MIDLAND UNITS 1 & 2
JOB NO. 7220

REVIEW OF U.S. TESTING FIELD AND LABORATORY CONSTRUCTION TEST DATA ON SOILS USED AS FILL

BECHTEL ASSOCIATES PROFESSIONAL CORPORATION
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REVIEW OF U. S. TESTING
FIELD AND LABORATORY CONSTRUCTION
TEST DATA ON SOILS USED AS FILL

This review of the quality control tests of the earth fill at the Midland Site was made as a result of settlement of the fill supported diesel generator building in excess of that predicted. Soil samples obtained in borings indicated that soil conditions beneath the plant structures are not compatible with the quality of fill that could be expected based on the results of the control tests made by U. S. Testing Company. All fill was accepted as it was being placed based on the results of the field tests performed by U. S. Testing Company.

The review showed many discrepancies in the test results as outlined in the following paragraphs. Review comments are based on the requirements of the technical specifications for fill placement and to subcontract entered into by U. S. Testing Company.

1. Use of Laboratory Test Compaction Curves

Table 9-1 of specification 7220-C-208, Page 143 required one field density and moisture content test be taken for each 500 cubic yards of fill placed. It also required one compaction, grain size, and specific gravity for each 10,000 cubic yards of material. This gives a ratio of 20 field density tests to 1 laboratory compaction test. Although 20:1 is not a strict upper limit, it is a guideline; should density tests be taken more frequently than one per 500 cubic yards of fill the ratio could be higher. The actual ratio is shown in Table A attached. In fact, some of the laboratory compaction tests were used to determine percent compaction for several hundred field density tests taken over a period exceeding two years. Even though no time requirements for the period of use of laboratory tests are specified, it is unlikely that any borrow source in this area would be of such uniform character that such extended use of a compaction curve, truly representative of a large quantity of material, would be applicable. Listed below are selected laboratory test data results indicating the wide range of soil properties that were reported. Such a wide range is typical for soils of the kind used in the fill making prediction of maximum density, based on visual inspection extremely difficult if not impossible without testing.

TEST	MIN. DENSITY (lbs/Ft^3)	MAX. DENSITY (lbs/ft^3)	OPT. MOISTURE (percent)
*BMP269		127.3	10
*BMP278		117.0	15.2
*BMP279		140.8	5.7
**RD24	100.9	119.2	
**RD55	90.2	109.7	
**RD61	109.3	125.3	

*BMP refers to proctor type test.
**RD refers to relative density test run by dry method.

2. Questionable Retests

A field density test that fails to meet requirements of the specification should have been reported to Bechtel who then would have required reworking of the area and retesting.

Of the 668 "failing" tests which were marked "cleared" by another test, in over 10% (72 tests) of the results, the clearing of the "failed" density test was apparently resolved by merely using another laboratory compaction curve with either lower maximum density, which resulted in in the percent compaction being increased sufficiently, or different optimum moisture content which caused the fill to meet the requirements of the specification. The possibility exists that soil was removed after a "failing" test and replaced by different material, but the records do not indicate this and it is not possible from the record to determine if a new density test was made. In other cases, tests labeled "failed" were incorrectly cleared though the same laboratory standard was referenced. For example, in some cases retests to clear a "failed" test were not taken in the same area or at the approximate same elevation. More than 40 retests were over 20 feet from the "failed" test location (as recorded in the test reports) and some were over 200 feet from the original test location. In general, if after a "failing" test the whole area is reworked, the density test location is not too critical assuming that the correct laboratory compaction curve is used for comparison. However, in the plant fill work areas were relatively small, and soil characteristics showed considerable variation necessitating retesting in the immediate vicinity of the "failing" test. Retest should be taken in the lift or soil layer that has been reworked. Almost 50 retests were taken at different elevations, some up to 10 ft. from the "failed" test. It should be noted that Bechtel field personnel gave the locations for retesting. This was not a U. S. Testing responsibility. Two retests were dated prior to the time the original test "failed". Over 130 "failing" tests were marked as ("non Q") and never recorded cleared, as they were outside the saftey related area.

Table B is a compilation of notes relative to questionable clearing of failed tests.

3. Theoretically Impossible Test Results

Soils cannot be more than 100 percent saturated; therefore, all field density test data points, when plotted as dry density versus moisture content, must be below the zero air voids curve as defined by the specific gravity of the material. Specifications do not require examination of the zero air voids curve, but it is considered common practice relative to compaction plots. There are numerous cases in the U. S. Testing Company data where points plot above the zero air voids curve. Figure 1 attached shows a typical laboratory compaction test curve with field test results plotted on it. Many of the field test results are to determine percent compaction plot above the zero air voids curve. Provided the specific gravity is correct this is not possible so that all such points must represent erroneous data.

The fact that a large number of test results plot above the zero air voids curve tends to make all test results questionable.

Also, referring to Figure 1 it would appear that soil density varied widely. Specifications called for compactive effort results as defined by ASTM D 1557 which is 56,255 ft-lb/ft^3 energy. This was modified to a laboratory test compactive effort of about 20,000 ft-lbs/ft^3 energy, often referred to as Bechtel Modified Proctor (BMP). Laboratory compaction test curves should be related to the same effort as that called for in the field for use in comparing with field density tests to determine percent compaction. According to plots of field data shown on Figure 1, density varied from about 108 lb/ft^3 to about 130 lb/ft^3. It is doubtful that the soil classification or other properties would be similar for such a wide variation in density. It is noted that 100 percent of modified Proctor (ASTM D 1557) which is difficult to obtain, is rated at 56,255 ft-lb/ft^3 energy. The curve plotted on Figure 1 is at about 20,000 ft-lb/ft^3 energy. For comparative purposes it was determined by U. S. Testing in 1974 that 100 percent of specified effort (20,000 ft-lb/ft^3) is approximately equal to 95 percent of the maximum density as determined by ASTM D 1557 (56,255 ft-lb/ft^3) Reference Figure 8.

4. Repeated use of Questionable Laboratory Test Data

Some laboratory compaction test data were used repeatedly even though they continued to show suspect field test results. This could be indicative of questionable laboratory data or the fact that soil was not being placed or compacted according to specifications. Either case is a cause for concern.

Several specific gravity calculations are in error, such as for BMP 273 and 274. In the case of BMP 273, the zero air voids curve passes through the laboratory compaction curve. In another example, BMP 297, the laboratory compaction curve is invalid due to calculation errors, yet was referenced by field density tests 22 times.

Table C is a compilation of notes relative to questionable test data.

5. Limits of Accuracy and Acceptability for Test Data

Figures 1 through 7 attached will be referenced in discussing limits of accuracy or acceptability for field test results as compared to laboratory test data. The figures show plots of compaction data for BMP 278 which are typical of all test results.

Specified laboratory compactive effort was 20,000 ft-lbs/ft^3 and field compaction effort was originally specified at 56,255 ft-lbs/ft^3 but was changed by Revision 5, dated 7/8/75, specification 7220-C-210, Section 13.7, Page 57 to also be equal to about 20,000 ft-lbs/ft^3.

The specified 20,000 ft-lbs/ft^3 effort establishes a compaction curve relating moisture and density for a specific soil. Moisture was specified for field placed fill to be within ± 2 percent of optimum moisture as determined by this effort. Density was specified to be greater than 95 percent of the maximum density. As compactive effort is increased in the laboratory test, maximum density will be increased and optimum moisture content will decrease. This change can only occur in the field to the extent that the field moisture content will permit it. Once field compaction is such that the fill density is significantly higher than about 105 percent of maximum, the specified tolerance from optimum moisture content in the laboratory compaction test may no longer be applicable for field control. A ± 2 percent numerical value of moisture content acceptable at the specified compactive effort would be too wet at a higher effort since the zero air voids curve defines the absolute maximum that can be achieved, indicating that higher densities for that soil are impossible. Therefore, if the record shows high densities for such material, the data are in error. This was apparently overlooked.

Plots of field data for compaction test BMP 278 are shown on Figures 1 through 6. The title of each figure gives the assumptions made in plotting data for the figure. In comparing figures 3 and 4 it is seen that a majority of field tests were made using the nuclear device. The two test results shown on Figure 4 for the sand cone method indicates one test result on each side of the zero air voids curve. The one falling above the zero air voids curve (shown on Figure 4) is designated by U. S. Testing Company as the only passing sand cone test (shown on Figure 6).

For a field test result to be valid as well as "Passing" it must fall within a well defined area on the plot containing the laboratory compaction curve. This area or window of acceptability is shown for a hypothetical compaction curve on Figure 7a that would meet requirements of Specification 7220-C-210. It is defined by horizontal lines at 95 percent and 105 percent of specified density, vertical lines through ± 2 percent of optimum moisture content, and a line parallel to the zero voids line indicating saturation about half way between the compaction curve and 100 percent saturation (zero air voids curve). The practical upper limit of 105 percent of specified density is not defined in the specifications. It was arbitrarily chosen as numbers greater than this give increasingly invalid comparisons between field test results and the specified laboratory compaction test curve. Therefore, if all data points fall within the defined window there would be no reason to assume that they are wrong. However, when many data points fall outside the designated area there is something wrong with the information and then all data points become suspect. A review of all data indicates that about 25 percent of the cohesive soil test results fall within this area.

Figure 7B shows an area where field test results would be acceptable, in theory even though not in strict accordance with the specifications. Figure 7B was arrived at by expanding Figure 7a to include test results up to a compactive effort related to ASTM D 1557 (56,255 ft-lb/ft^3) which is considered to be a practical upper limit. About 40 percent of all cohesive soil test results would plot in this area.

6. Accuracy of Test Equipment

Almost all (over 95%) field density tests on cohesive soils were made using the Nuclear Density device. Specification 7220-C-210 section 12.4.2 page 42 indicates this to be acceptable for moisture content determination provided that the results are compatible with those obtained by ASTM D 2216. Similarly, section 12.4.4 says density determined by the nuclear device is acceptable when results are compatible with density as determined by ASTM D 1556.

In a letter from U. S. Testing to Bechtel (dated May 30, 1974), the average deviation of the nuclear device from oven-dry moistures was +.12% for a set of 30 tests. However, the standard error of estimate is 1.8% for the data with the range of differences being from - 3.2% to +3.9%. Thus, accuracy of the nuclear device is questionable, and could translate into errors of about $\pm$ 4 pcf in the dry density calculation. (It should be noted that errors in the moisture content tend to shift the position of test results on a moisture density plot approximately parallel to the zero air voids curve, assuming the in-place wet density is correct, and thus do not explain the large number of points which plot outside the zero air voids. Compare Figures 1 and 9).

No reliable correlation between sand cone and nuclear density tests were carried out therefore there is no basis for determining if U. S. Testing would have performed better using the sand cone procedure.

However, it is clear that a large number of the nuclear density tests are wrong. This can be explained by considering the wet unit weight may have been wrong or both the moisture content and unit weight may have been wrong. A reliable correlation with properly conducted sand cone tests should have revealed this, but it was not apparently done.

7. Relative Density Tests

Cases were noted where densities in material classified on the data sheet as zone 3 (sand) were compared to the maximum densities in proctor type tests and other cases where densities in clay soils were compared to the maximum density in relative density tests. An error must exist in the record in such cases either in the classification of the soil on data sheet or in comparing field test results to inappropriate laboratory test data. In general, it appears that relative density tests were used in controlling density of sand fill. There were a significant number of arithmetic errors on calculation sheets even though there are signatures on the sheets indicating they had been checked. Over 100 errors were found in calculations, of relative density from 8/15/79 through 12/78 (not all of these errors change the acceptability of the test results).

ASTM D 2049 section 7.1.2 Wet Method states: "Note 2 - While the dry method is preferred from the standpoint of securing results in a shorter period of time, the highest maximum density is obtained for some soils in a saturated state. At the beginning of a laboratory test program, or when a radical change of materials occurs, the maximum density test should be performed on both wet and dry soil to determine which method results in the higher maximum density. If the wet method produces higher maximum densities (in excess of one percent) it shall be followed in succeeding tests." An example of wet and dry relative density is shown on Figure 10. U. S. Testing Company apparently did not do this frequently enough, or on a broad enough range of non-cohesive soil types. As a consequence many field density test results exceed 100 percent of maximum dry laboratory relative density. As an example, for laboratory test RD55 a total of 566 field tests were made. Of this total, 364 tests were greater than 100 percent compaction. The highest relative density found was 142.2 percent with the majority of tests over 100 percent falling in the range of 100 percent to about 130 percent. Since the difference in maximum density between wet and dry methods is about 4 to 5 lbs/c. ft. (based on recent data) any test result greater than about 115 percent (based on the dry method) is suspect.

Even if the wet laboratory test method data were available for all sands, it appears an unacceptably high number of field test results would greatly exceed 105 percent relative density even based on the wet maximum.

8. Summary

In summary, there are five major faults contained in the Midland Compacted Fill Density Test Reports as follows:

1. erroneous field density test data.
2. incorrect soil identification
3. incorrect (or questionable) laboratory test data.
4. calculation errors
5. improper or incomplete clearing of "failed" tests.

Items 4 and 5 represent existing faults in the data which could be corrected. However, as a result of items 1 through 3, there is no rational means of determining which test results are valid and which are not. Since more than one half of the test results for relative density and percent compaction fall outside the possible theoretical comparison limits, it must be concluded that these test results are suspect and should not be used alone for acceptance of plant area fill. Therefore, other means of testing have been established and employed to determine if the fill in any given area is acceptable.

Also in item 4 it should be noted that on many occassions the inplace density was divided by the maximum density from the relative density test to get percent compaction, these tests were also used to clear other pricing tests.

TABLE A

Listing of All Classifications Referenced in Plant Area Fill Soil Test Records Which were Used for 20 or More Field Density Tests

Classification	No. of Tests
B200	90
B251	31
B252	22
B254	42
B255	57
B260	68
B261	36
B262	165
B269	227
B270	226
B271	141
B274	37
B276	21
B277	158
B278	82
B297	22
R015	20
R016	61
R024	248
R030	54
R035	59
R038	39
R039	28
R040	35
R041	69
R042	103
R043	48
R044	71
R045	43
R049	63
R054	118
R055	566
R059	65
R061	589
R063	42
R065	59

Note: Spec. 7220-C-208 gives a ratio of approximately 20 field tests to each laboratory test.

TABLE B

Notes on Questionable Clearing of Failed Tests

1. Test number MD 245 fails due to high moisture. Cleared by MD 246 which references a proctor with higher optimum moisture content (OMC) such that the ±2% of optimum requirement is met.

2. MD 205 fails with moisture content 6% above the OMC. Cleared by MD 215, which references a relative density lab standard, and is itself still 6% away from the OMC of the proctor referenced by MD 205.

3. MD 223 fails because of high moisture. Cleared by MD 728 which has actually a higher moisture content and lower density, but references a different proctor; the retest passes and clears the failure.

4. Both MD 844 and 886 fail because of high moisture and low density. They are cleared by MD 888 which references a new proctor with lower maximum density and higher OMC than the first.

5. MD 251 fails due to moisture being too high. Cleared by MD 253 which uses a higher OMC proctor.

6. MD 668 clears MDR 634, but the two tests show no correspondence in location, moisture, density, or lab standard.

7. MD 771 failed, being too dry. Cleared by MD 782, which has almost identical moisture content and dry density but uses a new BMP with lower optimum moisture.

8. MD. 2384 clears MD 2342, referencing a different proctor with an OMC which fits the in-situ conditions. However, the dry density of MD. 2384 is way too high to fit the original soil classification, and in addition, it falls outside of the zero air voids curve for the classification which it has been changed to.

9. MD 556 clears MD 554 by using a BMP with lower moisture requirements. The field densities differ by 24 pcf and would seem to be different material.

10. MD 558 clears MD 555 but has too high a density to be the same soil as MD 555. It also uses a different proctor.

11. MD 566 and 568, classified as BMP 262 cohesive soils, are cleared by MD 569 which is classified as RD 33 and has totally different soil properties than the two failures.

12. MD 1317, 18, 19 and 20 fail and are all cleared by MD 1477 taken over 5 weeks later. There is poor correspondence in the soil properties and the proctor is different from failing to passing test.

13. MD 2965 clears MD 2963 with a different proctor through the test results would have been passing with the original BMP.

14. MD 1388, classified as BMP 278, is cleared by MD 1461, classified as RD 55.

15. MD 170, classified as RD 24 is cleared by MD 173, classified as BMP 234.

16. MDR 287 fails with a relative density of 77%. Cleared by MDR 291 which has .1 pcf lower density but arbitrarily rounds up the relative density to 80%; it passes and clears the failure.

17. In all of the following field density tests on sand, the passing test has approximately the same or lower density than the failures, but references a lower maximum density RD lab standard:

MDR 343	clears	MDR 339
MDR 514	clears	MDR 507
MDR 513	clears	MDR 508
MDR 515	clears	MDR 509
MDR 516	clears	MDR 510
MDR 522A	clears	MDR 521
MDR 558	clears	MDR 556, 557
MDR 480	clears	MDR 473
MDR 555	clears	MDR 525, 527, 534
MDR 533	clears	MDR 526, 530, 531

18. MD 2384 clears MD 2342, but is at 7' lower elevation.

19. MD 123 clears MD 122, but is at 10.5' lower elevation.

20. MD 149 clears MD 142, but is at 10' higher elevation.

21. MD 1694 clears MD 1693 but is 43' away from the site of the first test.

22. MD 3114 clears MD 3102, but the two tests are 68' apart.

23. MD 186 clears MD 183 though it is 110' away.

24. MD 1209 clears MD 1207 and MD 1205, yet is 183 ft. away from the failures.

25. MD 1097, dated August 4, 1977, cleared by MD 1048 dated July 16, 1977.

Note: This table gives typical observations and is not meant to be all-inclusive.

TABLE C

Notes on Questionable Test Data

1. The first field density test to reference RD 24 (5/75) has a relative density of 170.6%. The standard continued to be used, however, with relative densities greater than 100% occuring repeatedly.

2. Similarly for RD 30, the first two tests (9/75) have 114% and 122% relative densities, yet the standard was used for 10 months, 54 tests, with 52% of the results over 100%.

3. During the first two weeks of use (7/76), RD 41 was referenced 22 times with 12 tests over 100% relative density (5 tests over 110% and 3 over 120%). The standard was used for 5 months, however, with over 40% of the results over 100%.

4. The first test using RD 55 (8/76) has a relative density of 119%, with the field test being made the same day as the standard and, thus, assumedly the same material. These results would throw doubt on the lab standard, yet it was used for two full years and 566 tests, with 64% of the results over 100% relative density.

5. Even high density structural backfill standards such as RD 61 (maximum density of 125.3 pcf), used 593 times, show over 25% of the tests having greater than 100% relative density.

6. The first seven tests referencing BMP 269 (scattered over a two month period around 7/76) all fall outside the zero air voids curve. This classification was used for 1 1/2 years, referenced 227 times.

7. The first two tests referencing BMP 270 (7/76) fall 6 pcf above the zero air voids curve. Continued use of this proctor for over 2 years resulted in 226 tests with 82 outside the theoretical maximum.

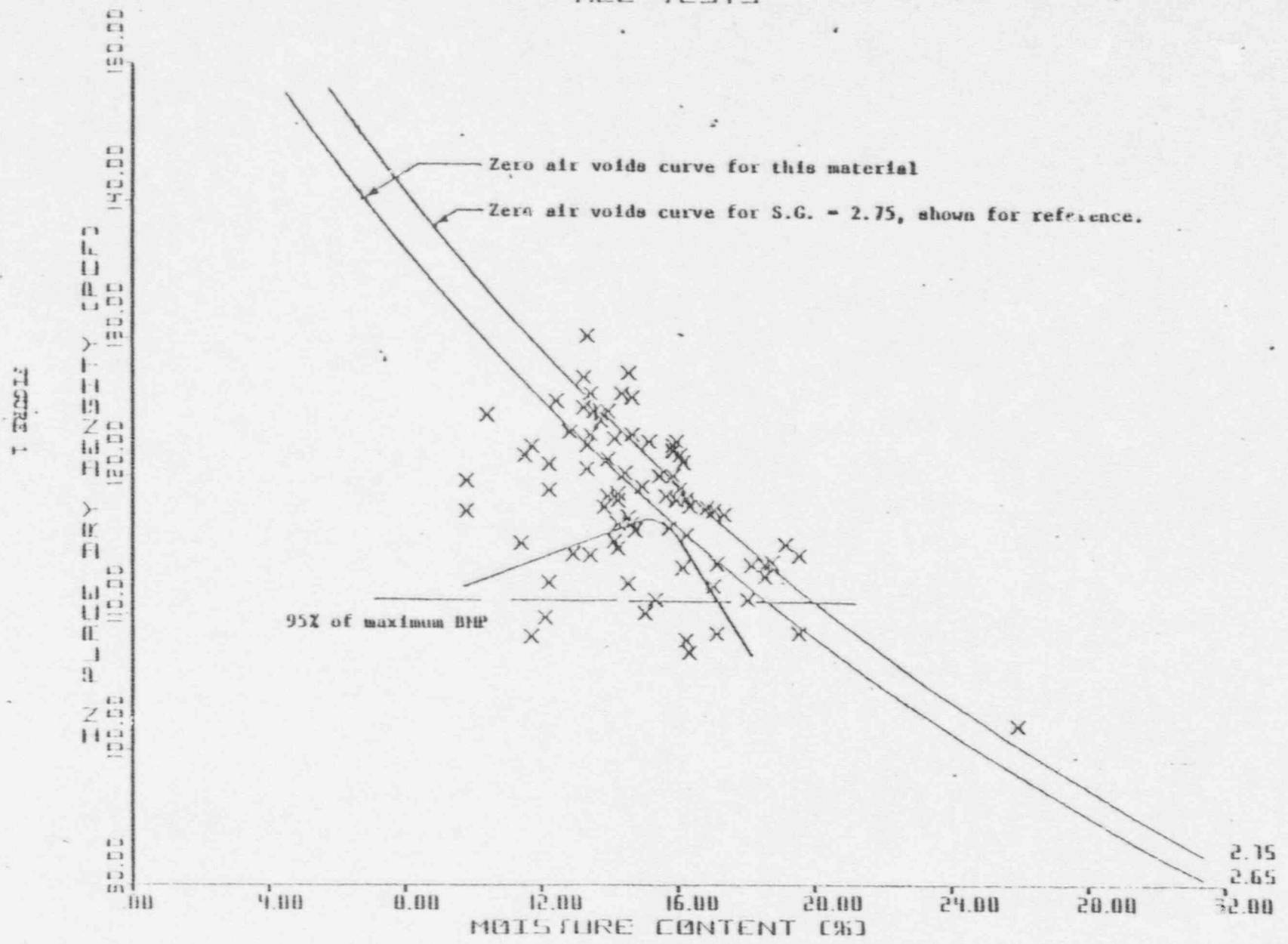
8. For the first month (4/77) all BMP 278 tests fall on or outside the zero air voids curve. For the next month, over half the tests did the same, or have greater than 105% compaction. The standard was used over half a year, with 43 out of a total of 82 tests outside the zero air voids curve.

Note: This table gives typical observations and is not meant to be all-inclusive.

MOISTURE-DENSITY FOR BMP 278

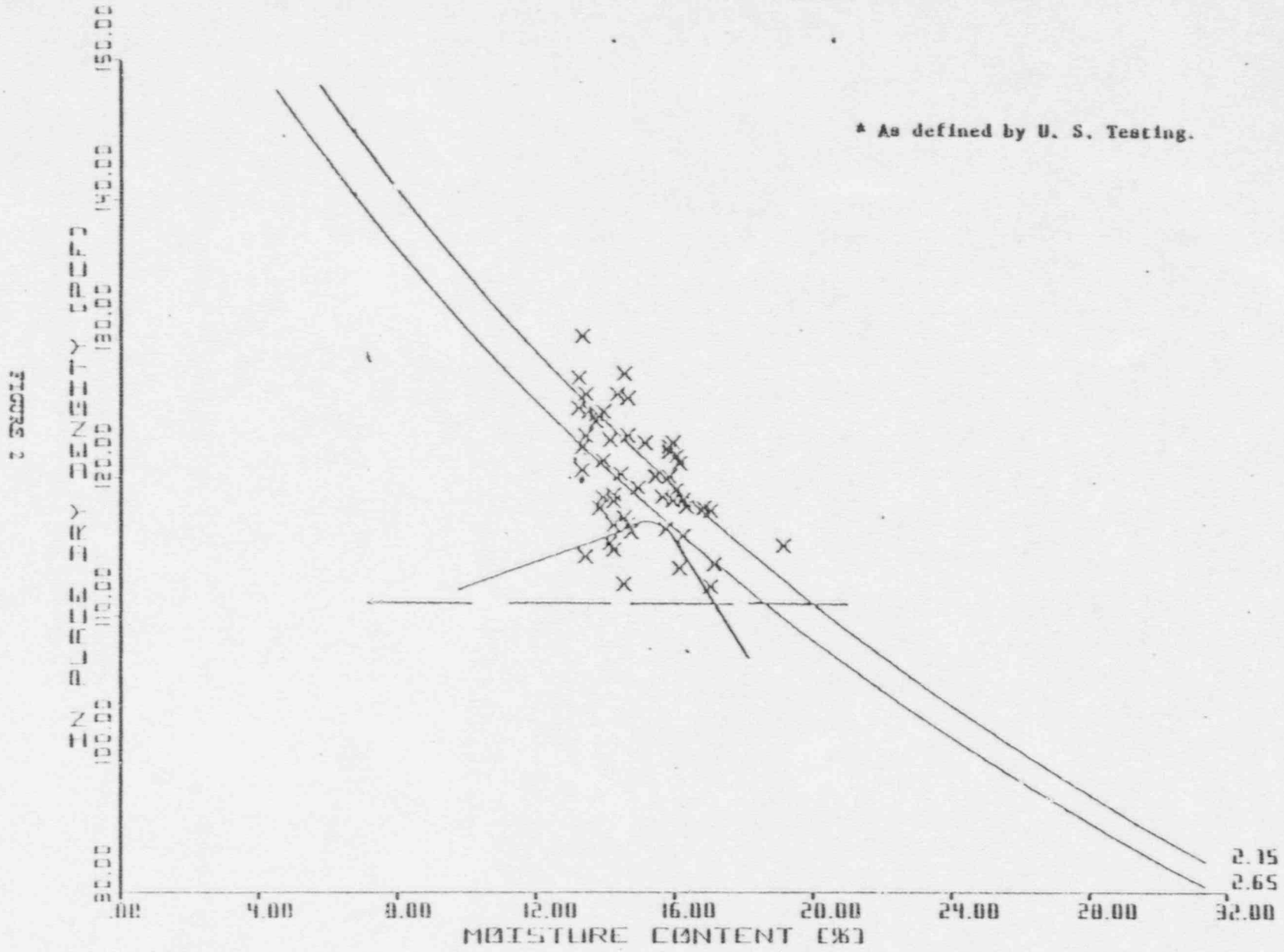
SPECIFIC GRAVITY = 2.65

ALL TESTS



MOISTURE-DENSITY FOR BMP 27L

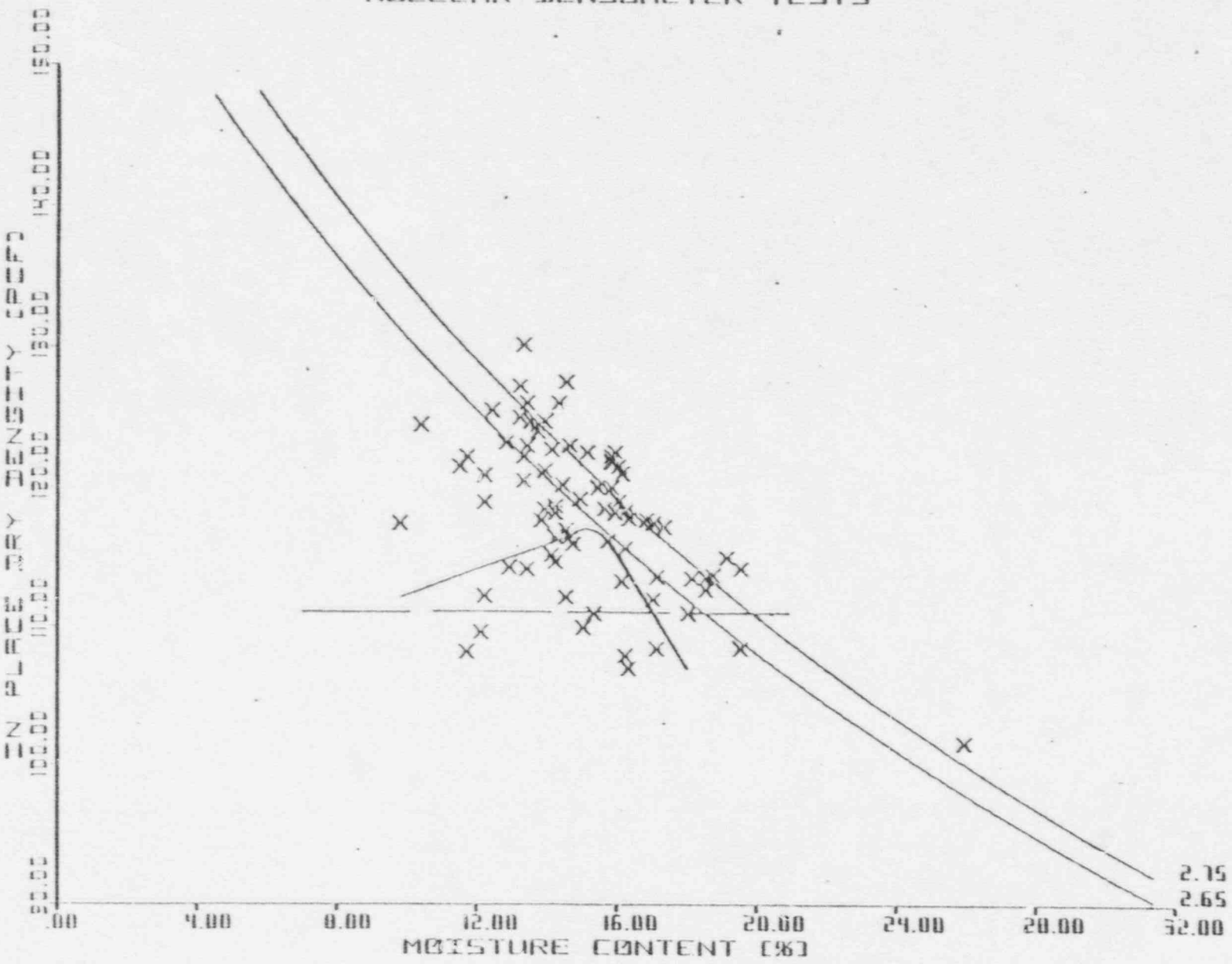
SPECIFIC GRAVITY = 2.65
PASSING TESTS ONLY*



* As defined by U. S. Testing.

MOISTURE-DENSITY FOR BMP 278

SPECIFIC GRAVITY = 2.65
NUCLEAR DENSOMETER TESTS



MOISTURE-DENSITY FOR BMP 27L

SPECIFIC GRAVITY = 2.65
SAND-CONE TESTS

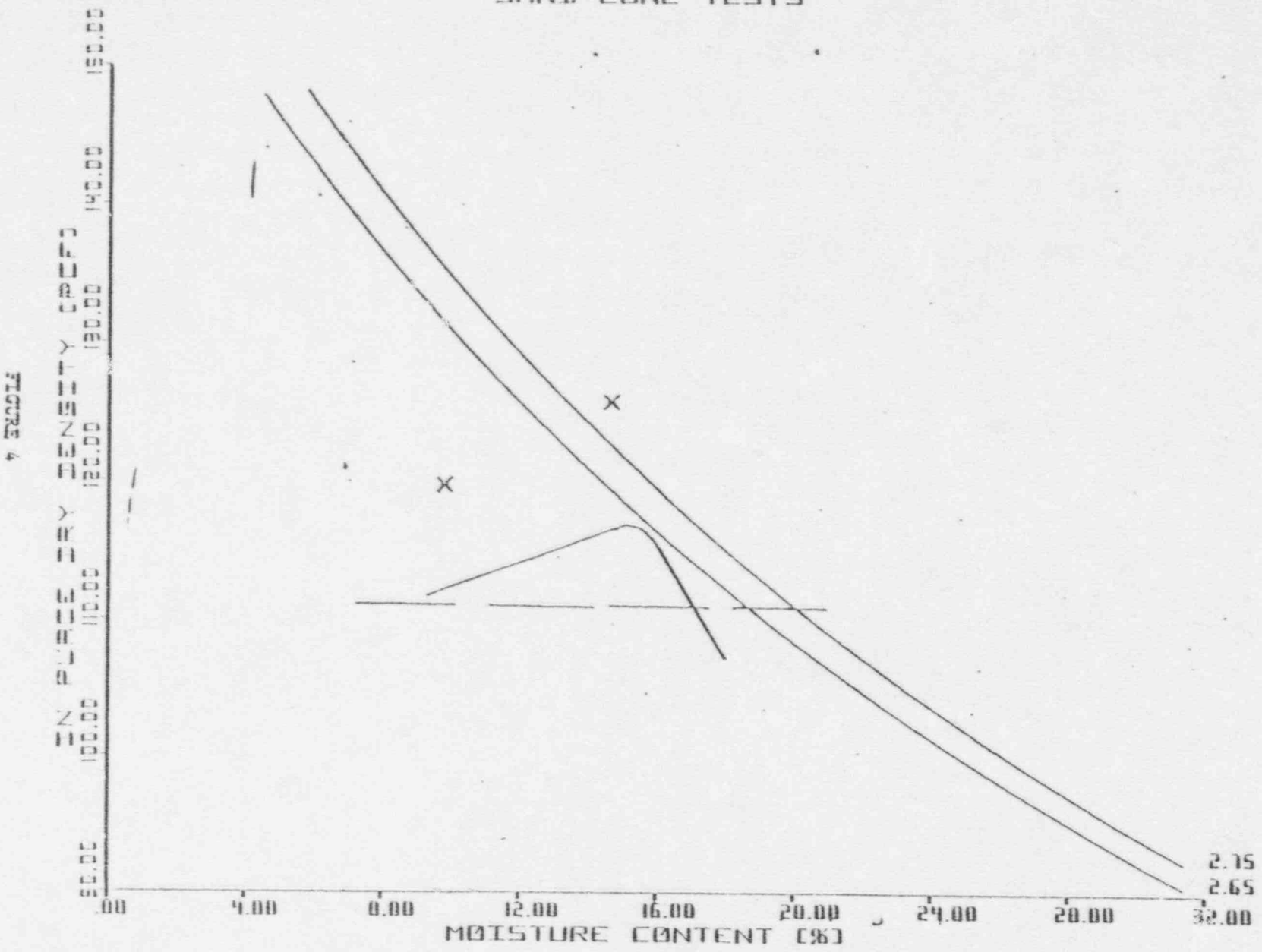


FIGURE 4

MOISTURE DENSITY FOR BMP 27&

SPECIFIC GRAVITY = 2.65
NUC. DENS. PASSING TEST*

*As defined by U. S. Testing

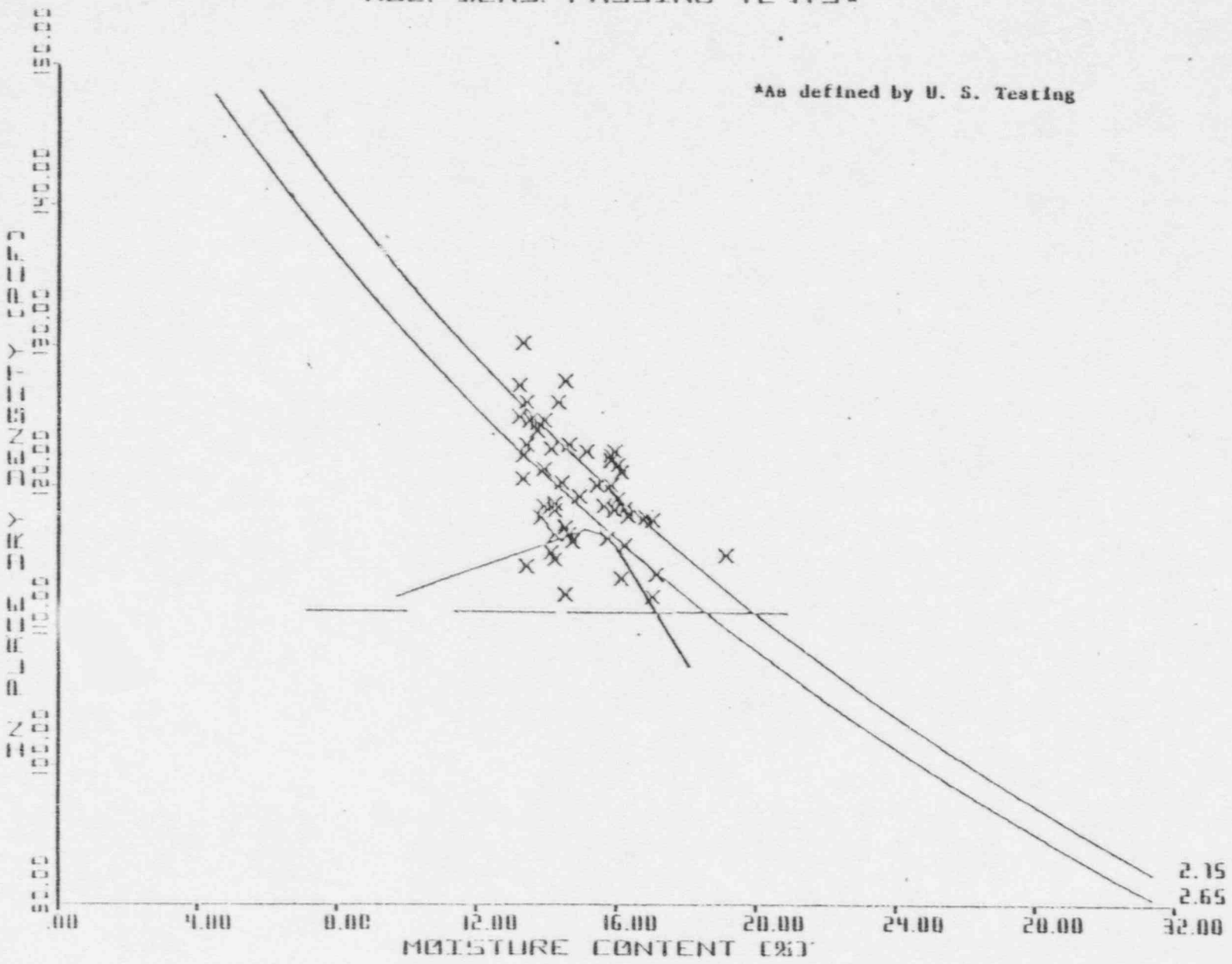


FIGURE 5

MOISTURE-DENSITY FOR BMP 27L.

SPECIFIC GRAVITY = 2.65
SAND-CONE PASSING TESTS*

*As defined by U. S. Testing

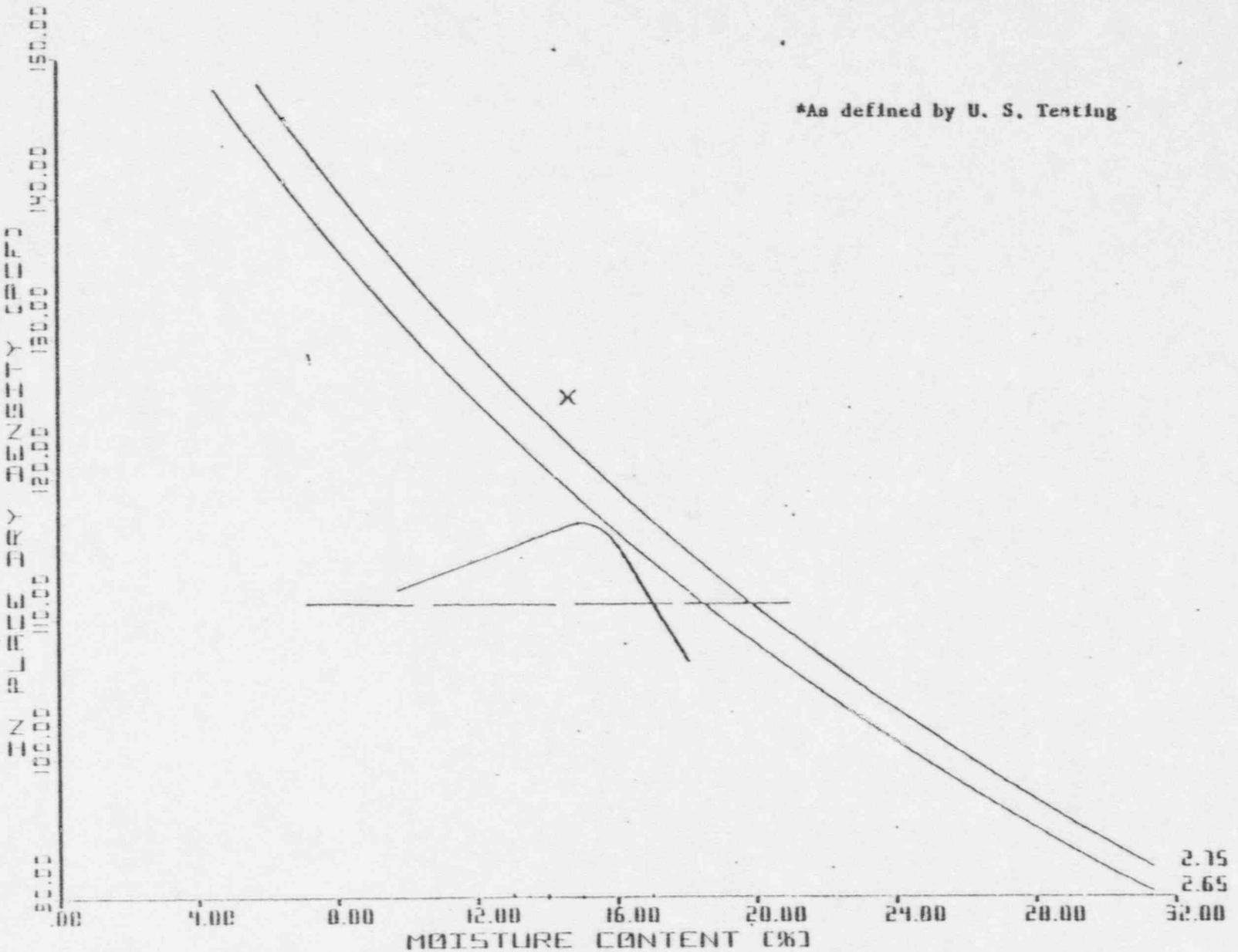


FIGURE 6

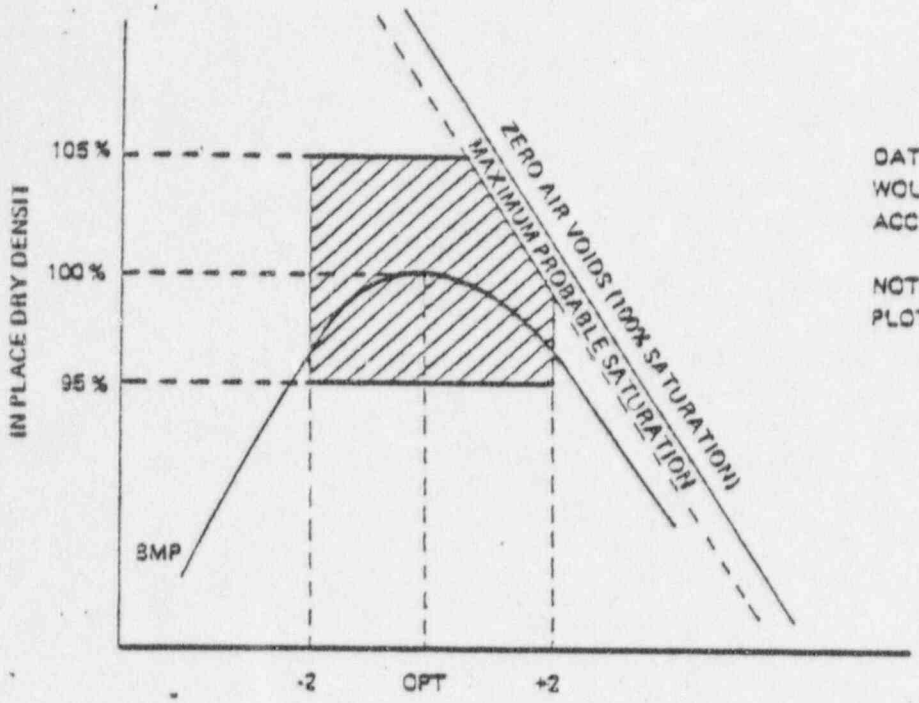


FIGURE 7-A

DATA POINTS THAT PLOT IN SHADED AREA WOULD BE GENERALLY ACCEPTABLE ACCORDING TO SPECIFICATIONS

NOTE: ABOUT 25% OF ALL FIELD DATA PLOTS IN THE SHADED AREA

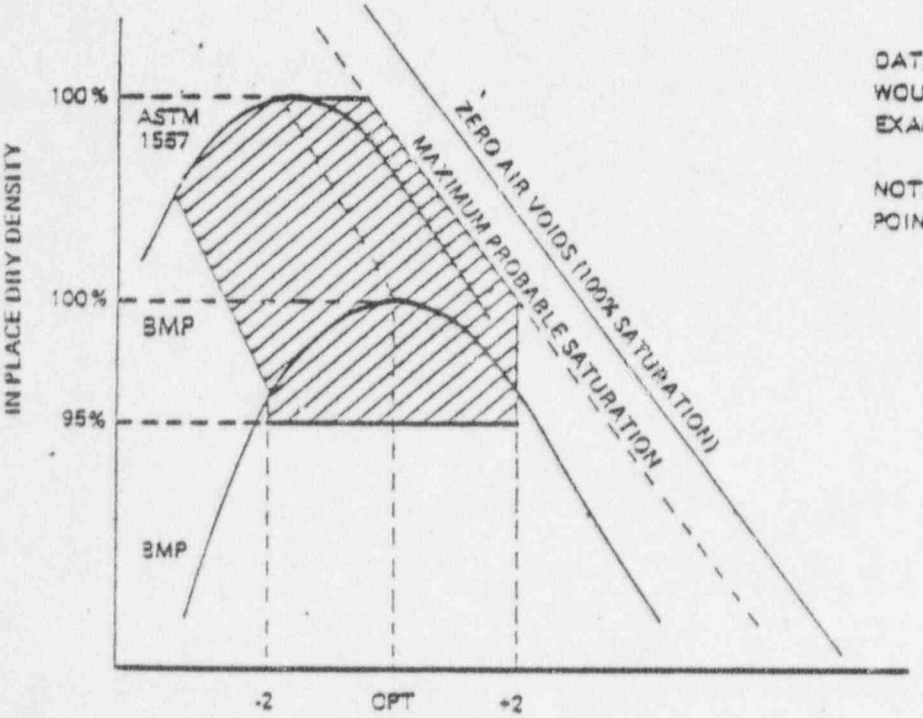


FIGURE 7-B

DATA POINTS THAT PLOT IN SHADED AREA WOULD BE ACCEPTABLE REGARDLESS OF EXACT SPECIFICATION WORDING

NOTE: ABOUT 40% OF ALL FIELD DATA POINTS PLOT IN THE SHADED AREA

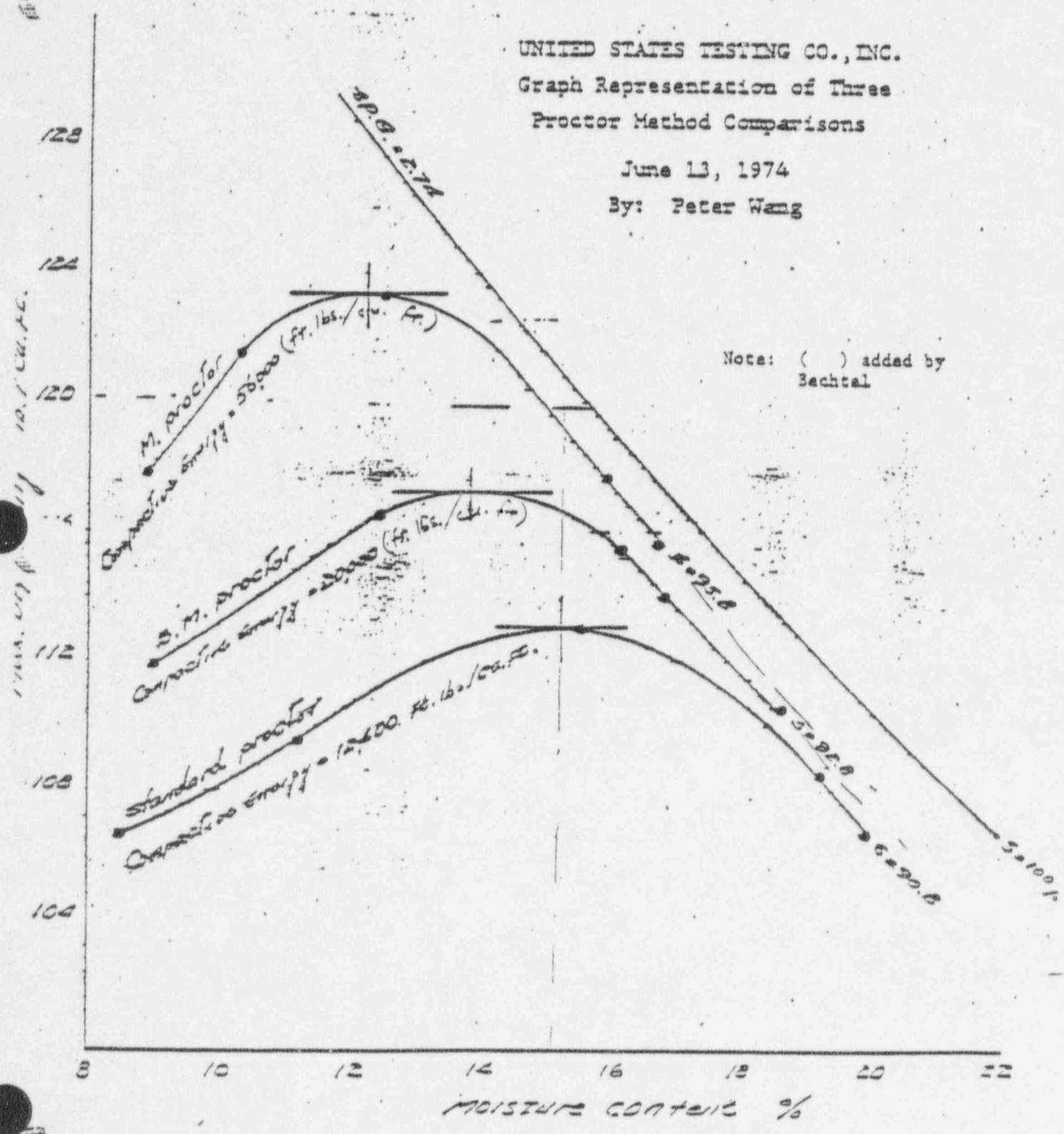
FIGURE 7: WINDOWS OF ACCEPTABILITY (A) BASED ON BMP SPECIFICATION (B) REGARDLESS OF EXACT WORDING OF SPECIFICATION

UNITED STATES TESTING CO., INC.

Graph Representation of Three Proctor Method Comparisons

June 13, 1974

By: Peter Wang



Note: ( ) added by Bechtal

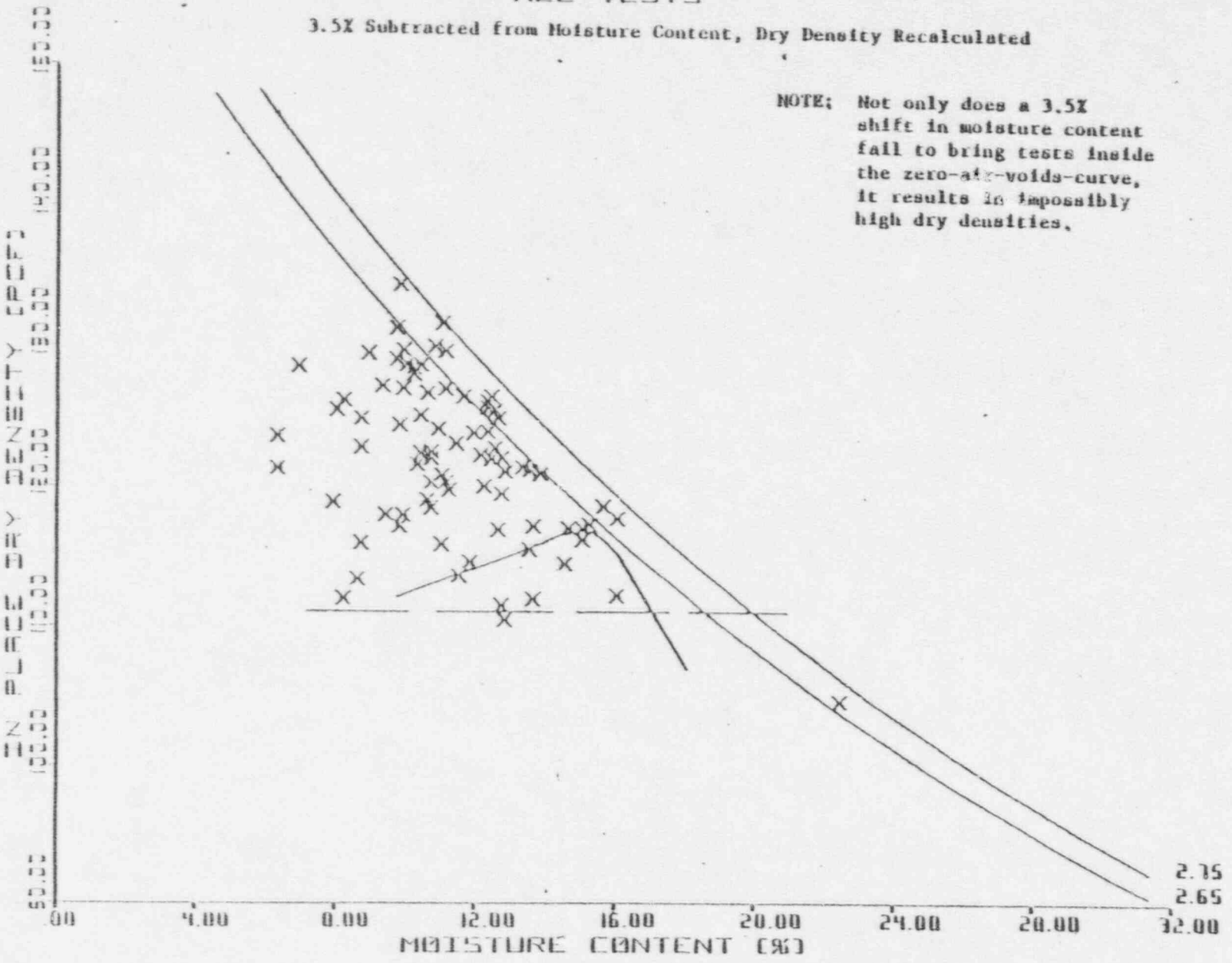
FIGURE 8

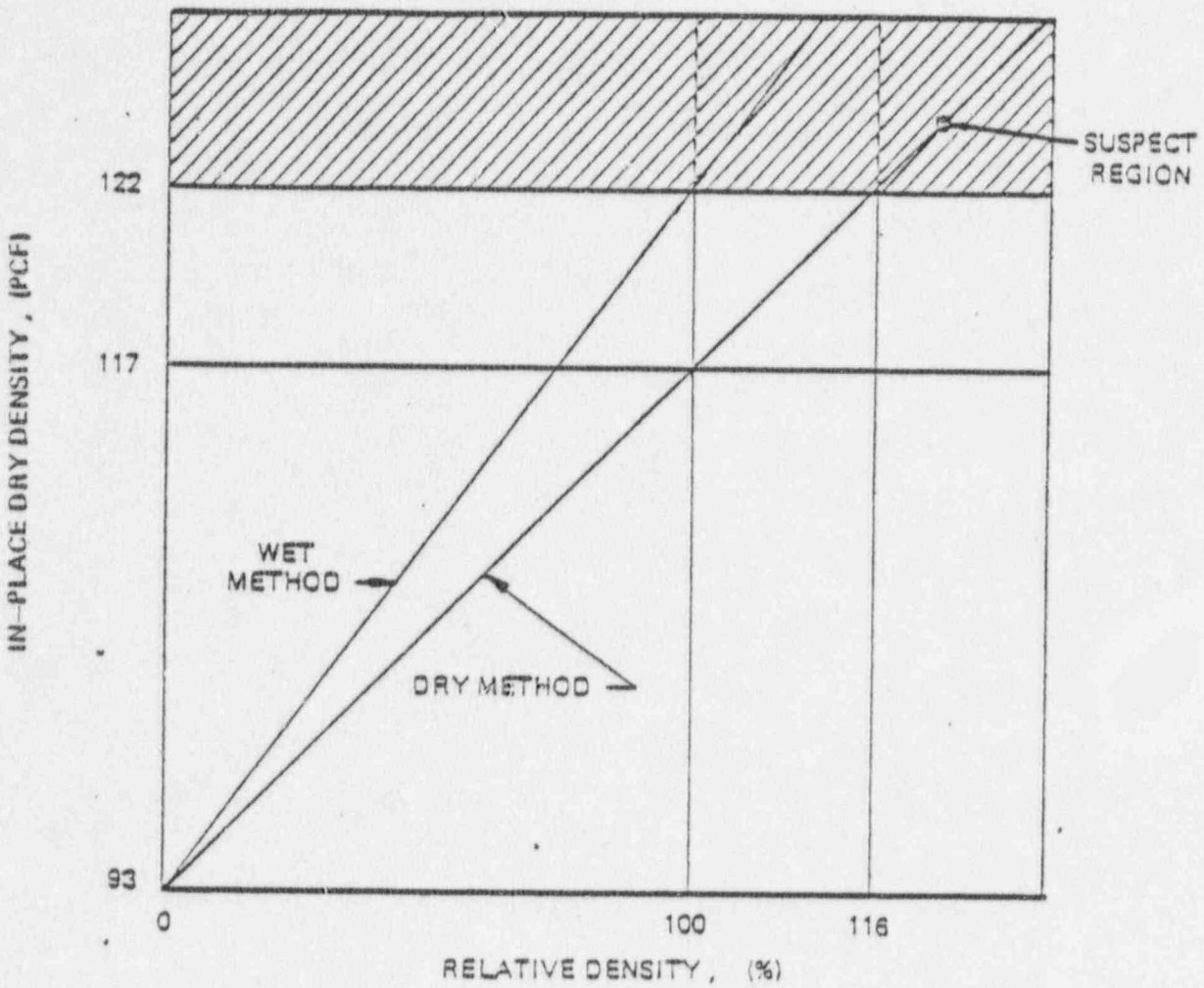
MOISTURE-DENSITY FOR BMP 27

SPECIFIC GRAVITY = 2.65
ALL TESTS

3.5% Subtracted from Moisture Content, Dry Density Recalculated

NOTE: Not only does a 3.5% shift in moisture content fail to bring tests inside the zero-air-voids-curve, it results in imposibly high dry densities.





NOTE: VALUES FOR DRY DENSITY ARE TYPICAL OF A RANDOM FILL SAND. ANY TESTS SHOWING MORE THAN 117% RELATIVE DENSITY WOULD BE SUSPECT IN THIS EXAMPLE. STRUCTURAL SANDS TEND TO SHOW ONLY 2 OR 3 PCF INCREASE IN MAXIMUM DENSITY AND THUS RESULTS AT MUCH LOWER RELATIVE DENSITY WOULD BE SUSPECT, SAY 105 – 110 PERCENT

FIGURE 10
CHANGE IN RELATIVE DENSITY SCALE FROM DRY TO WET METHODS OF OBTAINING MAXIMUM DENSITY, BASED ON RECENT LAB RESULTS

ATTACHMENT 12

Docket No. 50-329
Docket No. 50-330

Consumers Power Company
ATTN: Mr. Stephen H. Howell
Vice President
1945 West Parnall Road
Jackson, MI 49201

Gentlemen:

This refers to the inspection conducted by Mr. E. J. Gallagher of this office on September 11-14, 1979, of activities at the Midland Nuclear Power Plant construction site authorized by NRC Construction Permits No. CPPR-81 and No. CPPR-82 and to the discussion of our findings with Mr. B. J. Marguglio and others of your staff, and others of the Midland site staff at the conclusion of the inspection.

The enclosed copy of our inspection report identifies areas examined during the inspection. Within these areas, the inspection consisted of a selective examination of procedures and representative records, observations, and interviews with personnel.

During this inspection, certain of your activities appeared to be in noncompliance with NRC requirements, as described in the enclosed Appendix A.

This notice is sent to you pursuant to the provisions of Section 2.201 of the NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations. Section 2.201 requires you to submit to this office within thirty days of your receipt of this notice a written statement or explanation in reply, including for each item of noncompliance: (1) corrective action taken and the results achieved; (2) corrective action to be taken to avoid further noncompliance; and (3) the date when full compliance will be achieved.

Based on our telephone discussion with you on September 21, 1979, it is our understanding that the personnel performing inspections of the prestressing system whose qualifications we consider do not meet the provisions of Regulatory Guide 1.58 and ANSI N45.2.6 have been relieved from such duties until further evaluation of the requirements and further discussion with the Region III office. Please include in your response your plans to reconfirm the qualifications of other personnel performing quality control inspections on the Midland project.

DUPE OF

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In accordance with Section 2.790 of the NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations, a copy of this letter, the enclosures, and your response to this letter will be placed in the NRC's Public Document Room, except as follows. If the enclosures contain information that you or your contractors believe to be proprietary, you must apply in writing to this office, within twenty days of your receipt of this letter, to withhold such information from public disclosure. The application must include a full statement of the reasons for which the information is considered proprietary, and should be prepared so that proprietary information identified in the application is contained in an enclosure to the application.

We will gladly discuss any questions you have concerning this inspection.

Sincerely,

Gaston Fiorelli, Chief
Reactor Construction and
Engineering Support Branch

Enclosures:
1. Appendix A, Notice of Violation
2. IE Inspection Reports No. 50-329/79-19 and No. 50-330/79-19

cc w/encls:
Central Files
Reproduction Unit NRC 20b
PDR
Local PDR
NSIC
TIC
Ronald Callen, Michigan Public Service Commission
Dr. Wayne E. North
Myron M. Cherry, Chicago

RIII	RIII	RIII	RIII	RIII
Gallagher/bk	Hayes	Fiorelli	Cook	Vandel
9/24/79				

Appendix A

NOTICE OF VIOLATION

Consumers Power Company

Docket No. 50-329
Docket No. 50-330

Based on the results of an NRC inspection conducted on September 11-14, 1979, it appears that certain of your activities were not conducted in full compliance with NRC requirements as noted below. These items are infractions.

1. 10 CFR 50, Appendix B, Criterion III requires, in part, that appropriate quality standards are specified and included in design documents and that deviations from such standards are controlled.

   CPCO Quality Assurance Program Policy No. 3 states, in part, that "the assigned lead design group or organization assures that the design and material are suitable and that they comply with design criteria and regulatory requirements."

   Contrary to the above, Specification C-211, sections 8.1.2 and 8.2.4 permits the use of lean concrete as a substitute of safety-related structural backfill and compacted sand material while stating that "lean concrete shall be made of non-Q material and workmanship". This permits the use and installation of non-Q (non-safety related) material in safety-related areas without benefit of the licensee's quality assurance program. Non-Q (non-quality) lean concrete has been used in various areas of the plant fill including observed areas in the safety-related tank farm area.

2. 10 CFR 50, Appendix B, Criterion II requires, in part, that the quality assurance program provide for indoctrination and training of personnel performing activities affecting quality as necessary to assure that suitable proficiency is achieved and maintained.

   CPCO Quality Assurance Program Policy No. 2 complies with the requirements of Regulatory Guide 1.58 and ANSI N45.2.6, "Qualification of Inspection, Examination, and Testing Personnel for the Construction Phase of Nuclear Power Plants". In addition, the licensee's contractor, Bechtel Power Corporation, procedure G-8.1, section 5.2, requires specific education and experience requirements to be satisfied to be considered for certification as a Level I inspector. Those requirements include: Two years related experience or high school graduate plus one year related experience or college level work leading to associates degree in related discipline plus six months of related experience

in equivalent testing, examination or inspection activities associated with power plants, heavy industrial facilities or other similar facilities.

Contrary to the above, five QC inspection personnel performing measurings, tests and examination of the containment prestressing system were not qualified in accordance with the above prerequisites in that they had no prior related education nor prior related work experience in equivalent testing or inspection activities.

U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

REGION III

Report No. 50-329/79-19; 50-330/79-19

Docket No. 50-329; 50-330 License No. CPPR-81; CPPR-82

Licensee: Comsumer Power Company
1945 West Parnall Road
Jackson, MI 49201

Facility Name: Midland Nuclear Power Plant, Units 1 and 2

Inspection At: Midland Sice, Midland, Michigan

Inspection Conducted: September 11-14, 1979

Inspector: E. J. Gallagher 9/25/79

Approved By: D. W. Hayes, Chief 9/25/79
Engineering Support Section 1

Inspection Summary

Inspection on September 11-14, 1979 (Report No. 50-329/79-19; 50-330/79-19)
Areas Inspected: Containment prestressing system work procedures, work activities and quality records (units 1 and 2); QC inspector qualifications; status of soils work activities and 50.55(e) reports relative to containment prestressing system and concrete expansion anchors. The inspection involved a total of 27 inspector-hours by one NRC inspector.
Results: Three areas were inspected. Two items of noncompliance were identified in the areas inspected. (Infraction - inadequate design control - Paragraph 2.a; Infraction - inadequate QC personnel qualifications - Paragraph 1.c).

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DETAILS

Persons Contacted

Principal Licensee Employees (CPCO)

*B. W. Marguglio, Director Quality Assurance
*D. M. Miller, Site Manager
*T. C. Cooke, Project Superintendent
*G. T. Black, Quality Assurance Engineer
*R. Wheeler, Staff Engineer
*J. L. Corley, Section Head - IE & TV
*D. Horn, Civil QA Supervisor

Bechtel Power Company

*J. A. Rutgers, Project Manager
*W. L. Barclay, Project Quality Control Engineer
*A. J. Boos, Project Field Engineer
*W. J. Creel, Quality Assurance Engineer
*L. A. Breisback, Project Quality Assurance Engineer

*Denotes those in attendance at exit meeting.

Licensee Action on Previously Identified Items

(Closed) Noncompliance (329/79-10-01; 330/79-10-01): Inadequate control of design interfaces; (a) Specification C-2 specified material for prestressing system sheathing to conform to ASTM A-366-66 or 68 while FSAR Section 3.8.1.6.3 required ASTM A-513, type 1, Grade 1010-1020 or A-53 type E or S, Grade B. FSAR Section 3.8.1.6.3 has been revised via amendment 22 to be compatible with specification C-2 requirements. (b) Specification C-49, Section 6.2.2 specified the chemical limitations for prestressing system corrosion protective grease to be a maximum of 5 ppm chlorides, nitrates and sulphides while FSAR table 3.8-25 required 2ppm (chloride), 4ppm (nitrates) and 2ppm (sulphide). Specification C-49 has been revised via change notice 9004 to meet the commitments in the FSAR.

(Open) Unresolved (329/79-10-02; 330/79-10-02): Unavailable quality records relative to performance tests on prestressing system; items 1 and 2 of the unresolved items remains unresolved since the quality records are being researched. Item 3 relative to buttonhead rupture tests quality records were made available and reviewed for tendon V-79, V-77, V-82, V-83 and found acceptable. Items 1 and 2 will be pursued during subsequent inspections.

Functional or Program Areas Inspected

During this inspection the containment prestressing system procedures, work activities, quality records, and inspection and testing personnel qualifications were inspected. In addition, significant construction deficiencies reportable in accordance with 10 CFR 50.55(e) relative to containment prestressing system, concrete expansion anchors for component supports and site soils and settlement were reviewed.

1. Containment Prestressing System (Unit 2)

a. Procedures

The inspector reviewed the following procedures for containment prestressing work activities:

(1) C-2, Revision 12 (May 10, 1979) including FCR C-1986 (revised stressing sequence), FCR C-2046 (calibration of stressing jacks and gauge). INRYCO had approved the changes.

(2) C-2-146-9, Field Installation Manual, including FCR Nos. 2062, 2049, 2048, 2047, 2041, 2042, and 2020.

(3) PQCI-9.10, Inspection of Post-Tensioning System

(4) C-49, Revision 2, Tendon Sheathing Filler Material and FCR 2069 SCN 9003, and SCN 9004.

The inspector indicated to the licensee at the exit meeting that PQCI-9.10 had not been revised to the revised requirements of C-2-146-9. The licensee informed the inspector that the changes would be incorporated and that the QC inspectors are aware of the field changes in effect.

b. Reportable 10 CFR 50.55(e) on Prestressing Tendons

Notification in accordance with 10 CFR 50.55(e) was made by licensee on July 26, 1979 that a number of containment prestressing tendons were fabricated and shipped to the site with indeterminant wire lengths and in violation of the 1/8 inch maximum wire differential. NCAR 33 was issued on July 27, 1979 documenting the deficiency. NCR 2373 was also issued placing the 7 vertical tendons already installed in the Unit 2 containment and 10 horizontals received in storage at the site on hold.

Inspections by the licensee at INRYCO's Melrose Park, Illinois facility and Wiremill facility in Florida were performed to

investigate the cause and which facility is responsible for the fabrication of the deficient tendons. It was determined that the tendons fabricated at the Wiremill facility produced the tendon with differentiated wire due to the following reasons: (1) back tension device was switched off and not operating resulting in varying wire lengths, (2) catcher clamp was found to be damaged due to weld fatigue, and (3) limit switch had excessive travel. These three mechanical deficiencies contributed to the production of differential wires in the tendons fabricated.

A total of 38 tendons have been fabricated at the newly opened Wiremill facility. Tendons traced were as follows:

Seven verticals installed (on-hold)

Ten horizontals on-site in storage (rejected and shipped back to INRYCO)

Seven verticals (on-hold at Wiremill)

Ten horizontals (on-hold at Wiremill)

INRYCO has submitted a salvage procedure for the seven verticals installed in Unit 2. Procedure F-365-9.2 Revision 1, was currently under review and comment which proposes a method to field cut and modify to satisfy requirements.

Bechtel has performed two quality program verification surveys of the INRYCO facilities. Results are documented in QPVS No. 9Q and 10Q. In addition, a Bechtel inspector is stationed at the Wiremill facility to perform continued inspection of the tendon fabrication.

The NRC regional office will review the final 50.55(e) report upon receipt.

c. Qualifications of QC Inspectors for Prestressing Work Activity

During a May 14-17, 1979 inspection (report No. 329/79-10; 330/79-10; page 4) the NRC inspector had indicated to the licensee that none of the Bechtel QC inspectors to be assigned the inspection and testing of the containment prestressing system has any prior related work experience on prestressing systems nor construction of power facilities. At this time no work had begun on the installation of the prestressing system. The inspector, indicated that this matter would be reviewed during followup inspections.

During this inspection the matter of qualification of quality control inspection and testing personnel was once again reviewed.

The personnel qualification and training records of eleven quality control personnel were reviewed and compared to the requirements of Regulatory Guide 1.58 and ANSI N45.2.6. It was concluded that five of the individuals certified as level I inspectors were not qualified in accordance with the above standards as well as Bechtel program requirements contained in PSP-G-8.1, Qualification, Evaluation, Examination, Training and Certification of Construction Quality Control Personnel.

Section 5.2 (Education and Experience Requirements) of G-8.1 requires that one of the following requirements be satisfied in order for an individual to be considered for certification as a level I inspector:

(1) Two years related experience in equivalent testing, examination or inspection activities associated with power plants, heavy industrial facilities or other similar facilities.

(2) High school graduate and one year of related experience in equivalent testing, examination or inspection activities associated with power plants. . .

(3) Completion of college level work leading to an Associate Degree in a related discipline plus six months of related experience in equivalent testing, examination or inspection activities associated with power plants. . .

It is important to note that the above requirements are also included in Regulatory Guide 1.58 and ANSI N45.2.6 and requires education in a related discipline (i.e. technical, engineering, etc.) and prior work experience in a related field of testing, examination or inspection activities (i.e. concrete, soils, prestressing, etc.)

The personnel qualifications of five of the QC inspectors certified as level I indicated no prior related education nor prior related work experience nor prior related construction experience. A summary of the individuals qualifications are contained in Appendix I. These individuals have performed various QC inspections on the Unit 2 containment prestressing system. It is important to note that the remaining six QC inspectors have not had any prior experience with prestressing systems, however, they have had prior construction experience.

Discussions with the licensee's contractor Project Quality Control Engineer (PQCE) indicated that an attempt was made to secure fully qualified personnel through the corporate office. However, that office was unable to supply the requested personnel based on comments by the PQCE.

The licensee's contractor (Bechtel) informed the NRC inspector that Section 5.1.2 of program G-8.1 states, "The education and experience requirements specified below shall not be treated as absolute. These requirements may be altered when other factors provided reasonable assurances to the supervisor responsible for certifying a lower level candidate that the person can competently perform a particular task." The license indicated relaxation of the education and experience requirements was exercised based on the above provisions.

The inspector informed the licensee that while it was fully recognized that the requirements for education and experience are not absolute, the intent of the Regulatory Guide 1.58 and ANSI N45.2.6 was that the individual has prior related education and related experience while perhaps not the exact length of time.

The inspector indicated to the licensee that the liberal interpretation of the requirements were unacceptable and considered to be an item of noncompliance with 10 CFR 50, Appendix B, Criterion II. (329/79-19-01; 330/79-19-01)

d. Observation of Prestressing System Work Activities (Unit 2)

The inspector observed selected work activities relative to the Unit 2 prestressing system. The following specific items were observed:

(1) Tendon D124 stressing using calibrated Jack No. 1 and Gauge No. 191; Bushing ID MW-303, Beaning Plate GM-257; lock off load and tendon elongation were within predicated range.

(2) Grease tank temperature 152°F; required temperature is 140° to 210°F.

(3) Tendon D-112 stressing; Field Anchor ID MQ-120; Bearing Plate GS-136.

(4) Completed Tendon D-124 and D-312

The above work was observed to be performed according to the prescribed work procedures.

e. Quality Records for Prestressing System (Unit 2)

The following prestressing system qyality records were reviewed:

(1) Nonconformance Reports

NCR-2205 (Open) Lack of acceptance/rejection criteria for rust and bent wires on tendons H13-252 and H13-24.

NCR-2505 (Open) Tendon D-301-2 had 5 wires broken during stressing.

NCR-2372 (Open) Issued 50.55(e) on differential wire lengths.

NCR-2382 (Closed) One wire on shop-end buttonheaded but sent to site - wire repaired.

NCR-2383 (Open) Tendon H21-234 and H21-236 inspected with "E" rust status - unacceptable rust - wires pulled for testing.

The above NCR's will be reviewed when fully dispositioned by the licensee.

(2) Buttonhead Repair Log

This log tracks the buttonheads inspected and indicates the number defective and repaired in order to meet specification requirements on permissible number of buttonheads defective. Tendon V-90 indicated six buttonheads were defective after repairs made. Specification C-2 permits only four. The licensee indicated V-90 is being reviewed and repairs to be recommended by engineering.

(3) Stressing Gauge Dial Comparison

The stressing gauges are compared to a master gauge once daily. If the gauge is determined to be out of calibration the last tendon stressed is completely restressed with a calibrated gauge. The new stressing valves are then compared to the work performed with the uncalibrated gauges and evaluated to determine if other tendons require work.

Tendon D-321, V-28 and D-121 were restressed due to gauges being out-of-calibration.

(4) Field Buttonhead Records - Tendons V2-2, V3-2, V13-2, V14-2 and V54-2 were reviewed and found acceptable.

The inspector indicated to the licensee that the quality for the tendons completed to date have not been completely assembled in order to perform a complete review of each tendon. Various inspection and quality documentation is located in various files without a complete review of an individual package as required by the Field Inspection report.

The licensee indicated the completed tendon package would be assembled and reviewed prior to final acceptance of the work.

2. Review of Site Soils and Settlement

a. Backfilling Procedure

Specification C-211(Q), Revision 7, Structural Backfill, Section 8.1.2 and 8.2.4 permits the use of lean concrete in lieu of structural backfill and sand backfill material. This specification is used for placement of safety-related soils. The above sections state, "Lean concrete shall be made of non-Q (non-safety related) material and workmanship."

The inspector observed lean concrete material placed adjacent to the borated water storage tanks in the tank farm area which is designated as a safety-related "Q" area. The licensee informed the inspector that previously placed lean concrete material in safety-related areas were also designated and placed as non-safety related material.

10 CFR 50, Appendix B, Criteria III requires that appropriate quality standards are specified and that deviations from such standards are controlled. Contrary to the above, materials being used in safety-related structures were specified and permitted to be of non-safety related material and workmanship. The quality assurance program has not provided control over this safety-related work activity.

This is considered an item of noncompliance with 10 CFR 50, Appendix B, Criterion III (329/79-19-02; 330/79-19-02)

b. Placement of Soils

Specification C-211, Section 8.3.1 requires that equipment being used to compact soils be qualified prior to use. Quality control initiated NCR 2492 on August 30, 1979 due to Bechtel

construction use of an unqualified type of handheld compaction equipment ("po-go stick") in safety-related "Q" areas. The Bechtel project field engineer dispositioned the NCR as not being valid while being aware of the specification requirement.

The "po-go stick" was again later used in safety-related areas. Bechtel QA department subsequently issued Stop work report No. 6 for use of such equipment until such time that the nonconformance was resolved.

The licensee has indicated that Bechtel Geotech has directed the field to qualify the equipment as required prior to any further use.

The NRC inspector questioned the licensee why the project field engineer was permitted to disposition the NCR as invalid and again permit the use of the equipment in violation of the requirements. The licensee indicated that the quality management personnel would take appropriate action to preclude such events and that QA acted promptly in issuing the stop work report.

c. Status of Site Settlement

The surcharge load in and around the diesel generator building has been removed as of the end of August, 1979. Soil response to the removal of the surcharge is being monitored. Discussion with the licensee, Bechtel Geotech and DR. Dunnicliff indicated that the soil has rebound approximately 3/16 of an inch; expected rebound is predicted to be on the order of 1/2 inch or less.

Temporary dewatering system in the vicinity of the Unit 1 and 2 valve pits have been installed, however no pumping or drawdown of the ground water had begun at the time of this inspection.

Pile tests are being planned in the vicinity of the service water pumphouse structure. Tests are to begin in early October by Bechtel Consultants.

Excavation of soft-material in the borated water storage tank farm was in progress with placement of sand material inside and around the tank foundations. Sand was being placed using qualified handheld compaction equipment to 85% relative density for support of structures and 80% relative density for areas other than under structures.

3. Review of 50.55(e) on Concrete Expansion Anchors

Specification C-305, Revision 9, Section 6.2.2 requires shell type expansion anchors to be tension tested to the specified loads. In

addition, in-process inspection is required. Because in-process inspection had not always been performed it was requested to randomly select 60 anchors to verify adequacy of past installations.

After testing 32 of the anchors, the results indicated nine failures where the anchor slipped prior to achieving the test load. At this time MCAR 34 was issued on August 21, 2979. Results are documented on NCR-2461 and NCR-2481.

Engineering requested another 100 anchors to be inspected (TWX-5383 dated August 24, 1979) for proper setting and tension tests. The results of the additional tests are documented on QCFM-6560/AI-667 dated September 6, 1979. Visual results indicate 20 acceptable and 82 unacceptable (i.e. not fully set). Twenty-three (23) could be reset. Sixty (60) 3/8 inch anchors were tension tested of which two failed while 37 1/2 inch and five 5/8 inch were tensioned and found acceptable.

The licensee indicated that approximately 900 of the shell type anchors have been installed prior to identifying the deficiency. Because of the above information the licensee reported the deficiency in accordance with the requirements of 10 CFR 50.55(e).

The licensee is continuing to evaluate the results of the testing and what corrective action is required to resolve the deficiency. The final 50.55(e) report will be reviewed upon receipt by the NRC.

Exit Interview

The inspector met with the licensee representatives (denoted under Persons Contacted) on September 14, 1979. The inspector summarized the scope and findings of the inspection. The findings were also discussed via telephone with Mr. B. Marguglio and management of RIII NRC on September 17, 1979. The licensee acknowledged the findings as reported.

Attachment: Appendix I

APPENDIX I

PRESTRESSING SYSTEM QC PERSONNEL QUALIFICATIONS

Individual	Bechtel Employee	Certified Level 1	Related Education	Related Experience	On-Site Training	Areas of Inspection
A	7-12-79	8-6-79	none-high school	none-janitor, cook, IGA	25 hours	Tendon insertion, buttonheading, stressing, greasing (1st shift)
B	7-12-79	8-6-79	none-high school	none-Ramada Inn, printer	23 hours	Tendon insertion, buttonheading, stressing, greasing (1st shift)
C	7-12-79	8-6-79	none-3 year college	none-student last	26 hours	Tendon insertion, buttonheading, stressing, greasing(2nd shift)
D	7-16-79	8-6-79	none-B. A. Business	none-student last	26 hours	Tendon insertion, buttonheading, stressing, greasing (1st shift)
E	7-12-79	8-6-79	none-high school	none-bar tender	28 hours	Terminated on 8-10-79

ATTACHMENT 13

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

OCT 16 1979

Docket Nos. 50-329
and 50-330

APPLICANT: Consumers Power Company

FACILITY: Midland Plant, Units 1 & 2

SUBJECT: SUMMARY OF JULY 18, 1979 MEETING ON SOIL DEFICIENCIES AT THE MIDLAND PLANT SITE

On July 18, 1979, the NRC staff met in Bethesda, Maryland with Consumers Power Company and the Bechtel Corporation to discuss deficiencies in the fill used at the site for Midland Plant, Units 1 & 2. Also present were representatives of the ACRS staff. Meeting attendees are listed in Enclosure 1.

In response to NRC requests, the applicant has documented in detail the presentations given during this meeting. The presentations are contained in S. H. Howell's letter to J. G. Keppler dated August 10, 1979. In view of the August 10, 1979 letter, no summary of the presentations is contained herein. Rather, additional discussion consisting of comments and questions given during and following the presentations are summarized.

During the presentation regarding remedial work in progress or planned (item 3 of the presentations), the staff noted that underground piping from the borated water storage tanks and service water lines pass under railroad tracks, and that these and other piping are subject to loads due to construction cranes and other traffic. The staff requested the applicant to describe the design features and other measures which assure that such piping is not subjected to excessive loads. The applicant will respond at a later date.

The applicant noted that it is performing laboratory investigations of the stainless steel piping removed from the condensate storage tank. This underground piping was found to be heavily corroded. It was noted that the injection piping from BWST is of the same composition and is also unprotected from electro-chemical attack. The test-pits in the tank farm area which are being dug to investigate the effect of the air discharged from underground pneumatic lines was also described. Results will be reported shortly.

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The staff noted that the response to its 10 CFR 50.54 requests for acceptance criteria for remedial actions (e.g., questions 4, 6, etc.) had not resulted in identification of criteria in advance of the remedial action. Rather the reply notes that the criteria will be determined during or after the remedial action. The staff stated that this approach by the applicant does not provide for timely staff feedback at the outset, but rather the staff must await results of the program to determine what acceptance criteria were used and if they are acceptable. Thus, the remedial action is being conducted entirely at the applicant's own risk.

The applicant's presentation of the permanent site dewatering system (presentation item 3.3) noted that the system is not designed to seismic Category I requirements, but that the monitoring aspects of the system are safety grade. The NRC staff noted that acceptance criteria for the dewatering system are given in the Standard Review Plan (Section 2.4.13, Revision 1) and requested that the applicant address Branch Technical Position HMB/GSB 1, "Safety Related Permanent Dewatering Systems", Revision 1, attached thereto. The applicant will respond in the near future. The quality assurance plan for implementing the dewatering system will also be provided in future reports.

Bechtel described the structural and seismic analytical investigations being performed or planned for the affected structures (item 4 of the presentations). The staff noted that further review of the acceleration (g) value used for site design has been impacted by staff manpower restructuring for the TMI-2 investigations and that use of outside contractors for the Midland seismic review is presently being considered. The staff also noted that its present review indicates some areas of disagreement with the applicant's proposed loads combinations and design criteria for SSE and differential settlement, and with the treatment of cracks in structural walls. The staff will further document these and other positions at a later date.

Bechtel reported (item 7 of the presentations) the results of its investigations into the cause of insufficient compaction of the plant area fill, and identified five causes considered to be the most probable. The applicant noted its agreement with the Bechtel findings. Bechtel noted that personnel were not included as a most probable cause because its review of qualifications and experience of both Bechtel and US Testing personnel had shown presence of sufficient education, experience, and training to carry out the tasks assigned. The NRC staff noted that it disagrees with Bechtel's finding that personnel qualification was not a probable cause, and stated that further review of the basis for this Bechtel finding will be needed.

Staff comments regarding the QA/QC aspects (presentation item 8) were based upon the applicant's 10 CFR 50.54(f) responses to question 1 by letter of April 24, 1979:

(1) The applicant's response in item B.1 of Appendix I (page I-3) states its conclusion that "Specifications C-210 and C-211 provide sufficient criteria by which to ensure that the fill is adequately placed to prevent excessive settlement." The staff noted its disagreement with this statement. The staff noted, for example, that its I&E investigations show that the specifications did not require qualification of equipment used to compact material, the lift thicknesses permitted were excessive for adequate compaction, the moisture control was unclear and the compactive effort to develop 95% of compaction was internally in conflict within Specification C-210.

(2) The applicant's response in item B.2 of Appendix I (page I-3) noted that letters, TWX's, telecons, and memoranda are often used to clarify the intent of the specifications, and that "it is possible" that in some situations the clarification provided through such methods may have modified the specification without formally changing the wording of the specifications. The staff commented that a more positive statement appears to be warranted based upon the findings of I&E. Numerous examples where telecons and memoranda were used to change the requirements of the specifications without revising the controlled document itself was cited in I&E Inspection Report No. 50-329/78-20 and 50-330/78-20. I&E found that not only did these memoranda change the requirements of the specifications, but in some instances, conflicted with previous engineering directives.

(3) The staff noted that its review of QA aspects was continuing and that further requests for information would be issued.

At the conclusion of the presentations, the NRC staff noted that the information presented was significant to the present review, and requested that the applicant document and submit its presentations, including copies of the viewgraph slides used.

Darl Hood, Project Manager
Light Water Reactors Branch No. 4
Division of Project Management

Enclosure:
As stated

cc: See next page

ENCLOSURE 1

ATTENDEES

July 18, 1979

Consumers Power Company

G. S. Keeley
D. E. Horn
T. Thiruveneadam
T. C. Cooke

NRC:NRR

D. S. Hood
D. M. Gillen
R. E. Lipinski
J. Gilray
F. Schauer
L. Heller
L. S. Rubenstein

NRC:OZLD

R. Hoefling

NRC:IE

D. W. Hayes
G. Gallagher
J. B. Henderson

ACRS

D. Zukor
P. Tam

Bechtel*

T. E. Johnson (BPC)
P. A. Martinez (BPC)
K. Wiedner (BPC)
D. Riat (AA)
W. R. Ferris (SF)
H. Wahl (AA)
A. B. Arnold (SF)
B. Dhar (AA)
F. J. Hsiu (AA)
S. S. Afifi (AA)
G. Richardson (BPC)
A. J. Boos (BPC)
J. R. Davie (G)

Bechtel Consultants

R. B. Peck
R. Loughney
C. H. Gould

* BPC = Bechtel Power Corporation
AA = Ann Arbor, Michigan
SF = San Francisco, Calif.
G = Gaithersburg, Md.

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

SECTION 1.0, NRC QUESTION

SUPPLEMENTAL REQUEST FOR ADDITIONAL SOILS SETTLEMENT INFORMATION

23. We have reviewed your response to question 1 of our March 21, 1979 letter, "10 CFR 50.54 Request Regarding Plant Fill," including related amendments or supplements in your letters dated May 31, July 9, and August 10, 1979. We find that the information provided is not sufficient for completion of our review. Accordingly, provide the following additional information:

(1) Your response to question 1a does not provide sufficient information relative to the root causes of the 13 deficiencies. In order to determine the acceptability of corrective actions for the 13 deficiencies considering the possibility that these deficiencies are of a generic nature that could affect other areas of the facility, a more complete understanding of the root cause of each deficiency is necessary. Accordingly, provide a clearer description of the root causes of each of the 13 deficiencies, including a detailed discussion of the conditions that existed to allow these deficiencies and the changes that have been made to preclude the recurrence of such deficiencies. In this regard, if contributing causes are inadequate procedures, inspections, specification call outs, design reviews, audits, and/or technical direction, a clear and detailed description is necessary as to what allowed these conditions to exist and why.

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

SECTION 2.0, INTRODUCTION

2.1 General

Subsections 3.1 through 3.13 of this Response to Question 23, Part (1) provide information supplementing our Responses to the NRC 10 CFR 50.54(f) Request Regarding Plant Fill for Midland Plant Units 1 and 2, Consumers Power Company Docket Numbers 50-329 and 50-330, transmitted from CPCo (S.H. Howell) to the NRR (H.R. Denton) on April 24, 1979 and our presentation to the Staff given on July 18, 1979, in Bethesda, Maryland, and documented via our transmittal from CPCo (S.H. Howell) to I&E (J.G. Keppler) on August 10, 1979. This introduction provides the rationale for determining the root cause of each of the 13 deficiencies identified through the investigations by the NRC, CPCo, and Bechtel; comments concerning the significance of the 13 deficiencies; and an explanation of the format used in addressing each deficiency.

In arriving at the root cause, the following factors were considered.

a. The purpose of the quality assurance program is to provide confidence that quality-related activities are performed in a controlled manner such that the product conforms to the FSAR and design requirements.

b. The control measures applicable to the performance of the quality-related tasks are to provide sufficient direction and methodology to supplement the capability of the assigned personnel.

c. Personnel assigned the responsibility of performing the quality-related tasks are to have the required capability, knowledge, and skill (when supplemented by specifications, drawings, procedures, instructions, and the prescribed control measures) to satisfactorily perform their assigned responsibilities.

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d. As the quality assurance program develops and is implemented, revisions or corrections will be necessary to:

1. Achieve the optimum balance or relationship between personnel capabilities and the prescribed control measures

2. Accommodate unique or unplanned events

3. Incorporate related experience and state-of-the-art improvements

The 13 deficiencies identified through investigations by Bechtel, CPCo, and the NRC are each addressed with the same intensive effort, irrespective of their contribution to the cause of the settlement. The relative contribution that each deficiency made to the settlement can be qualitatively derived from Sections 7.0 (Cause Investigation) and 8.0 (Quality Assurance and Quality Control Aspects) of the documentation transmitted on August 10, 1979. Essentially, this documentation pointed out that the most probable causes of the settlement were as follows:

a. In some cases, lift thickness exceed the capability of the equipment being used. This was shown by the lift thickness/compactive effort tests conducted to qualify compaction equipment prior to resuming soils work. This indicates that the equipment was not adequately qualified.

b. Reliance on soil test results, or on the evaluation of the test results, provided a common mode failure mechanism because:

1. Construction relied on test results, or on the evaluation of the test results, from inprogress placements for qualification of equipment during the work.

2. Quality Control depended on the results, or on the evaluation of the results, of in-place soils tests for acceptance of the work. Associated with this principal reliance, surveillance type inspection procedures were applied to other soils work activity in the power block at least part of the time.

Therefore, deficiencies most closely associated with these two probable causes would bear the most significant contribution to settlement.

2.2 Definitions

The following information is provided to achieve a common understanding of the terms used and information included in Part (1) of this Response to Question 23.

Title: This identifies the information as being in response to the applicable part of Question 23 under 10 CFR 50.54(f), transmitted from the NRR (L.S. Rubenstein) to CPCo (S.H. Howell) on September 11, 1979.

Deficiency Description: This provides a restatement of the reported deficiency as originally stated in the CPCo response referenced below.

I&E Report Reference: This identifies the pages of Inspection Report 78-20 which bear upon the reported deficiency.

CPCo Response Reference: This identifies the portion of the CPCo (S.H. Howell) letter to the NRR (H.R. Denton), Serial Howe-121-79, Appendix I, dated April 24, 1979, which provided the original response.

Discussion: This provides background information relative to the reported deficiency as it relates to the implementation of the Quality Assurance Program.

Quality Assurance Program Criterion: This identifies, by title, the Quality Assurance Program criterion, listed in Appendix B to 10 CFR 50, which is applicable to the reported deficiency and the identified root cause.

Program Element: This identifies the program element, governed by the criterion, which is applicable to the reported deficiency and the identified root cause.

Quality Assurance Program Policy: This identifies the Nuclear Quality Assurance Manual, Job 7220 section and number which define the related Quality Assurance Program Policy. The Manual identifies requirements and assigns responsibility for developing and implementing control measures for performing related quality assurance activities.

Control Document: This identifies the current control document developed and implemented by the organizations assigned the responsibility for performing the quality assurance activities under their cognizance.

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Instructions, Procedures, and Drawings: This identifies the instructions, procedures, and drawings which are prepared to supplement the control documents when it is necessary to provide more specific direction and methodology. This information is provided only when this level of subtier document is pertinent to the deficiency being discussed.

Root Cause: This identifies the root cause, for the reported deficiency described under "Discussion."

Remedial Action (Soils): This describes the actions taken or to be taken as a result of the reported deficiency which are needed to assure that prior and future soil placements conforms to the quality requirements defined in the FSAR and design documents.

Corrective Action (Programmatic): This describes the actions taken or to be taken to correct the root cause in the policies, procedures, and instructions in order to prevent recurrence of a similar type of deficiency.

Corrective Action (Generic): This describes the actions taken or to be taken when root causes are potentially generic to work other than soils work. The actions are to assure that the same deficiencies do not exist or, if found to exist on completed work, are investigated to the extent necessary to assure that the work conforms to quality requirements defined in the FSAR and design documents and that the work quality is evidenced in the quality records.

In view of your comments during our presentation to the NRC Staff on September 5, 1979 in Bethesda, Maryland, during which we presented some of this information, please note the added emphasis that we have placed on communicating both the programmatic and generic corrective actions.

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

SECTION 3.0, DISCUSSION AND EVALUATION

3.1 Category I, Item 1

Deficiency Description: Inconsistency between specifications and the Dames & Moore Report

I&E Report Reference: Pages 9, 10, 16, and 17

CPCo Response Reference: Category I, Item 1

Discussion: A number of consultant reports were added to the PSAR as appendixes. The reports contained considerable and sometimes conflicting information. The information contained in the consultant reports was subject to being misconstrued as commitments. The personnel who reviewed and provided input for the PSAR did not provide documented disposition of the Dames & Moore Report recommendations to identify those recommendations which were PSAR commitments and those which were not.

Quality Assurance Program Criterion: Design control

Program Element: Design input

Quality Assurance Program Policy: Nuclear Quality Assurance Manual, Section II, Number 2, "Design Control Procedure" (April 1978); and Section II, Number 4, "Design Criteria" (March 1974)

Control Document: Engineering Department Procedure 4.22, Revision 1, "Preparation and Control of SAR" (June 1974)

Root Cause: During the preparation and early revisions of the PSAR there were no procedural requirements or methods for documenting the disposition of consultant recommendations in the PSAR.

Remedial Action (Soils): The Dames & Moore Report was reviewed and recommendations were identified and dispositioned. Dames & Moore recommendations which were included in the FSAR were unaffected by this review and no revisions to the FSAR were necessary as a result of this review. However, as a result of other activities, changes were made in design and construction documents which relate to some subjects covered in the Dames & Moore Report.

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Corrective Action (Programmatic): Engineering has revised Engineering Department Procedure 4.22 to clarify that Engineering personnel preparing the FSAR will follow the requirements of Regulatory Guide 1.70, Revision 2, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants" (September 1975). Specifically, Regulatory Guide 1.70 (Pages iv and v of the Introduction) requires that such consultant reports only be referenced with the applicable commitments and supporting information included in the text (third paragraph, Page v). Such a requirement precludes repetition of this circumstance. | 8

Corrective Action (Generic): Consultant reports other than Dames & Moore were considered in accordance with the guidelines provided in NRC Regulatory Guide 1.70, Revision 2. Consultant reports were not attached to the FSAR, but portions of consultant reports were extracted and incorporated into the FSAR text itself. Those portions incorporated into the FSAR become commitments. Therefore, disposition of recommendations in consulting reports has been adequately accounted for in the preparation of the FSAR.

Verification that those portions of consultant reports determined to be commitments and incorporated into the FSAR have been adequately reflected in project design documents has been accomplished via the FSAR rereview program described in the response to Question 23, Part (2). | 10

The two Bechtel QA audit findings reported in our April 24, 1979, response (Paragraph D.1, Page I-8) have been closed out. The results of this audit are being utilized in the FSAR control system study committed to in Subsection 3.3 of this response to Part (1).

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

3.2 Category I, Item 2

Deficiency Description: Lack of formal revisions of specifications to reflect clarification of specification requirements

I&E Report Reference: Pages 9 through 14

CPCo Response Reference: Category I, Item 2

Discussion: Interoffice memoranda, memoranda, telexes, TWXs, etc were often used to clarify the intent of the specifications. It is possible that in some situations the clarifications provided through these methods were interpreted by the user as modifying the specification without formally changing the wording of the specification.

Quality Assurance Program Criterion: Design control

Program Element: Design change control

Quality Assurance Program Policy: Nuclear Quality Assurance Manual, Section II, Number 5, "Design Process and Change Control" (June 1977)

Control Document: Engineering Department Project Instruction 4.49.1, Revision 3, "Specification Change Notice" (May 1979)

Root Cause: Prior to Revision 2 (May 4, 1979), Engineering Department Project Instruction 4.49.1 did not address the use of interoffice memoranda, memoranda, telexes, TWXs, etc which might be interpreted by the user as modifying the requirements of the specification.

Remedial Action (Soils): Applicable Specifications 7220-C-210 and 7220-C-211 were revised to incorporate interpretations that affected specification requirements. The acceptability of the completed work was independently determined by a subsequent subsurface investigation program.

Corrective Actions (Programmatic):

1. On April 3, 1979, Midland Project Engineering Group Supervisors in all disciplines were reinstructed that the only procedurally correct methods of implementing specification changes are through the use of specification revisions or Specification Change Notices. This was followed by an interoffice memorandum from the Project Engineer to all Engineering Group Supervisors on April 12, 1979.

2. Engineering Department Project Instruction 4.49 was revised in Revision 2 to state, "Under no circumstances will interoffice memoranda, memoranda, telexes, TWXs, etc be used to change the requirements of a specification."

Corrective Action (Generic): A review of interoffice memoranda, memoranda, telexes, TWXs, and other correspondence relating to specifications for construction and selected procurements of Q-Listed items will be initiated.

The purpose of the review will be to identify any clarifications which might reasonably have been interpreted as modifying a specification requirement and for which the specification itself was not formally changed. An evaluation will be made to determine the effect on the technical acceptability, safety implications of the potential specification modification, and any work that has been or may be affected. If it is determined that the interpretation may have affected any completed work or future work, a formal change will be issued and remedial action necessary for product quality will be taken in accordance with approved procedures.

The foregoing procedure will be followed for all specifications applying to construction of Q-Listed items.

For specifications concerning the procurement of Q-Listed items, the foregoing procedure will be implemented on a random sampling basis. The sample size has been established and the specification selection has been made.

Review and acceptance criteria for the specifications have been defined.

The review of the initially selected procurement specifications indicated that the acceptance criteria were not met in one discipline. The review was expanded to 100% of the specifications in that discipline (both construction and procurement specifications), and for the other disciplines the sample of procurement specifications was increased to permit each discipline's review to be evaluated individually.

This expanded review is scheduled to be completed by June 5, 1981.

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

3.3 Category I, Item 3

Deficiency Description: Inconsistency of information within the FSAR relating to diesel generator building fill material and settlement

I&E Report Reference: Pages 6 through 8

CPCo Response Reference: Category I, Item 3

Discussion: When the FSAR was prepared and reviewed, the major backfill operations were complete. There were no known inconsistencies or recent design document changes related to FSAR Subsections 2.5.4 and 3.8.5; therefore, these subsections were essentially inactive and were not subject to any further review. The inconsistencies within the FSAR and between the FSAR and design documents were not detected. The inconsistency between Subsections 2.5.4 and 3.8.5 with respect to the settlement values resulted because the two subsections were prepared by separate organizations (Geotechnical Services and Civil Engineering), neither of which were aware of the multiple display of similar information in the opposite subsection. The inconsistency between FSAR Subsection 2.5.4 and the project design drawing (Drawing 7220-C-45) with respect to the fill material resulted because at the time of FSAR preparation the Geotechnical Services personnel preparing the FSAR were unaware, in this case, of the status of the design drawing prepared by Civil Engineering.

Quality Assurance Program Criterion: Design control

Program Element: Design input

Quality Assurance Program Policy: Nuclear Quality Assurance Manual, Section II, Number 4, "Design Criteria" (March 1974)

Control Documents: Engineering Department Procedure 4.22, Revision 1, "Preparation and Control of Safety Analysis Reports" (June 1974); Engineering Department Project Instruction 4.25.1, Revision 6, "Design Interface Control (Internal)" (September 1979); and Engineering Department Project Instruction 4.1.1, Revision 0, "Preparation of the Design Requirements Verification Checklist" (July 1974)

Root Cause: The control document did not provide sufficient procedural control for preparation and review of the FSAR.

RESPONSE TO QUESTION 23, PART (1) 50.54(f)

Remedial Action (Soils): The inconsistencies between FSAR Subsections 2.5.4 and 3.8.5 have been corrected via FSAR Revision 18 (February 28, 1979). The same revision also corrected the inconsistency between FSAR Subsection 2.5.4 and Design Drawing C-45.

Corrective Actions (Programmatic):

1. A study was completed which examined current procedures and practices for the preparation and control of the FSAR in view of these experiences. Procedural changes have been initiated by the revision of or addition to the Engineering Department Procedures. | 8

| 8

2. To preclude any future inconsistencies between the FSAR and specifications, Engineering Department Project Instruction 4.1.1 has been revised to state that all specification changes, rather than just "major changes," will be reviewed for consistency with the FSAR. | 8

| 8

Corrective Action (Generic): FSAR sections have been rereviewed as discussed in the Response to Question 23, Part (2). | 10

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

3.4 Category I, Item 4

Deficiency Description: Inconsistency between basis for settlement calculations for diesel generator building and design basis

I&E Report Reference: Pages 20 and 21

CPCo Response Reference: Category I, Item 4

Discussion: The initial settlement calculations were performed by Geotechnical Services based on preliminary information provided by Project Engineering. The final diesel generator building foundation design configuration (as described in the FSAR) was different from the preliminary information. The originator of the final design configuration did not interface with Geotechnical Services to verify impact on final settlement calculations. It was subsequently determined that the change in foundation design would have an insignificant effect on the calculation. However, no changes or notations to the original calculations were made, thus resulting in an inconsistency between the basis for settlement calculations and design basis.

Quality Assurance Program Criterion: Design control

Program Element: Design coordination

Quality Assurance Program Policy: Nuclear Quality Assurance Manual, Section II, Number 2, "Design Control Procedures" (April 1978); Section II, Number 9, "Design Interface" (March 1974); and Section II, Number 10, "Speciality Group Design Control" (June 1977)

Control Documents: Engineering Department Procedure 4.22, Revision 1, "Preparation and Control of Safety Analysis Reports" (June 1974); Engineering Department Project Instruction 4.25.1, Revision 6, "Design Interface Control (Internal)" (September 1979); Procedure FP-6437-1, "Design Calculations" (January 1979); and Engineering Department Procedure 4.37, Revision 2, "Design Calculations" (May 1976).

Root Causes:

1. Diesel generator building foundation design changes initiated by Project Engineering were not coordinated with Geotechnical Services, as required by the control documents.

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

2. Geotechnical Procedure FP-6437 did not require that the calculations show evidence of any evaluations for changes to input data, even when considered to be of no significance to the results.

Remedial Action (Soils): Settlement calculations will be revised after the completion of the diesel generator building surcharge operation. At that time, the design drawing will be coordinated with Geotechnical Services and any changes or notations needed to reflect design changes will be made.

Corrective Actions (Programmatic):

1. An interoffice memorandum dated April 12, 1979, was issued by Geotechnical Services to alert personnel of the need to revise or annotate calculations to reflect current design status.

2. In view of the above, Geotechnical Services has revised Procedure FP-6437 to require that calculations be annotated to reflect current design status. | 8

3. Engineering Department Procedure 4.37 has also been revised to require that calculations be annotated to reflect current design status. | 8

Corrective Action (Generic): This is considered an isolated case and not generic based on Quality Assurance audits of Geotechnical Services conducted in February and August 1979. The results of these audits indicate that this area is effectively controlled. Quality Engineering surveys and Quality Assurance monitorings will verify future coordination of design documents by Geotechnical Services and Project Engineering.

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

3.5 Category I, Item 5

Deficiency Description: Inadequate design coordination in the design of the duct bank

I&E Report Reference: Pages 23 and 24

CPCo Response Reference: Category I, Item 5

Discussion: Four vertical duct banks were designed and constructed without sufficient clearance to allow for relative vertical movement between the duct banks and the building footings. Civil Drawings 7220-C-1001 and 7220-C-1002 (which show the footing requirements) were coordinated with Electrical Drawing 7220-E-502 (which shows the duct bank stub-up location and dimensions), as required by Engineering Department Procedure 4.46 and Engineering Department Project Instruction 4.25.1. Drawing 7220-E-502 refers to Drawing 7220-E-543, which shows a minimum size for the underground duct bank some distance away from the stub-up. Neither electrical nor civil drawings show how or where to accomplish the transition from the stub-up size to the underground duct size, nor do they show firm definition of duct size. The transition and final size of each duct were established by the Field Engineers during construction. The civil design was based on the stub-up dimensions shown in Drawing 7220-E-502, and did not acknowledge that the duct bank size under the slab and/or footing was to be determined by Field Engineering.

Quality Assurance Program Criterion: Instructions, procedures, and drawings

Program Element: Preparation of drawings

Quality Assurance Program Policy: Nuclear Quality Assurance Manual, Section II, Number 2, "Design Control Procedures" (April 1978); and Section II, Number 9, "Design Interface" (March 1974)

Control Documents: Engineering Department Procedure 4.46, Revision 3, "Project Drawings" (May 1976) and Engineering Department Project Instruction 4.25.1, Revision 6, "Design Interface Control (Internal)" (September 1979)

Instructions, Procedures, and Drawings: Electrical Standard Detail Drawings and Civil Standard Detail Drawings

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

Root Cause: Failure of the drawings to provide Construction with the information necessary to prevent interference.

Remedial Actions (Soils):

1. Provisions were made to allow independent vertical movement between the diesel generator building and the duct banks.

2. Bechtel Project Engineering has reviewed the design drawings for cases where ducts interface with structures to determine the possibility of the duct being enlarged over the design requirements and the effect this enlargement may have upon the structures' behavior. Forty-four individual or groups of similar buried electrical duct banks were reviewed. The terminations of each case were reviewed, resulting in the identification of 23 questionable vertical interfaces. Based on geometry, depth of vertical leg, and whether sufficient details were available on the design drawing, 11 cases were identified for detailed investigation. Additional information was obtained from the jobsite to define how the interface was constructed and whether any unusual behavior existed.

   The review concluded that several nonsafety-related transformer pads experiencing differential settlement may be exaggerated by the duct bank interface. However, in no case except the diesel generator building has settlement been completely restricted or do details, geometry, or subgrade conditions indicate that settlement would be completely restricted.

Corrective Actions (Programmatic):

1. Civil/Structural Design Criteria 7220-C-501 has been modified to contain the requirement that a duct bank penetration shall be designed to eliminate the possibility of the nonspecific size duct interacting with the structures. | 10 | 10

2. The civil standard detail drawings have been revised to include a detail showing horizontal and vertical clearance requirements for duct bank penetrations. The detail addresses any mud mat restrictions. | 8 | 8

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

Corrective Action (Generic): This condition is not considered generic, but rather an anomaly unique to electrical duct banks. The uniqueness arises from the practice of not pinpointing the size or location of the duct bank on the drawings and leaving it to be established during construction.

3.6 Category II, Item 1

Deficiency Description: Insufficient compactive effort used in backfill operation

I&E Report Reference: Not applicable

CPCo Response Reference: Category II, Item 1

Discussion: Specifications 7220-C-210 and 7220-C-211 specified requirements for selection and approval of compaction equipment on the basis of demonstration. The equipment was used on the basis of achieving either satisfactory in-place test results or satisfactory evaluation of the test results. There were no field control documents or procedures to define requirements for the qualification of soils compaction equipment. There were no control documents to govern the requirements for control measures pertaining to soils placement and compaction. Construction and Quality Control relied on in-place soil test results, or on the evaluation of these results, to determine the acceptability of placement and compaction activities. These soil test results or their evaluations were in error in numerous cases.

Quality Assurance Program Criterion: Instructions, procedures, and drawings

Program Element: Preparation of instructions, procedures, and drawings

Quality Assurance Program Policy: Nuclear Quality Assurance Manual, Section IV, Number 1, "Construction Site Quality Program" (April 1978); and Section V, Number 13, "Procedure Control" (June 1977)

Control Document: Field Procedure FPG-1.000, "Initiating and Processing Field Procedures, Instructions, and Specifications" (January 1979)

Instructions, Procedures, and Drawings: Field Instruction FIC 1.100, Revision 0, "Q-Listed Soils Placement Job Responsibilities Matrix" (July 1979)

Root Causes:

1. Reliance was placed on in-place test results, or on the evaluation of the test results, for evaluating compaction equipment. Satisfactory soil test results, or evaluations of test results, implied that adequate compactive effort was obtained and equipment capability and fill placement methods were not questioned. (Incorrect soils test results are addressed in Subsection 3.10.)

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

2. The Quality Assurance Program requirement to establish responsibility for measures to control the placement and compaction of soils and the qualification of construction equipment was not adequately implemented.

Remedial Actions (Soils):

1. Compaction equipment currently in use has been qualified and Construction has been notified of the parameters governing the use of the equipment.

2. Project Quality Control Instruction (PQCI) C-1.02 was revised to include verification of the use of qualified equipment and compliance with qualified procedures.

Corrective Actions (Programmatic):

1. Field Instruction FIC 1.100, "Q-Listed Soils Placement Job Responsibilities Matrix," has been prepared and establishes responsibilities for performing soils placement and compaction.

2. Field Instruction 1.100 has been supplemented by establishing requirements for demonstrating equipment capability, including responsibility for equipment approval, and providing records identifying this capability. | 8 | 8

3. Quality Assurance has issued a Nuclear Quality Assurance Manual amendment to clarify the requirement that procedures include measures for qualifying equipment under specified conditions. | 10 | 10

4. Engineering clarified specifications and Construction prepared procedures (governing the soils compaction equipment) to implement the requirements of the Nuclear Quality Assurance Manual as stated in Item 3 (above). | 10 | 8 | 10

Corrective Action (Generic): Construction specifications, instructions, and procedures were reviewed to identify any other equipment requiring qualification which has not yet been qualified. No such equipment was identified.

3.7 Category II, Item 2

Deficiency Description: Insufficient technical direction in the field

I&E Report Reference: Pages 24 through 26

CPCo Response Reference: Category II, Item 2

Discussion: The Dames & Moore Report and Civil/Structural Design Criteria 7220-C-501 state, in part, "Filling operations shall be performed under the technical supervision of a qualified Soils Engineer...." The technical direction and supervision were provided by Field Engineers and Supervisors who were assigned the responsibility for soils placement. The technical direction and supervision provided were not properly deployed to overcome the lack of documented instructions and procedural controls. Reliance on test results, or on the evaluations of test results, did not identify the need for additional direction and supervision.

Field Procedure FPG 3.000, "Job Responsibilities of Field Engineers, Superintendents, and Field Subcontract Engineers," was not intended to provide instructions for the performance of specific tasks and functions.

Quality Assurance Program Criterion: Instructions, procedures, and drawings

Program Element: Preparation of instructions, procedures, and drawings

Quality Assurance Program Policy: Nuclear Quality Assurance Manual, Section IV, Number 1, "Construction Site Quality Program" (April 1978); and Section V, Number 13, "Procedure Control" (June 1977)

Control Document: Field Procedure FPG 3.000, "Job Responsibilities of Field Engineers, Superintendents, and Field Subcontract Engineers" (October 1977)

Instructions, Procedures, and Drawings: None

Root Cause: Reliance on test results, or on the evaluations of test results, and surveillance by Quality Control instead of providing sufficient technical direction through documented instructions and procedural controls. (Incorrect Soil Test Results are addressed in Subsection 3.10).

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

Remedial Action (Soils): One fulltime and one parttime onsite Geotechnical Soils Engineer have been assigned. These engineers provide technical d' ction and monitoring of the process.

Corrective Action (Programmatic): Field Instruction FIC 1.100, "Q-Listed Soils Placement Job Responsibilities Matrix," has been prepared and establishes responsibilities for performing soils placement and compaction.

Corrective Action (Generic): Design documents, instructions, and procedures for those activites requiring inprocess controls will be reviewed to assess the adequacy of existing procedural controls and technical direction. Engineering review has been completed, and Field Engineering and Quality Control review is scheduled for completion by February 27, 1981. Any revisions required will be completed by April 17, 1981. 10

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

3.8 Category III, Item 1

Deficiency Description: Inadequate Quality Control inspection of placement of fill

I&E Report Reference: Pages 25 through 29

CPCo Response Reference: Category III, Item 1

Discussion: The Nuclear Quality Assurance Manual requires that Construction Quality Control Procedures "define the method for indirect control by monitoring of processing methods, equipment, and personnel, when inspection of processed items is impossible or disadvantageous." Control Document SF/PSP G-6.1, "Quality Control Inspection Plans," does not adequately include or reference this requirement in the instructions for preparation of Quality Control Instructions. Quality Control Instruction PQCI C-1.02 did not adequately satisfy this requirement. The inspection of soils was accomplished by "surveillance," and did not require verification of the controls specified in Specifications 7220-C-210 and 7220-C-211. Soil test results, or the evaluations of soil test results, were used as the basis for quality verification.

Quality Assurance Program Criterion: Inspection instructions, procedures, and drawings

Program Element: Establishment of an inspection program, documented instructions and procedures for accomplishing the inspection activity, and the preparation of instructions and procedures

Quality Assurance Program Policy: Nuclear Quality Assurance Manual, Section IV, Number 5, "Field Inspection and Test" (June 1977)

Control Document: SF/PSP G-6.1, Revision 4, "Quality Control Inspection Plans" (January 1978)

Instructions, Procedures, and Drawings: PQCI C-1.02, Revision 4, "Compacted Backfill" (July 1979)

Root Causes:

1. Control Document SP/PSP G-6.1 does not include sufficient specificity in its requirements for the preparation of inspection instructions.

2. Too much reliance was placed on the Quality Control Inspector's ability, without sufficiently specific inspection instructions.

3. Reliance was placed on soil test results, or on the evaluation of soil test results, which were in error in numerous cases. (Incorrect Soil Test Results are addressed in Subsection 3.10.)

Remedial Actions (Soils):

1. PQCI C-1.02 has been revised to incorporate the specific characteristics to be verified by Quality Control.

2. An in-depth soils investigation program, which was implemented as described in our prior transmittals, provides verification of the acceptability of the soils or identifies any nonconformances requiring further remedial action.

Corrective Action (Programmatic): Control Document SF/PSP G-6.1 has been revised to provide requirements for inspection planning specificity and for the utilization of scientific sampling rather than percentage sampling. |10 |10

Corrective Actions (Generic)

1. QCIs in use will be reviewed to ascertain that provisions have been included consistent with the revised control document. This action and any required revisions are scheduled to be completed by April 17, 1981. |10

2. The impact of Corrective Action Item 1 (above) on completed work will be evaluated, and appropriate actions will be taken as necessary. This action is scheduled to be completed by April 17, 1981. |10

3.9 Category III, Item 2

Deficiency Description: Inadequate soil moisture testing

I&E Report Reference: Pages 14 through 16

CPCo Response Reference: Category III, Item 2

Discussion: Prior to 1976, moisture content was controlled by tests performed after compaction. Few or no tests were performed on the fill during compaction, as required by Specification 7220-C-210, Section 12.6. "During compaction" was interpreted by personnel in the field as the entire process of placing, compacting, and testing. The moisture content was measured during the density test, which was performed immediately after compaction. Reconditioning was done after testing.

Quality Assurance Program Criterion: Inspection instructions, procedures, and drawings

Program Element: Establishment of an inspection program, the documented instructions and procedures for accomplishing the inspection activity, and the preparation of instructions and procedures

Quality Assurance Program Policy: Nuclear Quality Assurance Manual, Section IV, Number 5, "Field Inspection and Test" (June 1977)

Control Document: SF/PSP G-6.1, Revision 4, "Quality Control Inspection Plans" (January 1978)

Instructions, Procedures, and Drawings: PQCI, C-1.02, Revision 4, "Compacted Backfill" (July 1979)

Root Causes:

1. Control Document, SF/PSP G-6.1 does not require sufficient specificity for establishing an inspection program and for the preparation of inspection instructions.

2. Reliance was placed on the informal incorrect interpretations of the specification relative to moisture testing. This is discussed in Subsection 3.2.

3. Reliance was placed on Quality Control surveillances of moisture testing.

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

4. Reliance was placed on the incorrect results of the density tests, or on the incorrect evaluation of the results, to the exclusion of the moisture test results. (Incorrect Soil Test Results are addressed in Subsection 3.10).

Remedial Actions (Soils):

1. The specifications were revised to provide more definitive requirements for soil moisture testing.

2. PQCI C-1.02 was revised to provide specific inspection requirements for verifying soil moisture content, rather an surveillance.

3. Field instruction FIC 1.000, "Q-Listed Soils Placement Job Responsibility Matrix," has been prepared, and establishes responsibilities for performing soils placement and compaction.

Corrective Actions (Programmatic):

1. Control Document SF/PSP G-6.1 has been revised to provide requirements for inspection planning specificity and for the utilization of scientific sampling rather than percentage sampling. |10 |10

2. Engineering Department Project Instruction 4.49.1, Revision 3 now states, "Under no circumstances will interoffice memoranda, memoranda, telexes, TWXs, etc be used to change the requirements of a specification." This will provide controlled and uniform interpretation of specification requirements.

3. On April 3, 1979, Midland Project Engineering Group Supervisors in all disciplines were reinstructed that the only procedurally correct methods of implementing specification changes are through the use of specification revisions or Specification Change Notices. This was followed by an interoffice memorandum from the Project Engineer to all Engineering Group Supervisors on April 12, 1979.

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

Corrective Actions (Generic):

1. QCIs in use will be reviewed to ascertain that provisions have been included consistent with the revised control document. This action and any required revisions are scheduled to be completed by April 17, 1981.

2. The impact of Corrective Action Item 1 (above) on completed work will be evaluated, and appropriate actions will be taken as necessary. This action is scheduled to be completed by April 17, 1981.

3. A review of interoffice memoranda, memoranda, telexes, TWXs, and other correspondence relating to specifications for construction and selected procurements of Q-Listed items will be initiated.

   The purpose of the review will be to identify any clarifications which might reasonably have been interpreted as modifying a specification requirement and for which the specification itself was not formally changed. An evaluation will be made to determine the effect on the technical acceptability, safety implications of the potential specification modification, and any work that has been or may be affected. If it is determined that the interpretation may have affected any completed or future work, a formal change will be issued and remedial action necessary for product quality will be taken in accordance with approved procedures.

   The foregoing procedure will be followed for all specifications applying to construction for Q-Listed items.

   For specifications concerning the procurement of Q-Listed items, the foregoing procedure has been implemented on a random sampling basis. The sample size has been established and the specification selection has been made.

   Review and acceptance criteria for the specifications have been defined.

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

The review of the initially selected procurement specifications indicated that the acceptance criteria were not met in one discipline. The review was expanded to 100% of the specifications in that discipline (both construction and procurement specifications), and for the other disciplines the sample of procurement specifications was increased to permit each discipline's review to be evaluated individually.

This expanded review is scheduled to be completed by June 5, 1981.

RESPONSE TO QUESTION 23, PART (1) |50.54(f)|

3.10 Category III, Item 3

Deficiency Description: Incorrect soil test results

I&E Report Reference: Not applicable

CPCo Response Reference: Category III, Item 3

Discussion: A review of soils test reports indicates that some test reports contain errors and inconsistencies in data. Surveillance and test report reviews did not identify these errors and inconsistencies. The Quality Control surveillance and review included steps to verify that the test results were reported as either percent compaction or relative density, as appropriate; that specification requirements for compaction and moisture content were within specified limits; and that the report form was properly completed and contained the required data and authorized signature. This was in accordance with the requirements of Quality Control Instruction 7220-SC-1.05, "Material Testing Laboratories," which includes instructions for monitoring the performance of verification testing performed by the testing laboratory.

Quality Assurance Program Criterion: Control of purchased material, equipment, and services (subcontractors)

Program Element: Surveillance of the subcontractor's performance

Quality Assurance Program Policy: Nuclear Quality Assurance Manual, Section IV, Number 11, "Field Subcontractor Control" (June 1977); and Section IV, Number 5, "Field Inspection and Test" (June 1977)

Control Document: SF/PSP G-9.1, Revision 1, "Control of Subcontractor Work" (July 1977)

Instructions, Procedures, and Drawings: Quality Control Instructions 7220-SC-1.05, "Material Testing Services" (October 1977)

Root Cause: Technical procedures available to control the testing were inadequate, and the technical direction of the testing operations did not avoid or detect the incorrect soil test results.

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

Remedial Actions (Soils):

1. Geotechnical Services has completed an investigation which includes an in-depth review of testing performed by U.S. Testing and the reported test results. The purpose of this investigation was to identify the type of testing errors which were made in order to facilitate analysis by U.S. Testing and to accomplish Programmatic Corrective Action (below) and Remedial Action Item 2 (below).

2. Based on Item 1 above, the requirements for the control of testing were adjusted, requiring the Testing Subcontractor to check all field density tests for cohesive material against a zero-air-voids curve. A specification change has been issued. Selection of proctor curves will no longer be a problem because each field density test will be accompanied by a separate laboratory standard which will provide a direct comparison. This was directed by a letter to U.S. Testing and reflected in Specification Change Notice C-208-9004, dated April 13, 1979.

3. PQCI-SC-1.05 was revised to add more stringent requirements for in-process inspection of U.S. Testing's soil testing activities.

4. An in-depth soils investigation program which was implemented as described in our prior transmittals, provides verification of the acceptability of the soils or identifies any nonconformances requiring further remedial action. This action is identical to Remedial Action Item 2 in Subsection 3.8.

Corrective Action (Programmatic): Guidelines for surveillance of testing operations have been developed and included in Field Instructions for the onsite Soils Engineer. Engineering/Geotechnical Services has developed the guidelines, and Field Engineering has prepared the instructions. | 8 | 8

Corrective Actions (Generic):

1. U.S. Testing was required to demonstrate to cognizant Engineering Representatives that testing procedures, equipment, and personnel used for | 10

quality verification testing (for other than NDE and soils) were capable of providing accurate test results in accordance with the requirements of applicable design documents. |10 |10

2. A sampling of U.S. Testing's test reports (for other than NDE and soils) were reviewed by cognizant Engineering Representatives to ascertain that results evidence conformance to testing requirements and design document limits. |10 |10

RESPONSE TO QUESTION 23, PART (1) (50.54(f))

3.11 Category III, Item 4

Deficiency Description: Inadequate subcontractor test procedures

I&E Report Reference: Not applicable

CPCo Response Reference: Category III, Item 4

Discussion: The procedures used for soils testing did not cover the following activities:

1. Developing and updating the family of proctor curves;

2. Visually selecting the proper proctor curves;

3. Developing additional proctor curves for changing materials occurring between normal frequency curves; and

4. Using alternative methods of determining the proper laboratory maximum density where visual comparison is not adequate.

Bechtel Specification 7220-G-22, Revision 1 (June 22, 1973) is an attachment to Specification 7220-C-208 and specifies the requirements for instructions, procedures, and drawings. These technical procedures were not prepared.

Quality Assurance Program Criterion: Control of purchased material, equipment, and services (subcontractor)

Program Element: Control of supplier-generated (subcontractor-generated) documents

Quality Assurance Program Policy: Nuclear Quality Assurance Manual, Section III, Number 9, "Supplier Document Review" (June 1977); and Section IV, Number 11, "Field Subcontractor Control" (June 1977)

Control Document: SF/PSP G-9.1, Revision 1, "Control of Subcontractor Work" (July 1977)

Instructions, Procedures, and Drawings: Quality Control Instructions 7220/SC-1.05, "Material Testing Services" (October 1977)

RESPONSE TO QUESTION 23, PART (1) [50.54(E)]

Root Cause: Adequate technical procedures for control of the testing were not prepared.

Remedial Actions (Soils):

1. Geotechnical Services has completed an investigation which includes an in-depth review of testing performed by U.S. Testing and the reported test results. The purpose of this investigation was to identify the type of testing errors which were made in order to facilitate analysis by U.S. Testing and accomplish Remedial Action Item 2.

2. Based on Item 1 above, the requirements for the control of testing were adjusted requiring the Testing Subcontractor to check all field density tests for cohesive material against a zero-air-voids curve. A specification change has been issued. Selection of proctor curves will no longer be a problem because each field density test for cohesive material (unless otherwise directed by the onsite geotechnical soils engineer) will be accompanied by a separate laboratory standard which will provide a direct comparison. This was directed by a letter to U.S. Testing and reflects Specification Change Notice C-208-9004, dated April 13, 1979.

3. One full-time and one part-time onsite Geotechnical Soils Engineer have been assigned. These engineers will review U.S. Testing's procedures and monitor their implementation.

Corrective Action (Programmatic): Field Instruction FIC 1.100, "Q-Listed Soils Placement Job Responsibilities Matrix," has been prepared and establishes responsibilities for performing surveillance of testing operations.

Corrective Actions (Generic):

1. Design documents, instructions, and procedures for those activities requiring inprocess controls will be reviewed to assess the adequacy of existing procedural controls and technical direction. Engineering review has been completed, and Field Engineering and Quality Control review is scheduled for completion by February 27, 1981. Any revisions required will be completed by April 17, 1981.

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

2. U.S. Testing was required to demonstrate to cognizant Engineering Representatives that testing procedures, equipment, and personnel used for quality verification testing (for other than NDE and soils) were capable of providing accurate test results in accordance with the requirements of applicable design documents. | 10 | 10 | 10

3. A sampling of U.S. Testing's test reports (for other than NDE and soils) were reviewed by cognizant Engineering Representatives to ascertain that results evidence conformance to testing requirements and design document limits. | 10 | 10

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

3.12 Category IV, Item 1

Deficiency Description: Inadequate corrective action for repetitive nonconforming conditions

I&E Report Reference: Pages 17 through 20

CPCo Response Reference: Category IV, Item 1

Discussion: There were nonconformances reported which are considered to be repetitive. These include, but are not limited to: CPCo Nonconformance Reports QF-29, QF-52, QF-68, QF-120, QF-130, QF-147, QF-172, QF-174, QF-199, and QF-203; CPCo Audit Findings F-77-21 and F-77-32; and Bechtel Nonconformance Reports 421, 686, 698, and 1005.

The Nuclear Quality Assurance Manual, Section V, Number 10, states in Subparagraph 2.5.2, "Nonconformances which, due to their repetition or impact (potential or actual) upon quality, should be brought to management's attention for special action." | 10

Quality Assurance Department Procedure C-101, Revision 1, "Project Quality Assurance Trend Analysis" (July 1977) states in Paragraph 1.0, "This procedure provides a mechanism for identifying quality trends and initiating corrective action to prevent recurrence...." The reviews made in accordance with this procedure did not identify the significance of the repetitive nature of the nonconformances and the need for special action beyond that for the individual reports.

Control Document SF/PSP G-3.2 defines the requirements for review of Management Corrective Action Requests (MCARs).

Quality Assurance Program Criterion: Corrective action

Program Element: Actions pertaining to significant conditions adverse to quality

Quality Assurance Program Policy: Nuclear Quality Assurance Manual, Section V, Number 10, "Management Corrective Action" (March 1979)

Control Documents: SF/PSP G-3.2, Revision 5, "Control of Nonconforming Items" (September 1979) and QADP C-101, Revision 1, "Project Quality Assurance Trend Analysis" (July 1977)

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

Root Causes:

1. The conditions under which nonconformances are considered to be repetitive are not adequately defined in the control documents.

2. The trending activity did not provide timely responses to repetitive product nonconforming conditions.

Remedial Action (Soils): Not applicable

Corrective Action (Programmatic): Control documents have been revised to provide an improved definition of implementing requirements for identifying repetitive non-conforming conditions. This action has been completed for QADP C-101. Action for SF/PSP G-3.2 has also been completed. 10 10

Corrective Action (Generic): Consistent with the intent of the programmatic change above, Quality Assurance will review nonconformance reports which were open, as of November 13, 1979, or became open prior to implementation of the improved Project Quality Assurance Trend Analysis program as stated above. This review will be to identify any repetitive nonconforming conditions pertaining to product type or activity, or pertaining to nonconformance cause. This action is scheduled to be completed by December 31, 1980. 10 8

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

3.13 Category IV, Item 2

Deficiency Description: Bechtel Quality Assurance auditing and monitoring did not identify the problems relating to the settlement. This lack of identification of problems by the auditing and monitoring contributed to a conclusion that soils operations were adequately controlled.

I&E Report Reference: Pages 17 through 20

CPCo Response Reference: Category IV, Item 2

Discussion: Quality Assurance auditing and monitoring is aimed at evaluating the adequacy of policies and procedures and evaluating the degree of compliance with the policies and procedures. It is not a quality verification activity, although it may identify deficiencies in the performance of quality-related activities that could result in unsatisfactory product quality. In the case of soils operations, Quality Assurance auditing and monitoring found that quality-related activities were being performed as planned, quality verification activities (primarily soil testing) were being performed, and the soil test results, or their evaluation, provided evidence of compliance with the established standards. The auditing and monitoring did not identify the policy and procedure inadequacies.

Quality Assurance Program Criterion: Auditing

Program Element: Auditing

Quality Assurance Program Policy: Nuclear Quality Assurance Manual, Section VI, Number 1, "Quality Audit System" (March 1979)

Control Documents: Quality Assurance Department Procedure, Section C, Number 1, "Project Quality Monitoring" (September 1977); and Section C, Number 5, "Project Quality Audits" (September 1977)

Root Cause: Quality Assurance audit and monitoring was oriented more toward evaluating the degree of compliance with established procedures rather than toward the assessment of policy and procedural adequacy or toward the assessment of product quality.

RESPONSE TO QUESTION 23, PART (1) [50.54(f)]

Corrective Action (Generic): The Quality Assurance audit and monitoring program will be revised to emphasize and increase attention to the need for evaluating policy and procedural adequacy and assessment of product quality. A specialized audit training program will be developed and implemented to ensure guidance for this revised approach. These actions will be accomplished by December 31, 1980. | 10

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

December 6, 1979

Docket Nos. 50-329
50-330

Consumers Power Company
ATTN: Mr. Stephen H. Howell
Vice President
1945 West Parnall Road
Jackson, MI 49201

Gentlemen:

This letter transmits to you an Order Modifying Construction Permits No. CPPR-81 and No. CPPR-82. This action is being taken as a result of findings by inspectors from Region III, Office of Inspection and Enforcement made during the period of October 1978 to January 1979, and the conclusions of the NRC staff after reviewing responses to the 10 CFR 50.54(f) request of March 21, 1979, regarding the proposed remedial work under and around safety-related structures and systems at the site, some of which is currently underway. The Order pertains to the problems associated with the soil foundation materials at the site.

As part of the Order there are two Notices of Violation. The first Notice of Violation is Appendix A which contains information concerning four infractions with several examples, all of which relate to the soil foundation problems. The second Notice of Violation, Appendix B, contains information concerning an item of noncompliance which was determined to be a material false statement. Actions that Consumers Power Company may take as a result of this Order are described in the Order.

Sincerely,

Edson G. Case
Acting Director
Office of Nuclear Reactor
Regulation

Sincerely,

Victor Stello, Jr.
Director
Office of Inspection
and Enforcement

Enclosures:
1. Order Modifying Construction Permits, CPPR-81 and CPPR-82
2. Appendix A
3. Appendix B

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

DUPE OF 7912270004

This information is false, in that materials other than controlled compacted cohesive fill were used to support the diesel generator building and information presented concerning the supporting soils influenced the staff review of the FSAR.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
CONSUMERS POWER COMPANY	)	Docket No. 50-329
(Midland Nuclear Power Plant,	)	50-330
Units 1 and 2)	)	

ORDER MODIFYING CONSTRUCTION PERMITS

I

The Consumers Power Company (the Licensee) is a holder of Construction Permits No. CPPR-81 and No. CPPR-82 which authorize the construction of two pressurized water reactors in Midland, Michigan. The construction permits expire on October 1, 1981 and October 1, 1982, for Unit 2 and Unit 1 respectively.

II

On August 22, 1978, the Licensee informed the NRC Resident Inspector at the Midland site that unusual settlement of the Diesel Generator Building had occurred. The Licensee reported the matter under 10 CFR 50.55(e) of the Commission's regulations by telephone on September 7, 1978. This notification was followed by a series of interim reports dated September 29, 1978, November 7, 1978, December 21, 1978, January 5, 1979, February 23, 1979, April 3, 1979, June 25, 1979, August 10, 1979, September 5, 1979, and November 2, 1979.

Following the September 1978 notification, inspectors from the Region III, Office of Inspection and Enforcement, conducted an investigation over the period of October 1978 through January 1979. This investigation revealed a breakdown in quality assurance related to soil construction activities under and around safety-related structures and systems in that (1) certain design and construction specifications related to foundation-type material properties

and compaction requirements were not followed; (2) there was a lack of clear direction and support between the contractor's engineering office and construction site as well as within the contractor's engineering office; (3) there was a lack of control and supervision of plant fill placement activities which contributed to inadequate compaction of foundation material; (4) corrective action regarding noncomformances related to plant fill was insufficient or inadequate as evidence by repeated deviations from specification requirements; and (5) the FSAR contains inconsistent, incorrect, and unsupported statements with respect to foundation type, soil properties and settlement values. The details of these findings are described in the inspection reports 50-329/78-12, 50-330/78-12 (November 14, 1978) and 50-329/78-20, 50-330/78-20 (March 19, 1979) which were sent to the Licensee on November 17, 1978 and March 22, 1979 respectively.

The items of noncompliance resulting from the NRC investigation are described in Appendix A to this Order. In addition, as described in Appendix B to this Order, a material false statement was made in the FSAR in that the FSAR falsely stated that "All fill and backfill were placed according to Table 2.5-9." This statement is material in that this portion of the FSAR would have been found unacceptable without further Staff analysis and questions if the Staff had known that Category I structures had been placed in fact on random fill rather than controlled compacted cohesive fill as stated in the FSAR.

As a result of questions raised during the NRC investigation of the Diesel Generator Building settlement, additional information was necessary to evaluate

the impact on plant safety caused by soil conditions under and around safety-related structures and systems in and on plant fill, and the Licensee's related quality assurance program. On March 21, 1979, the Director, Office of Nuclear Reactor Regulation, formally requested under 10 CFR 50.54(f) of the Commission's regulations information concerning these matters to determine whether action should be taken to modify, suspend or revoke the construction permit. Additional information was requested by the Staff in letters dated September 11, 1979 and November 19, 1979. The Licensee responded to these letters, under oath, in letters dated April 24, 1979, May 31, 1979, July 9, 1979, August 10, 1979, September 13, 1979, and November 13, 1979. The Licensee has not yet responded to the November 19, 1979 requests.

Several of the Staff's requests were directed to the determination and justification of acceptance criteria to be applied to various remedial measures taken and proposed by the licensee. Such criteria, coupled with the details of the remedial action, are necessary for the Staff to evaluate the technical adequacy and proper implementation of the proposed action. The information provided by the licensee fails to provide such criteria. Therefore, based on a review of the information provided by the Licensee in response to the Staff questions, the Staff cannot conclude at this time that the safety issues associated with remedial action taken or planned to be taken by the Licensee to correct the soil deficiencies will be resolved. Without the resolution of these issues the Staff does not have reasonable assurance that the affected safety-related portions of the Midland facility will be constructed and operated without undue risk to the health and safety of the public.

III

Under the Atomic Energy Act of 1954, as amended, and the Commission's regulations, activities authorized by construction permits or portions thereof may be suspended should the Commission find information which would warrant the Commission to refuse to grant a construction permit on an original application. We have concluded that the quality assurance deficiencies involving the settlement of the Diesel Generator Building and soil activities at the Midland site, the false statement in the FSAR, and the unresolved safety issue concerning the adequacy of the remedial action to correct the deficiencies in the soil construction under and around safety-related structures and systems are adequate bases to refuse to grant a construction permit and that, therefore, suspension of certain activities under Construction Permits No. CPPR-81 and No. CPPR-82 is warranted until the related safety issues are resolved.

IV

Accordingly, pursuant to the Atomic Energy Act of 1954, as amended, and the Commission's regulations in 10 CFR Parts 2 and 50, IT IS HEREBY ORDERED THAT, subject to Part V of this Order, Construction Permits No. CPPR-81 and No. CPPR-82 be modified as follows:

(1) Pending the submission of an amendment to the application seeking approval of the remedial actions associated with the soil activities for safety-related structures and systems founded in and on plant fill material and the issuance of an amendment to Construction Permits No. CPPR-81 and

and No. CPPR-82 authorizing the remedial action, the following activities are prohibited:

(a) any placing, compacting, or excavating soil materials under or around safety related structures and systems;

(b) physical implementation of remedial action for correction of soil-related problems under and around these structures and systems, including but not limited to:

(i) dewatering systems
(ii) underpinning of service water building
(iii) removal and replacement of fill beneath the feedwater isolation valve pit area
(iv) placing caissons at the ends of the auxiliary building electrical penetration areas
(v) compaction and loading activities;

(c) construction work in soil materials under or around safety-related structures and systems such as field installation of conduits and piping.

(2) Paragraph (1) above shall not apply to any exploring, sampling, or testing of soil samples associated with determining actual soil properties on site which has the approval of the Director of Region III, Office of Inspection and Enforcement.

V

The Licensee or any person whose interest is affected by this Order may within 20 days of the date of this Order request a hearing with respect to all or any part of this Order. In the event a hearing is requested, the issues to be considered will be:

(1) whether the facts set forth in Part II of this Order are correct; and

(2) whether this Order should be sustained.

This Order will become effective on the expiration of the period during which a hearing may be requested, or in the event a hearing is requested, on the date specified in an Order made following the hearing.

FOR THE NUCLEAR REGULATORY COMMISSION

Jason G. Case, Acting Director
Office of Nuclear Reactor
Regulation

Victor Stello, Jr., Director
Office of Inspection
and Enforcement

Attachments:
1. Appendix A
2. Appendix B

Dated at Bethesda, Maryland,
this 6th day of December, 1979.

DEC 6 1979

Appendix A

NOTICE OF VIOLATION

Consumers Power Company

Docket No. 50-329
Docket No. 50-330

This refers to the investigation conducted by the Office of Inspection and Enforcement at the Midland Nuclear Power Plant, Units 1 and 2, Midland, Michigan, at your offices in Jackson, Michigan, and at Bechtel Corporation, Ann Arbor, Michigan of activities authorized by NRC License No. CPPR-81 and No. CPPR-82.

Based on the results of the investigation conducted during the period December 11, 1978 through January 25, 1979, it appears that certain of your activities were not conducted in full compliance with NRC requirements as noted below. These items are infractions.

1. 10 CFR 50, Appendix B, Criterion III requires, in part, that measures shall be established and executed to assure that regulatory requirements and the design basis as specified in the license application for structures are correctly translated into specifications, drawings, procedures and instructions. Also, it provides that measures shall be established for the identification and control of design interfaces and for coordination among participating design organizations.

   CPCo Topical Report CPC-1-A, Policy No. 3, Section 3.4 states, in part, "the assigned lead design group or organization (i.e., the NSSS supplier, A&E supplier, or CPCo) assure that designs and materials are suitable and that they comply with design criteria and regulatory requirements."

   CPCo is committed to ANSI N45.2 (1971), Section 4.1, which states, in part, "measures shall be established and documented to assure that the applicable specified design requirements, such as a design basis, regulatory requirements . . . are correctly translated into specifications, drawings, procedures, or instructions."

   Contrary to the above, measures did not assure that design bases were included in drawings and specifications nor did they provide for the identification and control of design interfaces. As a result, inconsistencies were identified in the license application and in other design basis documents. Specific examples are set forth below:

   a. The FSAR is internally inconsistent in that FSAR Figure 2.5-48 indicates settlement of the Diesel Generator Building to be on the order of 3" while FSAR Section 3.8.5.5 (structural acceptance criteria) indicates settlements on shallow spread footings

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founded on compacted fill to be on the order of 1/2" or less. The Diesel Generator Building is supported by a continuous shallow spread footing.

b. The design settlement calculations for the diesel generator and borated water storage tanks were performed on the assumption of uniform mat foundations while these foundations were designed and constructed as spread footing foundations.

c. The settlement calculations for the Diesel Generator Building indicated a load intensity of 3000 PSF while the FSAR, Figure 2.5-47, shows a load intensity of 4000 PSF, as actually constructed.

d. The settlement calculations for the Diesel Generator Building were based on an index of compressibility of the plant fill between elevations 603 and 634 of 0.001. These settlement values were shown in FSAR Figure 2.5-48. However, FSAR, Table 2.5-16, indicates an index of compressibility of the same plant fill to be 0.003.

e. PSAR, Amendment 3, indicated that if filling and backfilling operations are discontinued during periods of cold weather, all frozen soil would be removed or recompacted prior to the resumption of operations. Bechtel specification C-210 does not specifically include instructions for removal of frozen/ thawed compacted material upon resumption of work after winter periods.

f. PSAR Amendment 3 indicates that cohesionless soil (sand) would be compacted to 85% relative density according to ASTM D-2049. However, Bechtel specification C-210, Section 13.7.2 required cohesionless soil to be compacted to not less than 80% relative density.

2. 10 CFR 50, Appendix B, Criterion V requires, in part, that activities affecting quality shall be prescribed and accomplished in accordance with documented instructions, procedures or drawings.

CPCo Topical Report CPC-1-A, Policy No. 5, Section 1.0 states, in part, that, "Instructions for controlling and performing activities affecting quality of equipment or operation during design, construction and operations phase of the nuclear power plant such as procurement manufacturing, construction, installation, inspection, testing . . . are documented in instructions, procedures, specifications . . . these documents provide qualitative and quanititive acceptance criteria for determining important activities have been satisfactorily accomplished."

CPCo is commited to ANSI N45.2 (1971), Section 6 which states, in part, "activities affecting quality shall be prescribed by documented instructions, procedures, or drawings, of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings."

a. Contrary to the above, instructions provided to field construction for substituting lean concrete for Zone 2 material did not address the differing foundation properties which would result in differential settlement of the Diesel Generator Building.

b. Also, contrary to the above, certain activities were not accomplished according to instructions and procedures, in that:

(1) The compaction criteria used for fill material was 20,000 ft-lbs (Bechtel modified proctor test) rather than a compactive energy of 56,000 ft-lbs as specified in Bechtel Specification C-210, Section 13.7.

(2) Soils activities were not accomplished under the continuous supervision of a qualified soils engineer who would perform in-place density tests in the compacted fill to verify that all materials are placed and compacted in accordance with specification criteria. This is required by Bechtel Specification C-501 as well as PSAR, Amendment 3 (Dames and Moore Report, page 16).

3. 10 CFR 50, Appendix B, Criterion X requires, in part, that a program for inspection of activities affecting quality shall be established and executed to verify conformance with the documented instructions, procedures and drawings for accomplishing the activity.

CPCo Topical Report CPC 1-A, Policy No. 10, Section 3.1, states, in part, that "work activities are accomplished according to approved procedures or instructions which include inspection hold points beyond which work does not proceed until the inspection is complete or written consent for bypassing the inspection has been received from the organization authorized to perform the inspections."

CPCo is commited to ANSI N45.2 (1971), which states, in part, "A program for inspection of activities affecting quality shall be established and executed by or for the organization performing the activity to verify conformance to the documented instructions, procedures, and drawings for accomplishing the activity."

Contrary to the above, Quality Control Instruction C-1.02, the program for inspection of compacted backfill issued on October 18, 1976, did not provide for inspection hold points to verify that soil work was satisfactorily accomplished according to documented instructions.

4. 10 CFR 50, Appendix B, Criterion XVI requires, in part, that measures shall be established to assure that conditions adverse to quality such as failures, deficiencies, defective material and nonconformances are promptly identified and corrected. In case of significant conditions adverse to quality, measures shall assure that corrective action is taken to preclude repetition.

CPCo Topical Report CPC-1-A, Policy No. 16, Section 1.0 states, in part, "corrective action is that action taken to correct and preclude recurrence of significant conditions adverse to the quality of items or operations. Corrective action includes an evaluation of the conditions that led to a nonconformance, the disposition of the nonconformance and completion of the actions necessary to prevent or reduce the possibility of recurrence."

Contrary to the above, measures did not assure that soils conditions of adverse quality were promptly corrected to preclude repetition. For example:

a. As of January 25, 1979, moisture control in fill material had not been established nor adequate direction given to implement this specification requirement. The finding that the field was not performing moisture control tests as required by specification C-210 was identified in Quality Action Request SD-40, dated July 22, 1977.

b. Corrective action regarding nonconformance reports related to plant fill was insufficient or inadequate to preclude repetition as evidenced by repeated deviations from specification requirements. For example, nonconformance reports No. CPCo QF-29, QF-52, QF-68, QF-147, QF-174, QF-172 and QF-199 contain numberous examples of repeated nonconformances in the same areas of plant fill construction.