accordingly, the load combinations will incorporate jacking effects rather than jacking loads.

6.2 ADDITIONAL DESIGN CRITERIA (ACI 349/RG 1.142)

In accordance with the Applicant's response to question 15 of the 50.54(f) inquiry, an analysis of the critical sections of the underpinned structure will be performed using load combinations 15 through 18 of Table SWP-1. An additional analysis will be performed using the criteria set forth in ACI 349-76 as supplemented by NRC Regulatory Guide 1.142. This analysis will also consider the effects of the final jacking loads.

6.3 LOAD FACTOR

A load factor of 1.0 for jacking preload effects has been used for the loading combinations presented in Table SWP-1.

6.4 SEISMIC LOADS

The committed preliminary design of the underpinning utilizes approximated seismic loads that were extrapolated from a previous analysis of the SWPS utilizing FSAR SSE spectra. The seismic loads applied to the design of the SWPS underpinning were increased by 50 percent to approximate the effects of the site-specific response spectrum (SSRS). The final design of the underpinning structure will be adequate to sustain SSRS loads.

6.5 ALLOWABLE STRESSES

In accordance with FSAR criteria, the maximum rebar tensile stress allowed in the SWPS rebar is $0.9 F_y$ or 54 ksi for computing section capacities (F_y equals the American

Society for Testing and Materials minimum specified yield stress). The ultimate compressive strength of concrete is based on a strain of 0.003 inch per inch.

7.0 STRUCTURAL REANALYSIS OF THE SERVICE WATER PUMP STRUCTURE WITH UNDERPINNING

A structural reanalysis will be performed to confirm the structural adequacy of the existing building with the final underpinning for both construction and in-service (including long-term settlement) conditions. In addition, structural reanalysis will confirm the required jacking loads, develop allowable maximum relative displacements for the building during construction, and confirm the permanent underpinning design. Where the reanalysis identifies a need for structural modification to the existing building, the modification will be made.

7.1 PRELIMINARY REANALYSIS

To conduct the preliminary building reanalysis, the structural elements were reviewed to determine those which were considered most critical in the light of the remedial plan adopted. These elements were identified to be the upper and lower base slabs and the exterior side walls of the building portion founded on fill. The reanalysis utilized load combinations 1 through 14 presented in Table SWP-1.

The lower base slab was analyzed as a two-way slab. Design bending moments and shears were calculated using conventional small deflection plate theory. Load combinations 1, 2, and 11 were considered to be the most critical combinations

for this slab. Load combination 11 proved to be the most severe of these combinations.

The upper base slab was also analyzed as a two-way plate element. As with the lower slab, the design bending moments and shears were calculated using small deflection plate theory. Based on the conservative assumption that the soil under the upper slab provided no support, load combination 11 was selected as the most critical, as it provides for compartment flooding to a depth of 12.5 feet.

Design bending moments and shears for the exterior side walls of the building overhang were calculated by analyzing the walls as a box beam cantilevered from the deep section of the structure with consideration for the effects of shear lag. Load combinations 1 and 11 were considered to be the most critical for these walls. Load combination 11 proved to be the most severe of these combinations.

The underpinning wall was designed as a shear wall for in-plane loading and was checked for flexure due to out-of-plane loading assuming varying end restraint. For both designs, load combination 11 was considered most critical.

The connectors used to tie the underpinning wall to the existing structure were designed to resist shearing, tensile and compressive forces on the interfaces between the wall and existing structure. The adequacy of the connectors was verified by the shear friction provisions of ACI 318-71. Load combination 11 was also the controlling case in the design of the connectors.

The underpinned structure was also reanalyzed for stability. In accordance with PSAR Subsection 3.8.6.3.4, the structure was reanalyzed for sliding, overturning, and buoyancy. The results of this analysis show that that the stability requirements are satisfied and the capacity of each structural element investigated is in excess of the forces imposed by the loading combinations.

7.2 CONSTRUCTION CONDITION REANALYSIS

The construction sequence selected for the SWPS underpinning work is one which best assures maintaining the structural integrity of the existing building. For application during this sequence, a building deflection limit after groundwater drawdown will be selected based on foundation and structural deformations and structural capacities as the maximum allowable building overhang movement during underpinning installation. This building movement will be monitored by an instrumentation system using extensometers accurate to ± 0.001 inch as discussed in Section 4.6. If the deflection limit is exceeded, the construction sequence and procedures will be reevaluated and appropriate changes will be implemented if necessary.

7.3 FINAL REANALYSIS

7.3.1 Schedule

The final building reanalysis is under way, concurrent with the preliminary reanalysis. This work is currently scheduled to be completed in February 1982.

Underpinning tunneling work is currently scheduled to start in April 1982.

7.3.2 Reanalysis Objectives

The final reanalysis will assure adequate performance of the structure or indicate particular areas which need remedial measures to withstand postulated load combinations. The analysis will also check the preliminary jacking loads and indicate any necessary adjustments, which will then become final jacking loads. The final reanalysis will also ascertain the effects of long-term differential settlement of the underpinning on the structure. The final reanalysis will constitute the basis for acceptance of the underpinned building at the Operating License stage of this proceeding.

7.4 ANALYTICAL PROCEDURES

There are three components to any structural analysis. The first is determination of external loads representative of actual loads to which the structure may be subjected during its service life. The second stage involves calculation of the distribution of stresses within the structure caused by application of the external loads. Third, forces are converted to stresses and compared to allowables derived from the strength of the materials used.

7.4.1 Determination of External Loads

The external loads are briefly addressed in this section. They consist of many common type of loads such as dead, live, wind, seismic, and some special loads from the

effects of jacking preload and differential settlement.

7.4.1.1 Dead Loads

Dead loads are determined from the self-weight of structures, the weight of permanent equipment, and hydrostatic pressures.

7.4.1.2 Live Loads

Design live loads are defined to consider probable load variations during the normal function of the building and applied to the floor and roof slabs. Lateral soil pressures are included in the live load category.

7.4.1.3 Wind and Tornado Loads

These loads are determined from the external velocity pressure which varies as a function of the wind velocity and the shape of the building. The tornado load causes an additional internal pressure loading in the enclosed portions of the building. This internal pressure loading is determined from a tornado depressurization analysis. Also included in this category are tornado missile loads.

7.4.1.4 Buoyancy Load

The buoyant load is determined from the volume of submerged portion of the building during the probable maximum flood, as described in detail in FSAR Section 2.4.

7.4.1.5 Seismic Loads

Calculating seismic forces involves solving equations of motion for the building response due to ground motion. The seismic forces are determined using a lumped mass

model together with the response spectrum nodal superposition technique. For further information on the technique, the damping values, and the ground response spectra, see Section 3.7 of the FSAR and the testimony of Dr. R.P. Kennedy to be filed in this proceeding. The computed seismic response accelerations are multiplied by the structural element masses to provide the seismic forces for the seismic structural analysis. The existing building will be subjected to a seismic margin review against the SSRS loads as described in the testimony of Dr. R.P. Kennedy.

7.4.1.6 Thermal Loads and Effects

Thermal loads are mainly the reaction loads on the structure due to thermal movement of piping systems. They are determined from the piping system analysis. Thermal effects result from the existence of thermal gradients through the wall thickness.

7.4.1.7 Jacking Preload

Jacking preload effects consist of forces, moments, and deformations retained in the structure after the permanent underpinning is attached to the building and the jacking force is transferred to the underpinning. Before permanent attachment of the underpinning to the existing structure, the jacking force is treated as an external load.

7.4.1.8 Settlement Effect

The long-term differential settlement effect is included in the analysis for sustained dead and 25 percent of live loads, using the appropriate soil springs.

7.4.1.9 Other Loads

Other local loads, such as reactions from missile impact, are determined from appropriate analyses.

7.4.2 Internal Force Distribution

Internal force magnitudes and distribution and structural displacements are determined by solving a series of force-displacement equations. A three-dimensional, analytical model representing the elastic behavior of the SWPS under load conditions serves as the basis for the equations. The details of the methods of solution are similar to those set forth in Appendix B to the Auxiliary Building testimony.

7.4.3 Comparison to Allowables

The comparison to allowables proceeds by selecting locations subjected to the highest internal forces and moments. Two options are generally used to verify adequacy:

1. Forces and moments are converted to stresses and compared to stress allowables.
2. Forces and moments are compared to section capacities.

The details of the methods of comparison to allowables are discussed in Appendix B to the Auxiliary Building testimony.

8.0 GEOTECHNICAL CONSIDERATIONS

8.1 CHARACTERISTICS OF THE UNDERLYING SOILS

The original site investigation and subsequent borings near the SWPS disclosed the presence of compact glacial till throughout the immediate vicinity. Table SWP-2 lists the successive boring programs pertinent to the SWPS,

the dates the borings were made and the type of technical information developed from the boring and sampling.

In 1981 an investigation by Woodward-Clyde Consultants (WCC) added information on subsoil conditions. These WCC borings included numbers COE-14, COE-15A, COE-16, and COE-16A. Borings Nos. COE-16 and 16A, made at the northeast corner of the SWPS, provided detailed properties of the glacial till.

A plan of the immediate area of the SWPS underpinning with locations of borings relevant to the underpinning design is shown in the upper panel of Fig. SWP-26. In the lower panel of that drawing is a geological section developed through the U-shaped underpinning wall with the wall unfolded as if it were being viewed in a single vertical plane. The borings are plotted at positions projected at right angles to the line of the underpinning wall. Standard sampler penetration resistance is shown at the borings where these values were obtained.

The borings near the planned underpinning wall revealed three general subsoil strata which are described in the following paragraphs, in order of depth from the ground surface. The properties of these three strata are summarized in Table SWP-3.

8.1.1 Stratum F, Fill

This stratum consists of clay with lesser amounts of sand, extending from present ground surface typically to a depth of 34 feet, or from elevation 634 to 600. The tests on

WCC boring samples demonstrate that the fill is chiefly a clay soil of moderate plasticity with 65 percent passing the 200 sieve size. Median shear strength of the clay from nine undrained shear tests on clay in the WCC borings is 1.5 ksf. Beneath the overhang structure, sampler penetration resistance has a median value of 17 blows per foot in the clay and 16 blows per foot in sand fill at the southwest of the overhang. There are a number of thin layers of concrete.

8.1.2 Stratum A, Alluvium

This stratum consists of very compact sand mixed and interlensed with lesser amounts of silt and clay, extending typically to elevation 590. In some locations it is in pockets within the upper portion of the glacial till. It is chiefly classified as "SM, silty sand" with some amount of small gravel, with 28 percent passing the 200 sieve size. Standard sampler penetration resistance is medium to very high, generally between 40 and 120 blows per foot with a median of 90 blows. Test values of undrained shear strength from three CIU triaxial tests average 25 ksf under chamber pressures of about 2 ksf. Drained friction angles average 41 degrees. These exceptionally high strength and sampler penetration resistance values indicate that after deposition by water action, the alluvium was overridden by the waning continental ice sheet.

8.1.3 Stratum T, Undisturbed Glacial Till

This stratum, which consists of extremely compact sandy clay till, was encountered typically below elevation 590

down to the maximum depth explored in the borings. The presence of undisturbed glacial till will be determined in the field by the onsite geotechnical engineer, utilizing the Water Ways Experiment Station penetrometer device.

Continuous sampling at the WCC borings indicates that the till is remarkably consistent for the full depth of those borings. Detailed testing at Boring Nos. COE-16 and COE-16A yielded the following average properties: 57 percent passing the 200 sieve size; liquid limit of 17; plastic limit of 11; natural water content of 9 percent. Standard sampler penetration resistance ranges typically from 50 to 120 blows per foot with a median value of 75 blows. Ten undrained triaxial tests performed on the WCC boring samples yielded a median shear strength of 18 ksf. The preconsolidation stress evidenced in several WCC consolidation tests is at least 48 tons per square foot. For the purpose of settlement analysis, modulus of elasticity (E) of this extremely compact sandy clay till was assessed based on the following conventional correlation: E equals 500 times the undrained shear strength. This E would be at least 6,000 to 9,000 ksf.

The glacial till found at the SWPS location would have been deposited in the original advance of the continental ice by being pressed directly on an underlying resistant surface by the thrust of the ice sheet. It is one of the hardest and most stable glacial soils encountered in the northern and eastern United States. For example, its test properties are superior to the glacial till "hardpan" of New

York City which serves as a supporting stratum for many of the largest buildings in the country and which is assigned a nominal allowable bearing capacity of 12 tons per square foot.

8.2 BEARING CAPACITY OF UNDERPINNING PIERS

The SWPS underpinning piers will be founded at or below elevation 587 on undisturbed glacial till. Ultimate bearing capacity is that value of unit loading on a foundation which will cause shear failure in the supporting soil, leading to continuous downward movement. The safety factor against such a failure equals the ultimate bearing capacity divided by the prescribed combinations of applied loading. The bearing capacity commitment in FSAR Subsection 2.5.4.10.1 for the foundation design requires a safety factor of 3 against dead load plus sustained live load and a safety factor of 2 for these loads plus the seismic load. In engineering practice these values represent a conservative selection.

For purposes of computing the ultimate bearing capacity for the SWPS underpinning it is appropriate to multiply the till's undrained shear strength by a "bearing capacity factor". Based on the testing conducted at the SWPS location as well as a review of other relevant soil boring information contained in Fig. SWP-26 and Table SWP-3, an undrained shear strength value of 8 ksf has been conservatively selected for the glacial till. The shear strength properties of the alluvial material are even more favorable than those determined for glacial till.

The bearing capacity factor is a parameter which relates cohesive shear strength and ultimate bearing pressure. As demonstrated by A. W. Skempton in Reference 2, it is a function of the shape of the footing and its depth of embedment in the supporting soil. A distinctly conservative bearing capacity factor of 6.5 was selected for this analysis on the basis of a depth of embedment which is at least equal to the 6-foot width of the base of the north underpinning wall. With this bearing capacity factor and an undrained shear strength of 8 ksf, the ultimate bearing capacity is 52 ksf.

An evaluation was performed using the drained strength parameters from WCC testing set forth in Table SWP-4 ($C' = 0.73$ ksf and $\phi = 36^\circ$). The analysis is set forth in Table SWP-5. The ultimate bearing capacity is approximately 160 ksf.

Safety factors are determined by dividing the ultimate bearing capacity by the various applied loads. The unit loads on the base of the 6-foot wide underpinning walls serving as a continuous footing are as follows:

1. Maximum direct jacking load (north wall), equivalent to distributed dead plus sustained live load of the overhang portion of the SWPS, equals 6.8 ksf at the bearing surface.
2. Net weight of concrete underpinning pier, obtained by subtracting the weight of soil excavated in the pits from the gross weight of the concrete piers and applying this over the 6-foot wide bearing surface equals 0.5 ksf.

3. An allowance has been included in the applied loading for a conservative assessment of downdrag, which is a downward-directed, vertical shear force on the interface between the walls of the underpinning pier and the surrounding clay fill that is produced by the small settlement of the fill. The peak downdrag value associated with construction drawdown is equivalent to 4.7 ksf bearing pressure. Eventually, downdrag is greatly reduced as the dewatering settlements stabilize. The long-term downdrag is conservatively taken to be 2 ksf on the bearing surface.
4. The equivalent vertical loading of the (0.12 g) FSAR SSE multiplied by 1.5 to account for the possible increase in site ground acceleration, equals 38.4 kips per foot of length of the underpinning wall, or 6.4 ksf on the 6-foot wide bearing area.

Utilizing the lower ultimate bearing capacity of 52 ksf, determined from the undrained shear strength, and these various combinations of design loading, safety factors were obtained as set forth in Table SWP-2.

8.3 ESTIMATE OF SETTLEMENT OF THE UNDERPINNING PIERS

The anticipated total settlement of the underpinning wall was computed utilizing elastic theory and a conservative selection of undrained modulus of elasticity of 4,000 ksf. The particular equation employed is that given on Figure 11-9 of Reference 3, which contains factors to allow for the shape and embedment of the permanent underpinning. The total settlement thus computed is estimated to be between 0.4 to 0.5 inch over the 40-year life of the SWPS. This includes the immediate settlement, settlement due to volume change from primary consolidation and long-term, delayed secondary compression settlement.

The underpinning scheme with its load applied by jacks will prestress the till into "secondary compression", which is that long-term gradual settlement which takes place under load in fine grained strata after the hydrostatic excess pore water pressures have been dissipated. It is manifested as a straight line relationship between settlement and log of time in a semi-log plot. Secondary compression has also been referred to as "secondary consolidation."

It is a fundamental provision of the underpinning scheme that the immediate settlements and consolidation, if any, will occur during the jacking phase and only the secondary compression will remain to take place in the 40-year life of the structure. It is intended that the jacking operation be continued until the following criteria are satisfied:

1. On a semi-log time plot, the progression of settlement in the later stage of jacking will plot as a straight line
2. No more than 0.05 inch of settlement will occur in the last 30 days of jacking, and
3. No more than 0.01 inches settlement will occur in the last 10 days as measured by extensometer dial gages.

After these criteria are satisfied, it is assured that secondary compression alone remains to occur. Once this condition has been reached, sufficient data will be available to make a prediction of future settlements by an extrapolation of the straight line trend of secondary compression.

The secondary compression portion of the total settlement value has been estimated by weighing the following items of information:

1. The WCC testing report (Reference 4) yields a coefficient of secondary compression in the stress range associated with the underpinning piers equal to 0.0005 units of strain per log cycle of time. The underpinning piers will cause significant stress increase within a depth equal to one foundation width or 6 feet. Therefore, the settlement from secondary compression in each log cycle of time would equal 0.0005 times 6 feet times 12 to convert to inches, a value of 0.04 inches per log cycle. In the two log cycles of time from the completion of jacking to the 40-year life of the structure, secondary compression would total 0.1 inch by this computation.
2. Actual observations of settlement extending over several years at the SWPS indicate that the portion of this large structure founded on the sandy clay till settled in the range of 0.2 to 0.3 inch per log cycle of time. From this it would be reasonable to conclude that the smaller SWPS underpinning units would settle typically 0.1 to 0.2 inch per log cycle.
3. General experience of settlement of large structures on heavily preconsolidated clay, as illustrated by data presented by A. W. Skempton (Reference 2), indicates that long-term delayed settlement is typically one-fifth to one-third of the total settlement of the structure.

Based on the above considerations and on experience with similar controlled loading of spread footings on glacial till, it is estimated that two-thirds to three-quarters of the total computed settlement of 0.4 to 0.5 inch will be completed in the 90-day jacking period, leaving 0.1 to 0.2 inch of long-term settlement of the underpinning piers to take place in the 40-year life of the structure.

8.4 DIFFERENTIAL SETTLEMENT BETWEEN UNDERPINNING AND MAIN SWPS

Settlement of the corners of the main SWPS structure founded on undisturbed glacial till commenced in April 1978. These measurements defined semi-log straight lines which yield projected settlement between the present date and the 40-year life of the structure equal to 0.2 to 0.3 inch if loading conditions remained unaltered. The present loading is essentially the buoyant dead load of the structure with no water contained in the building's reservoirs and is equal to 1.6 ksf. The predicted long-term settlement for the bottom of the underpinning piers after jacking were estimated (see Section 8.0) to be 0.1 to 0.2 inch. Hence, the potential for differential settlement between the portion of the building to be underpinned and the main portion of the building presently founded on undisturbed glacial till is on the order of 0.1 to 0.2 inch, if the loading conditions on the latter portion of the building remain as they are now.

The long-term loading of the main portion of the SWPS and the sequence of operating conditions which could influence this future settlement trend are as follows:

8.4.1 Filling SWPS Reservoirs

The average distributed static design unit load of the main SWPS building, including dead and sustained live load, over the entire slab founded on undisturbed glacial till equals 3.2 ksf. This includes an allowance for the buoyancy from hydrostatic uplift with the groundwater level maintained

at elevation 627 and it also includes the weight of the water contained in the reservoir of the SWPS.

Of that 3.2 ksf, a total of 1.6 ksf, or one-half of the sustained loading is contributed by the weight of water in the building's water reservoirs. It is intended that the SWPS water reservoirs be totally filled before underpinning is completed. During regular operations of the SWPS, maintenance and cleaning will be accomplished by unloading reservoirs individually. Therefore, the water reservoirs' load will never be removed or reapplied all at one time. It is estimated that changes in loading after filling will amount to only one-quarter of the total of 1.6 ksf, or 0.4 ksf.

In April 1980 the SWPS reservoirs were filled to the extent of adding a unit load of 1.2 ksf. This loading was maintained until October 1980. The observed settlement in that period was no more than 0.2 inches. Full filling of the tanks would therefore be expected to cause a settlement of approximately 0.3 inches and partial emptying and refilling would cause up or down movement of about 0.1 inches. All of these movements refer to the main portion of the SWPS building and would be expected to have insignificant effects at the north wall underpinning.

8.4.2 Dewatering and Drawdown

Piezometer observations in the latter part of 1981 indicate that a groundwater level at about elevation 620 now exists beneath the SWPS structure. It is expected that there

will be a drawdown during underpinning to approximately elevation 585 along the north underpinning wall of the SWPS that could create lowering of piezometric levels in the glacial till beneath the structure. The line of permanent wells about 50 feet north and parallel to the north wall will create a drawdown to elevation 585 at the wells in late 1982 for the permanent dewatering within the plant area. On the basis of the assumed flow field and drawdown within the underlying glacial till, it is estimated that the drawdown for underpinning could cause a settlement of 0.2 inch beneath the north underpinning wall and less than 0.1 inch beneath the south wall of the main SWPS. This drawdown settlement will occur with the underpinning construction and will be recovered to some extent at the end of that operation. When the drawdown is reestablished in late 1982, the overall effect will be to create a differential settlement of about 0.1 inch across the structure with the north underpinning wall settling more than the main portion of the SWPS.

8.4.3 Summary of Differential Settlement

In summary, fluctuations of the water loading in the reservoir will be the principal influence on movements of the southern main body of the SWPS; whereas changes in drawdown of the plant area will chiefly affect settlements of the piers. An exact prediction of the settlements due to these effects acting concurrently cannot and need not be made. A distinctly conservative evaluation of these possible effects can be achieved by assuming a differential movement of 0.3 inch

between the center of the main block of the SWPS and the north wall underpinning elements and that differential settlement could occur with maximum settlement either at the underpinning or at the main SWPS block.

9.0 CONCLUSION

As a result of these investigations and analyses as presented herein, it is concluded that the underpinning can be constructed without damaging the existing structure. With the underpinning resting on sound foundation material, the structural analysis of the modified structure proves that the SWPS will safely perform its intended function for the 40-year life of the plant.

REFERENCES

1. Consumers Power Company, Midland Plant Units 1 and 2, Final Safety Analysis Report, Docket 50-329, 50-330
2. A. W. Skempton, "The Bearing Capacity of Clays," Building Research Conference Congress Proceedings, 1951
3. NAVFAC Design Manual DM-7, Soil Mechanics, Foundations, and Earth Structures, Department of the Navy, Naval Facilities Engineering Command, March 1971
4. Woodward-Clyde Consultants, Test Results, Auxiliary Building Soil Boring and Test Program, Midland Units 1 and 2, Midland, Michigan, October 26, 1981

APPENDIX A

SIGNIFICANCE OF SERVICE WATER PUMP STRUCTURE CRACKS

1.0 INTRODUCTION

For a general discussion of the nature and origin of cracking in reinforced concrete, see Section 1.0 of Appendix A to the auxiliary building testimony.

2.0 CRACKING AND SETTLEMENT

The cracks observed in the concrete walls and roof slabs in the service water pump structure (SWPS) exhibit characteristics consistent with normal volume change cracking of concrete which is anticipated in structures of this type and size. Neither the crack widths nor their observed orientations or patterns indicate or suggest that they were caused by settlement-induced stresses (imposed deformations). Furthermore, the amount of differential settlement (discussed in Subsection 1.4.2 of this testimony) observed in the SWPS is of a magnitude commonly experienced in construction. Such differential settlement is not likely to cause detrimental structural effects. Thus, the cracks observed in the SWPS are not structurally significant and do not impair the safety of the building.

The SWPS cracks have been mapped. (See Figs. SWP-11 through 13.) In general, the cracks are located on the roof and in the walls and are of an orientation and pattern that are consistent with volume change cracking which occurred

during curing as a result of temperature change and drying shrinkage.

2.1 ROOF SLAB

The roof slab of the SWPS is 1 foot, 9 inches thick, and is reinforced with 3/4-inch reinforcing bars spaced 12 inches apart each way, each face. One crack, approximately 0.020 inch wide, was reported on the top of the slab. It ran in the north-south direction and occurred at the location of a horizontal discontinuity. This is consistent with the effects of volume changes in the concrete.

On the underside of the roof slab, cracks have been recorded in several locations and, according to measurements taken in October 1981, are 0.020 inch wide or smaller (Fig. SWP-13). These cracks are not continuous with the cracks observed in the supporting walls. Therefore, the pattern of this cracking is not characteristic of cracks that would have resulted from bending moments caused by fill settlement on the north side of the building. The pattern is consistent, however, with normal anticipated volume change cracking.

2.2 WALLS

The interior walls of the SWPS are 18 inches to 24 inches thick and are reinforced with at least 3/4-inch reinforcing bars. The exterior walls are 2 feet to 4 feet thick and are reinforced with at least 3/4-inch reinforcing bars. Two cracks, one in the interior wall and the other in an exterior wall, have been measured and have maximum widths of approximately 0.030 inch (Figs. SWP-11 and 12). These

cracks are located at construction joints where concentration of the shortening due to volume change in the concrete would be expected to occur.

The remaining cracks, also located in both interior and exterior walls, are 0.025 inch wide or less (Fig. SWP-11 and 12). Their locations and orientations are typical of volume change cracks. The cracks observed in both the north and south ends of the building are of a comparable pattern, size and orientation, which indicates that they were not caused by bending moments induced by any differential settlement of the building. If there had been settlement-induced cracks, the pattern, size and orientation of the cracks would have differed in the north and south ends of the building.

Additionally, measurements of crack widths indicate a tendency for them to be narrower at the top and bottom ends of the crack than at mid-height. This is again atypical of flexural cracking for walls with reinforcing uniformly distributed over the height of the wall. Also, cracks generally are not continuous from one concrete placement to another, and most of the cracks occur in the more restrained portions of later placed concrete lifts. These observations further support the conclusion that the cracks are caused by volume changes in the concrete.

Although the crack patterns do not support a conclusion that they were caused by flexure, in the extreme possible case, cantilever action of the walls could have contributed to cracking. However, any residual stresses in

the walls that result from these cracks are of a magnitude similar to those that would be found in any ordinary cast-in-place reinforced concrete wall.

The location and orientation of the cracks observed in the SWPS suggest that the cracks probably occurred within a few days after concrete placement, before the concrete developed appreciable tensile strength. The cracks and the construction sequence for the north end of the SWPS are shown in Figs. SWP-8 and 11 through 13. The location and orientation of cracks indicate that the cracks were caused primarily by restrained volume change. These cracks are mainly in the upper, i.e., later-poured sections of the wall (between elevation 634'-6" and 656'-0").

2.3 SUMMARY

All the existing cracks in the roof slab and walls of the SWPS can be attributed to normal volume change in the concrete which is anticipated in structures of this type and size. Crack patterns, orientations, locations and reported settlement data do not support the conclusion that the cracks were caused by any settlement-induced stresses.

3.0 SIGNIFICANCE OF RESIDUAL STRESSES

An extensive discussion of the significance of residual stresses in reinforced concrete is set forth in Section 3.0 of Appendix A of the auxiliary building testimony and is incorporated herein by reference.

4.0 CONCLUSION

First, the types of observed cracks in the SWPS can all be attributed to normal volume change in concrete. The observed conditions suggest no deteriorations or distress which would indicate any deviation from normal design conditions. Thus, the observed cracks and reported settlement do not support any conclusion other than that this structure has remained, and will remain, in sound condition. With additional vertical support provided by underpinning, this conclusion is further substantiated.

Second, sound application of fundamental engineering practice precludes inclusion in load combinations of a term for residual stresses suggested by cracking. Such an inclusion would amount to double counting of residual stresses. (See Section 3.0 of Appendix A to the Auxiliary Building testimony.)

TABLE SWP-1

LOAD EQUATIONS FOR THE SERVICE WATER PUMP STRUCTURE
MODIFIED TO INCLUDE JACKING LOAD

I. FSAR SUBSECTION 3.8.6.3

Loading Under Normal Conditions

a. Normal Load Condition

$$U = 1.4D + 1.7L + F_L \quad (1)$$

b. Severe Environmental Condition

$$U = 1.25 (D + L + H_0 + E) + 1.0T_0 + P_L \quad (2)$$

$$U = 1.25 (D + L + H_0 + W) + 1.0T + P_L \quad (3)$$

$$U = 0.9D + 1.25 (H_0 + E) + 1.0T_0 + P_L \quad (4)$$

$$U = 0.9D + 1.25 (H_0 + W) + 1.0T + P_L \quad (5)$$

Shear Walls and Moment Resisting Frames

$$U = 1.4 (D + L + E) + 1.0T_0 + 1.25H_0 + P_L \quad (6)$$

$$U = 0.9D + 1.25 E + 1.0T_0 + 1.25H_0 + P_L \quad (7)$$

Structural Elements Carrying Mainly Earthquake Forces,
Such as Equipment Supports

$$U = 1.0D + 1.0L + 1.8E + 1.0T_0 + 1.25H_0 + P_L \quad (8)$$

Extreme Environmental and Abnormal Conditions

$$U = 1.05D + 1.05L + 1.25E + 1.0T_A + 1.0H_A + 1.0R + P_L \quad (9)$$

$$U = 0.95D + 1.25E + 1.0T_A + 1.0H_A + 1.0R + P_L \quad (10)$$

$$U = 1.0D + 1.0L + 1.0E' + 1.0T_0 + 1.25E_0 + 1.0R + P_L \quad (11)$$

$$U = 1.0D + 1.0L + 1.0E' + 1.0T_A + 1.0H_A + 1.0R + P_L \quad (12)$$

$$U = 1.0D + 1.0L + 1.0B + 1.0T_0 + 1.25H_0 + P_L \quad (13)$$

$$U = 1.0D + 1.0L + 1.0T_0 + 1.25W_0 + 1.0W' + P_L \quad (14)$$

II. Responses to NRC Requests Regarding Plant Fill, Question 1E

a. Normal Operating Condition

$$U = 1.05D + 1.28L + 1.05T + P_L \quad (15)$$

$$U = 1.4D + 1.4T + P_L \quad (16)$$

b. Severe Environmental Condition

$$U = 1.0D + 1.0L + 1.0W + 1.0T + P_L \quad (17)$$

$$U = 1.0D + 1.0L + 1.0E + 1.0T + P_L \quad (18)$$

Table 1 (continued)

where

- B = hydrostatic forces due to the postulated maximum flood (PMR)
- D = dead loads of structures and equipment plus any other permanent load-contributing stress
- E = operating basis earthquake load (OBE)
- E' = safe shutdown earthquake load (SEE)
- H_A = force on structure due to thermal expansion of pipes under accident condition
- L = conventional floor and roof live load (includes movable equipment loads or other loads which vary in intensity)
- P_L = effects of jacking preload on structure
- R = local force or pressure on structure or penetration caused by rupture of any one pipe
- T = cumulative effects of temperature, creep, shrinkage, and differential settlement
- T₀ = thermal effects during normal operating conditions, including linear expansion of equipment and temperature gradients
- T_A = total thermal effects which may occur during a design accident
- U = required strength to resist design loads or their related internal moments and forces

W = design wind load

W' = tornado wind loads, including missile effects
if applicable

TABLE SWP-2

Location*	<u>Calculated Bearing Pressure</u>		Ultimate Bearing Pressure (net ksf)	<u>Factor of Safety</u>			
	Dead Load (DL) + 25% Live Load (LL) (ksf)	SSE Load (E') (Peak Pressure, ksf)		DL + LL Actl. Min.	DL + LL + E' Actl. Min.	DL + LL Actl. Min.	DL + LL + E' Actl. Min.
<u>Underpinning Walls</u>							
Temporary peak loading during jacking including maximum downdrag and no seismic load							
North wall	(a) 12.0 (14.5)	--	52	4.3	3.0	--	--
Side wall	(b) 11.0 (14.7)	--	52	4.7	3.0	--	--
Long-term sustained loading including eventual downdrag and no seismic load							
North wall	(c) 9.3 (11.8)	6.4	52	5.6	3.0	3.3	2.0
Side Walls	(d) 8.3 (12.0)	9.2	52	6.3	3.0	3.0	2.0
<u>Lower Base Slab</u> el 587	3.8	7.1	52	13.7	3.0	4.8	2.0

Notes:

1. Average net bearing pressures are given.
2. Bearing pressures in parenthesis refer to gross pressures.
3. D = Dead load
4. L = 25% of live load
5. E' = Safe shutdown earthquake load (1.5 X safe shutdown earthquake)

Net Bearing Pressures

(Jacking Load + Net Weight of Concrete + Downdrag)

- (a) $6.8 + 0.5 + 4.7 = 12.0$ ksf
- (b) $5.5 + 0.8 + 4.7 = 11.0$ ksf
- (c) $6.8 + 0.5 + 2.0 = 9.3$ ksf
- (d) $5.5 + 0.8 + 2.0 = 8.3$ ksf

TABLE SWP-3 SUMMARY OF TEST BORING SERIES IN VICINITY OF THE
SERVICE WATER PUMP STRUCTURE UNDERPINNING

<u>Boring Series</u>	<u>Date Performed</u>	<u>Purpose of the Borings</u>	<u>Technical Data</u>
C	Oct. 1969	In original preconstruction investigation	Standard sampler penetration resistance (N values), no laboratory testing
D	June 1970	In original preconstruction investigation	Standard sampler penetration resistance (N values), no laboratory testing
SWP	Oct. 1974	Preconstruction investigation	N values, no laboratory testing
SW	Oct. 1978 to March 1979	Investigate character of fill beneath and around overhang	N values, grain size analyses
Test Pit	June 1979	To investigate fill condition at NE corner of SWPS	Material identification test including, moisture content, density, limits, sieve analysis, specific gravity, and compaction testing
CH	July 1979	Determine seismic velocities in fill and till	N values, no laboratory testing
PD	Dec. 1979 to Feb. 1980	Groundwater investigation	N values, grain size analyses

<u>Boring Series</u>	<u>Date Performed</u>	<u>Purpose of the Borings</u>	<u>Technical Data</u>
COE	April 1981 to May 1981	COE-16 and 16A: to obtain samples for test to support underpinning design	Continuous undisturbed sampling for identification and engineering properties tests - See WCC Report 10/1/81
WF	May 1981	Groundwater investigation for Permanent wells	Continuous undisturbed sampling for identification and grain size analysis

TABLE SWP-4 SERVICE WATER BUILDING UNDERPINNING
PROPERTIES OF FILL AND SANDY CLAY TILL

Stratum F: Fill

Median values of standard sampler penetration resistance, "N" values, in blows per foot; taken in underpinning zone below overhang foundation:

For Clay Fill, N = 17 blows per foot
For Sand Fill, N = 16 blows per foot
(Sandy material concentrated at the southwest corner and west wall of underpinning)

Stratum A: Sandy Alluvium

Median Standard Penetration Resistance:

N = 90 blows per foot;
28% passing the No. 200 sieve size;
Average undrained shear strength from three CIU triaxial tests by WCC in 1981 equals 25 ksf.

Stratum T: Hard Clay Till

Median Standard Penetration Resistance:

N = 75 blows per foot
57% passing the No. 200 sieve size;
liquid limit = 17
plastic limit = 11
Natural water content = 9%

Median Shear Strength from undrained triaxial tests

<u>Testing Grouping</u>	<u>Median Value of Shear Strength ksf</u>
Three UU triaxial tests	16
Seven CIU triaxial tests	22
All 10 undrained triaxial tests	18

Average drained strength parameters:

From 2 series of CIU triaxial tests by WCC, 1981:

$$C' = 0.73 \text{ ksf } \phi' = 36^\circ$$

Typical Consolidation Properties:

From 2 consolidation tests by WCC, 1981:

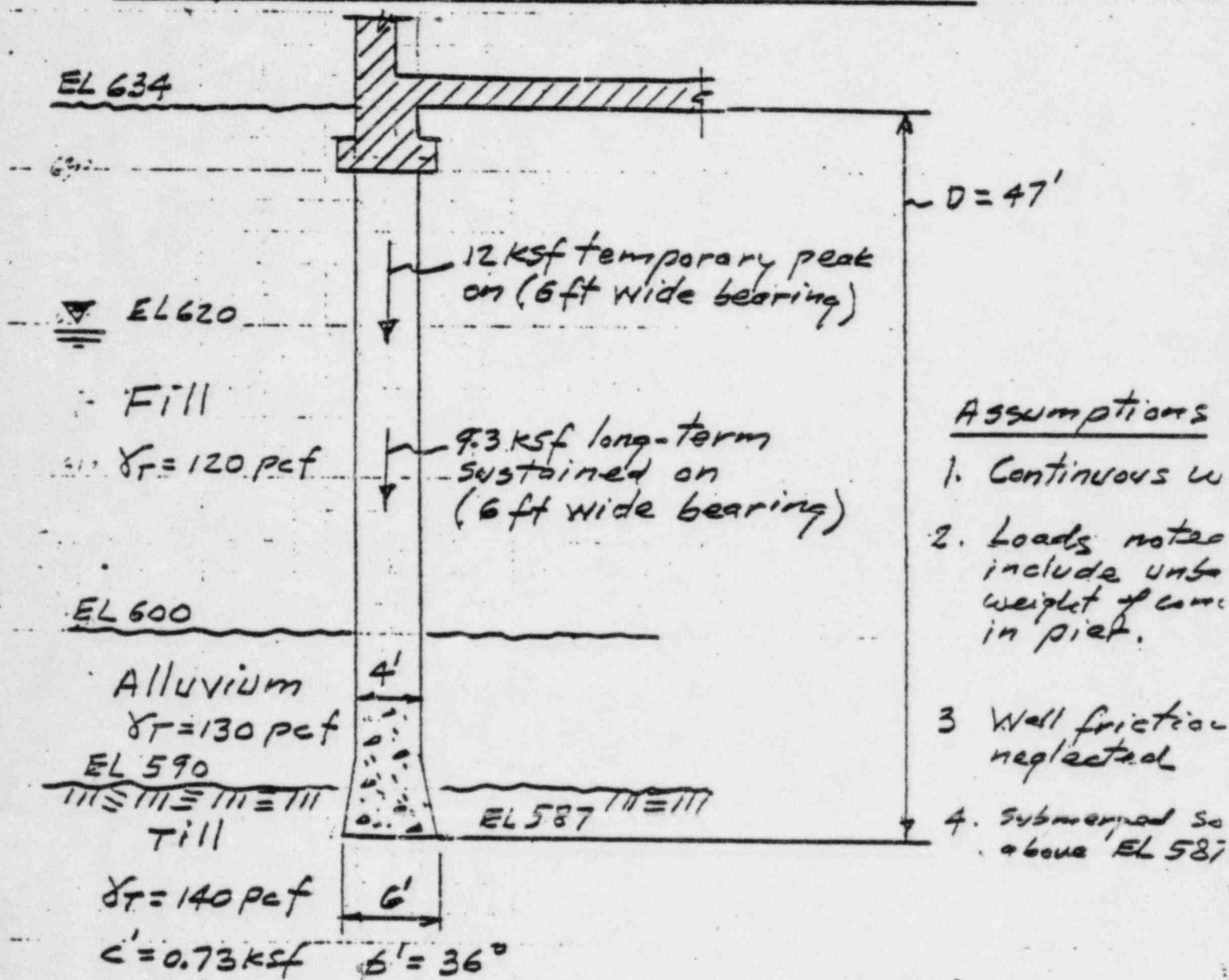
Recompression Ratio: $C_r / (1 + e_0) = 0.12$ (strain per log cycle of pressure)

Virgin Compression Ratio: $C_c / (1 + e_0) =$ (strain per cycle of pressure)

Coefficient of Secondary Compression: 0.0005 (strain per log cycle of time)

Coefficient of Consolidation: $C_v = 0.01$ cm per second.

Ultimate bearing capacity of foundation of underpin
Wall for Service Water Pump Structure



$$q_{ult} = C' N_c + \gamma' D N_q + \gamma' \frac{B}{2} N_\gamma$$

N_c } Bearing
 N_q } Capacity
 N_γ } factors

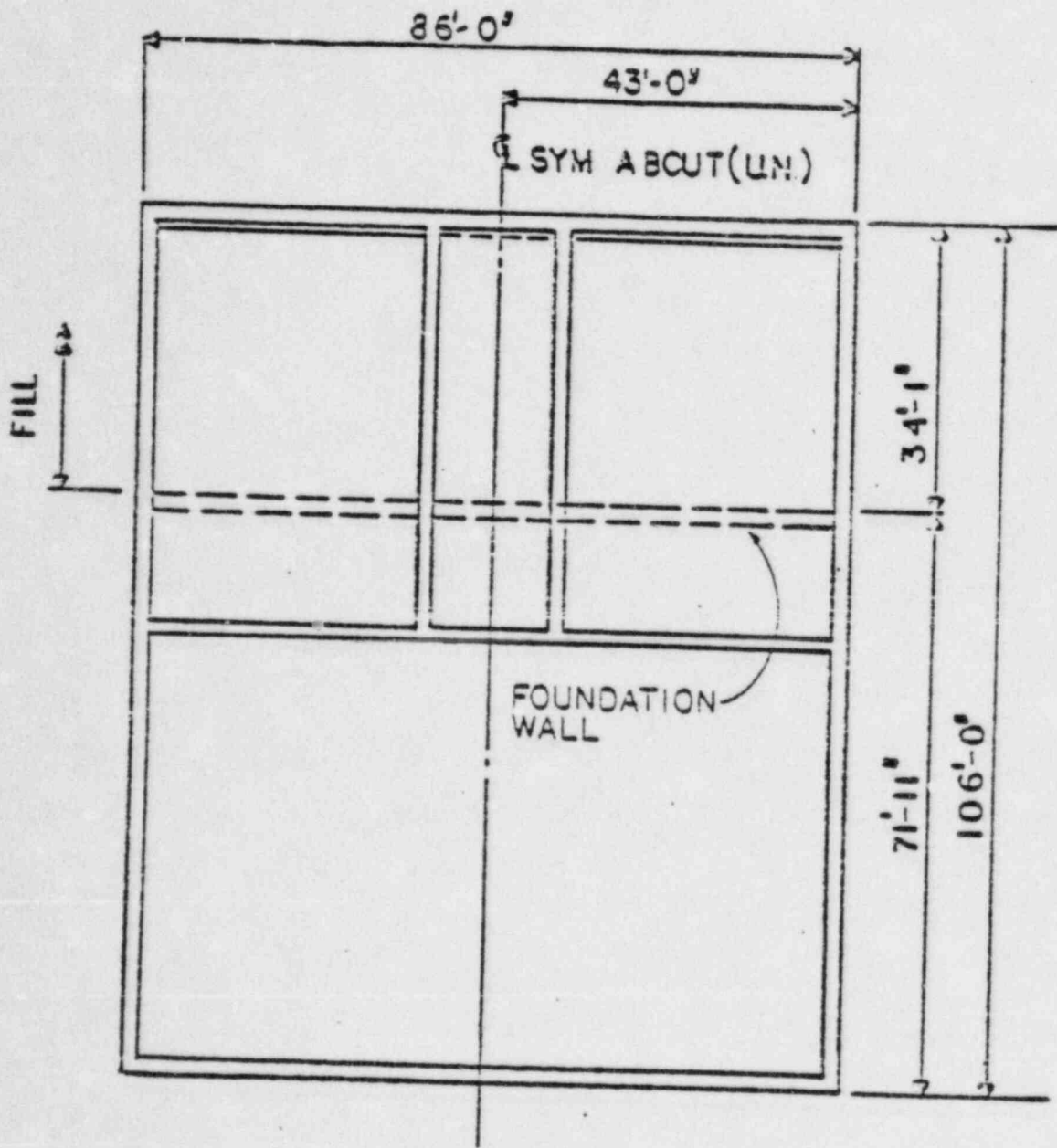
From NAVFAC DM-7 Fig. 11-1: $N_c = 56$, $N_q = 40$, $N_\gamma = 50$ (Rough base)

$$q_{ult} = 0.73 \times 56.0 + 0.058 \times 47.0 \times 40.0 + 0.078 \times \frac{6.0}{2} \times 50.0$$

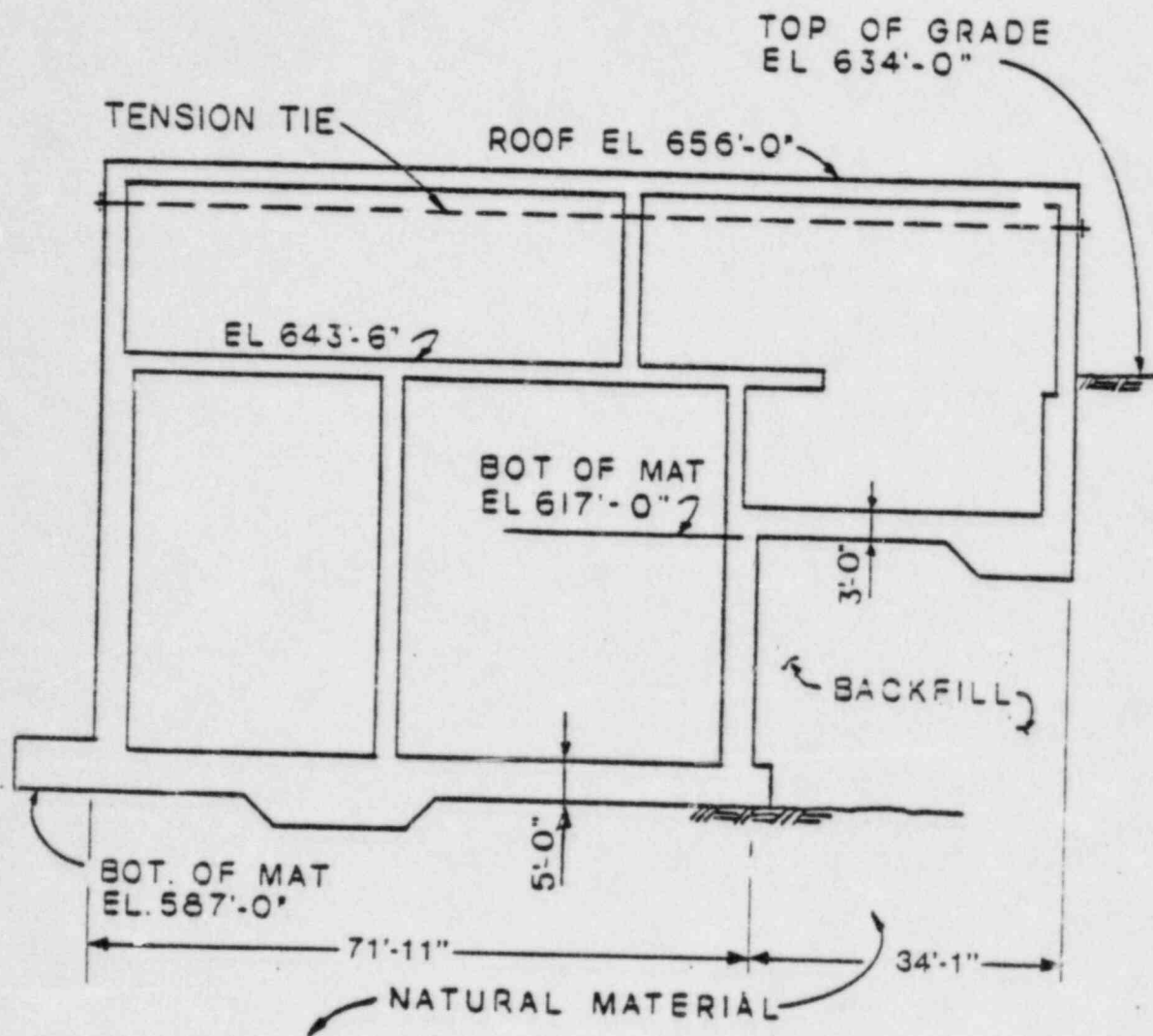
$$= 40.9 + 109.0 + 11.7 = 161.6 \text{ ksf}$$

$$F_s = \frac{161.6}{12.0} = 13. \text{ (For temporary peak load)}$$

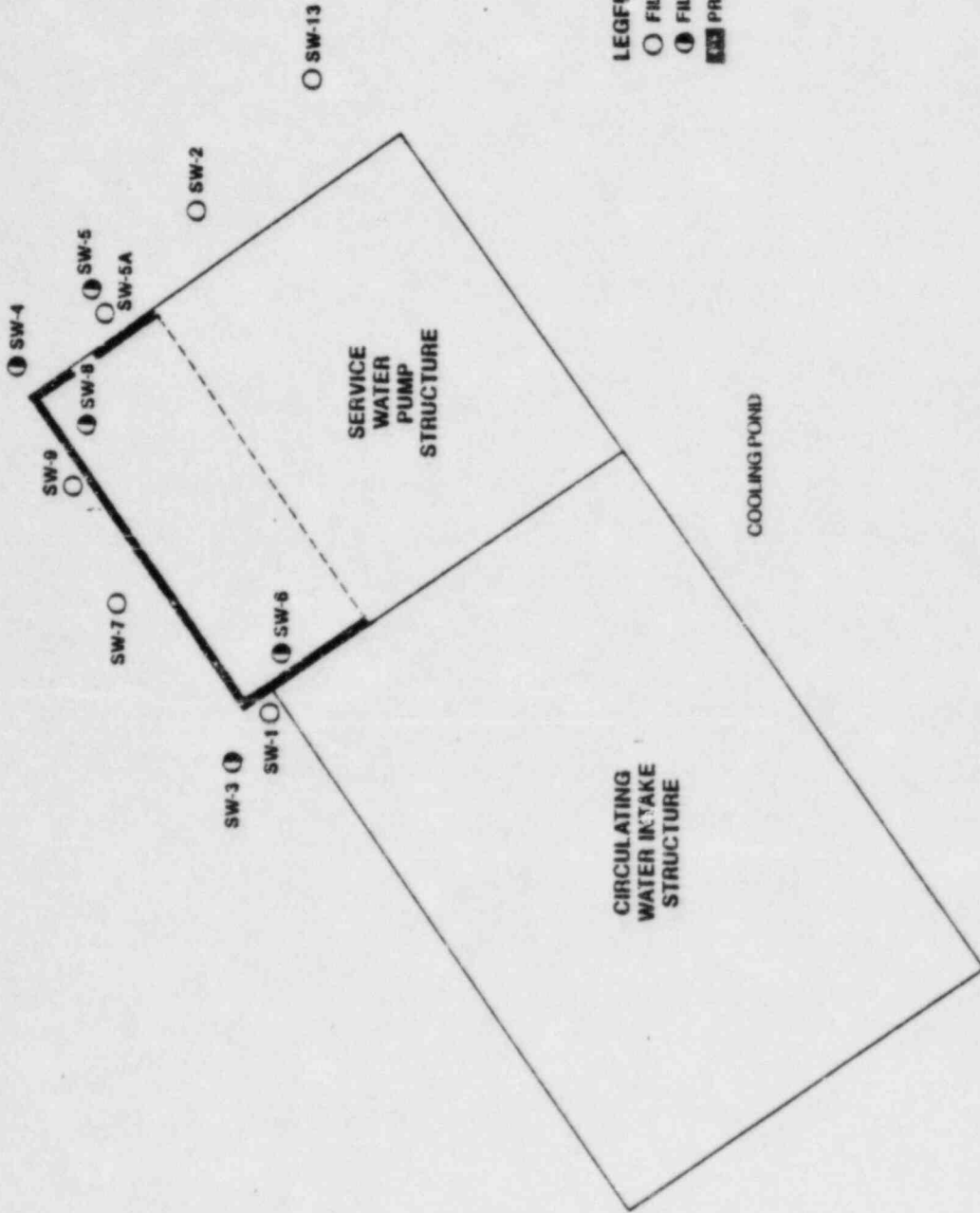
$$F_s = \frac{161.6}{12.0} = 13. \text{ (For long-term sustained load)}$$



PLAN OF SERVICE WATER PUMP STRUCTURE AT EL 634'-6"



**TYPICAL SECTION OF SERVICE WATER PUMP STRUCTURE
(Looking West)**



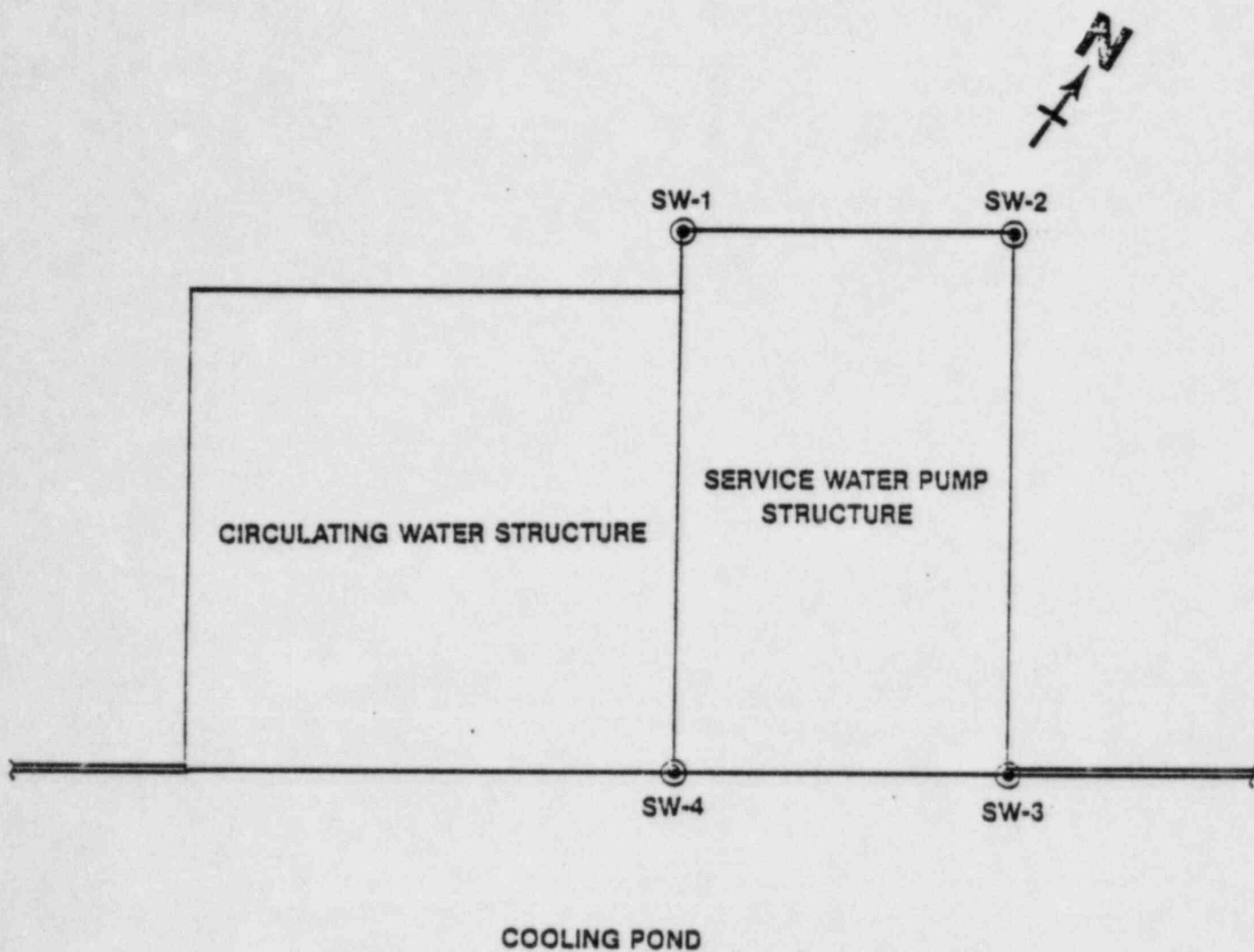
LEGEND

- FILL ONLY
- FILL - NATURAL SOIL
- ▬ PROPOSED UNDERPINNING WALL

BORING LOCATION PLAN

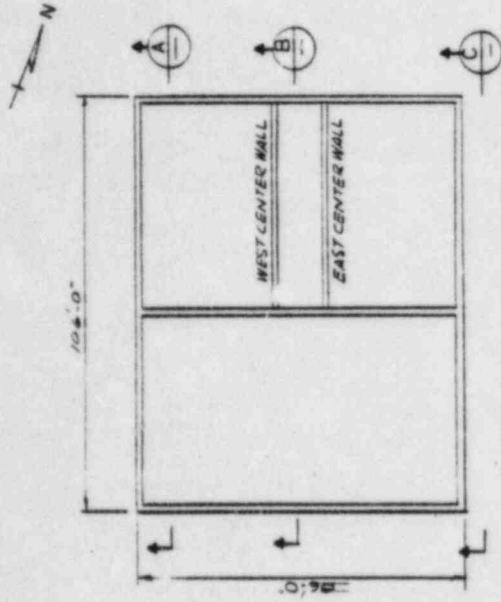
FIG SWP-4
G 1483 04

MARK REQUIREMENTS 1 AND 2
CONSTRUCTION 11/08/81

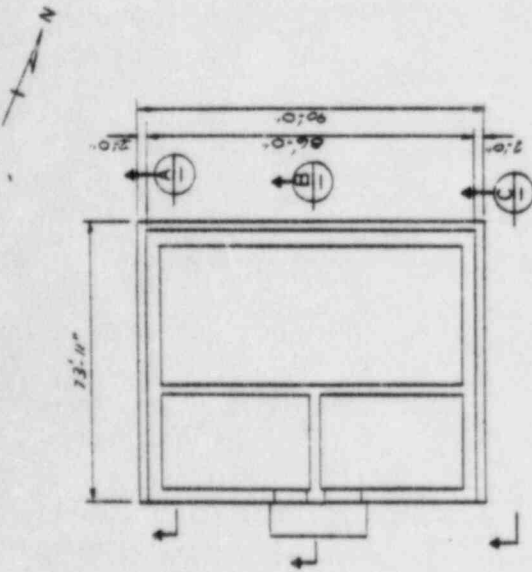


**SERVICE WATER STRUCTURE SETTLEMENT MARKER
LOCATIONS**

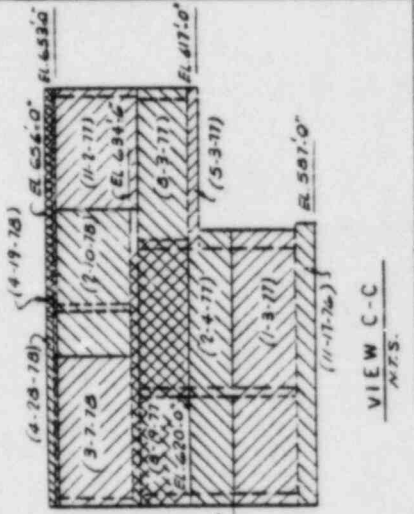
NOTE:
 DATES SHOWN ON SECTIONS
 INDICATE DATE CONCRETE
 WAS PLACED.



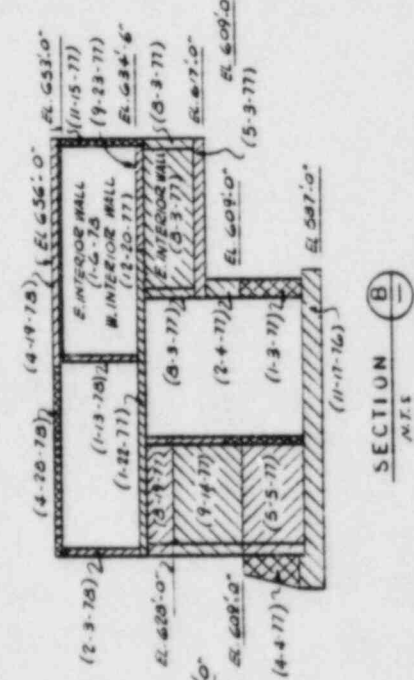
PLAN ABOVE EL 634.6'
 N.T.S.



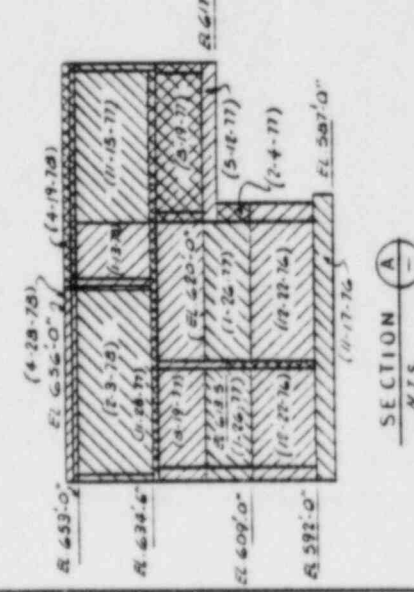
PLAN AT EL 592.0'
 N.T.S.



VIEW C-C
 N.T.S.

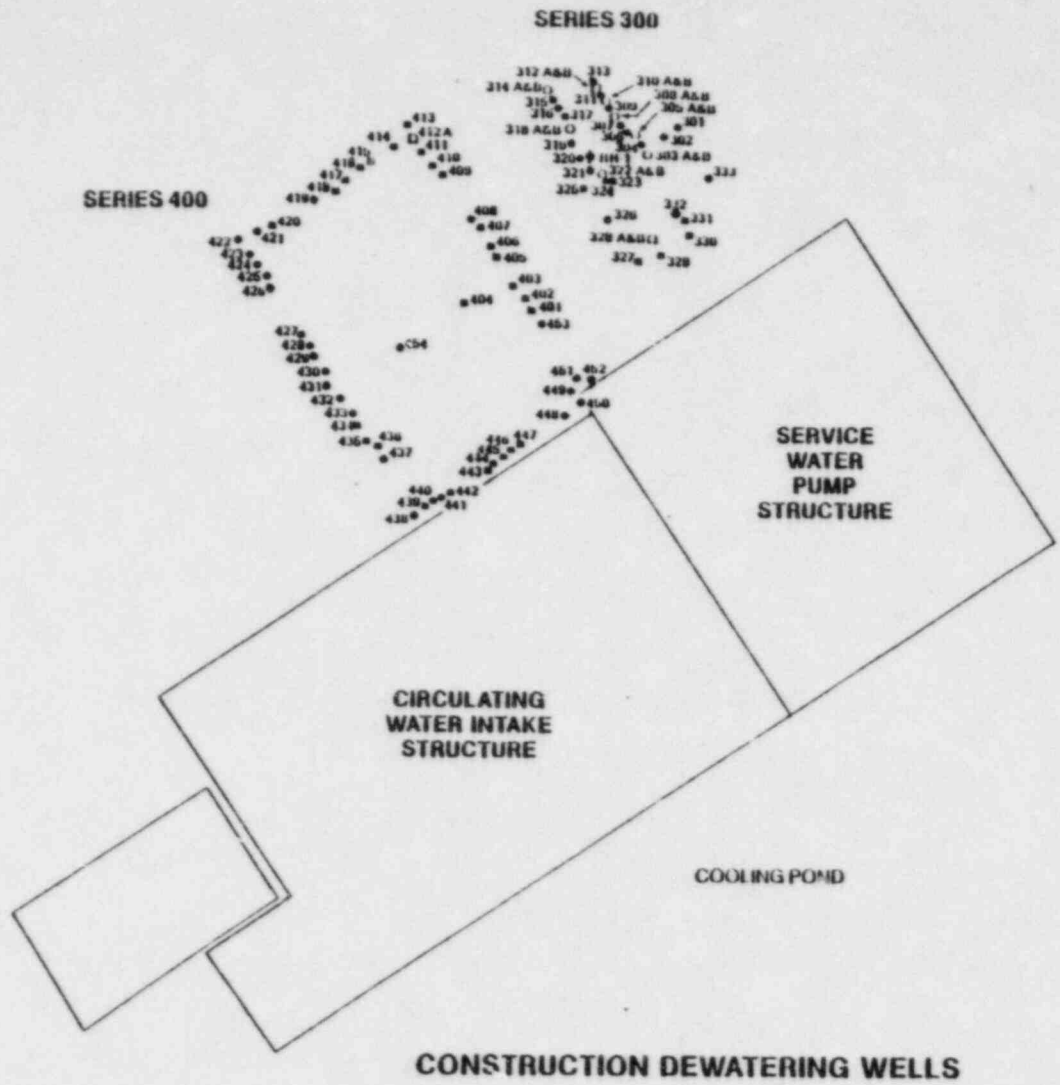


SECTION B
 N.T.S.



SECTION A
 N.T.S.

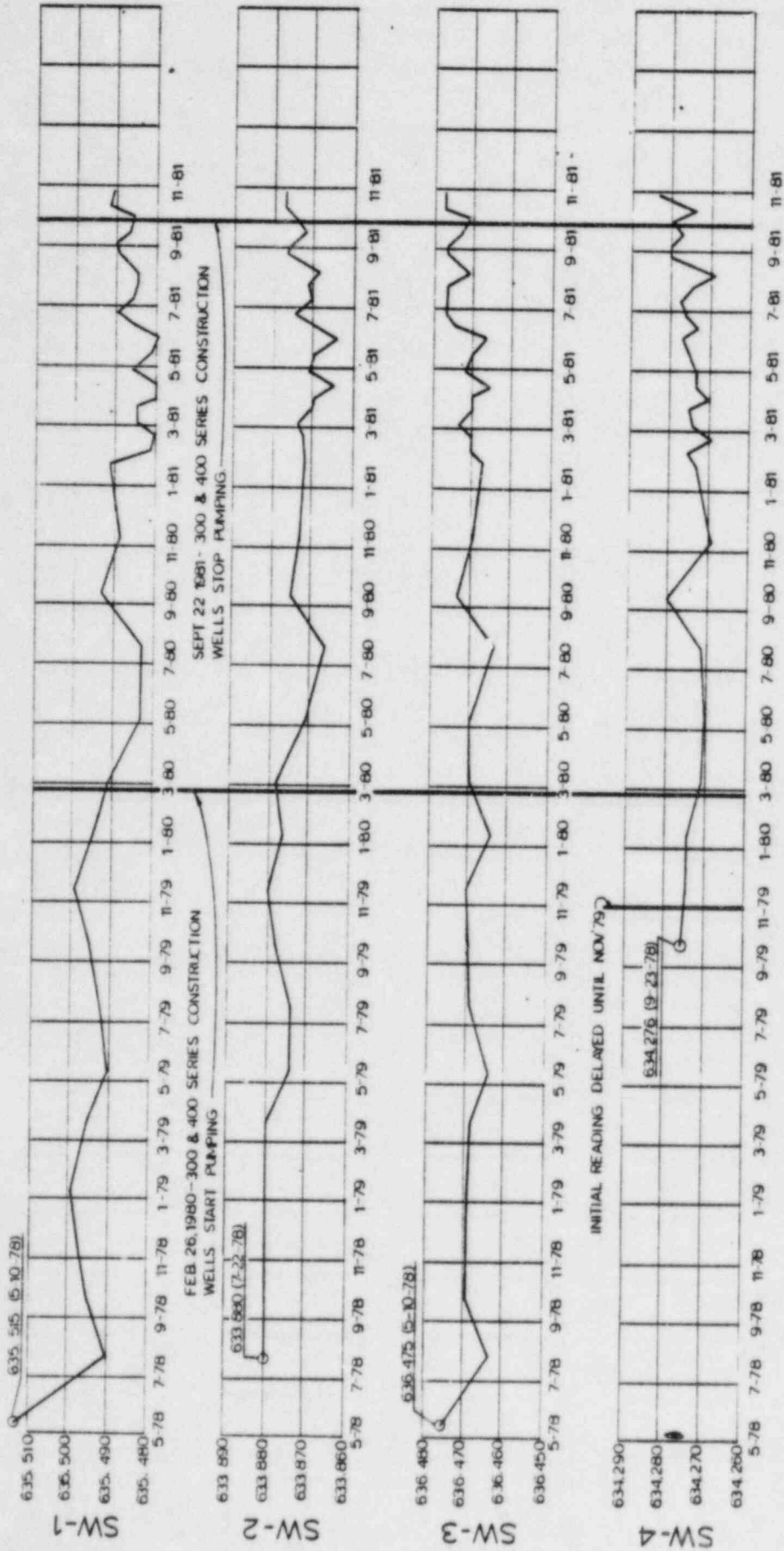
SERVICE WATER PUMP STRUCTURE
 CONCRETE PLACEMENT SEQUENCE
 FIG. SWP - 8.



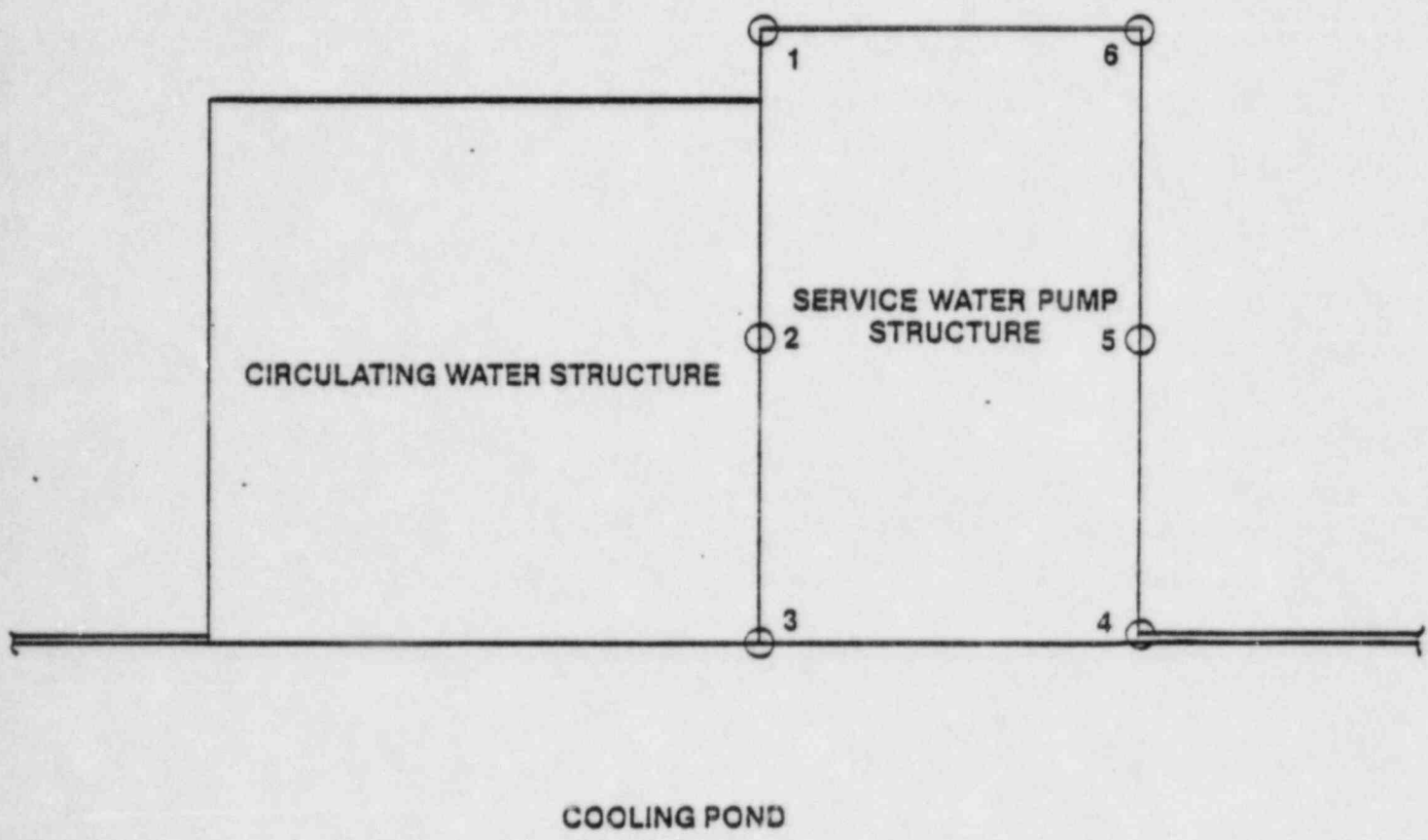
300 & 400 SERIES WELLS
STARTED 2/26/80
SHUTDOWN 9/22/81

- EXPLANATION**
- 2-INCH CONSTRUCTION DEWATERING WELLS
 - 3-INCH CONSTRUCTION DEWATERING WELLS
 - 6-INCH CONSTRUCTION DEWATERING WELLS
 - ◆ SUBCONTRACTOR INSTALLED OBSERVATION WELLS
 - ◻ DEWATERING WELLS NOT IN SERVICE AS OF 7/31/81

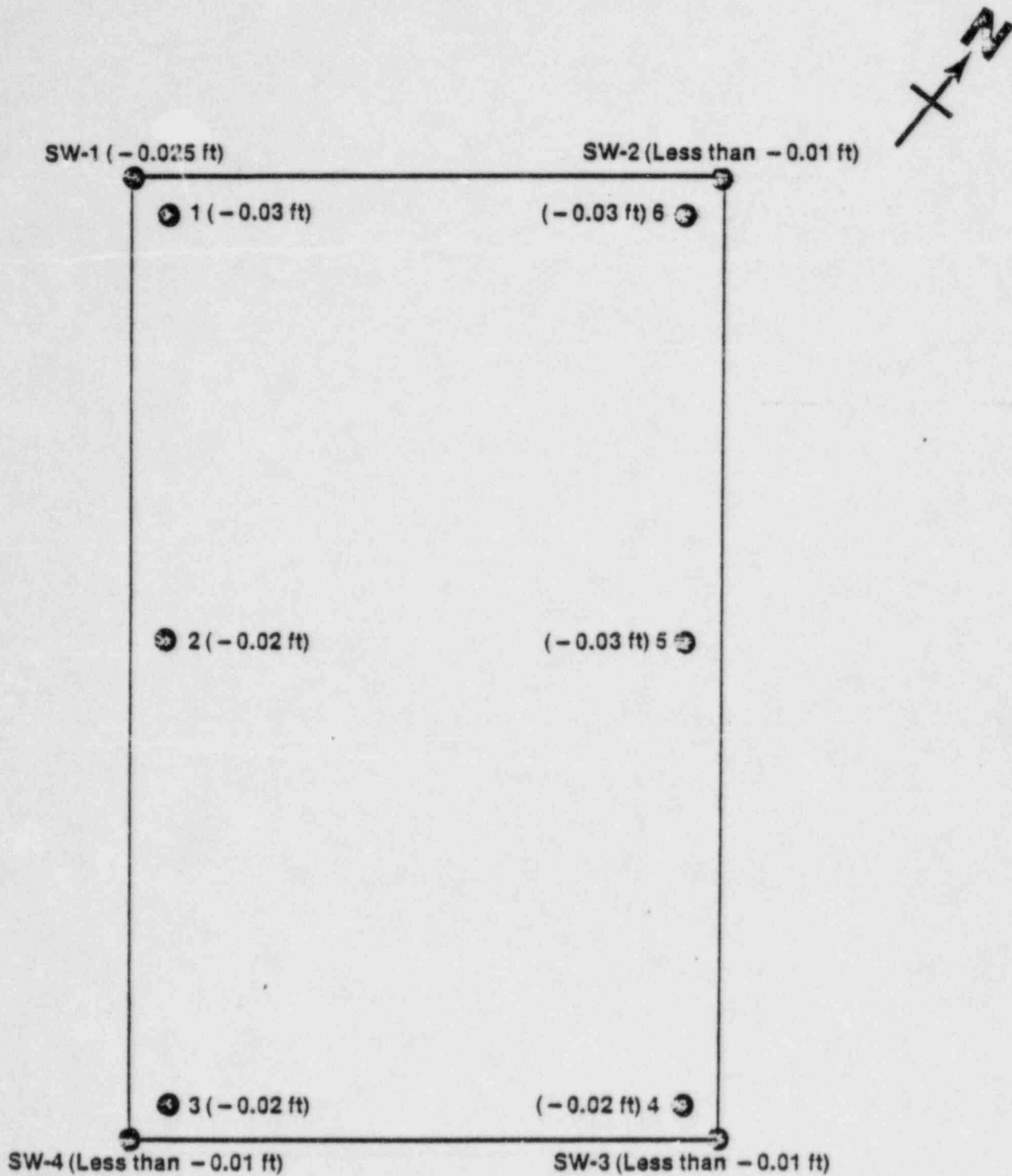
NOTE:
The A&B suffix indicates two
eductors are placed in one
6-inch construction dewatering



SERVICE WATER PUMP STRUCTURE
SETTLEMENT MARKER PLOTS
FIG SWP - 6



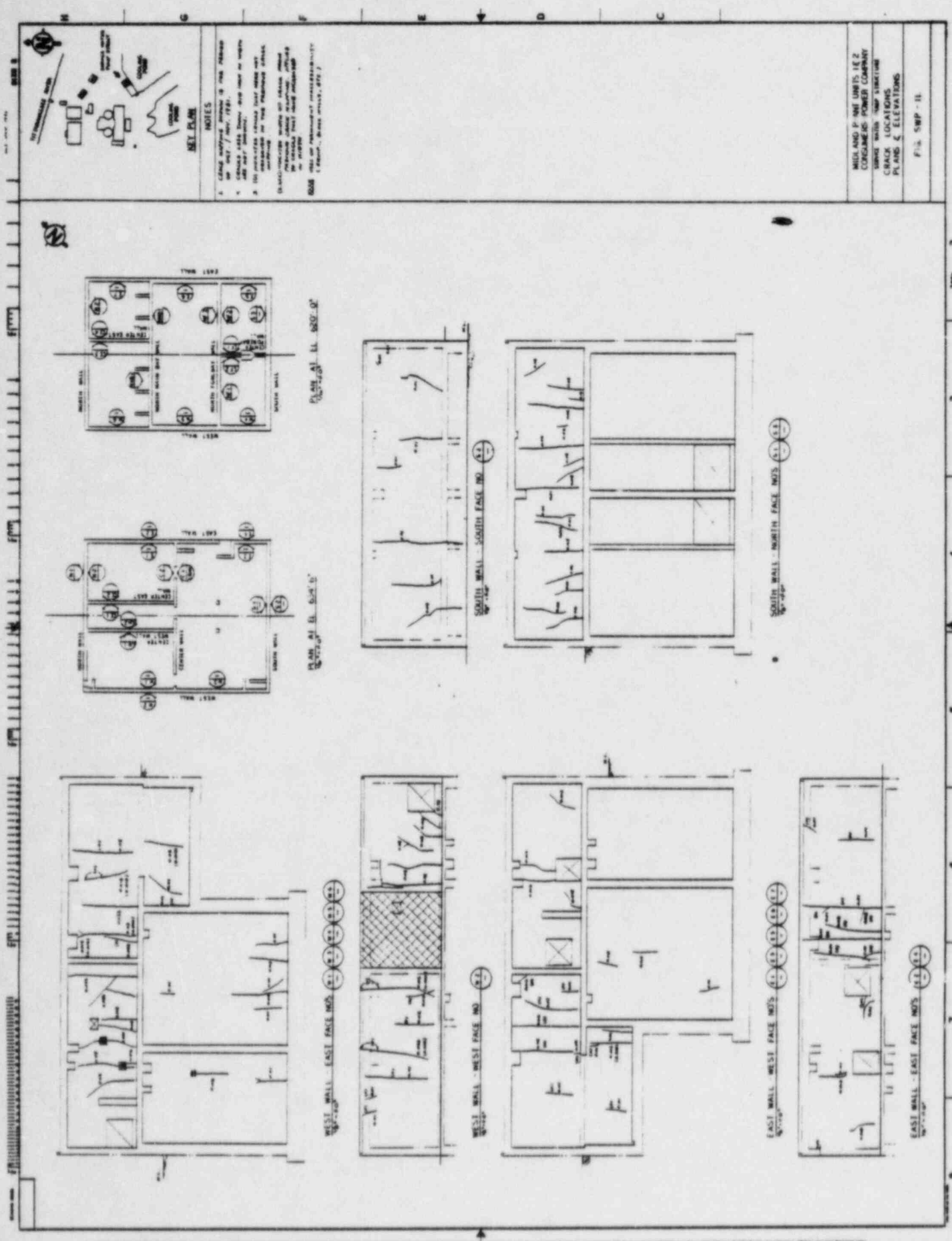
**SERVICE WATER PUMP STRUCTURE
CONSTRUCTION SURVEY CONTROL POINT
LOCATIONS**



SERVICE WATER PUMP STRUCTURE CHANGES IN ELEVATION

NOTE:

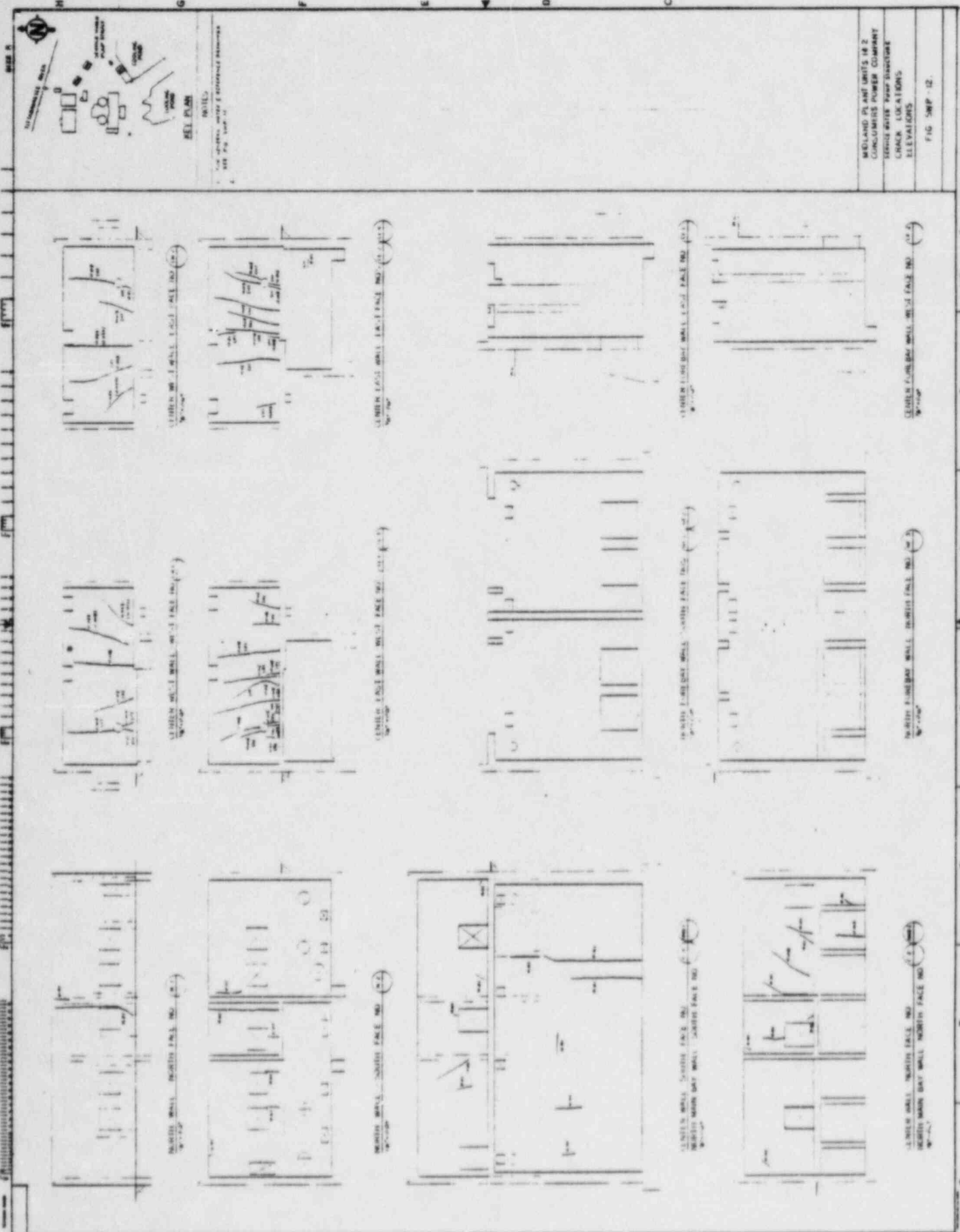
Settlements in () at markers 1 through 6 are measured from March 1978 and indicate movement through October 1981. Figures at markers SW1 through SW4 are measured from later dates (see figure 6)



NOTES

1. LEAK STOPPING SYSTEM IS FOR PREVENTION OF OIL LEAKS FROM THE TURBINE OIL SYSTEM.
 2. ALL ELECTRICAL EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE PRESENT CODES AND STANDARDS.
 3. ALL ELECTRICAL EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE PRESENT CODES AND STANDARDS.
- DESIGNED BY: [Name]
 DRAWN BY: [Name]
 CHECKED BY: [Name]
 APPROVED BY: [Name]

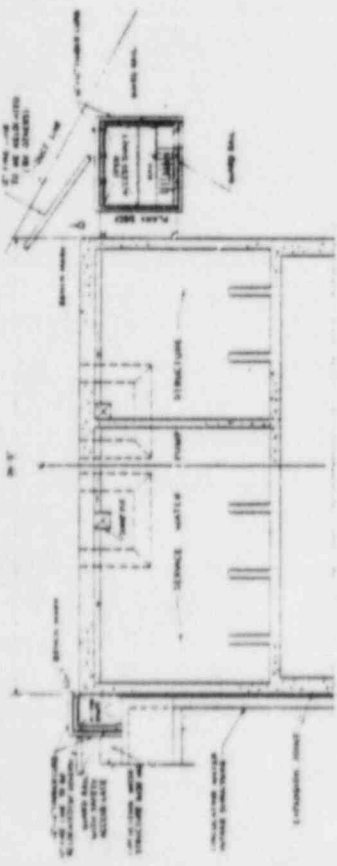
MIDLAND POWER UNITS, 1E 2
 CONDENSER POWER COMPANY
 UNIT NO. 100
 CRACK LOCATIONS
 PLANS & ELEVATIONS
 FIG. SWP - 11



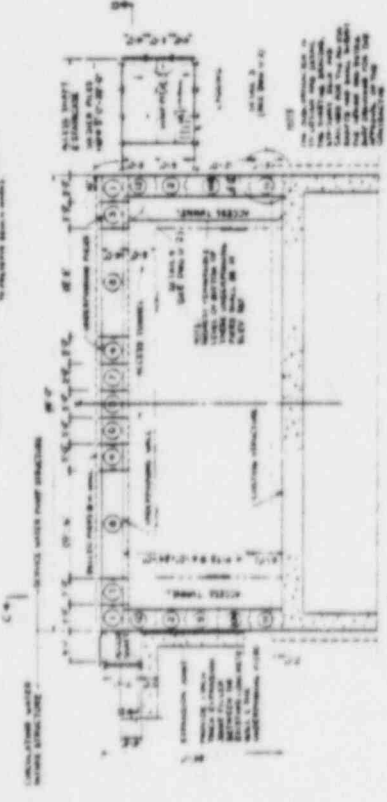
MELAND PLANT UNITS 1&2
 CONSUMERS POWER COMPANY
 SERVICE WATER PUMP STATION
 TRACK LOCATIONS
 ELEVATIONS

FIG. SWP-12

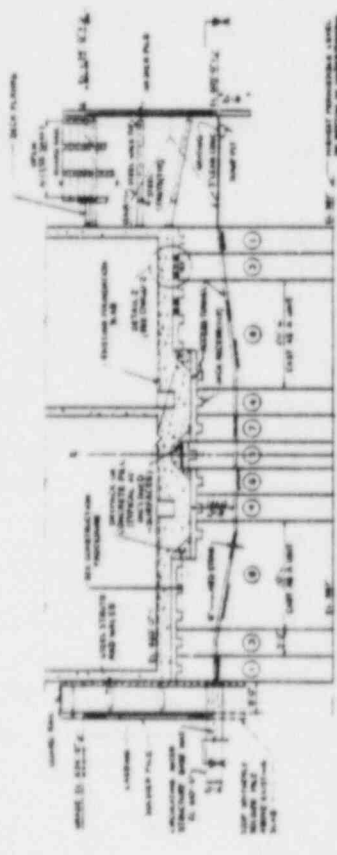
NOTE: ALL DIMENSIONS UNLESS OTHERWISE NOTED ARE TO FACE UNLESS OTHERWISE NOTED.



PLAN A-B
SCALE 1/8" = 1'-0"

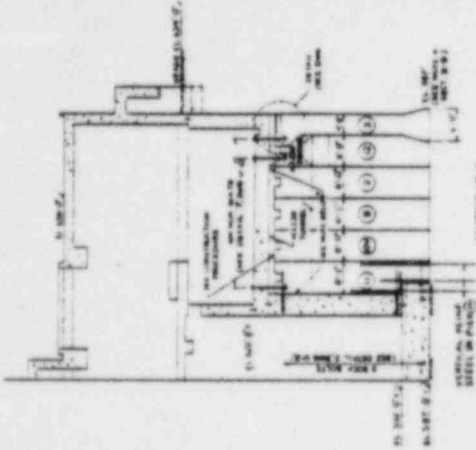


PLAN C-D
SCALE 1/8" = 1'-0"

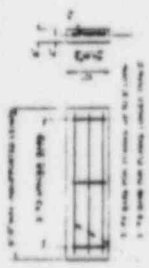


SECTION E-E
SCALE 1/8" = 1'-0"

SEE CONSTRUCTION NOTES FOR DETAILS OF STRUCTURE AND CONNECTIONS.



SECTION G-G
SCALE 1/8" = 1'-0"



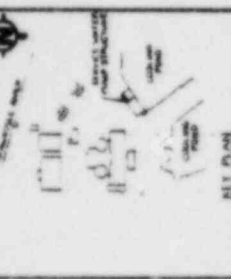
DETAIL
SCALE 1/4" = 1'-0"

STEELING LOAD TABLE

NO.	DESCRIPTION	AREA (SQ. FT.)	LOAD (KIP)	REMARKS
1	ROOF	100.00	10.00	
2	FLOOR	100.00	10.00	
3	WALL	100.00	10.00	
4	CEILING	100.00	10.00	
5	MECHANICAL	100.00	10.00	
6	WIND	100.00	10.00	
7	SEISMIC	100.00	10.00	
8	OTHER	100.00	10.00	
9	TOTAL	900.00	90.00	

LEGEND:
 (1) CONCRETE
 (2) STEEL
 (3) MECHANICAL
 (4) WIND
 (5) SEISMIC
 (6) OTHER

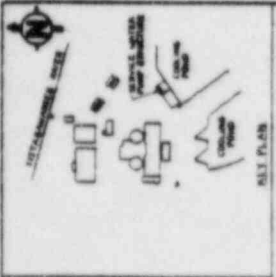
SEE CONSTRUCTION NOTES FOR DETAILS OF STRUCTURE AND CONNECTIONS.



PLAN
SCALE 1/4" = 1'-0"

GENERAL NOTES:
 1. ALL DIMENSIONS UNLESS OTHERWISE NOTED ARE TO FACE UNLESS OTHERWISE NOTED.
 2. ALL DIMENSIONS UNLESS OTHERWISE NOTED ARE TO FACE UNLESS OTHERWISE NOTED.
 3. ALL DIMENSIONS UNLESS OTHERWISE NOTED ARE TO FACE UNLESS OTHERWISE NOTED.
 4. ALL DIMENSIONS UNLESS OTHERWISE NOTED ARE TO FACE UNLESS OTHERWISE NOTED.
 5. ALL DIMENSIONS UNLESS OTHERWISE NOTED ARE TO FACE UNLESS OTHERWISE NOTED.
 6. ALL DIMENSIONS UNLESS OTHERWISE NOTED ARE TO FACE UNLESS OTHERWISE NOTED.
 7. ALL DIMENSIONS UNLESS OTHERWISE NOTED ARE TO FACE UNLESS OTHERWISE NOTED.
 8. ALL DIMENSIONS UNLESS OTHERWISE NOTED ARE TO FACE UNLESS OTHERWISE NOTED.
 9. ALL DIMENSIONS UNLESS OTHERWISE NOTED ARE TO FACE UNLESS OTHERWISE NOTED.
 10. ALL DIMENSIONS UNLESS OTHERWISE NOTED ARE TO FACE UNLESS OTHERWISE NOTED.
 11. ALL DIMENSIONS UNLESS OTHERWISE NOTED ARE TO FACE UNLESS OTHERWISE NOTED.
 12. ALL DIMENSIONS UNLESS OTHERWISE NOTED ARE TO FACE UNLESS OTHERWISE NOTED.
 13. ALL DIMENSIONS UNLESS OTHERWISE NOTED ARE TO FACE UNLESS OTHERWISE NOTED.
 14. ALL DIMENSIONS UNLESS OTHERWISE NOTED ARE TO FACE UNLESS OTHERWISE NOTED.
 15. ALL DIMENSIONS UNLESS OTHERWISE NOTED ARE TO FACE UNLESS OTHERWISE NOTED.
 16. ALL DIMENSIONS UNLESS OTHERWISE NOTED ARE TO FACE UNLESS OTHERWISE NOTED.
 17. ALL DIMENSIONS UNLESS OTHERWISE NOTED ARE TO FACE UNLESS OTHERWISE NOTED.
 18. ALL DIMENSIONS UNLESS OTHERWISE NOTED ARE TO FACE UNLESS OTHERWISE NOTED.
 19. ALL DIMENSIONS UNLESS OTHERWISE NOTED ARE TO FACE UNLESS OTHERWISE NOTED.
 20. ALL DIMENSIONS UNLESS OTHERWISE NOTED ARE TO FACE UNLESS OTHERWISE NOTED.

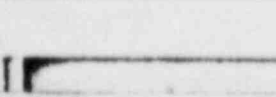
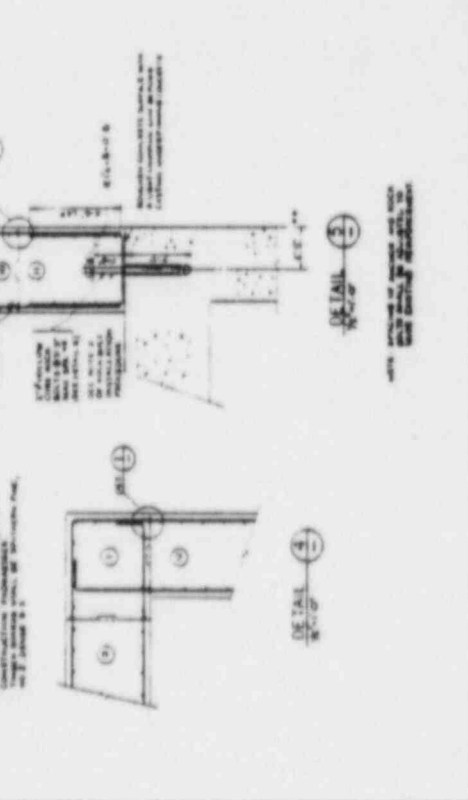
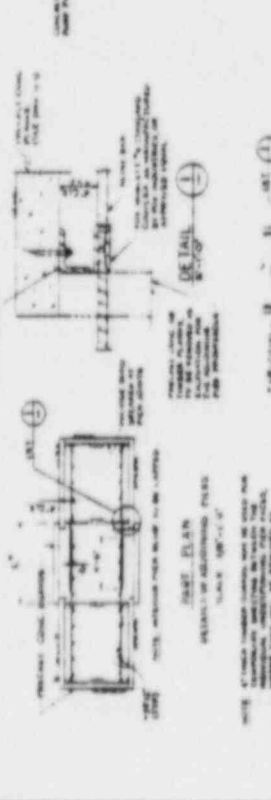
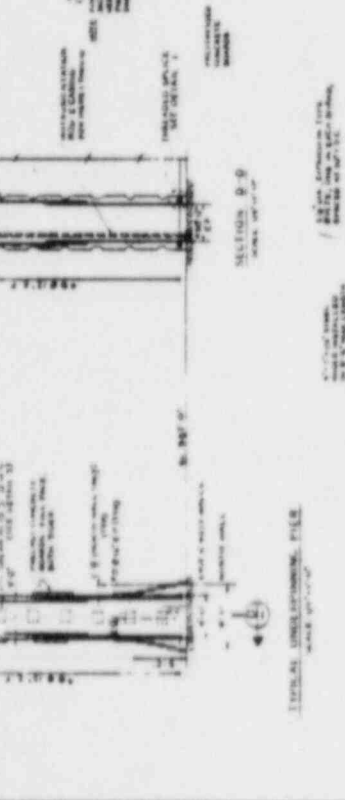
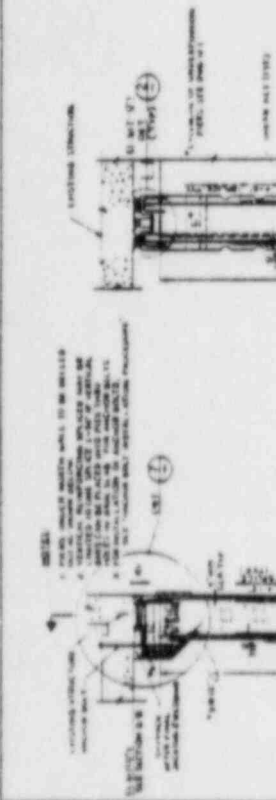
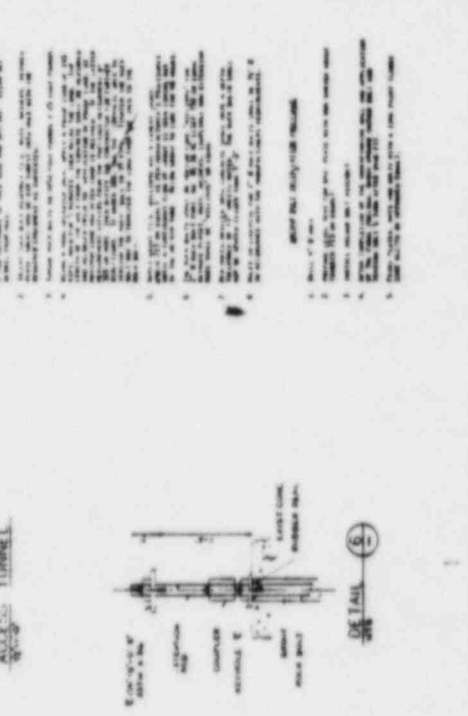
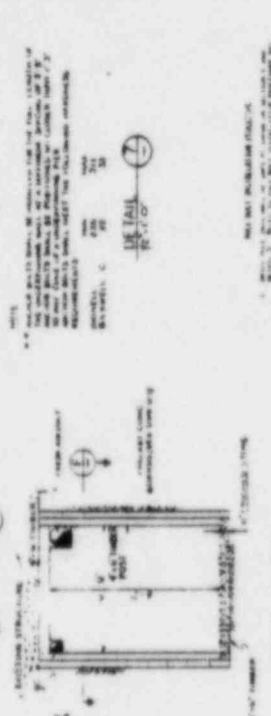
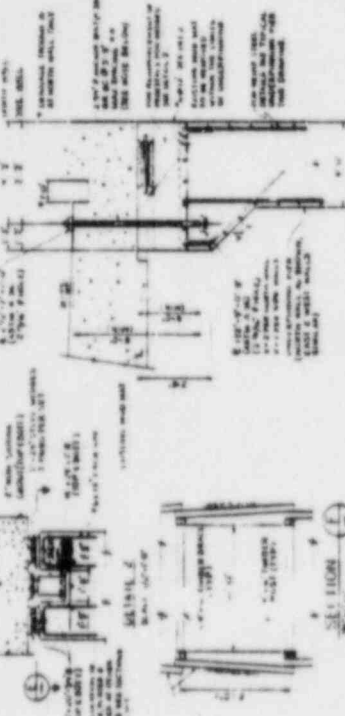
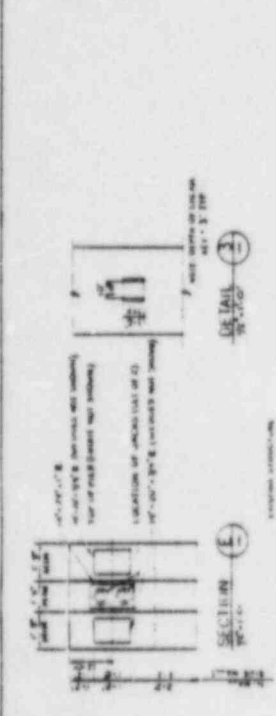
UNIVERSITY OF CALIFORNIA
 SERVICE WATER PUMP STRUCTURE
 UNDERGROUND PLAN & SECTIONS
 DRAWING NO. 100-100-100
 DATE: 10/10/10



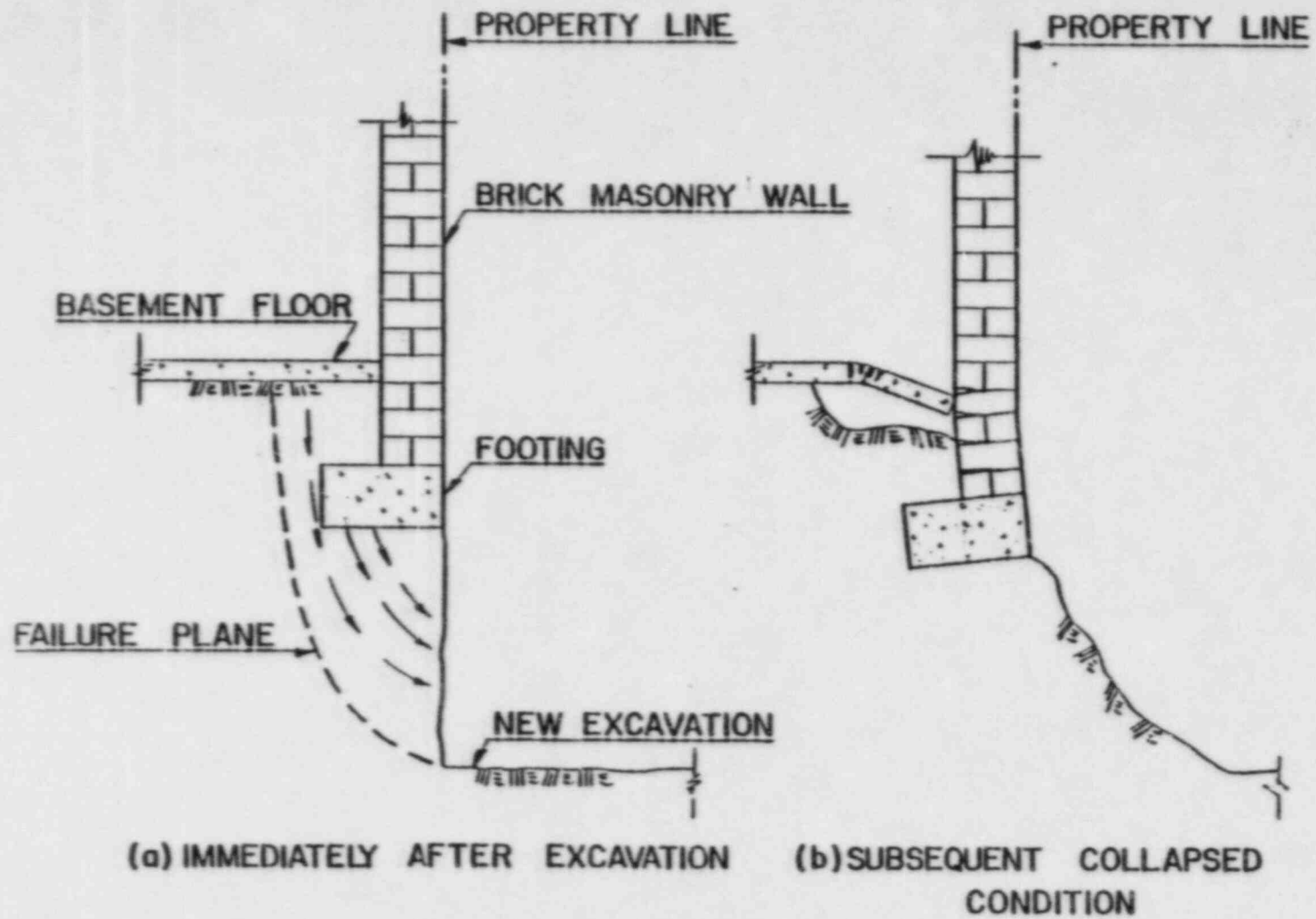
GENERAL NOTES:

1. ALL DIMENSIONS ARE IN FEET AND INCHES UNLESS OTHERWISE SPECIFIED.
2. THE STRUCTURE SHALL BE CONSTRUCTED OF REINFORCED CONCRETE.
3. THE FOUNDATION SHALL BE AS SHOWN ON THE ATTACHED FOUNDATION PLAN.
4. THE STRUCTURE SHALL BE FINISHED WITH A 2" THICK CONCRETE SURFACE.
5. THE STRUCTURE SHALL BE PAINTED WITH AN ANTI-RUST PAINT.
6. THE STRUCTURE SHALL BE MAINTAINED IN GOOD REPAIR AT ALL TIMES.
7. THE STRUCTURE SHALL BE SUBJECT TO INSPECTION BY THE ENGINEER AT ALL STAGES OF CONSTRUCTION.
8. THE STRUCTURE SHALL BE SUBJECT TO INSPECTION BY THE ENGINEER AT ALL STAGES OF CONSTRUCTION.
9. THE STRUCTURE SHALL BE SUBJECT TO INSPECTION BY THE ENGINEER AT ALL STAGES OF CONSTRUCTION.
10. THE STRUCTURE SHALL BE SUBJECT TO INSPECTION BY THE ENGINEER AT ALL STAGES OF CONSTRUCTION.

<p>WINDLASS PLANT UNIT 1 & 2 CHINA RIVER POWER COMPANY</p>
<p>SERVICE WATER PUMP STRUCTURE CHINA RIVER POWER COMPANY</p>
<p>DATE: 10/15/55</p>

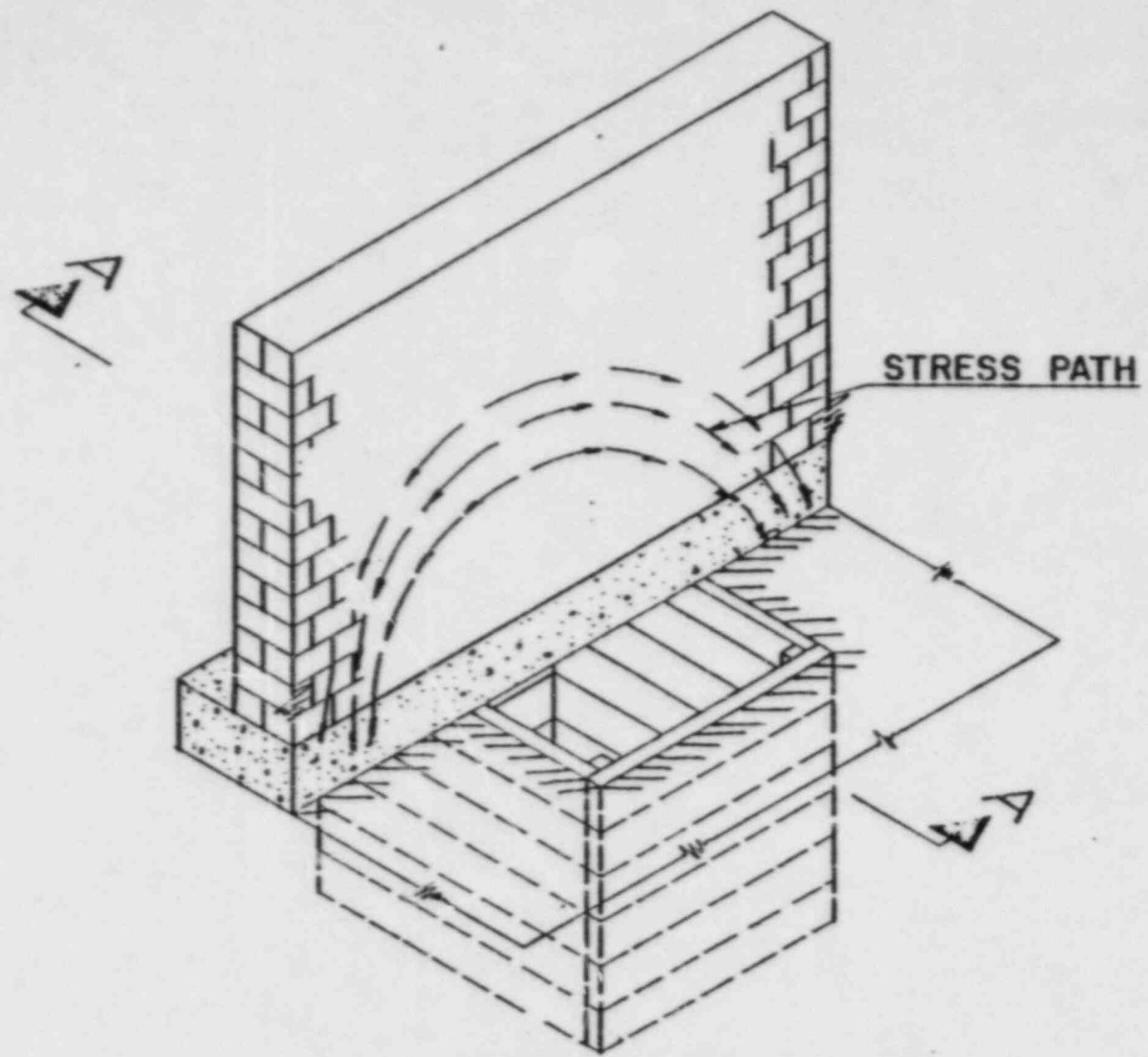


<p>WINDLASS PLANT UNIT 1 & 2 CHINA RIVER POWER COMPANY</p>
<p>SERVICE WATER PUMP STRUCTURE CHINA RIVER POWER COMPANY</p>
<p>DATE: 10/15/55</p>



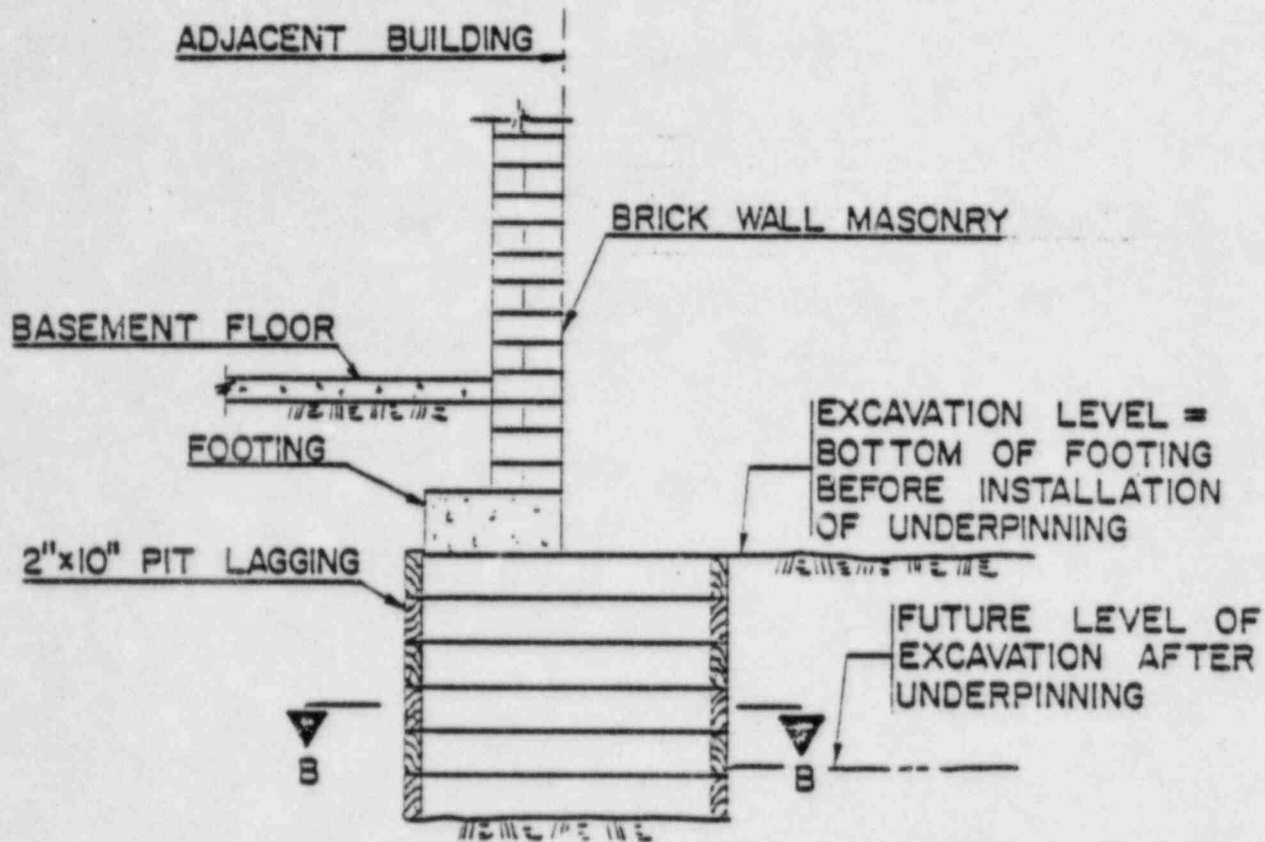
NEED FOR UNDERPINNING

FIG SWP-16

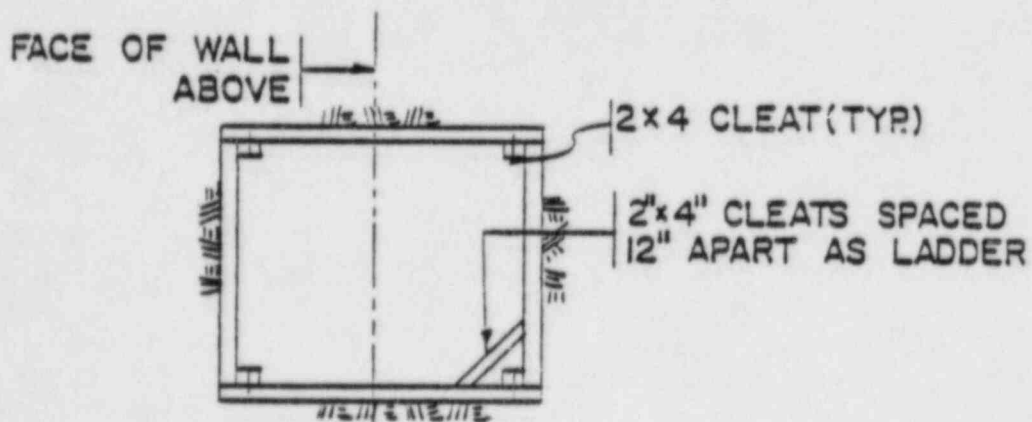


**UNDERPINNING PIT
ISOMETRIC**

FIG SWP-17

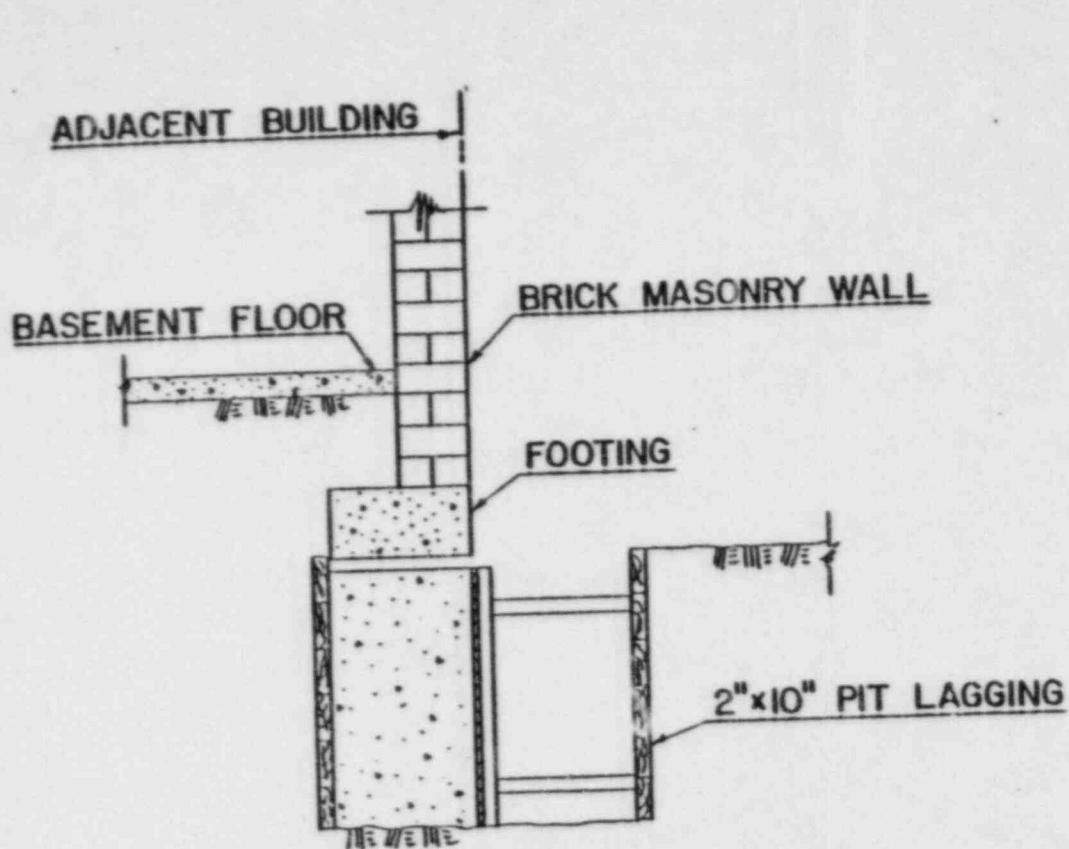


SECTION A-A
THROUGH UNDERPINNING PIT

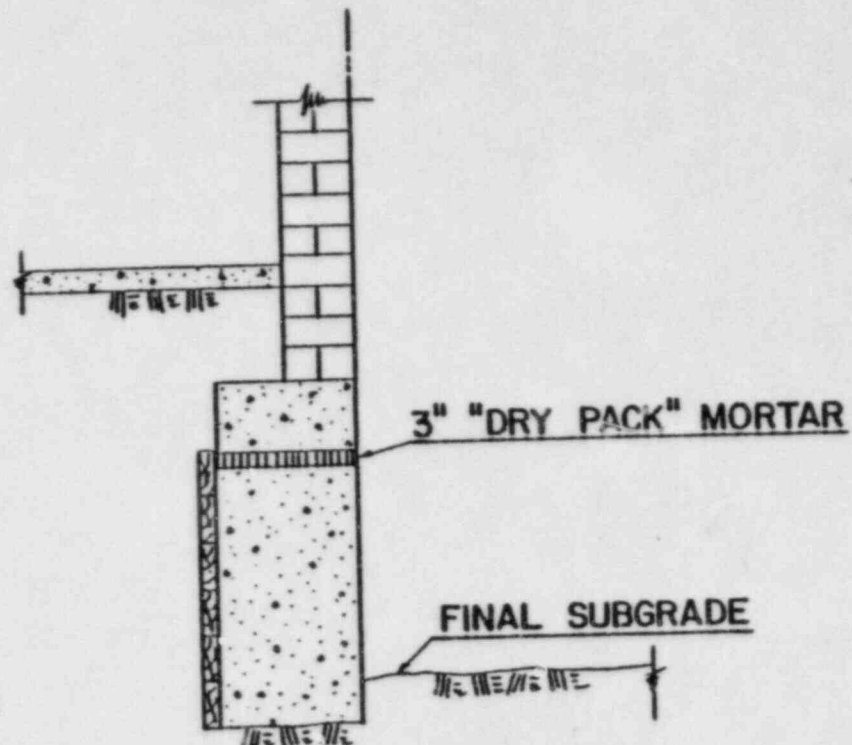


SECTION B-B
PLAN VIEW INSIDE PIT

SECTIONS THROUGH UNDERPINNING PIT

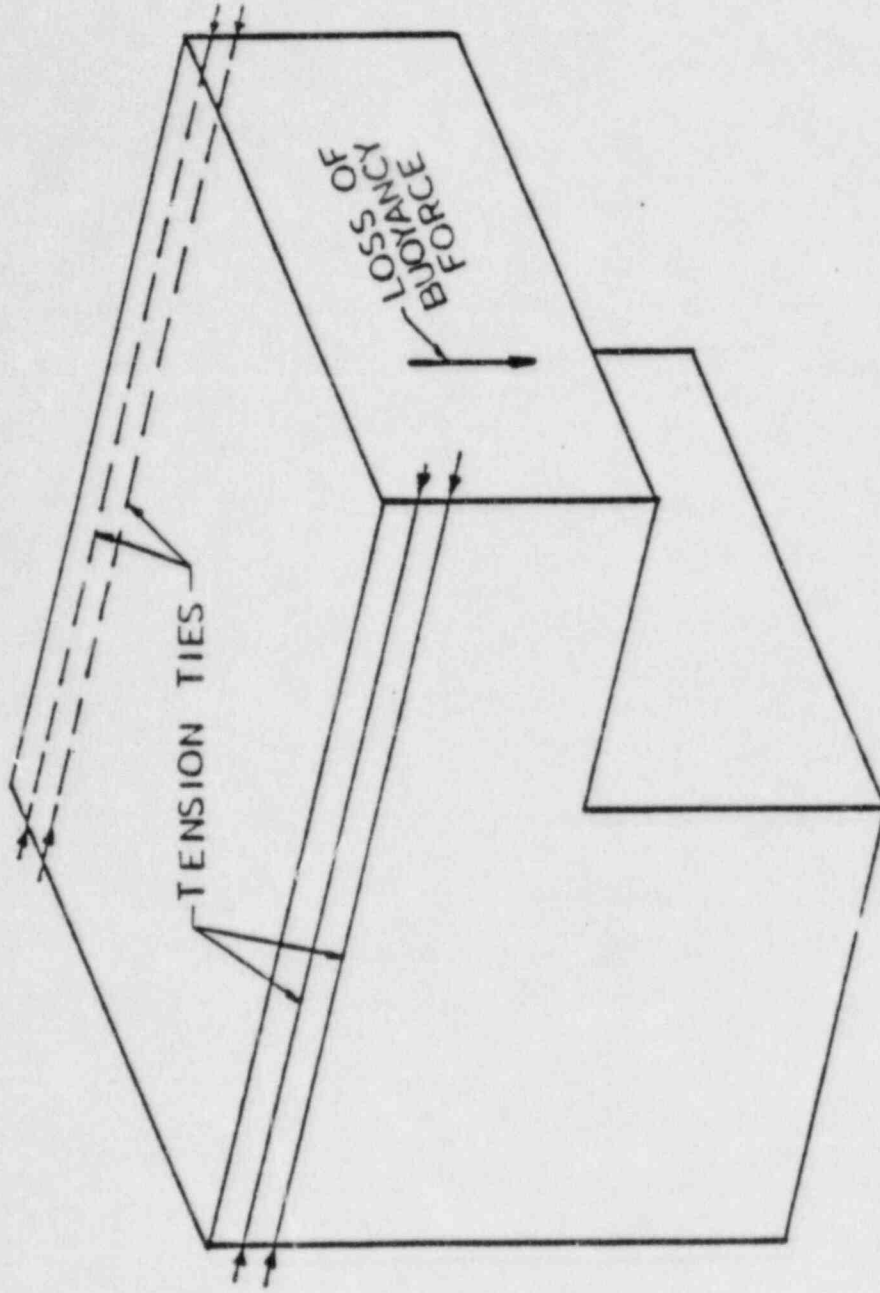


SECTION A-A
 FORMS CONSTRUCTED IN PIT;
 PIER CONCRETE PLACED

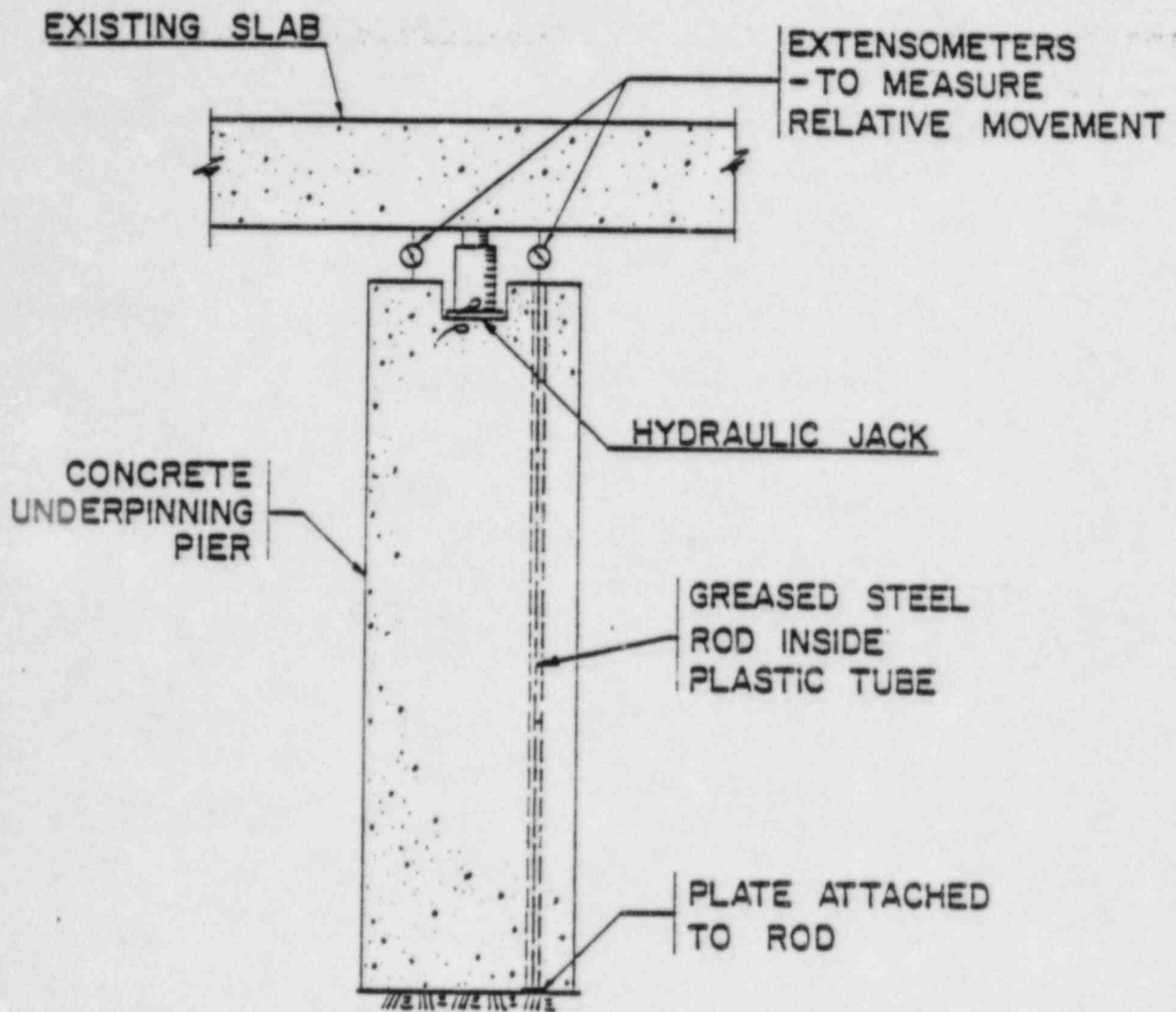


SECTION A-A
 FORMS REMOVED;
 GAP AT TOP FILLED WITH MORTAR
 AND EXCAVATION COMPLETED

UNDERPINNING CONSTRUCTION DETAILS

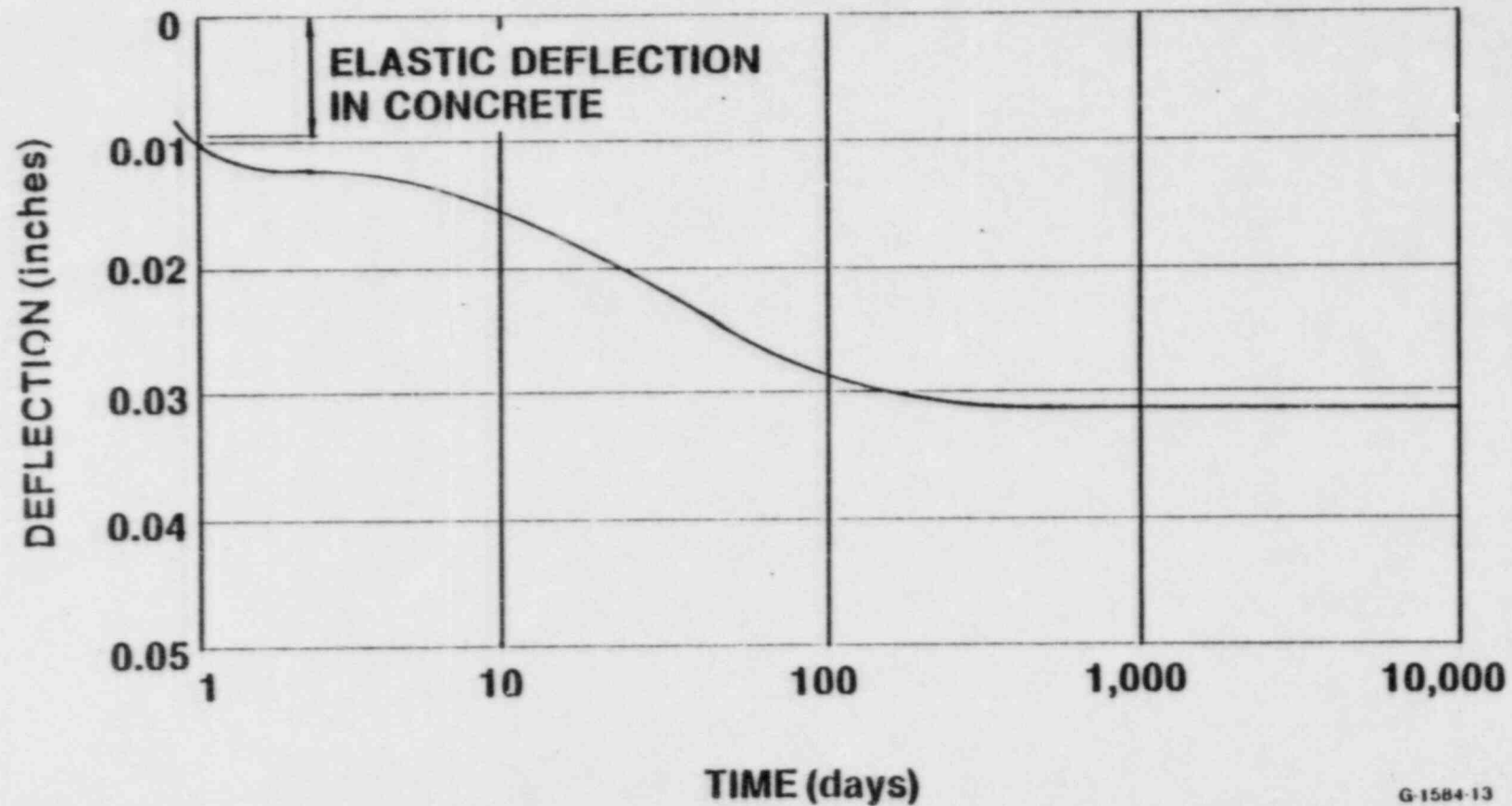


SERVICE WATER PUMP STRUCTURE
TENSION TIES



SECTION THROUGH INSTRUMENTED
UNDERPINNING PIER

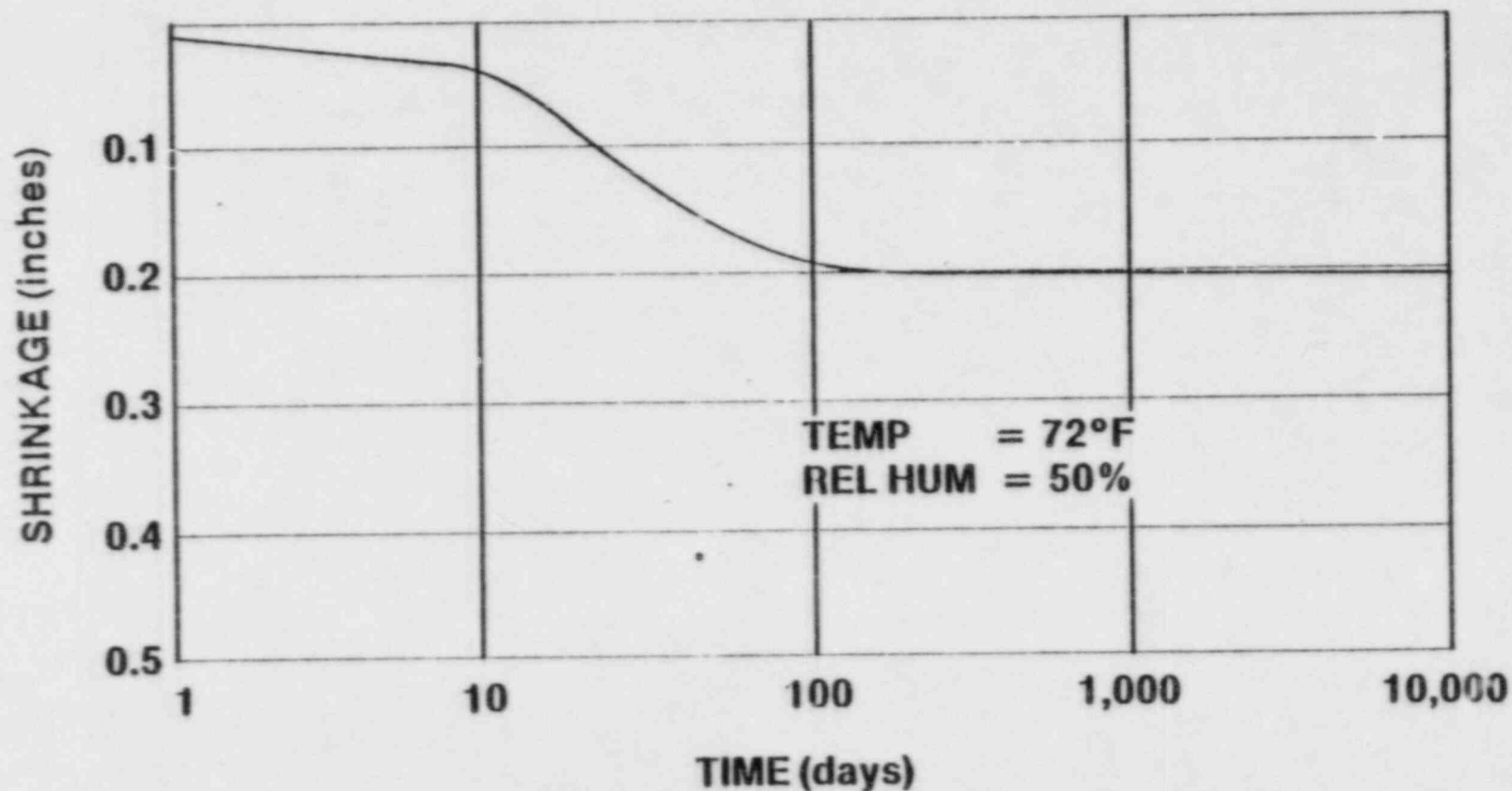
SERVICE WATER PUMP STRUCTURE ESTIMATED TOP OF PIER DEFLECTION DUE TO CREEP OF CONCRETE VS TIME



G-1584-13

FIG SWP-22

**SERVICE WATER PUMP STRUCTURE
ESTIMATED TOP OF PIER
DEFLECTION DUE TO
SHRINKAGE OF CONCRETE VS
TIME**

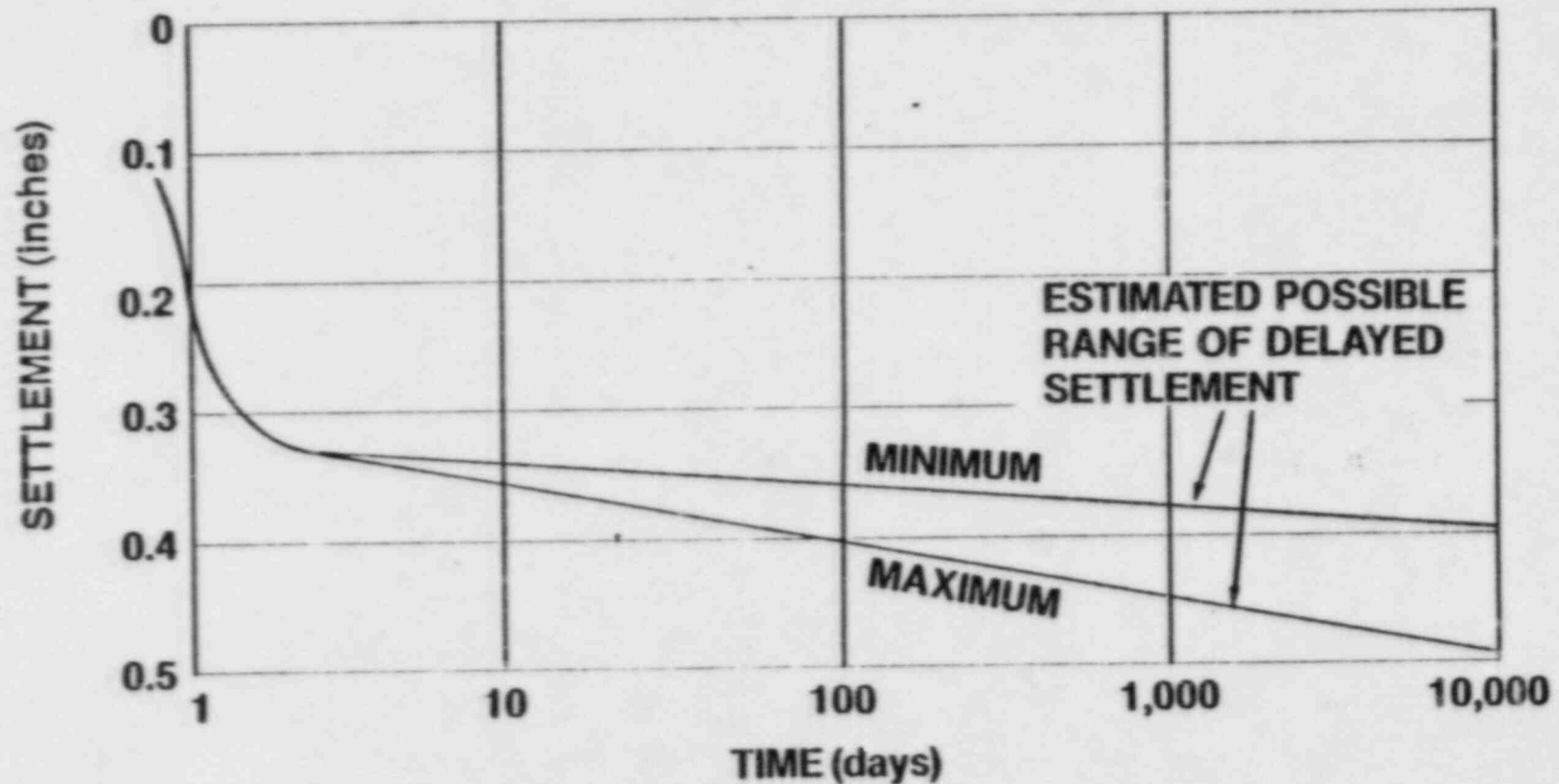


G-1584-11

FIG SWP-23

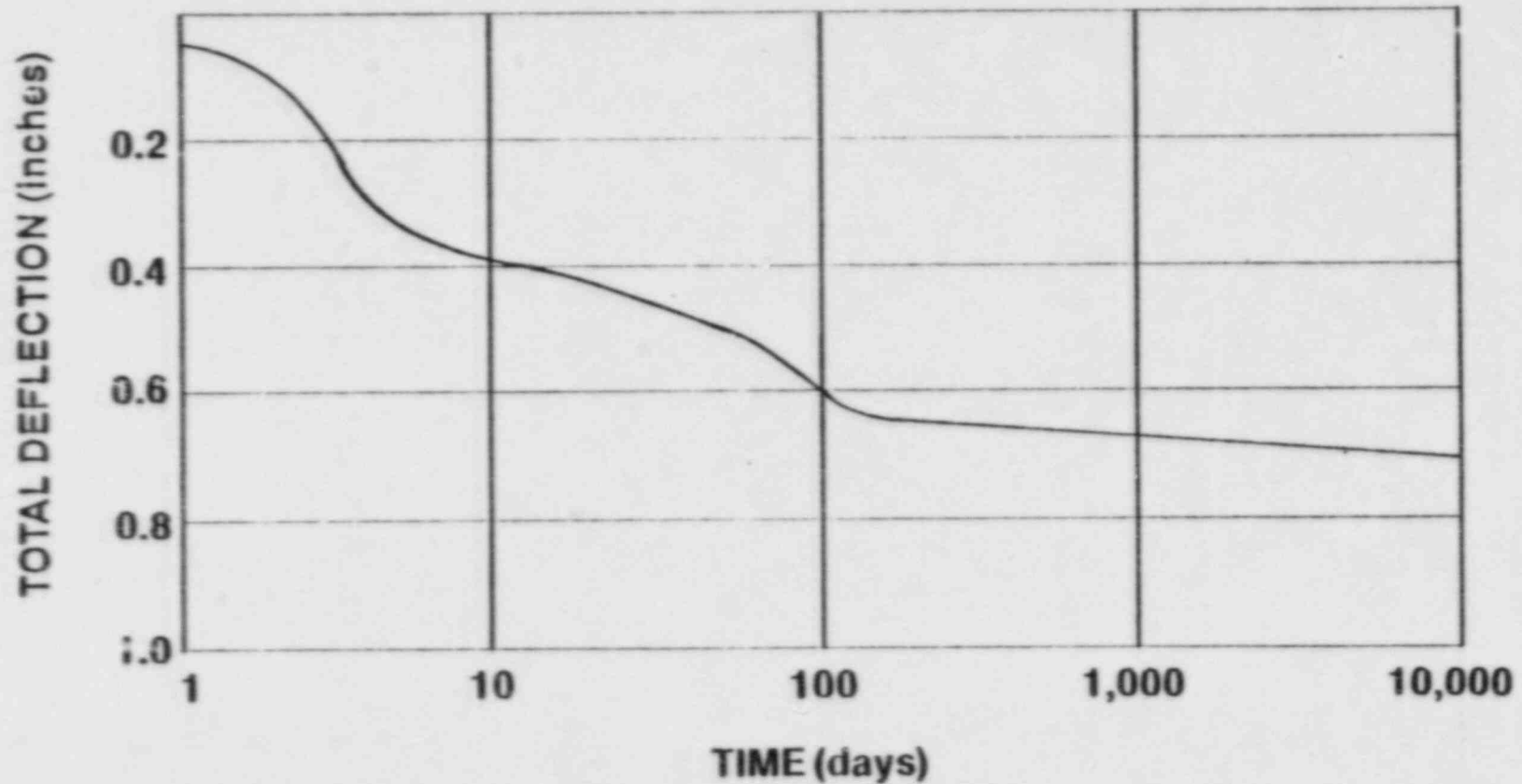
SERVICE WATER PUMP STRUCTURE ESTIMATED TOP OF PIER DEFLECTION DUE TO CONSOLIDATION OF SOIL VS TIME

(Time Is Measured from Start of Jacking)



SERVICE WATER PUMP STRUCTURE ESTIMATED TOP OF PIER DEFLECTION DUE TO TOTAL DEFORMATION VS TIME

(Based on Maximum Consolidation of Soil vs Time)



G 1584 12

FIG SWP-25

ENCLOSURE 14

Red 1-21-82 FV

Bechtel Associates Professional Corporation

777 East Eisenhower Parkway
Ann Arbor, Michigan

Mail Address: P. O. Box 1000, Ann Arbor, Michigan 48106



January 5, 1982

Mr. Dennis Bulzik
Consumers Power Company
1945 West Parnall Road
Jackson, Michigan

Dear Dennis:

As requested by Phil Steptoe in our January 4, 1982 meeting in Ann Arbor, I am forwarding one copy of my testimony for the diesel generator building.

It is my understanding that this latest draft will be submitted by Consumers Power Company to the NRC Staff for their information. Please note that Appendix "C", entitled "An Independent Evaluation of Cracks in the Diesel Generator Building", referenced in Section 3.0 is not included and will have to be submitted separately.

Please let me know if you need any further information.

Sincerely,

Karl Wiedner
Karl Wiedner
Engineering Manager

KW/cf

Enclosure

cc: R. Brown, Clark, Klein, Winter, Parsons & Prewitt
L. Curtis, Bechtel
J. Rutgers/A. Boos, Bechtel
P. Steptoe, Isham, Lincoln & Beale
(all with attachment)

1-27-82 P. Steptoe says this is a
draft to NRC. Seismic shakedown
is on hold

RECEIVED

JAN 11 1982

MIDLAND PROJECT
MANAGEMENT

Draft: 1/8/82

DIESEL GENERATOR BUILDING

ABSTRACT

The diesel generator building is a rectangular, reinforced concrete, box-like structure which houses four diesel generators. The building is founded on approximately 30 feet of plant fill and was constructed between the summer of 1977 and the spring of 1979. In August 1978 the actual building settlement exceeded the estimated 40-year settlement value stated in the Midland Final Safety Analysis Report. Construction was discontinued until the cause of the excessive settlement was identified and corrective measures were determined. With the input of consultants, surcharging and dewatering the plant fill were selected as the most effective and feasible corrective measures.

This testimony describes the structural reanalysis of the diesel generator building. The reanalysis shows there is assurance that the structure will perform its function safely, despite the settlement which has occurred and is predicted to occur over the operating life of the plant.

DIESEL GENERATOR BUILDING

TABLE OF CONTENTS

	<u>Page</u>
1.0 <u>BACKGROUND</u>	1
1.1 FUNCTION AND DESCRIPTION	1
1.2 SETTLEMENT BACKGROUND	2
2.0 <u>CORRECTIVE ACTION</u>	3
2.1 REMEDIAL OPERATIONS	3
2.1.1 <u>Surcharging</u>	3
2.1.2 <u>Status (As of December 6, 1979)</u>	4
2.2 STRUCTURAL REANALYSIS	6
2.2.1 <u>Structural Acceptance Criteria</u>	7
2.2.1.1 Load Cases	7
2.2.1.2 Load Combinations	9
2.2.1.3 Allowable Material Limits	11
2.2.2 <u>Diesel Generator Building Analytical Model</u>	12
2.2.3 <u>Application of Loads to the Building Model</u>	12
2.2.3.1 Dead Loads	12
2.2.3.2 Settlement Loads	13
2.2.3.3 Live Loads	16
2.2.3.4 Wind Loads	16
2.2.3.5 Tornado Loads	17
2.2.3.6 Seismic Loads	18
2.2.3.7 Thermal Loads	21
2.2.4 <u>Methods of Finite-Element Model Analysis</u>	21
2.2.5 <u>Structural Adequacy Computations</u>	24
3.0 <u>CRACK ANALYSIS</u>	26

Table of Contents (continued)

4.0	<u>CURRENT STATUS</u>	26
4.1	ANALYSES	26
4.2	CONSTRUCTION	27
4.3	FURTHER MONITORING	27
5.0	<u>CONCLUSIONS</u>	30
	<u>FOOTNOTES</u>	35
	<u>REFERENCES</u>	0

TABLES

- DGB-1 Loads and Load Combinations for Concrete Structures Other than the Containment Building From the FSAR and Question 15 of Responses to NRC Requests Regarding Plant Fill
- DGB-2 Loads and Load Combinations for Comparison Analysis Requested in Question 15 of NRC Requests Regarding Plant Fill
- DGB-3 Soil Properties Used in the Seismic Analysis
- DGB-4 Rebar Stress Values for the Diesel Generator Building Structural Members (According to FSAR and the Responses to NRC Requests Regarding Plant Fill, Question 15)
- DGB-5 Rebar Stress Values for the Diesel Generator Building Structural Members (According to ACI 349/1976, as Supplemented by Regulatory Guide 1.142)

FIGURES

- DGB-1 Site Plan of Midland Units 1 and 2 Power Plant
- DGB-2 Elevations of Diesel Generator Building
- DGB-3 Plan View and Sections of Diesel Generator Building
- DGB-4 Diesel Generator Building Duct Bank Layout
- DGB-5 Diesel Generator Building Duct Elevation View (Surcharge also Shown)
- DGB-6 Diesel Generator Building Finite Element Model
- DGB-7 Actual and Estimated Secondary Compression Settlements from September 14, 1979, to December 31, 2005, Assuming Surcharge Remains in Place

Table of Contents (continued)

- DGB-8 Comparison of Estimated Secondary Compression Values with Settlement Values Resulting from a Finite Element Analysis of the Diesel Generator Building
- DGB-9 Diesel Generator Building Dynamic Lumped Mass Model for Seismic Analysis
- DGB-10 Basis for Calculation of Equivalent Shear Wave Velocity
- DGB-11 Positive Plate Element Forces
- DGB-12 Typical Construction Sequence with Crack Mapping Shown for Typical Interior Wall, Center Wall-East Side, Looking West

APPENDICES

- A Assessment of the Effects of Cracks in Exterior Walls Subjected to Tornado Missile Effects
- B OPTCON
- C An Independent Evaluation of Cracks in the Diesel Generator Building

DIESEL GENERATOR BUILDING

1.0 BACKGROUND

1.1 FUNCTION AND DESCRIPTION

The diesel generator building houses four diesel generators that provide power to attain a safe shutdown of the Midland plant after a design basis accident and to operate the plant during unforeseen power outages. The diesel generators and the diesel generator building are classified as Seismic Category I items. As such, the generators must remain functional and the building must maintain its integrity under the action of the loads and load combinations described in Subsection 2.2.1, including during and after a postulated safe shutdown earthquake (SSE).

The diesel generator building is located directly south of the turbine building, as shown in Figure DGB-1. The diesel generator building is a two story, reinforced concrete, box-like structure that is partitioned by reinforced concrete walls into four bays, one for each diesel generator. (See Figures DGB-2 and DGB-3 for plan and section views of the building.) The diesel generator building was founded on plant fill and constructed between the summer of 1977 and the spring of 1979.

1.2 SETTLEMENT BACKGROUND

In August 1978, jobsite engineers determined from the Bechtel Foundation Data Survey Program⁽¹⁾ (for footnotes, see Page 30) that the settlement of the diesel generator building exceeded the estimated settlement value (approximately 3 inches) provided in Figure 2.5-48 of the Midland Final Safety Analysis Report (FSAR) (Reference 1). The diesel generator building settlement and the remedial actions taken are described in the testimony of Gilbert S. Keeley. Mr. Keeley's testimony describes how this matter was reported to the NRC, and the subsequent investigations leading to the conclusion that this unexpected settlement was related to insufficient compaction of plant fill. These investigations also showed that the diesel generator building was experiencing differential (i.e., uneven) settlement. It was determined that the four electrical duct banks penetrating the diesel generator building footing from below were restraining the uniform settlement of the building (refer to Figures DGB-4 and DGB-5). This restraint caused the formation of cracks in the concrete superstructure, most noticeably in the east wall and in the interior partition walls, and to a lesser extent in the north wall. The maximum crack width encountered at this time was 28 mils. These cracks were formed in addition to cracks caused by the normal shrinkage of concrete.

On November 3, 1978, the NRC was notified that, to eliminate duct bank interference with building settlement and to provide positive clearance between the building foundation and the duct banks, the duct banks would be separated from the diesel

generator building by releasing them at the building interface. When the duct banks were released, the maximum gap (1-1/2 inches) which existed between certain areas of the building and the soil surfaces partially closed. In addition, a number of the existing concrete cracks decreased in width after duct bank release. Subsequent building settlement progressed fairly uniformly.

2.0 CORRECTIVE ACTION

Based on the recommendations of soil consultants Dr. R.B. Peck and Dr. A.J. Hendron, surcharging and subsequent implementation of a permanent dewatering program was selected as the remedial plan. The criteria for selection and further discussion of surcharging are provided in the testimony of Drs. Peck and Hendron. Further discussion of the dewatering program will be provided in the testimony of engineering geologist William Paris of Bechtel.

2.1 REMEDIAL OPERATIONS

2.1.1 Surcharging

As stated in Interim Report 4 to Management Corrective Action Report 24, surcharging of the diesel generator building began in January 1979. Approximately 20 feet of sand was gradually placed within the diesel generator building and around its perimeter, extending outward 20 feet from each wall except along the north wall where the diesel generator building is close to the turbine building. At that location, sand extended

approximately 19 feet and was retained by a 20-foot high temporary retaining wall (refer to Figure DGB-5). Crack mapping was initiated prior to the start of surcharging. This provided a baseline survey for future crack observations and assessment of the building's response to surcharging. Subsequent crack mapping was done at approximately 1-year intervals, with the most recent crack mapping done in July 1981.

The hold on diesel generator building construction voluntarily implemented on August 23, 1978, was lifted in December 1978 because a completed structure would maximize the impact of surcharging. The additional weight of the concrete which would be placed was desirable for surcharge purposes, and the completion of the floor slab at elevation 664 and the roof slab would increase the structure's ability to distribute loads.

In August 1979 the soil consultants deemed the surcharge operation a success for the reasons stated in Dr. Peck's testimony. Removal of the surcharge soil (from elevation 654 to elevation 634) commenced on August 15, 1979, and was essentially complete by the end of August 1979. Settlement measurements continued during and after the removal of the surcharge.

2.1.2 Status (As of December 6, 1979)

On December 6, 1979, the NRC staff issued an Order Modifying Construction Permits. By that date, the remedial action required to stabilize the diesel generator building (i.e., surcharging) was already completed. Although the structural

reanalysis described in this testimony was not yet complete, Revision 3 of the responses to NRC Requests Regarding Plant Fill, Question 15 had been submitted to the NRC (September 1979). This response included acceptance criteria for Seismic Category I structures such as the diesel generator building that are partially or entirely founded on plant fill. These acceptance criteria have remained unchanged. [The response to Question 26 of the NRC Requests Regarding Plant Fill, submitted February 29, 1980, reiterated the response to Question 15 and added a commitment to perform an analysis in accordance with American Concrete Institute (ACI) 349 as supplemented by Regulatory Guide 1.142 for comparison only.] For additional information on the load combinations of the structural acceptance criteria, refer to Subsection 2.2.1.2.

The superstructure of the diesel generator building was completed by March 22, 1979. The majority of the work in progress during December 1979 was not civil/structural in nature. Remaining work included activities such as installing cable trays, conduit, heating, ventilating, and air conditioning (HVAC) ducts, etc. The civil/structural work remaining in the building at that time was the construction of secondary structural walls⁽²⁾ and steel platforms, neither of which contribute significant strength to the building. None of these activities constituted remedial actions associated with building settlement.

2.2 STRUCTURAL REANALYSIS

To account for the effect of the observed and predicted settlement on the diesel generator building, a structural reanalysis was performed. This reanalysis proceeded by defining the acceptance criteria for the structure (see Subsection 2.2.1). These acceptance criteria differ from the acceptance criteria used in the original design and analysis of the structure and set forth in the FSAR only in the addition of four load combinations that include the effect of settlement. These additional load combinations are described in Subsection 2.2.1.2, Equations 1 through 4.

To investigate the effects of the load combinations on the structure, the structural reanalysis uses two different mathematical models of the diesel generator building: a dynamic, lumped mass model and a static, finite-element model. The dynamic, lumped mass model (described in Subsection 2.2.3.6 and illustrated in Figure DGB-9) is used to generate seismic forces in the building, given the input ground motion from the operating basis earthquake (OBE) and SSE specified in the FSAR.

The finite-element model (described in Subsection 2.2.4 and illustrated in Figure DGB-6) is a more complex mathematical model that reduces the diesel generator building to an interrelated system of plate, beam, and boundary elements representing the walls, slabs, foundation, and soil. The finite-element model is used to assess the effect on individual elements of various load combinations applied to the structure as a whole.

(These load combinations include seismic forces generated with the dynamic, lumped mass model.) The finite-element model thereby allows the identification of those sections of the diesel generator building that will experience the greatest forces due to the postulated load combinations. The allowable stress is then calculated and compared to the actual stress level in these sections based on the forces derived from the finite-element model. This comparison shows that even those sections of the building experiencing the highest forces meet the acceptance criteria.

2.2.1 Structural Acceptance Criteria

Because of the settlement problem, a structural reanalysis of the diesel generator building was performed to determine if the structure met the structural acceptance criteria which are consistent with FSAR Subsection 3.8.6.3, with settlement effects included as outlined in the response to NRC Requests Regarding Plant Fill, Question 15, Revision 3, September 1979 (Reference 2).

2.2.1.1 Load Cases

The following loads are considered in the reanalysis:

1. Dead loads (D)
2. Effects of settlement combined with creep, shrinkage, and temperature (T)

3. Live loads (L)
4. Wind loads (W)
5. Tornado loads (W')
6. OBE loads (E)
7. SSE loads (E')
8. Thermal effects (T_0)

Thermal effects appear twice in this list (Items 2 and 8). For load combinations committed to in the response to Question 15 of the NRC Requests Regarding Plant Fill, thermal effects are contained within the settlement effects term, T. For load combinations committed to in FSAR Subsection 3.8.6.3, thermal effects are contained in the thermal term, T_0 (Refer to Table DGB-1).

All other load cases appearing in the load combinations for Seismic Category I structures listed in FSAR Subsection 3.8.6.3 (e.g., rupture of pipe lines) do not occur in the diesel generator building and are not addressed.

2.2.1.2 Load Combinations

The load combinations employed for the original analysis and design of the diesel generator building are provided in FSAR Subsection 3.8.6.3. The original FSAR load combinations did not contain a settlement effects term (T). For the structural reanalysis performed in response to Question 15 of the NRC Requests Regarding Plant Fill (September 1979), four additional load combinations were established and committed to be considered. These additional combinations consider the effects of differential settlement in combination with long-term operating conditions and with either wind load or OBE. Table DGB-1 provides the load combinations listed in FSAR Subsection 3.8.6.3 and the four additional load combinations. These load combinations comprise the acceptance criteria for the diesel generator building and are hereinafter referred to as the Midland acceptance criteria.

By requiring combination of differential settlement with wind loads and OBE, the Midland acceptance criteria are more stringent than the requirements of ACI 318.⁽³⁾ ACI 318 only requires combining the effects of differential settlement with the dead loads and live loads. The Midland acceptance criteria are less stringent than ACI 349, because ACI 349 as supplemented by Regulatory Guide 1.142 includes load combinations that combine the effects of differential settlement with extreme loads such as tornados and SSEs. In the response to Question 26 of NRC Requests Regarding Plant Fill, a commitment was made to do a separate structural reanalysis of the diesel generator building

in accordance with ACI 349, as supplemented by Regulatory Guide 1.142, for comparative purposes only.⁽⁴⁾ Table DGB-2 provides the load combinations of ACI 349 as supplemented by Regulatory Guide 1.142.

It is unnecessary to use all Table DGB-1 load combinations in the structural reanalysis. A number of combinations can be eliminated from the analysis after comparison with more severe loads or load equations. For example, Equations 6 and 10 from Table DGB-1 are:

$$1. \quad U = 1.25 (D + L + H_0 + E) + 1.0T_0 \quad (6)$$

$$2. \quad U = 1.4 (D + L + E) + 1.0T_0 + 1.25H_0 \quad (10)$$

Because there are no significant forces on the structure due to thermal expansion of pipes (H_0), these two expressions can be rewritten in simpler forms:

$$1. \quad U = 1.25 (D + L + E) + 1.0T_0 \quad (6)$$

$$2. \quad U = 1.4 (D + L + E) + 1.0T_0 \quad (10)$$

The second expression is more critical than the first. Therefore, Equation 10 is used in the analyses and is considered to envelop the lower force components resulting from an analysis using Equation 6. Utilizing this approach with the entire set of load combinations eliminates the less critical equations and condenses the list to 10 load combinations.

	<u>Load Combinations</u>	<u>Table DGB-1 Equation No.</u>
1.	$1.05D + 1.28L + 1.05T$	(1)
2.	$1.4D + 1.4T$	(2)
3.	$1.0D + 1.0L + 1.0W + 1.0T$	(3)
4.	$1.0D + 1.0L + 1.0E + 1.0T$	(4)
5.	$1.4D + 1.7L$	(5)
6.	$1.25 (D + L + W) + 1.0T_0$	(7)
7.	$1.4 (D + L + E) + 1.0T_0$	(10)
8.	$0.9D + 1.25E + 1.0T_0$	(11)
9.	$1.0 (D + L + E') + 1.0T_0$	(15)
10.	$1.0 (D + L + W') + 1.0T_0$	(18)

The same procedure can also be used to reduce the total number of load combinations that must be considered in the comparison ACI 349 analysis.

2.2.1.3 Allowable Material Limits

In accordance with regulatory requirements and the recommendations of the American Concrete Institute (ACI 318 and ACI 349), the maximum rebar tensile stress allowed in the diesel generator building rebar equals $0.90 f_y$ (where f_y equals yield stress) for computation of section capacities. Because the diesel generator building rebar has an f_y value of 60 ksi, the maximum allowable tensile rebar stress due to flexural and axial loads is 54.0 ksi. Rebar stress values calculated for critical, reinforced concrete sections of the diesel generator building were based on this maximum allowable rebar stress value of 54 ksi and a maximum allowable concrete strain level of 0.003.⁽⁵⁾

2.2.2 Diesel Generator Building Analytical Model

The structural reanalysis of the diesel generator building uses a finite-element model. The required load combinations were applied to this model and the resulting forces were investigated for compliance with the structural acceptance criteria. The diesel generator building was modeled as an assemblage of plate, beam, and boundary elements. The structure is defined by a set of 853 nodal points and 1,294 elements. Of these elements, 901 are plate elements representing walls and slabs, 141 are beam elements representing footings, and 252 are boundary elements (translational springs, in both the vertical and horizontal directions) representing varying soil pressures. Certain items, such as steel platforms and lightly reinforced, interior secondary structural walls, have not been included in the model for the reasons listed in subsequent sections.

Figure DGB-6 illustrates an isometric view of the finite-element model.

2.2.3 Application of Loads to the Building Model

The following loads have been applied to the model in the manner noted.

2.2.3.1 Dead Loads

The dead load of the structure was simulated by specifying a mass acceleration value equaling that of gravity (32.2 ft/s^2). Secondary structural walls and platforms were not

included in the model because their contribution to the gross weight of the structure is minimal (less than approximately 3 percent) relative to the sum of the other loads considered. Their exclusion does not significantly affect the magnitude or distribution of stresses. The louvers on both the north wall and south wall, along with the doors on the north and south walls of the building, were modeled simply as penetrations, with dimensions equivalent to those of the doors and louvers. This is acceptable because the doors and louvers contribute insignificantly to the building stiffness and total building weight. The diesel generator pedestals and the ground floor slabs were omitted from the finite-element model because they were not constructed monolithically with the remainder of the structure. Consequently, they do not add stiffness to the structure.

2.2.3.2 Settlement Loads

The settlement effects were modeled into the structure by representing varying soil conditions as boundary elements comprised of translational (vertical and horizontal) springs. At 84 locations along the building footing, a set of springs with varying properties (one vertical spring and at least one horizontal spring) was applied to represent the nonhomogenous nature of soil conditions existing beneath the diesel generator building.

Spring values were developed for two general cases: those springs calculated for long-term loading and those springs

calculated for short-term loading, e.g., tornados and earthquakes. For long-term loading, a set of springs was calculated for the determination of structural stresses caused by the settlement of the diesel generator building after 40 years. These springs were calculated at each nodal point along the foundation by dividing the total load represented at the selected point by the predicted settlement at that point, so that the spring constant was expressed in terms of force/unit displacement. The predicted settlement values from September 14, 1979, to December 31, 2025, are addressed in Dr. Peck's testimony. The settlement values used in calculating long-term spring values are presented in Figure DGB-7 and comprise the following:

1. Actual settlements from September 14, 1979, to January 16, 1980
2. Predicted secondary consolidation from January 16, 1980, to December 31, 1981 (These values are a portion of settlement values shown in Figure 27-12 of Reference 2.)
3. Predicted secondary consolidation from December 31, 1981, to December 31, 2025 (These values are also shown in Figure 27-13 of Reference 2.)
4. Estimated dewatering settlement of 1/4 inch in the fill

These settlements used in calculating long-term spring values are based on the conservative assumption that the

surcharge remains in place over the 40-year life of the plant, thus exceeding actual settlement predictions. Figure DGB-8 compares these settlement values with those settlement values resulting from the finite-element analysis of the diesel generator building model. The comparison shows a good correlation between values resulting from the finite-element model and estimated settlement values generated by Dr. Peck and Bechtel soil engineers.⁽⁶⁾ Because the estimates of the soils engineers are based on the conservative assumption of the surcharge remaining in place over the 40-year life of the plant, the model overestimates the settlement loads on the structure considered in the structural reanalysis and is therefore conservative.

Figure DGB-8 also indicates the settlement and differential settlement occurring in the building after September 1979 (subsequent to removal of the surcharge material). As Figure DGB-8 shows, the settlement and differential settlement which has occurred since the removal of the surcharge are very small compared with the settlement and differential settlement conservatively estimated for the purpose of the structural reanalysis.

The other set of springs was developed for short-term loading, in which it was assumed that the structural movement was small enough to assume the soil was linearly elastic. The modulus of elasticity was calculated using soil density and measured shear wave velocity values. Springs were developed for the vertical and horizontal modes. These springs were calculated by

determining the amount of force required to produce a unit displacement in the direction indicated by the particular mode. The footings of the diesel generator building were assumed to be resting on a large mass of elastic soil for the vertical mode and embedded within the mass of soil for the horizontal mode.

2.2.3.3 Live Loads

Live loads were applied to the modeled structure by applying pressure loads on the plate elements which represent the floor slab at elevation 664 and the roof at elevation 680. During the plant life, a maximum live load of 100 psf is predicted to occur on the roof slab, whereas for the floor at elevation 664, a maximum live load of 250 psf is postulated. One hundred percent of the live load was used in the design of individual structural members, such as floor slab at elevation 664 and roof slab at elevation 680. For overall building response, however, the live loads considered were limited to 25 percent of the above maximum loads. This 25-percent value represents the live load expected to be present when the plant is in operation, i.e., 100 percent of the live load will not act simultaneously on every square foot of the floor space.

2.2.3.4 Wind Loads

Loads resulting from the design wind (100-year recurrence with a velocity of 85 mph) were applied to the modeled structure as a pressure load on the plate elements that represent

the exposed walls. Wind loads on the roof and south wall hatch covers were determined assuming the hatch covers were in place. These loads were then distributed to the nodal points which define the perimeter of the respective hatches.

2.2.3.5 Tornado Loads

As specified in BC-TOP-3-A⁽⁷⁾ (Reference 3), various combinations of velocity wind pressure, atmospheric pressure drop, and local pressures were applied to the modeled structure. The maximum wind velocity of the tornado was 360 mph.

The original structural analysis performed in accordance with the FSAR considered various tornado-generated missiles. The analysis considered missiles equivalent to a 4-inch by 12-inch by 12-foot wooden plank (108 pounds) traveling end-on at 300 mph at any height; a 4,000-pound automobile with a velocity of 72 mph no higher than 30 feet above the ground with a contact area of 20 square feet; a 1-inch diameter, 3-foot long, 8-pound steel bar traveling at 216 mph at any height in any direction, and a 35-foot long utility pole, 13-1/2 inches in diameter, weighing 1,490 pounds, traveling at 144 mph, and striking the structure not more than 30 feet above the ground. For tornado-generated missile loads, the structure was allowed to locally exceed the yield strain.

The results of the original tornado-generated missile load analysis showed the diesel generator building was acceptable. Results of missile impact tests conducted over the

last 6 years indicate that reinforced concrete walls, thinner than the exterior walls of the diesel generator building, have a considerable margin against local damage. The tests indicate that a wall thickness of 12 inches would sufficiently preclude unacceptable local damage (spalling) from these missiles. (The thinnest exterior wall of the diesel generator building is 30 inches thick.) For further information on missile impact, and its effect on cracked walls, refer to Appendix A.

2.2.3.6 Seismic Loads

The seismic response of a structure depends on the stiffness properties and mass of the structure, the input seismic motion at the structure location, and the soil properties of the foundation medium. Of these parameters, only soil properties are affected by insufficient compaction of backfill. The following paragraphs describe how the effects of surcharging and insufficient compaction were accounted for in the revised diesel generator building seismic analyses. The design spectra and design time-history as defined in FSAR Section 3.7 have been used in the reanalyses.

The analytical models used for the original seismic analysis and for the seismic reanalyses described in this testimony are one-dimensional, stick-type, lumped mass models using beam elements to represent the structural stiffness and impedance functions to represent the foundation medium (see Figure DGB-9).

The effect of soil-structural interaction is accounted for by coupling the structural model with the foundation media. The foundation media are represented by impedance functions which represent the equivalent spring stiffness and radiation damping coefficients as specified in BC-TOP-4-A (Reference 4).

The structural stiffness of the lumped mass model was not revised in the new dynamic analysis. The difference in the new model was confined to the treatment of the soil-structural interface. The revised analysis developed the impedance functions based on the building's foundation dimensions and the modification in the soil properties described below. In addition, for the horizontal and torsional accelerations, the weight of the soil and the concrete base slabs together with the diesel generator pedestals within the building were included in this revised model.

The original (presettlement) diesel generator building seismic analysis was based on the underlying till material, which has a shear wave velocity value of 1,359 ft/s (see Table DGB-3). This value was not adjusted for the 30 feet of plant fill between the till and building foundation elevation. The first seismic reanalysis accounted for the soil properties of the fill by averaging the measured shear wave velocity of the fill and underlying till (Figure DGB-10) over a depth of 75 feet, which is the smallest dimension of the building. This resulted in the value of 796 ft/s, which was used in the seismic reanalysis. However, the effect of decreasing shear wave velocity to a lower bound estimate of 500 ft/s was also analyzed. Both the measured

*Averaged
to the
measured
value*

shear wave velocity value of 796 ft/s and the lower bound shear wave velocity value of 500 ft/s were supplied by soil consultants.

↑
Assumed.

The floor spectra at all elevations of the diesel generator building were generated using a shear wave velocity value of 796 ft/s. The resulting floor response spectra were combined in an enveloping fashion with the spectra developed in the original analysis which used a shear wave velocity value of 1,359 ft/s. The floor response spectra were further broadened to account for a lower bound shear wave velocity of 500 ft/s. Thus, conservative floor response spectra were generated.

The results of the seismic reanalysis indicated that the seismic forces at all elevations of the diesel generator building were somewhat higher than the forces determined in the original analysis. The highest seismic acceleration was derived from an analysis using a shear wave velocity of 796 ft/s. This increased seismic load was conservatively simulated by applying the maximum structural acceleration occurring in the dynamic model to each element in the finite-element model in north-south, east-west, and vertical directions. The combined effect of the three directional responses was assessed using the square-root-of-the-sum-of-the-squares method recommended in NRC Regulatory Guide 1.92.

The ability of the structure to withstand these increased seismic forces in combination with the other loads is described in Subsection 2.2.5.

2.2.3.7 Thermal Loads

Thermal effects were included in the model as a linear variation of temperature across the thickness of an element. The thermal effect due to linear variation of temperature across the thickness of an element (also called gradient) primarily results in bending moments being applied to the element.

In general, the temperature gradient of most concern for the diesel generator building is that anticipated to occur in the winter. In accordance with the Handbook of Concrete Engineering (Reference 5) and FSAR meteorological data, the equivalent, steady-state, exterior winter temperature of 14.6F was calculated. The corresponding maximum interior temperature was 75F, thus resulting in a maximum gradient of 60F. For additional information on how thermal effects were accounted for in the analysis, see Subsection 2.2.5.

2.2.4 Methods of Finite-Element Model Analysis

An elastic, static analysis of the modeled structure was performed using finite-element methods. This analysis method divides a structure's components into discrete elements of finite size, each having its own structural properties such as thickness, material properties such as modulus of elasticity (E), and Poisson's ratio of lateral and vertical strains (ν). The elements are connected at common points called nodal points. A system of finite-elements and nodal points is termed a finite element model (see Figure DGB-6). Loads are then applied to the

model as either surface loads on the elements or nodal loads at specific nodal points. Displacement of the nodal points resulting from the applied loads is then calculated, from which element forces and stresses are determined. The particular finite-element analysis program used for this analysis is the Bechtel Structural Analysis Program⁽⁹⁾ (BSAP).

To determine force components in accordance with accepted analysis techniques, the force components resulting from each load condition are calculated independently. Various load factors are then applied to the separate load conditions, which are assembled to create the required load combinations of Table DGB-1. Using this combined response, the structure is examined to ensure that the allowable stress limit is not exceeded.

2.2.5 Structural Adequacy Computations

The computations necessary to verify structural adequacy were performed using a computer analysis program (OPTCON) capable of analyzing reinforced concrete sections. This reinforced concrete analysis program models a portion of the diesel generator building and analyzes it for forces that resulted from the BSAP finite-element model analysis. Refer to Appendix B for additional information concerning OPTCON.

To determine the structural adequacy of the diesel generator building, the modeled structure was partitioned into structural categories (i.e., north wall, center wall, roof, etc).

Critical elements from each category were then selected for further investigation based on their axial force, moment, and in-plane shear force (see Figure DGB-11). Once the critical elements were selected, thermal gradients were assigned to each element based on the location of that element within the model. Using OPTCON, rebar stress values were then calculated in these critical elements to verify that the allowable rebar stress value was not exceeded.

All structural categories of the diesel generator building were investigated and all were found to meet the structural acceptance criteria. Table DGB-4 shows the results of the analysis. The left-hand column of Table DGB-4 shows the element with the highest rebar stress value for each structural category. The second column shows the load combination which produces the highest stress. In other words, this is the load combination which is critical for this category. The third column presents the rebar stress value computed by OPTCON for each critical element within each structural category. The highest rebar stress value (reflecting the combined effects of flexural, axial, and in-plane shear loads) exists in the slab at elevation 664 where the rebar stress value is 39.2 ksi. The fourth column indicates the concrete compressive stress associated with the maximum rebar tensile stress in each structural category.

The final structural reanalysis of the diesel generator building showed that the critical load combinations (Table DGB-1)

are those which include either the tornado load case (W'), the OBE load case (E), or the SSE load case (E'), specifically:

$$1. \quad 1.0D + 1.0L + 1.0W' + 1.0T_0 \quad (18)$$

$$2. \quad 1.4 (D + L + E) + 1.0T_0 \quad (10)$$

$$3. \quad 1.0D + 1.0L + 1.0E' + 1.0T_0 \quad (15)$$

In approximately 70 percent of the diesel generator building, the tornado load combinations produce the highest stress level. .

As stated in Subsection 2.2.1.2, an additional analysis of the diesel generator building was performed for comparison purposes (also see response to Question 26 of Reference 2). This comparison analysis used the more stringent load combinations of ACI 349 as supplemented by Regulatory Guide 1.142 (see Table DGB-2 for a list of load combinations). Even when using these more stringent load combinations, the structure meets the acceptance criteria (refer to Table DGB-5).

3.0 CRACK ANALYSIS

All concrete structures experience cracking to some extent. Concern about concrete cracking diminishes after the cause of cracking has been established, and actions have been implemented to remedy the situation.

Concrete cracking has a number of causes, including the following:

1. Shrinkage during curing, before the concrete has developed its full strength
2. Either static or dynamic loads within the elastic capacity of the section
3. Temperature changes in a structure when no provision was made for movement or controlled cracking
4. Differential settlement: Most settlement-induced cracks occur during construction and the early life of the structure.

The cracks in the diesel generator building were caused by shrinkage or a combination of shrinkage and strains induced by foundation displacements. Cracking due to shrinkage is typical of concrete structures and merely indicates that restraint was provided by existing structures while the more recently placed concrete was curing and shrinking. For an independent evaluation of cracks in the diesel generator building, also see Appendix C.

4.0 CURRENT STATUS

4.1 ANALYSES

The structural reanalysis of the diesel generator building required as a result of the settlement problem is completed and highlighted in Section 2.2 of this testimony. One additional analysis has also been performed to evaluate building response to ground accelerations in excess of the present FSAR SSE values. Results of this analysis demonstrate that the diesel generator building is capable of withstanding the effects of a seismic event 50% larger than the original SSE.

4.2 CONSTRUCTION

Construction continues on the diesel generator building. Structurally, this building is complete except for construction of secondary structural walls and the installation of steel platforms. Other ongoing activities include installation of electrical conduit and HVAC equipment.

The permanent dewatering system referenced earlier is presently being installed. This is discussed in the testimony of W. Paris.

Biweekly settlement readings of the diesel generator building continue. These readings indicate that very little settlement or differential settlement has occurred since removal

of the surcharge in August 1978. Dr. Peck's testimony addresses this subject.

4.3 FURTHER MONITORING

Crack mapping was initiated prior to the start of surcharging. Crack width measurements were taken in January and February 1979, November and December 1979, and July 1981. Cracks less than 0.010 inch were not mapped. The measurements taken in July 1981 indicate that some settlement-induced cracks may have increased in width by 0.005 to 0.010 inch and that other settlement-induced cracks may have decreased by 0.005 inch. The maximum crack width is 0.020 inch, which occurs at a number of locations. All other cracks are 0.015 inch or less. However, maximum crack width measurements are very subjective and difficult to measure accurately. Therefore, regular measurements of differential settlement over the 40-year life of the plant will be relied on to confirm that actual differential settlement is within the limits of the acceptance criteria employed in the structural reanalysis.

5.0 CONCLUSIONS

The structural reanalysis performed on the diesel generator building verifies that the integrity of the structure will not be violated, even under the most critical load combinations. The analysis described in this testimony shows that the diesel generator building satisfies the Midland acceptance criteria and ACI 349.

The structural reanalysis of the diesel generator building was performed in a conservative fashion. The following contributed to the conservatism of the analysis:

1. Assuming surcharge remains in place when predicting 40-year settlement values
2. Broadening the floor spectra to account for the lower and upper shear wave velocity values of 500 and 1,359 f/s, respectively. 9
3. Applying maximum seismic accelerations to the entire diesel generator building

The likelihood of settlement-induced cracking of concrete has been minimized by a number of actions, including the following.

1. Releasing the duct banks from the structure allowed unrestrained settlement.
2. Applying a surcharge to the diesel generator building consolidated the plant fill.
3. Completing the structure provided additional strength and stiffness.

The diesel generator building is a massive, heavily reinforced concrete structure with extensive reserve strength.

Based on the analysis performed, it can be stated that the settlement has had minimal effect on the structural strength, and there is reasonable assurance that the diesel generator building will safely perform its intended function over the operating life of the Midland plant.

FOOTNOTES

⁽¹⁾The Bechtel Foundation Settlement Data Survey Program was issued for construction use on May 20, 1977. The objective of this program was the establishment of surveys to maintain a record of the settlement of major structures, including:

1. Placing permanent bench marks and control monuments at the jobsite
2. Establishing elevations for the monuments from which settlement readings will be made
3. Taking periodic settlement readings at the settlement markers installed at selected locations on structures in accordance with an established schedule

⁽²⁾Secondary structural walls: Certain walls in the diesel generator building which are subjected to light equipment loads were initially intended to be blockwalls. Following further investigation, these blockwalls were changed to lightly reinforced concrete walls. Because these walls are not relied on in the overall building response, they are referred to as secondary structural walls and have not been included in the finite-element model.

⁽³⁾The ACI is an organization of engineers, architects, scientists, constructors, and individuals associated in their

technical interest with the field of concrete. The purpose of the ACI is to further engineering and technical education, scientific investigation and research, and development of standards for the design and construction of concrete structures. The two ACI standards referenced in this testimony are ACI 318, Building Code Requirements for Reinforced Concrete, and ACI 349, Code Requirements for Nuclear Safety Related Concrete Structures. The ACI 318 code covers the proper design and construction of typical reinforced concrete structures (office structures, commercial buildings, etc). ACI 318 was approved for use on the Midland project at the time the construction permits were issued. It is one of many codes and standards incorporated by reference in the FSAR. The ACI 349 code covers the proper design and construction of concrete structures which form part of a nuclear power plant. Adherence to ACI 349 is not an NRC requirement, nor is ACI 349 included in the FSAR as one of the licensing bases of the Midland plant.

(4) In February 1980, in response to the NRC Requests Regarding Plant Fill, Question 26, a commitment was made to check the structural adequacy of the diesel generator building in accordance with ACI 349 as supplemented by Regulatory Guide 1.142. This check was intended for comparison purposes only, and it does not modify the structural acceptance criteria of the diesel generator building as established in the FSAR and the response to Question 15. ACI 349, as supplemented by Regulatory Guide 1.142, requires the

inclusion of the settlement effects term (T) in all load combinations.

- (5) According to nuclear industry practice, rebar yield strain and maximum concrete strains are allowed to be locally exceeded when analyzing a structure for tornado-generated missile loads.
- (6) Bechtel soil engineers generated estimated settlement values using extrapolation; the settlement versus time plot of the diesel generator building in the surcharged condition was used for this purpose. Estimated settlement values resulting from the finite-element model analyses were obtained by applying loads to the model, and then dividing the resultant force at the foundation by the appropriate spring constant to obtain units of length.
- (7) BC-TOP-3-A: This report is authored by the Bechtel Power Corporation and contains criteria for the design of nuclear power plant structures for extreme winds and tornado effects. Extreme wind criteria cover wind velocities up to and including the wind velocities of hurricanes. The extreme wind velocities specified in this report are identical to those defined by the wind speed map of ANSI Building Code Requirements A58.1/1972. The velocities defined correspond to a mean recurrence interval of 100 years. The design criteria and procedures described in BC-TOP-3-A (Revision 3), have been reviewed and deemed acceptable by the Regulatory staff. (Refer to the letter dated October 4, 1974, from

R.W. Klecker, Technical Coordinator for Light Water Reactors, Group 1, Directorate of Licensing, to J.V. Morowski, Vice President-Engineering, Bechtel Power Corporation.)

- (8) BC-TCP-4-A: This report is authored by Bechtel Power Corporation and contains the general practice used by Bechtel Power Corporation for the seismic analysis of nuclear power plant structures and components. This includes the methods of establishing mathematical models for structures and components and the various applicable methods of computing seismic responses such as floor accelerations, shear, moments, and displacements. The design criteria and procedures described in BC-TOP-4-A (Revision 3) have been approved by the NRC staff. (Refer to the letter dated October 31, 1974, from R.W. Klecker, Technical Coordinator for Light Water Reactors, Group 1, Directorate of Licensing, to J.W. Morowski, Vice President-Engineering, Bechtel Power Corporation.)
- (9) BSAP: The Bechtel Structural Analysis Program (BSAP) is a general purpose, finite-element program for analysis of structural systems subject to static, dynamic, and thermal loads. The program incorporated an extensive library of beam, shell, and solid elements so that virtually any type of structure can be represented. Common applications include analysis of nuclear plant structures, pressure vessels, high-rise buildings, transmission towers, and bridges. BSAP is based on and incorporates features of the SAP program developed at the University of California at Berkeley by

Professor E.L. Wilson (Reference 6). The SAP program was modified to extend capability, enhance usability, and reduce cost of application.

REFERENCES

1. Consumers Power Company, Midland Plant Units 1 and 2 Final Safety Analysis Report, Docket 50-329, 50-330
2. Consumers Power Company, Responses to NRC Requests Regarding Plant Fill, Docket 50-329, 50-330
3. Bechtel Power Corporation, Tornado and Extreme Wind Design Criteria for Nuclear Power Plants, Revision 3, August 1974 (BC-TOP-3-A)
4. Bechtel Power Corporation, Seismic Analyses of Structures and Equipment for Nuclear Power Plants, Revision 3, November 1974 (BC-TOP-4-A)
5. M. Fintel, Handbook of Concrete Engineering, Van Nostrand Reinhold Company, September 1974
6. Edward L. Wilson, SAP - A General Structural Analysis Program (Report to Walla Walla District U.S. Engineers Office, Contract DACW 68-67-C-004), Structural Engineering Laboratory, University of California, Berkeley, California, September 1970

TABLE DGB-1

LOADS AND LOAD COMBINATIONS FOR CONCRETE
STRUCTURES OTHER THAN THE CONTAINMENT BUILDING
FROM THE FSAR AND QUESTION 15 OF RESPONSES TO
NRC REQUESTS REGARDING PLANT FILL

Responses to NRC Requests Regarding Plant Fill, Question 15

- a. Service Load Condition
- $U = 1.05D + 1.28L + 1.05T$ (1)
- $U = 1.4D + 1.4T$ (2)
- b. Severe Environmental Condition
- $U = 1.0D + 1.0L + 1.0W + 1.0T$ (3)
- $U = 1.0D + 1.0L + 1.0E + 1.0T$ (4)

FSAR Subsection 3.8.6.3

- a. Normal Load Condition
- $U = 1.4D + 1.7L$ (5)
- b. Severe Environmental Condition
- $U = 1.25 (D + L + H_0 + E) + 1.0T_0$ (6)
- $U = 1.25 (D + L + H_0 + W) + 1.0T_0$ (7)
- $U = 0.9D + 1.25 (H_0 + E) + 1.0T_0$ (8)
- $U = 0.9D + 1.25 (H_0 + W) + 1.0T_0$ (9)
- c. Shear Walls and Moment Resisting Frames
- $U = 1.4 (D + L + E) + 1.0T_0 + 1.25H_0$ (10)
- $U = 0.9D + 1.25E + 1.0T_0 + 1.25H_0$ (11)
- d. Structural Elements Carrying Mainly Earthquake Forces, Such as Equipment Supports
- $U = 1.0D + 1.0L + 1.8E + 1.0T_0 + 1.25H_0$ (12)
- e. Extreme Environmental and Accident Conditions
- $U = 1.05D + 1.05L + 1.25E + 1.0T_A + 1.0H_A + 1.0R$ (13)
- $U = 0.95D + 1.25E + 1.0T_A + 1.0H_A + 1.0R$ (14)

Table DGB-1 (continued)

$$U = 1.0D + 1.0L + 1.0E' + 1.0T_0 + 1.25H_0 + 1.0R \quad (15)$$

$$U = 1.0D + 1.0L + 1.0E' + 1.0T_A + 1.0H_A + 1.0R \quad (16)$$

$$U = 1.0D + 1.0L + 1.0B + 1.0T_0 + 1.25H_0 \quad (17)$$

$$U = 1.0D + 1.0L + 1.0T_0 + 1.25H_0 + 1.0W' \quad (18)$$

where

- B = hydrostatic forces due to the probable maximum flood (PMF)
- D = dead loads of structures and equipment and other permanent, load-contributing stress
- E = operating basis earthquake (OBE)
- E' = safe shutdown earthquake load (SSE)
- H₀ = force on structure caused by thermal expansion of pipes under operating conditions
- H_A = force on structure caused by thermal expansion of pipes under accident conditions
- L = conventional floor and roof live loads (includes moveable equipment loads or other loads which vary in intensity)
- R = local force, pressure on structure, or penetration caused by rupture of pipe
- T = effects of differential settlement, creep, shrinkage, and temperature
- T₀ = thermal effects during normal operating conditions
- T_A = total thermal effects which may occur during a design accident
- U = required strength to resist design loads or their related internal moments and forces
- W = design wind load
- W' = tornado wind loads, excluding missile effects, if applicable (refer to Subsection 2.2.3.5)

TABLE DGB-2
LOADS AND LOAD COMBINATIONS FOR
COMPARISON ANALYSIS REQUESTED IN
QUESTION 26 OF NRC REQUESTS
REGARDING PLANT FILL

ACI 349 as Supplemented by Regulatory Guide 1.142

a. Normal Load Condition

$$U = 1.4 (D + T) + 1.7L + 1.7R_0$$

$$U = 0.75 [1.4 (D + T) + 1.7L + 1.7T_0 + 1.7R_0]$$

b. Severe Environmental Condition

$$U = 1.4 (D + T) + 1.4F + 1.7L + 1.7H + 1.9E_0 + 1.7R_0$$

$$U = 1.4 (D + T) + 1.4F + 1.7L + 1.7H + 1.7W + 1.7R_0$$

$$U = 0.75 [1.4 (D + T) + 1.4F + 1.7L + 1.7H + 1.9E_0 + 1.7T_0 + 1.7R_0]$$

$$U = 0.75 [1.4 (D + T) + 1.4F + 1.7L + 1.7H + 1.7W + 1.7T_0 + 1.7R_0]$$

c. Extreme Environmental Conditions

$$U = (D + T) + F + L + H + T_0 + R_0 + W_T$$

$$U = (D + T) + F + L + H + T_0 + R_0 + E_{SS}$$

d. Abnormal Load Conditions

$$U = (D + T) + F + L + H + T_A + R_A + 1.5P_A$$

$$U = (D + T) + F + L + H + T_A + R_A + 1.25P_A + 1.0(Y_R + Y_J + Y_M) + 1.25E_0$$

$$U = (D + T) + F + L + H + T_A + R_A + 1.0P_A + 1.0(Y_R + Y_J + Y_M) + 1.0E_{SS}$$

where

Normal loads are those loads encountered during normal plant operation and shutdown, and include:

T = settlement loads

D = dead loads or their related internal moments and forces

Table DGB-2 (Continued)

- L = applicable live loads or their related internal moments and forces
- F = lateral and vertical pressure of liquids or their related internal moments and forces
- H = lateral earth pressure or its related internal moments and forces
- T₀ = thermal effects and loads during normal operating or shutdown conditions, based on the most critical transient or steady-state condition
- R₀ = maximum pipe and equipment reactions if not included in the above loads

Severe environmental loads are those loads that could infrequently be encountered during the plant life and include:

- E₀ = loads generated by the operating basis earthquake (OBE)
- W = loads generated by the operating basis wind (OBW) specified for the plant

Extreme environmental loads are those loads which are credible but highly improbable, and include:

- E_{SS} = loads generated by the safe shutdown earthquake (SSE)
- W_T = loads generated by the design tornado specified for the plant

Abnormal loads are those loads generated by a postulated high-energy pipe break accident and include:

- P_A = maximum differential pressure load generated by a postulated break
- T_A = thermal loads under accident conditions generated by a postulated break and including T₀
- R_A = pipe and equipment reactions under accident conditions generated by a postulated break and including R₀
- U = required strength to resist design loads or their related internal moments and forces
- Y_R = loads on the structure generated by the reaction on the broken high-energy pipe during a postulated break
- Y_J = jet impingement load on a structure generated by a postulated break

Table DGB-2 (Continued)

Y_M = missile impact load on a structure generated by or during a postulated break, such as pipe whipping

TABLE DGB-3
SOIL PROPERTIES USED IN
THE SEISMIC ANALYSIS

	<u>Original Analysis</u>	<u>First Revised⁽¹⁾ Analysis</u>	<u>Second Revised⁽¹⁾ Analysis</u>
Modulus of Elasticity (E)	22,000 ksf	6,598 ksf	2,609 ksf
Poisson's Ratio	0.42	0.45	0.40
Unit Weight (w)	135 pcf	116 pcf	120 pc/s
Shear Wave Velocity (V_s)	1,359 ft/s	796 ft/s	500 ft/s
Shear Modulus (G)	7,746 ksf	2,275 ksf	971 ksf

⁽¹⁾ Note different shear wave velocity values.

TABLE DGB-4

REBAR STRESS VALUES FOR THE DIESEL GENERATOR BUILDING
STRUCTURAL MEMBERS (ACCORDING TO THE FSAR AND RESPONSES
TO NRC REQUESTS REGARDING PLANT FILL, QUESTION 15)

<u>Description of Members/Location</u>	<u>Load⁽¹⁾ Combination</u>	<u>Tensile Rebar Stress Value (ksi) Allowable = 54 ksi</u>	<u>Compressive Concrete Stress⁽²⁾ Value (ksi) Allowable = 3.4 ksi</u>
<u>Exterior - West</u>			
2'-6" thick wall horizontal reinforcement, plate element 44	Tornado	25.03	0.425
<u>Exterior - South</u>			
2'-6" thick wall horizontal reinforcement, plate element 287	Seismic (A)	36.05	0.000 ⁽³⁾
<u>Elevation - 664'-0"</u>			
2'-0" floor slab E-W reinforcement, plate element 167	Tornado	39.15	0.068
<u>Elevation - 680'-0"</u>			
1'-9" floor slab N-S reinforcement, plate element 788	Tornado	36.06	0.834
<u>South</u>			
2'-0" missile shield wall south, horizontal reinforcement, plate element 631	Seismic (A)	32.84	0.372
<u>Interior</u>			
2'-0" interior missile shield wall, vertical reinforcement, plate element 824	Tornado	28.06	0.000 ⁽³⁾

TABLE DGB-4 (continued)

<u>Description of Members/Location</u>	<u>Load⁽¹⁾ Combination</u>	<u>Tensile Rebar Stress Value (ksi)</u> <u>Allowable = 54 ksi</u>	<u>Compressive Concrete Stress⁽²⁾ Value (ksi)</u> <u>Allowable = 3.4 ksi</u>
<u>North</u>			
2'-0" missile shield wall north, horizontal reinforcement, plate element 839	Tornado	13.85	0.000 ⁽³⁾
<u>Exterior - North</u>			
2'-6" thick wall horizontal reinforcement, plate element 767	Tornado	21.90	0.313
<u>Exterior - East</u>			
2'-6" thick wall horizontal reinforcement, plate element 896	Tornado	23.64	0.403
<u>Interior</u>			
1'-6" thick wall horizontal reinforcement, plate element 683	Tornado	16.66	0.000 ⁽³⁾
<u>South</u>			
2'-0" thick box missile shield/south, horizontal reinforcement, plate element 732	Tornado	8.02	0.000 ⁽³⁾
<u>Exterior Footing</u>			
2'-6" thick footing, beam element 87	Tornado	35.22	-

TABLE DGB-4 (continued)

<u>Description of Members/Location</u>	<u>Load⁽¹⁾ Combination</u>	<u>Tensile Rebar Stress Value (ksi) Allowable = 54 ksi</u>	<u>Compressive Concrete Stress⁽²⁾ Value (ksi) Allowable = 3.4 ksi</u>
<u>Interior Footing</u>			
2'-6" thick footing, beam element 47	Seismic (B)	29.50	-

NOTES:

⁽¹⁾The tornado load combination is $1.0 (D + L) + 1.0W' + 1.0T_0$.
The seismic load combinations are as follows:

- A. $1.0 (D + L) + 1.0(E') + 1.0(T_0)$
- B. $1.4 (D + L) + 1.4(E) + 1.0(T_0)$

⁽²⁾Concrete stresses shown are associated with maximum rebar tensile stresses shown in this table.

⁽³⁾Section is in tension.

TABLE DGB-5

REBAR STRESS VALUES FOR THE DIESEL GENERATOR BUILDING
 STRUCTURAL MEMBERS (ACCORDING TO ACI-349/1976
 AS SUPPLEMENTED BY REGULATORY GUIDE 1.142)

<u>Description of Members/Location</u>	<u>Load⁽¹⁾ Combination</u>	<u>Tensile Rebar Stress Value (ksi) Allowable = 54 ksi</u>	<u>Compressive Concrete Stress⁽²⁾ Value (ksi) Allowable = 3.4 ksi</u>
<u>Exterior - West</u>			
2'-6" thick wall horizontal reinforcement, plate element 44	Tornado	24.48	0.425
<u>Exterior - South</u>			
2'-6" thick wall horizontal reinforcement, plate element 65	Seismic (A)	32.82	0.000 ⁽³⁾
<u>Elevation - 664'-0"</u>			
2'-0" floor slab E-W reinforcement, plate element 167	Tornado	39.36	0.030
<u>Elevation - 680'-0"</u>			
1'-9" floor slab N-S reinforcement, plate element 788	Tornado	36.13	0.831
<u>South</u>			
2'-0" missile shield wall south, horizontal reinforcement, plate element 631	Seismic (B)	33.34	0.229
<u>Interior</u>			
2'-0" interior missile shield wall, vertical reinforcement, plate element 824	Tornado	27.99	0.000 ⁽³⁾

TABLE DGB-5 (continued)

<u>Description of Members/Location</u>	<u>Load⁽¹⁾ Combination</u>	<u>Tensile Rebar Stress Value (ksi) Allowable = 54 ksi</u>	<u>Compressive Concrete Stress⁽²⁾ Value (ksi) Allowable = 3.4 ksi</u>
<u>North</u>			
2'-0" missile shield wall north, horizontal reinforcement, plate element 839	Tornado	14.12	0.000
<u>Exterior - North</u>			
2'-6" thick wall horizontal reinforcement, plate element 767	Tornado	21.95	0.306
<u>Exterior - East</u>			
2'-6" thick wall horizontal reinforcement, plate element 896	Tornado	23.29	0.397
<u>Interior</u>			
1'-6" thick wall horizontal reinforcement, plate element 683	Tornado	15.93	0.000 ⁽³⁾
<u>South</u>			
2'-0" thick box missile shield/south, horizontal reinforcement, plate element 519	Tornado	7.66	0.000 ⁽³⁾
<u>Exterior Footing</u>			
2'-6" thick footing, beam element 7	Seismic (B)	32.76	-

TABLE DGB-5 (continued)

<u>Description of Members/Location</u>	<u>Load⁽¹⁾ Combination</u>	<u>Tensile Rebar Stress Value (ksi) Allowable = 54 ksi</u>	<u>Compressive Concrete Stress⁽²⁾ Value (ksi) Allowable = 3.4 ksi</u>
<u>Interior Footing</u>			
2'-6" thick footing, beam element 47	Seismic (B)	36.14	-

NOTES:

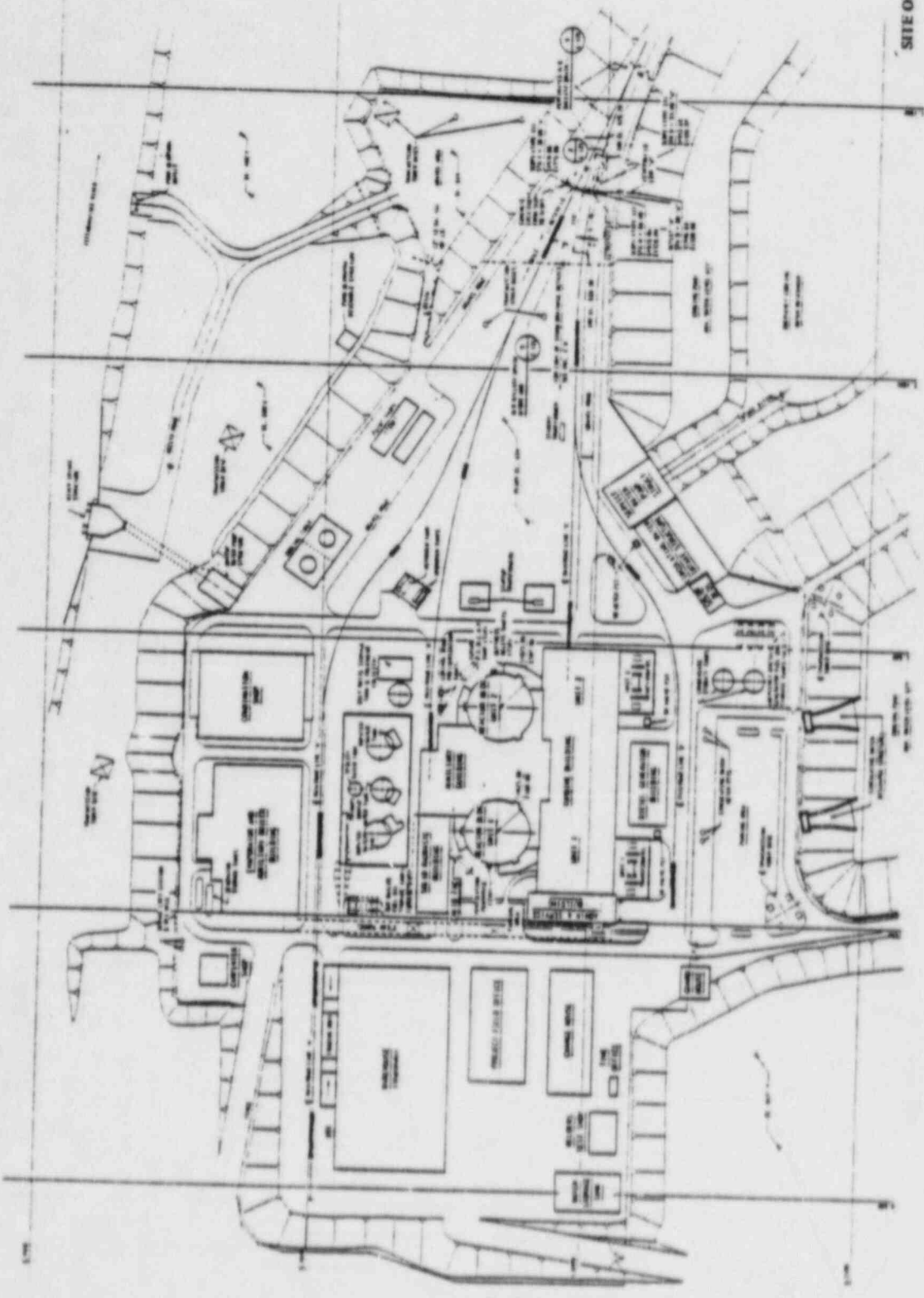
⁽¹⁾The tornado load combination is $1.0 (D + L) + 1.0W_T + 1.0T_0$
The seismic load combinations are as follows:

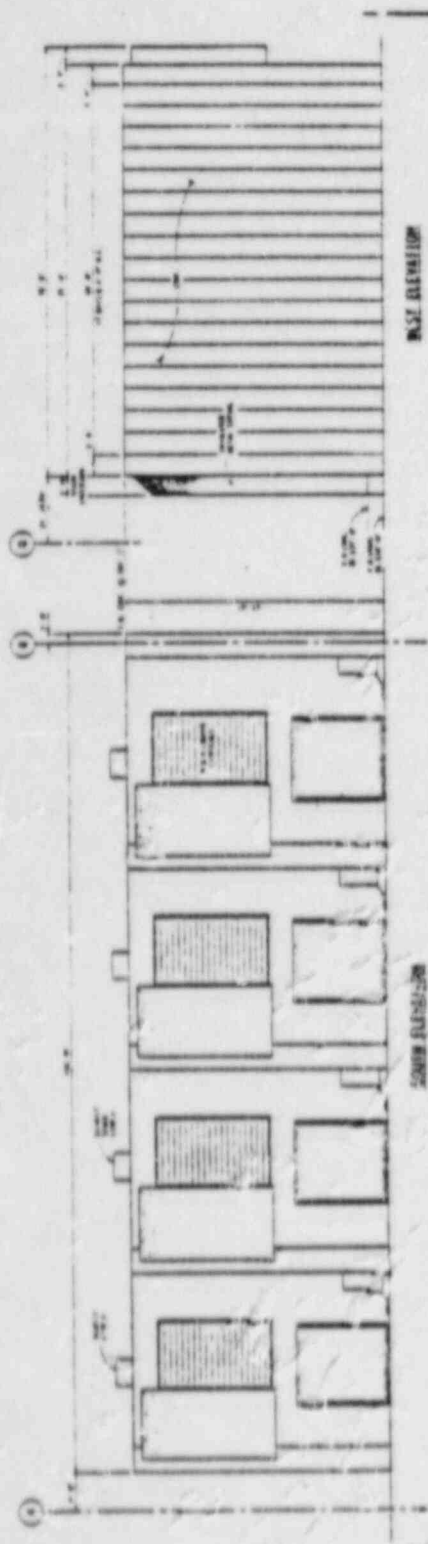
- A. $1.0 (D + T) + 1.0L + 1.0E' + 1.0T_0$
- B. $1.4 (D + T) + 1.7L + 1.9E$

⁽²⁾Concrete stresses shown are associated with the maximum rebar tensile stresses shown in this table.

⁽³⁾Section is in tension.

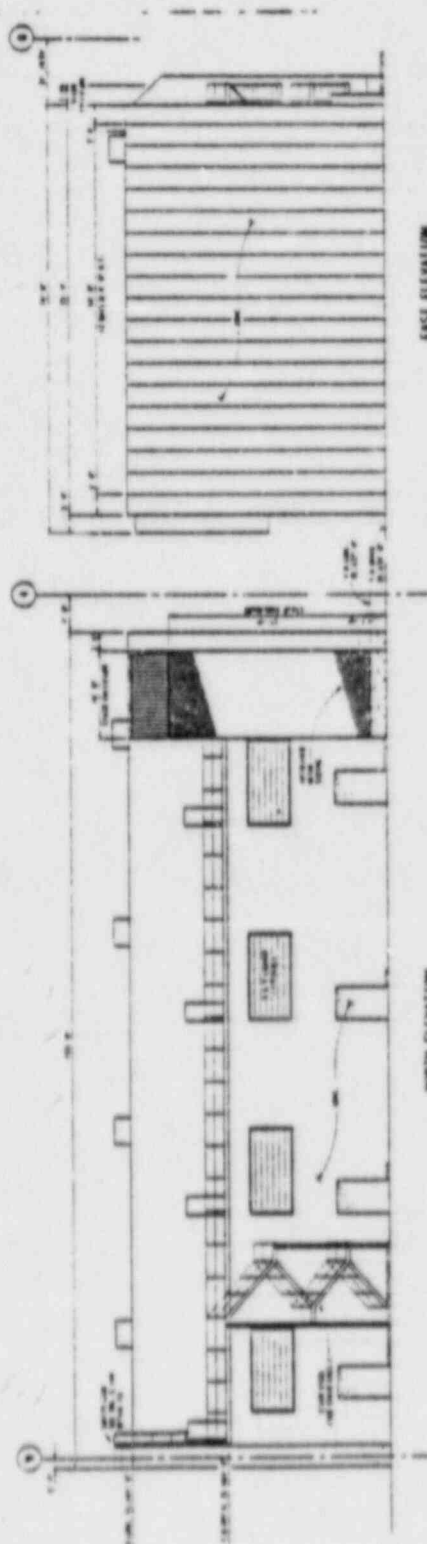
FIGURE DGB-1
SITE OF MIDLAND UNITS 1 AND 2
POWER PLANT





WEST ELEVATION

SOUTH ELEVATION



EAST ELEVATION

NORTH ELEVATION

FIGURE DCB-2
ELEVATIONS OF THE
DIESEL GENERATOR BUILDING

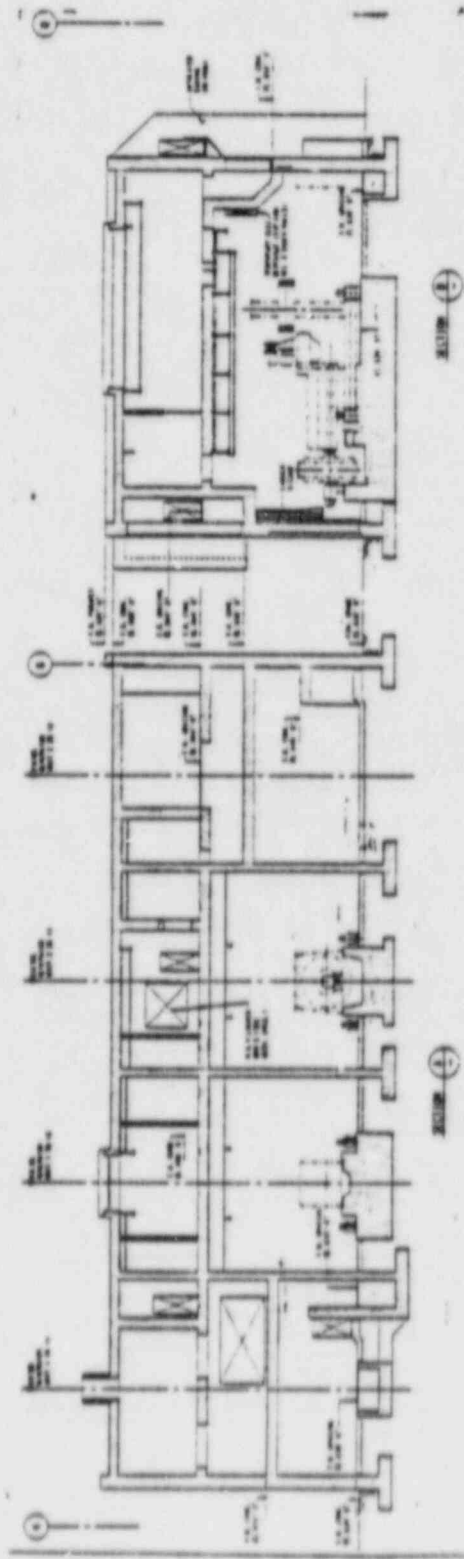
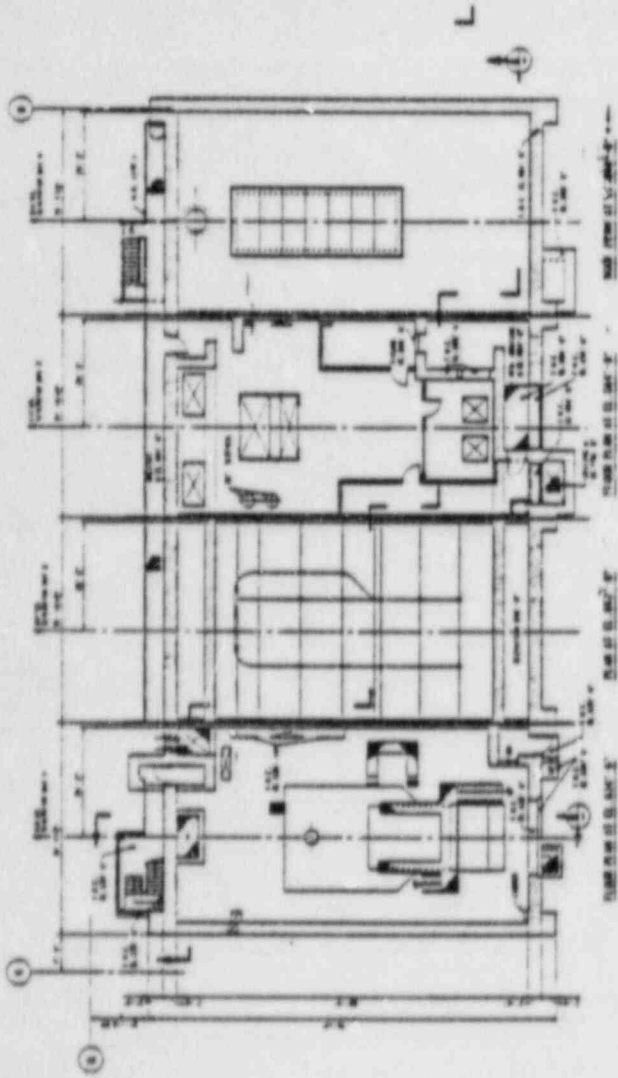


FIGURE DCB-3
 PLAN VIEWS AND SECTIONS OF THE
 DIESEL GENERATOR BUILDING

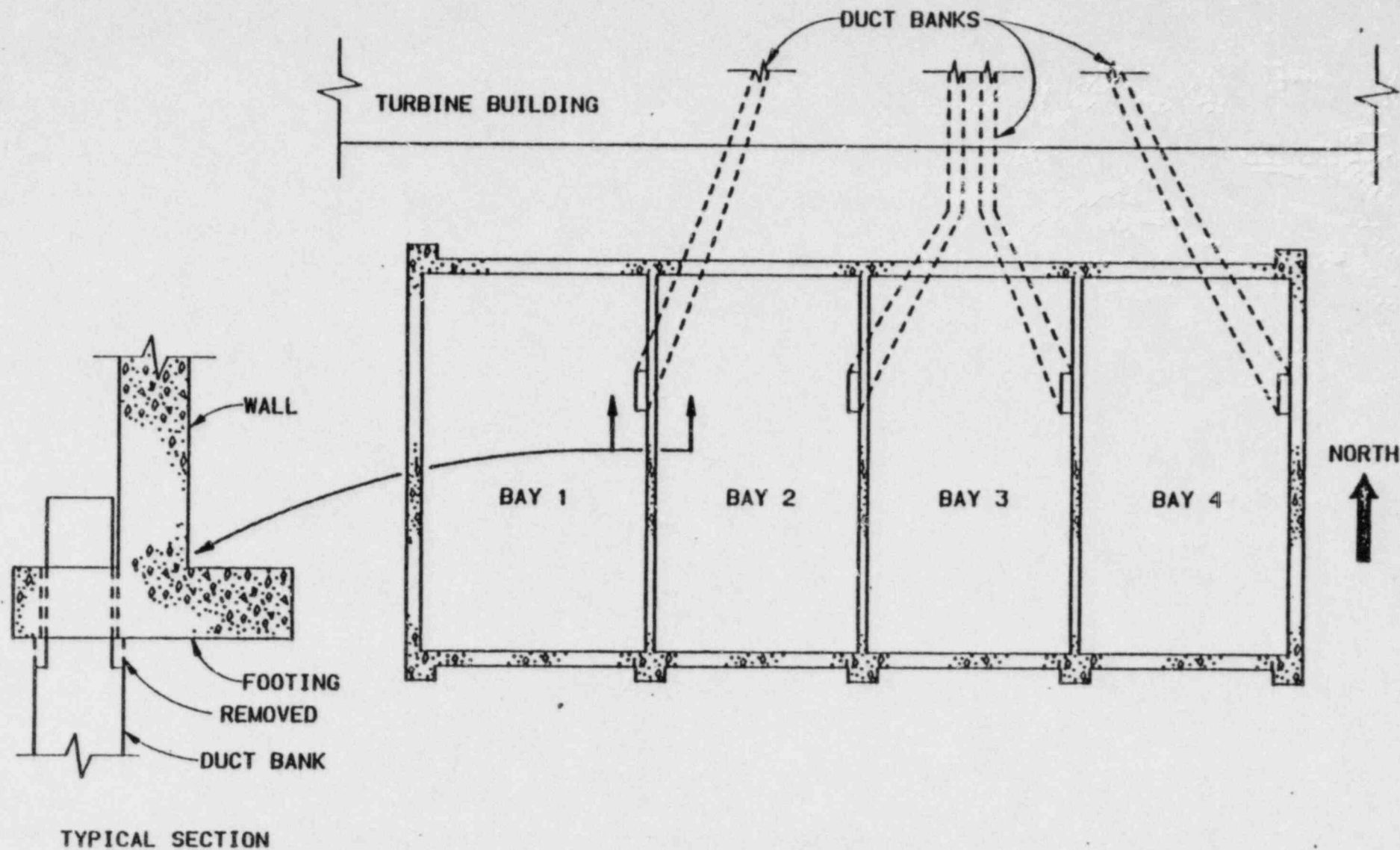


FIGURE DGB-4
 DIESEL GENERATOR BUILDING
 DUCT BANK LAYOUT

SECTION OF DIESEL GENERATOR BUILDING LOOKING WEST

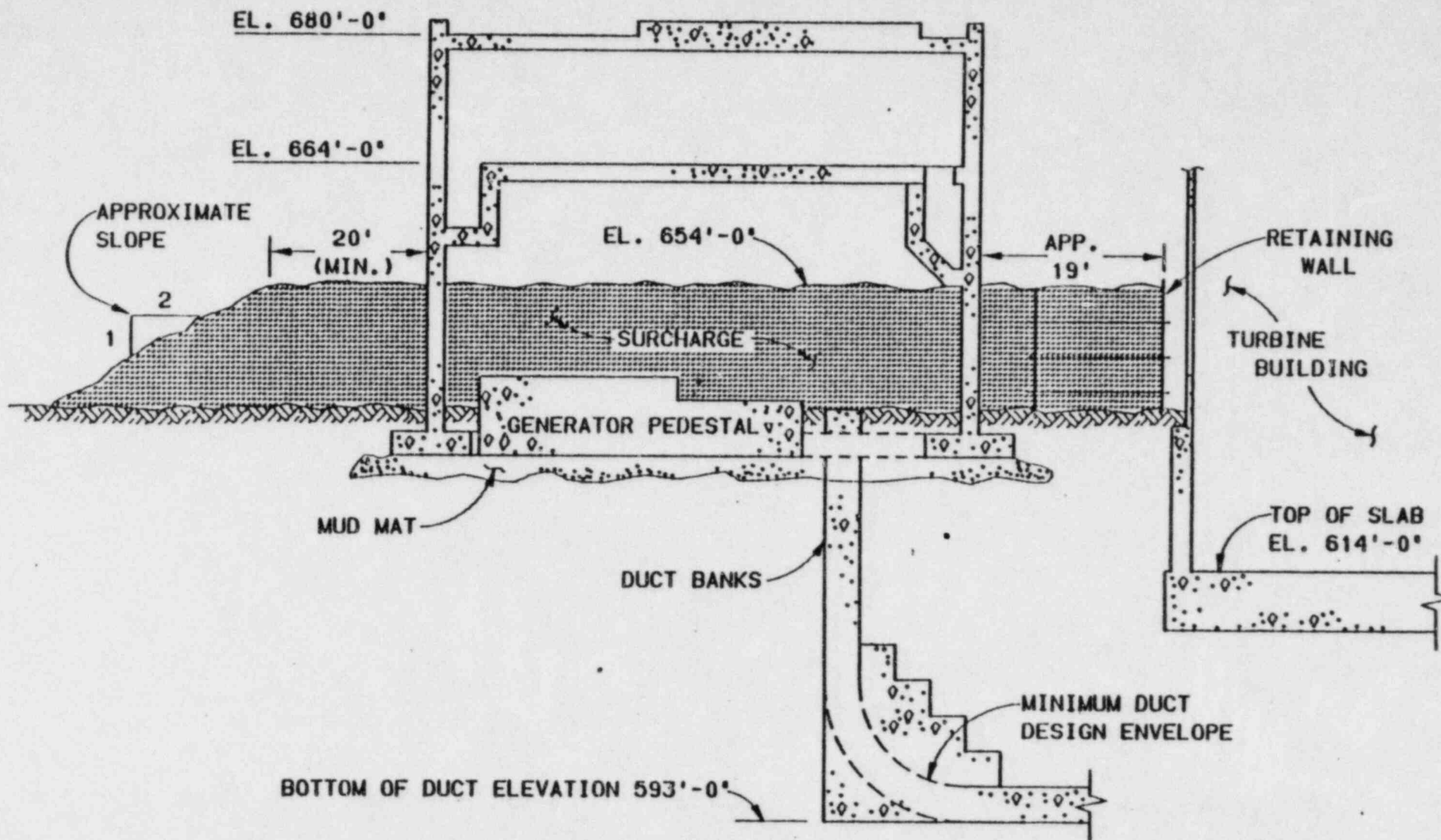


FIGURE DGB-5
DIESEL GENERATOR BUILDING DUCT BANK ELEVATION
(SURCHARGE ALSO SHOWN)

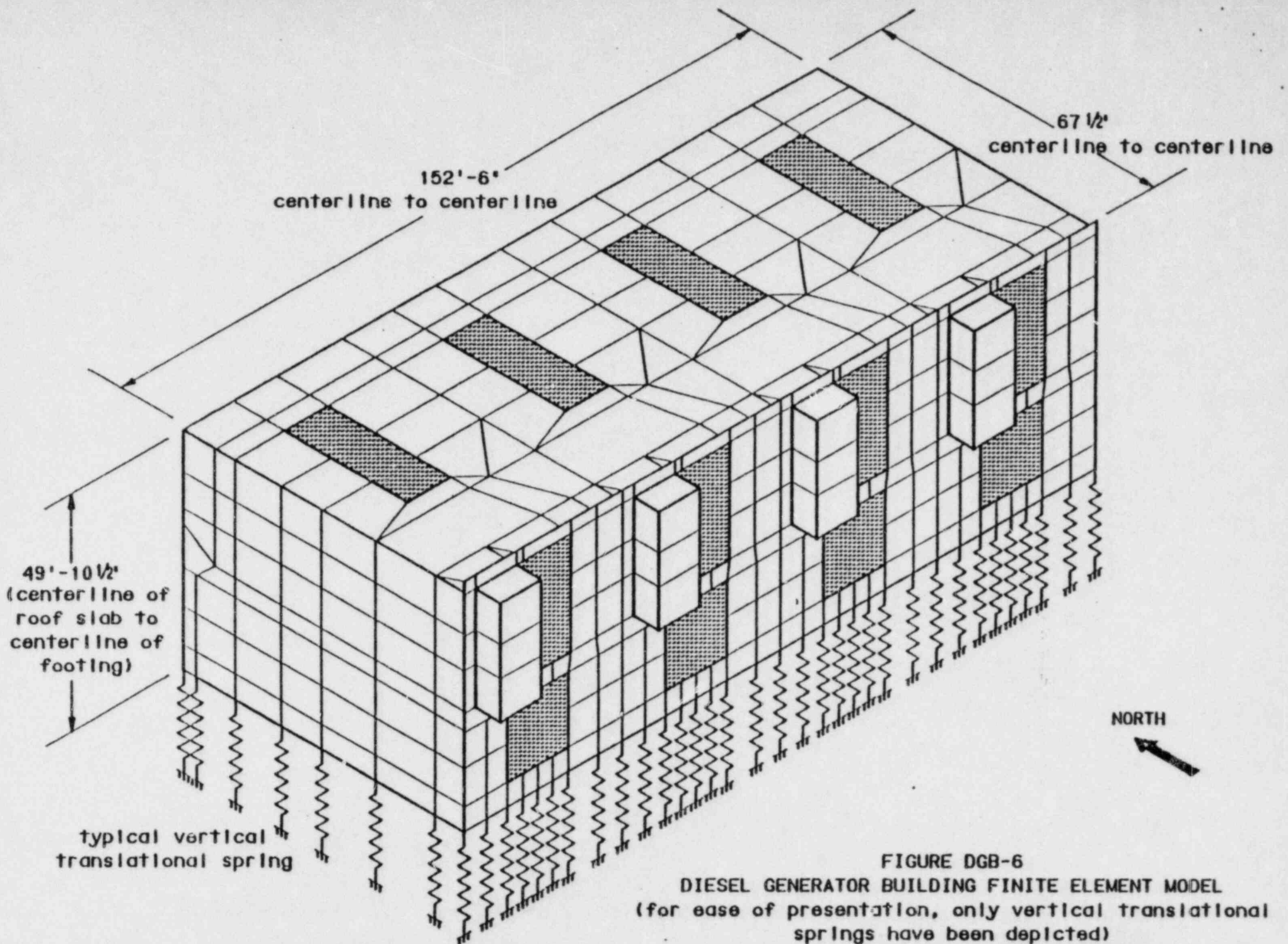
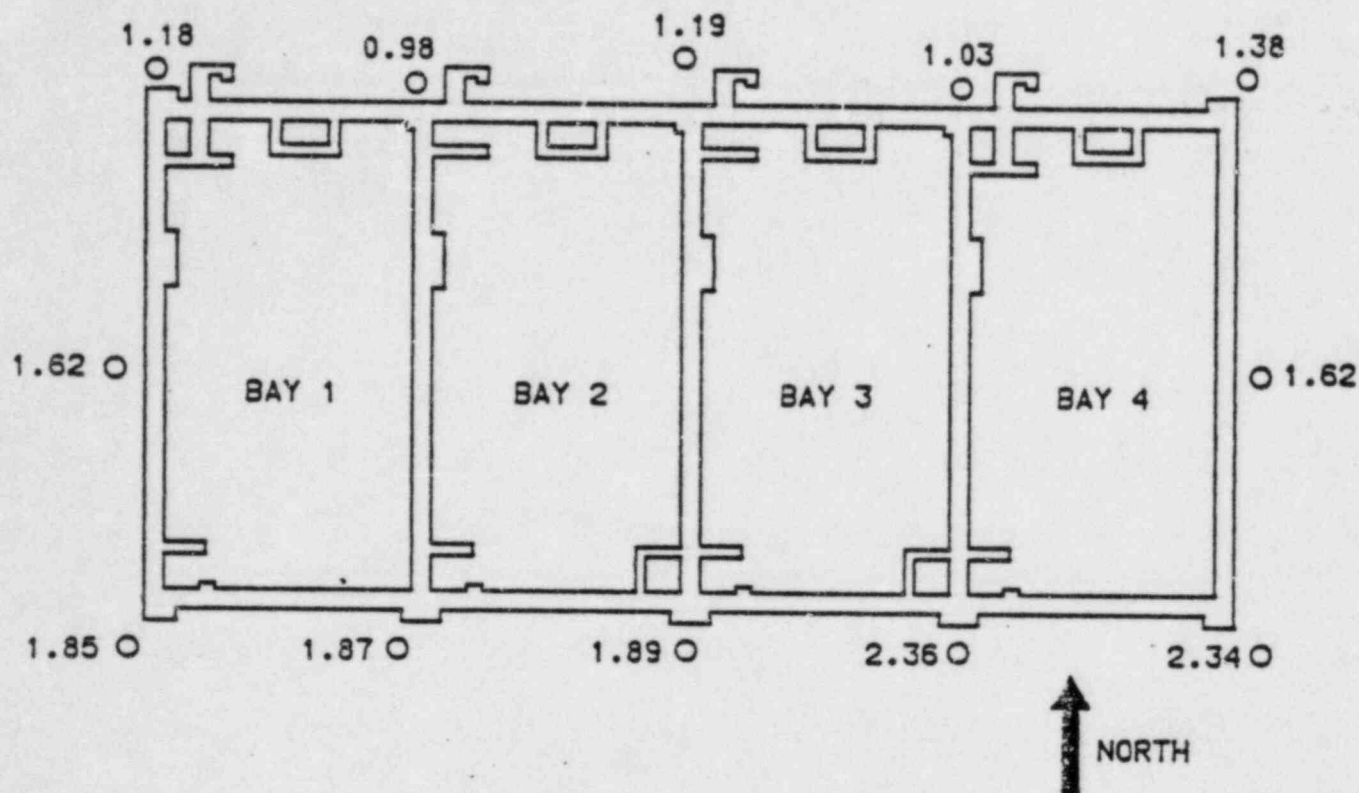


FIGURE DGB-6
DIESEL GENERATOR BUILDING FINITE ELEMENT MODEL
(for ease of presentation, only vertical translational
springs have been depicted)

DIESEL GENERATOR BUILDING

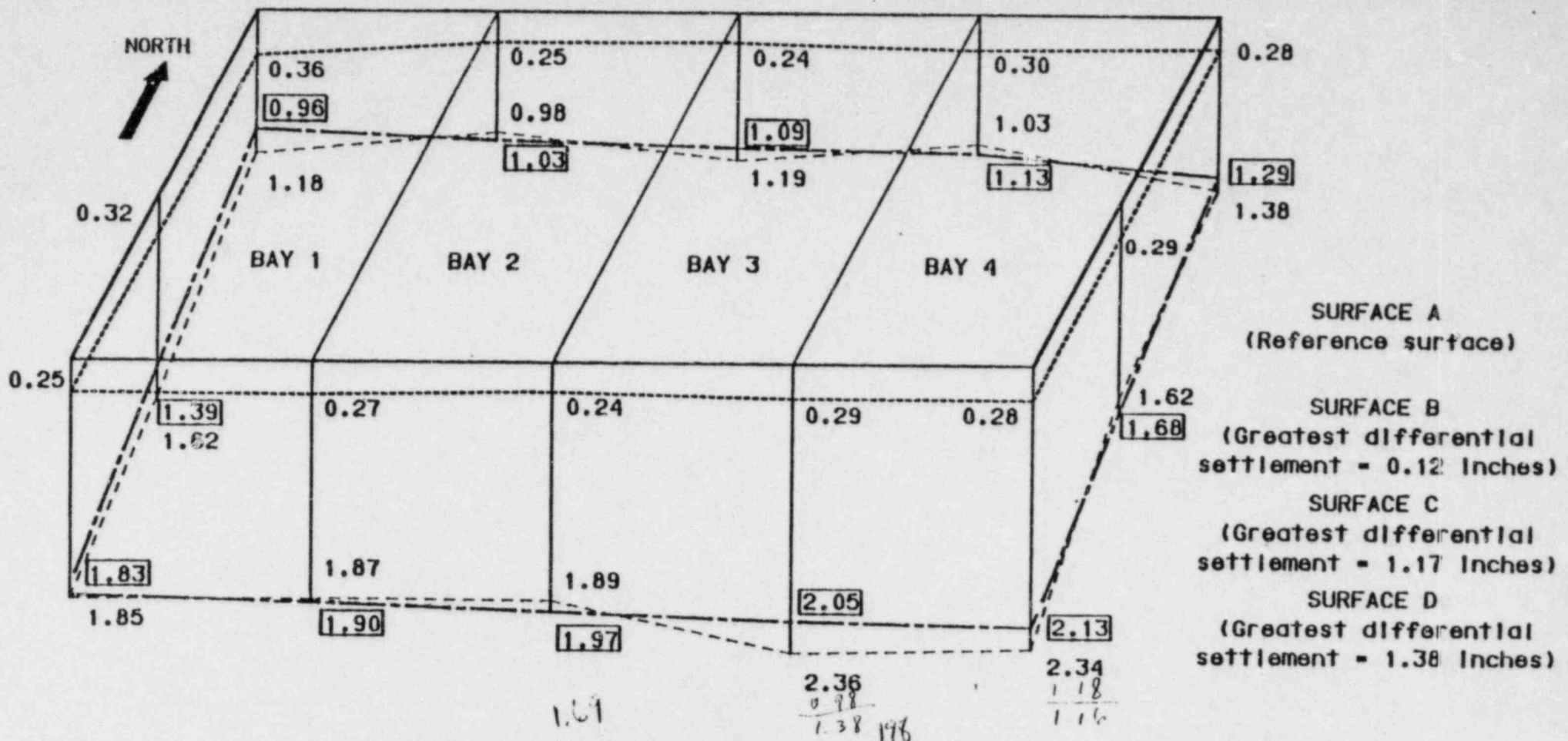


LEGEND

- — BUILDING SETTLEMENT MARKER
- 2.36 — SETTLEMENT IN INCHES

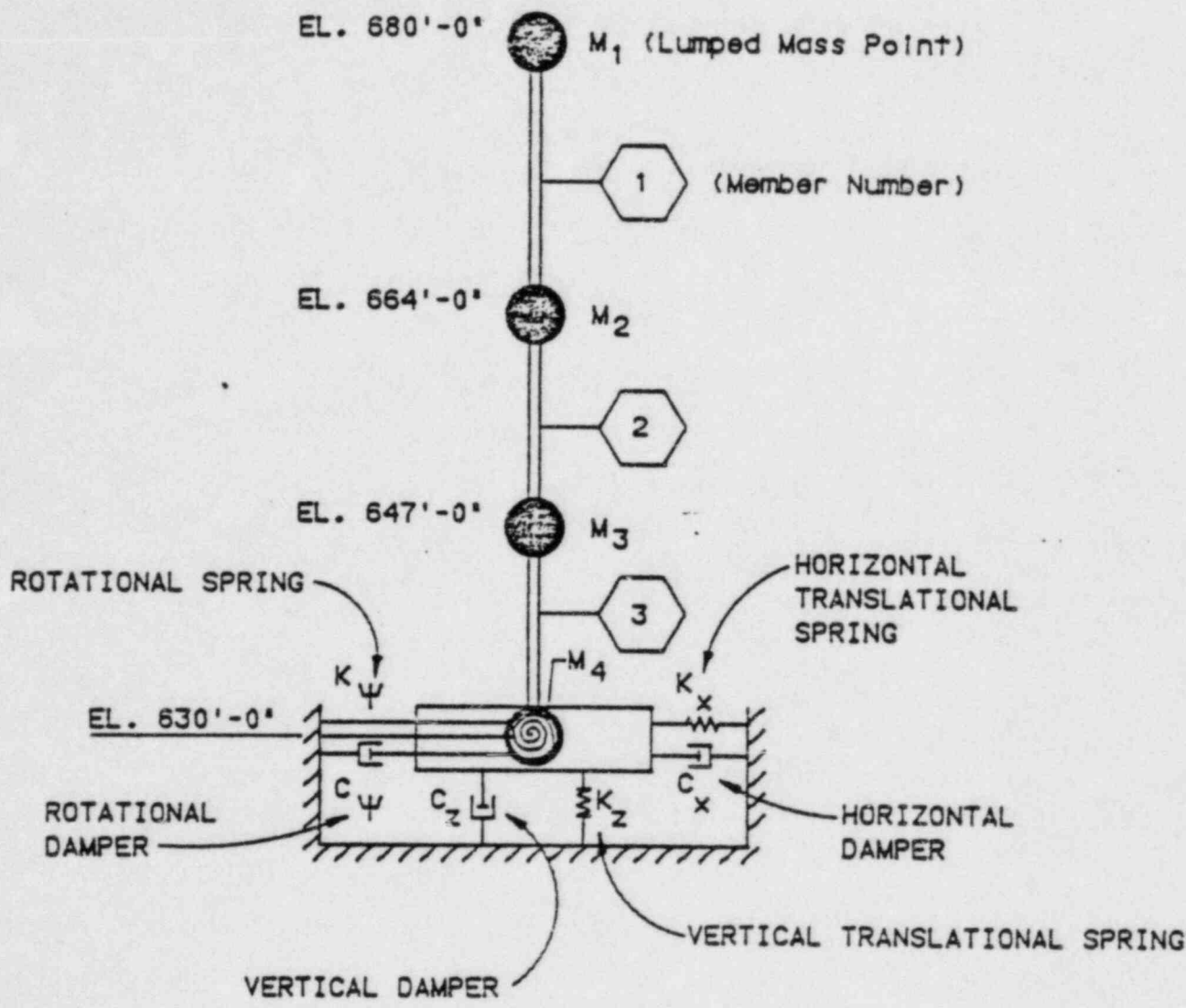
(THIS DRAWING AND THE INFORMATION CONTAINED ON IT WERE OBTAINED FROM ACTUAL MEASUREMENT AND VALUES FROM FIGURES 27-12 AND 27-13 OF THE RESPONSES TO NRC QUESTIONS REGARDING PLANT FILL)

FIGURE DGB-7
ACTUAL AND ESTIMATED SECONDARY COMPRESSION SETTLEMENT
FROM SEPT 14, 1979 to DEC 31, 2025
ASSUMING SURCHARGE REMAINS



- SURFACE A ——— REFERENCE (AS OF SEPTEMBER 14, 1979)
- SURFACE B - - - - - ACTUAL SETTLEMENT VALUES FROM SEPT. 14, 1979 TO SEPT. 17, 1981. THESE INCLUDE EFFECT OF DEWATERING TO APPROXIMATELY EL. 605'-0", AND REPRESENT MOVEMENT OF THE STRUCTURE DUE TO SETTLEMENT OF THE FILL AND NATURAL SOIL BELOW.
- SURFACE C - - - - - SETTLEMENT VALUES CALCULATED BY FINITE ELEMENT ANALYSIS, INDICATED THUS
- SURFACE D - - - - - ACTUAL AND ESTIMATED SECONDARY COMPRESSION AND FILL DEWATERING SETTLEMENT VALUES FROM SEPTEMBER 14, 1979 TO DECEMBER 31, 2025 ASSUMING SURCHARGE REMAINS IN PLACE.

FIGURE DGB-8
 COMPARISON OF ESTIMATED SECONDARY COMPRESSION AND FILL DEWATERING SETTLEMENT VALUES WITH SETTLEMENT VALUES RESULTING FROM A FINITE ELEMENT ANALYSIS OF THE DIESEL GENERATOR BUILDING



(K_ψ, C_z, K_x , etc are Impedance functions)

FIGURE DGB-9
 DIESEL GENERATOR BUILDING DYNAMIC LUMPED MASS MODEL
 FOR SEISMIC ANALYSIS

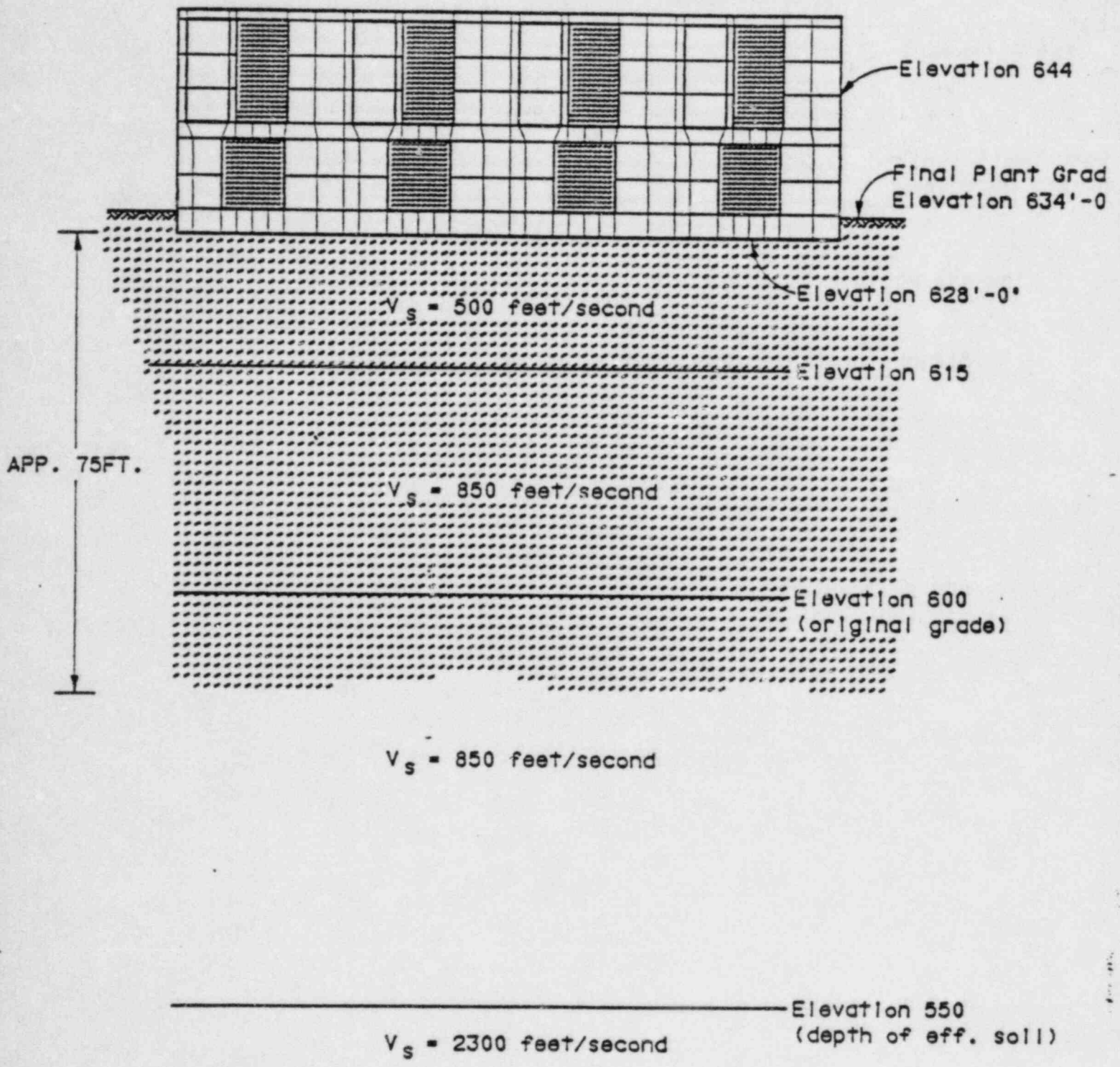
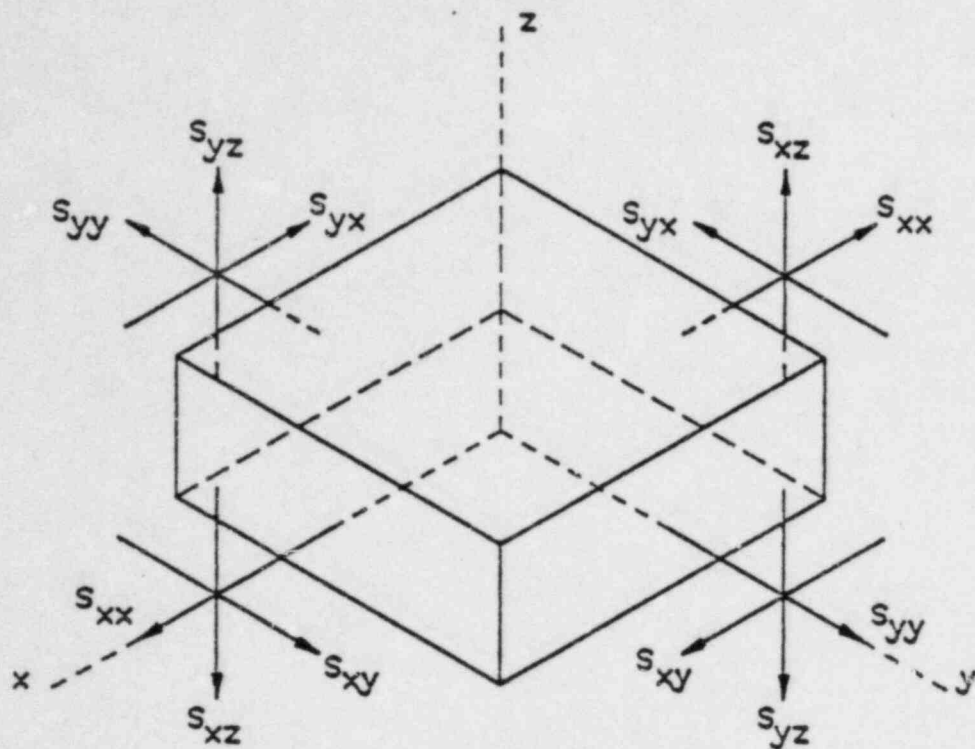


FIGURE DGB-10
 BASIS FOR CALCULATION OF
 EQUIVALENT SHEAR WAVE VELOCITY VALUES (V_s)
 (Shaded region represents the area over which measured shear wave velocity
 values (V_s) were averaged, resulting in a V_s value of 796 ft/sec.)



S_{xx} = axial force in x-direction
 S_{yy} = axial force in y-direction
 S_{xy}, S_{yx} = in plane shear force
 S_{xz}, S_{yz} = out-of-plane shear force
 M_{xx} = moment about y-axis
 M_{yy} = moment about x-axis

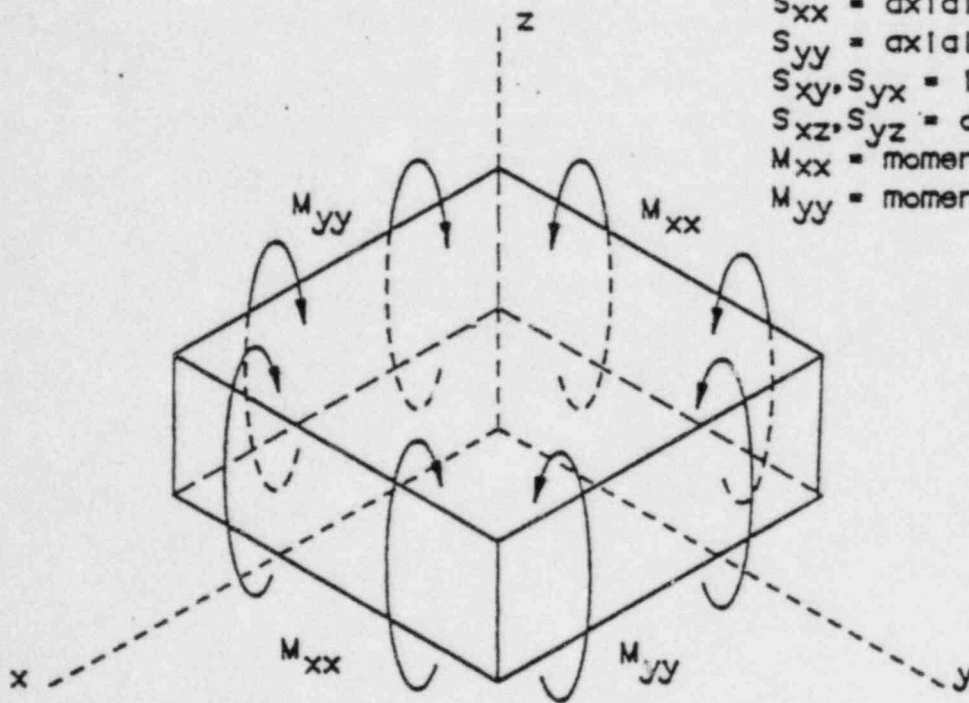
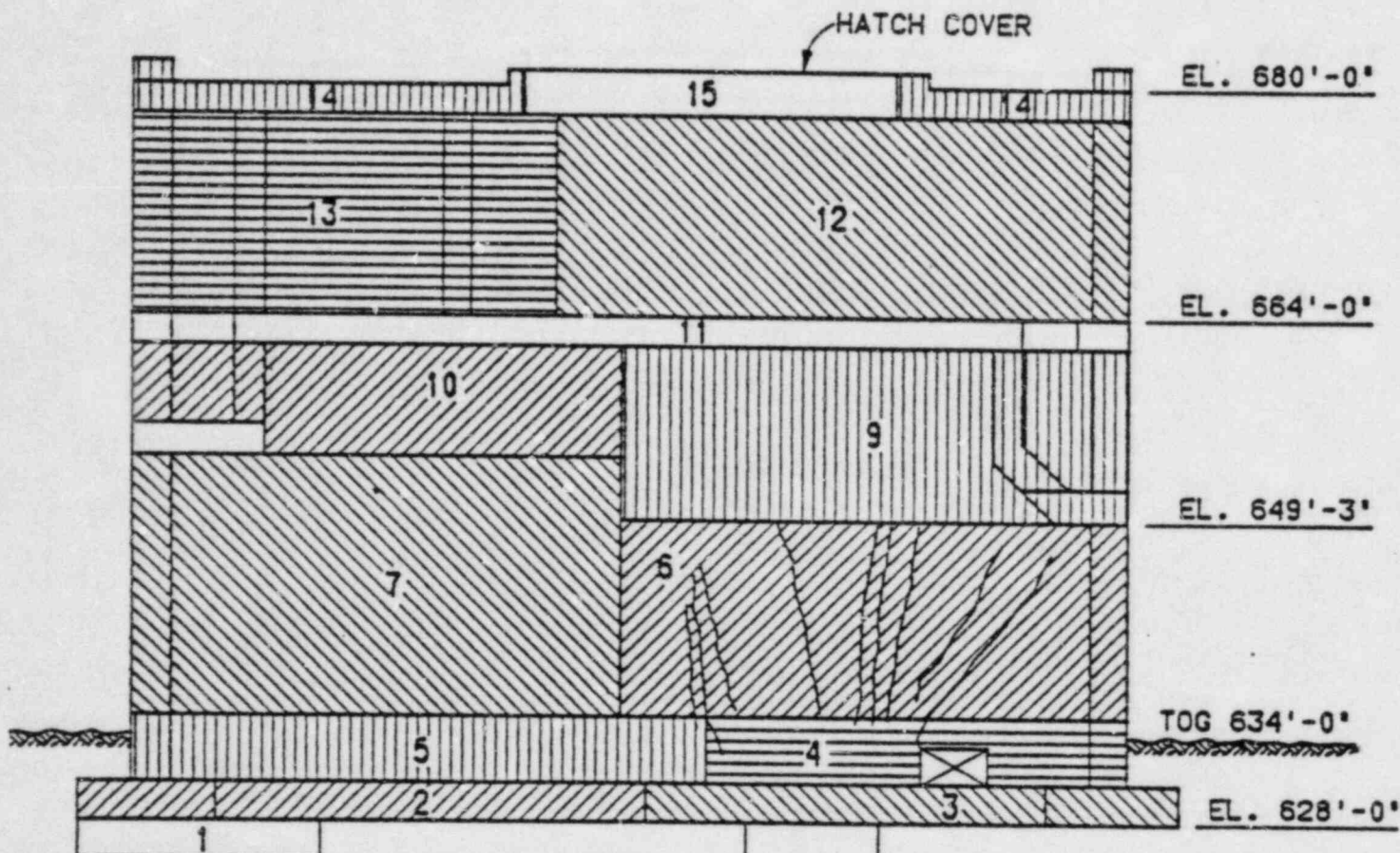


FIGURE DGB-11
POSITIVE PLATE ELEMENT FORCES



**BOLD NUMBERS SIGNIFY TYPICAL
CONCRETE POUR SEQUENCE**

DUCT BANK

FIGURE DGB-12
TYPICAL CONSTRUCTION SEQUENCE
WITH CRACK MAPPING SHOWN FOR TYPICAL INTERIOR WALL
CENTER WALL-EAST SIDE, LOOKING WEST

APPENDIX AASSESSMENT OF THE EFFECTS OF CRACKS
IN EXTERIOR WALLS SUBJECTED TO
TORNADO MISSILE EFFECTS

The tornado missiles postulated for the Midland plant are summarized in FSAR Table 3.5-9. A comparison of these missiles with the results of missile impact tests conducted over the last 6 years as shown in Table DGB-A1 indicates that the exterior walls have considerable margin against local damage. The tests indicate that a wall thickness of 12 inches would sufficiently preclude unacceptable local damage (spalling) from these missiles. (The thinnest exterior wall containing cracks in the diesel generator building is 30 inches; the thinnest exterior wall in the Midland plant is 24 inches.)

The tests indicate that the automobile missile was incapable of producing local damage (Reference 1). Wall response was checked using the quarter-sine wave forcing function given in Reference 2. A 24-inch wall with nominal reinforcing ($0.79 \text{ in}^2/\text{ft}$ EWEF) and conservatively assuming simple supports, would remain elastic, if struck by the 4,000 pound auto with a velocity of 106 fps.

The maximum interface force indicated by the utility pole tests was 170 kips (Reference 3). The yield resistance (based on a steel stress of $0.9 f_y$) of the 2-foot thick walls

assuming simple supports is approximately 445 kips. The impact duration was approximately 70 ms (Reference 3). Assuming a sustained step pulse of 170 kips, the calculated impulse duration would be 56 ms which would exceed the natural period of the wall by factors ranging between 2 and 10. In this range, with a resistance-to-force ratio (R/F) of $445 \div 170$ or 2.6, the walls would again remain elastic (Reference 4). The structural response from the lighter 8-pound rod and 108-pound plank would be much less than that associated with the 1,500-pound pole and 4,000-pound automobile.

The test data from Missile Impact Testing of Reinforced Concrete Panels (Reference 5) provide insight to the effect of a precracked concrete condition on the extent of damage to be expected from a subsequent missile strike. Eight of the 11 test slabs were subjected to more than one missile impact. The extent of damage and the effect of precracked slab condition on extent of damage from subsequent missile strikes are summarized in Table DGB-A2.

As seen in Table DGB-A2, all eight slabs were subjected to another missile strike while in a precracked condition (from a previous test) as indicated by an X under the C column. Spalling is indicated by an X under the S column. All slabs contained radial cracks. In most cases, these cracks extended beyond the backface fracture plane (see Figure DGB-A1). The formation of a backface fracture plane is indicated by a set of dominant circumferential cracks approximately 3 to 5 feet in diameter. When these characteristic circumferential cracks were not

observed, the backface fracture plane may not have formed. This is indicated by the letters "NF" in the column entitled "Radial Cracks - Beyond Fracture Plane."

An examination of data from these tests indicates no discernible difference in damage can be attributed to the existence of radial cracks caused by a previous missile impact. Only once was any difference in damage observed (test 16F). This was not due to radial cracks but by overlapping of backface fracture planes. The backface fracture plane formed in test 16F overlapped the one previously formed in test 15F. The concrete in the overlapped area was spalled. Spalling (in test 16F) was also observed outside the overlap area. Therefore, the additional damage is considered minor.

The radial cracks (roughly perpendicular to the back surface) can be considered analagous to the cracks caused by temperature, shrinkage, and possible previous loading history associated with settlement of the plant structures. Therefore, because no discernible difference in damage due to pre-existing radial cracks was observed in the tests, it is concluded that the cracks observed in the plant structures would have no significant effect on local damage due to tornado missile impact. It is also logical to conclude that no backface local damage would occur in the plant walls because the thinnest exterior wall (30 inches thick) with observed cracks in the diesel generator building is more than twice that required to preclude local damage (12 inches as determined from test data) from the missiles postulated for

the plant. A backface fracture plane (a precursor to spalling) would not be expected to form.

The effect of these cracks on structural response would also be insignificant because the predicted response from the heaviest missile is within the elastic range of the walls. Again, no difference in structural response was observed between precracked and previously uncracked test slabs. The test walls (less than 24 inches thick) were subjected to much more severe loading, as compared to the plant walls, and sustained some plastic response deformation as indicated by permanent set (difference between pre- and post-shot surface profile measurements).

In summation, the observed cracks in exterior plant walls will have an insignificant effect (if any at all) on local damage or structural response due to the tornado missiles postulated for the plant.

REFERENCES

1. A.E. Stephenson, Tornado Vulnerability Nuclear Production Facility, Sandia Laboratories, April 1975
2. Bechtel Power Corporation, Design of Structures for Missile Impact, BC-TOP-9-A, September 1974
3. A.E. Stephenson, Full Scale Tornado Missile Impact Tests, EPRI, NP-440, Prepared by Sandia Laboratories for EPRI, Research Project RP 399, July 1977
4. J.M. Biggs, H.J. Holley Jr., R.J. Hansen, J.K. Minami, S. Namyet, C.H. Norris, Structural Design for Dynamic Loads, McGraw-Hill Book Company, 1959
5. F.A. Vassallo, Missile Impact Testing of Reinforced Concrete Panels, Calspan Report HC-5609-D-1, prepared for Bechtel Corporation, January 1975

TABLE DGB-A1

COMPARISON OF PLANT MISSILES WITH TEST RESULTS

<u>Missile from Table 3.5-9</u>	<u>Test Missile</u>	<u>Test Slab Thickness (in.)</u>	<u>Backface Damage</u>	<u>Min. Thickness to Defeat Missile w/o Spalling Indicated by Tests (in.)</u>
108 lb 4"x12" plank @ 400 fps	200 lb 8" dia. pole @ 490 fps (Ref. 1)	24	None	
	200 lb 8" dia. pole @ 440 fps (Ref. 1)	12	Minor cracking	12
8 lb 1" dia. Steel rod @ 317 fps	8 lb 1" dia. Steel rod @ 303 fps (Ref. 2)	18	None	
	8 lb 1" dia. Steel rod @ 435 fps (Ref. 2)	12	backface cracks mostly radial	12
4,000 lb automobile @ 106 fps	3,300 lb automobile @ 73 fps (Ref. 3)	16	None	This missile was incapable of causing backface local damage
1,490 lb 13-1/2 in. dia. @ 211 fps	1,500 lb utility pole @ 205 fps (Ref. 2)	18	minor cracks	
	1,470 lb utility pole at 204 fps (Ref. 2)	12	cracks mostly radial	12

CROSS SECTION OF WALL

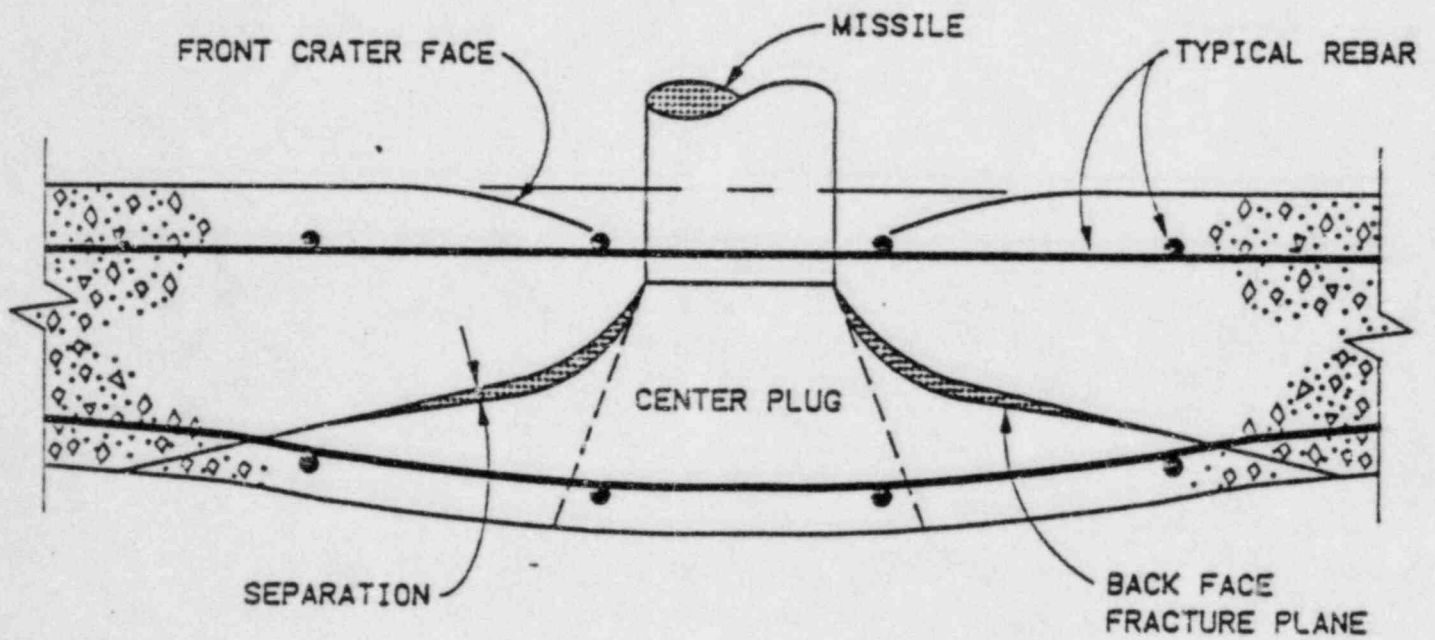


FIGURE DGB A-1
TYPICAL FRACTURE PLANES
IMPACT BELOCITY NEAR THRESHOLD OF SPALLING

APPENDIX B

OPTCON

The OPTCON computer code is a versatile and complete design and analysis program for reinforced concrete structures. The program may be used for the investigation of an existing reinforced concrete section where the reinforcing steel area is predetermined. Alternatively, it can be used for obtaining an optimum design by allowing the program to determine the minimum reinforcement required.

The computer program operates on the axial force/moment interaction diagram (IAD) of a section, where an IAD is a plot of the maximum allowable resistance of a section for given stress and strain limitations. Combinations of moment (M) and axial load (P) falling within this area are acceptable. Figure DGB-B1 depicts the appropriate IAD for a symmetrically reinforced, symmetrically shaped section subjected to a combination of flexural and axial loads.

The OPTCON program handles loads consisting of axial forces and corresponding bending moments due to different types of loads. Special subroutines are provided to incorporate the thermal effects into the design and/or investigation.

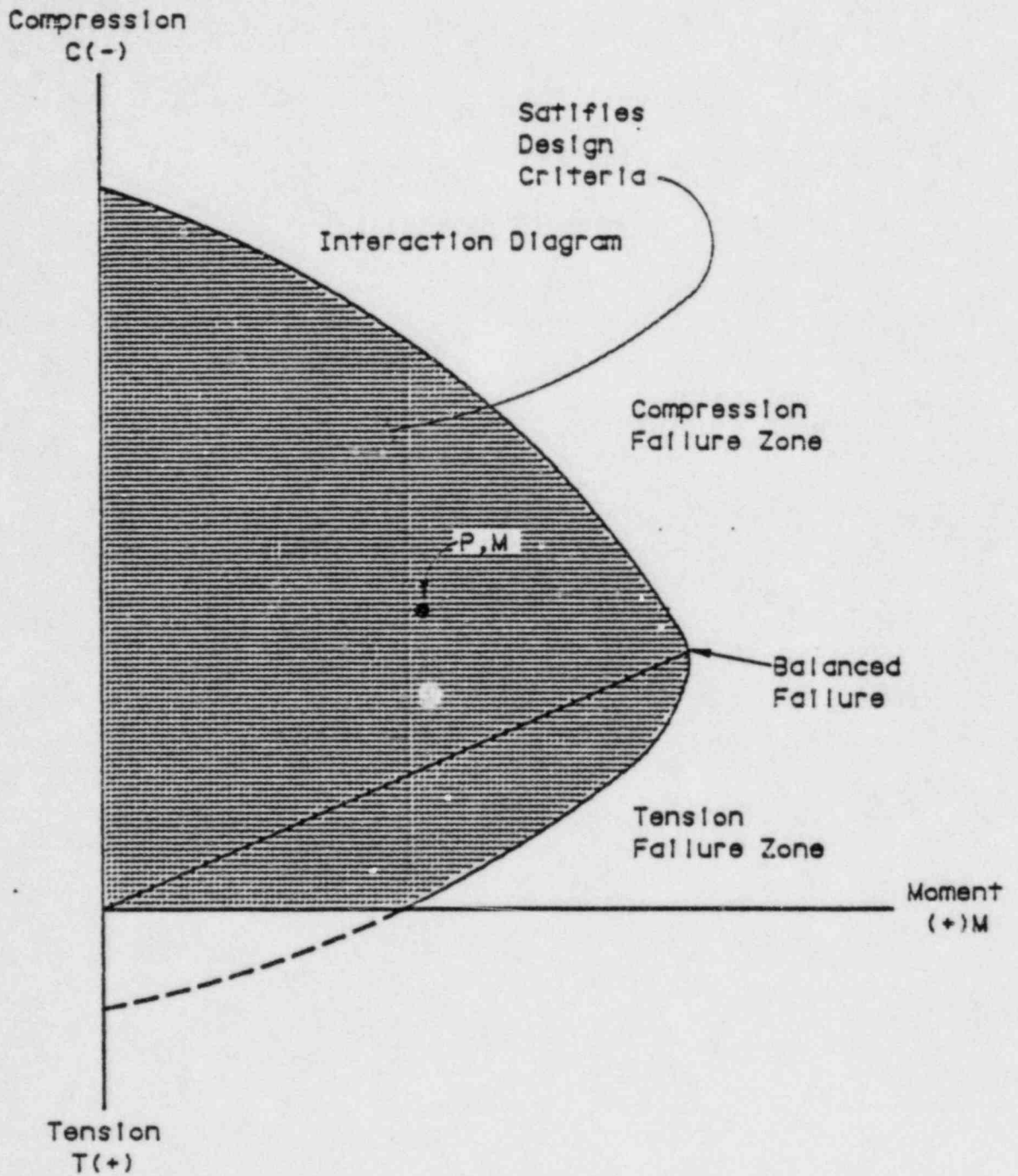


FIGURE DGB B-1
 TYPICAL INTERACTION DIAGRAM
 (for single axis bending and axial loads on a section
 with symmetrical reinforcement)