2/24/83

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION '83 FEB 23 P2:12

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of APPLICATION OF TEXAS UTILITIES GENERATING COMPANY, ET AL. FOR AN OPERATING LICENSE FOR COMANCHE PEAK STEAM ELECTRIC STATION UNITS #1 AND #2 (CPSES)	Docket Nos. 50-445 and 50-446

CASE'S PROVISIONAL PROPOSED FINDINGS OF FACT

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CASE'S PROVISIONAL
PROPOSED FINDINGS OF FACT

Pursuant to the Board's directive in its December 21, 1982, Reconsideration of December 7, 1982 Order, CASE (Citizens Association for Sound Energy), Intervenor herein, hereby files this, its Provisional Proposed Findings of Fact.

In its December 7, 1982, Order, the Board directed the parties "to file provisional proposed findings of fact on all controverted matters covered to date in the evidentiary record" by January 14, 1982 (p. 3). In its December 21, 1982, Order, the Board stated "Good cause has been shown to allow more time for these filings, and the date is therefore extended to and including February 25, 1983. Further, proposed findings of fact regarding the Walsh/Doyle allegations will not be included in these proposed findings, and a date therefor will be fixed after the record has been closed on evidence pertaining to such allegations." The Board further reaffirmed its previous Order that the parties were to file their proposed findings of fact simultaneously.

The Board also detailed its expectations as to what the proposed findings of fact should contain (p. 2 and 3), and stated "The Board intends, as it has previously informed the parties during trial, to request closing arguments that will cover in depth all controverted matters. It is contemplated that such

closing arguments will not be pro forma, but will cover the scope of proposed findings of fact, as well as conclusions of law and legal arguments." The Board further reiterated that "...these proposed findings are expressly stated to be open to subsequent modification or supplementation," as indicated in the Board's December 7, 1982 Order "...as a result of further information when the record is closed" (p. 4).

Since the Board's December 21, 1982, Order, the Board has filed its January 4, 1983, Memorandum and Order, in which it indicated that:

> The Intervenor has challenged the NRC Staff's competence in handling and investigating QC allegations by "whistle-blowers," and has questioned the Staff's alleged bias in favor of the Applicants. Clearly further evidence on these issues will be required when the evidentiary hearing resumes.9/ (Footnote 9/ Tr. 2669-70.)
>
> It is anticipated that one more (and hopefully final) hearing will be held after the Staff has completed its analyses and filed its documents as discussed in previous Board Orders.19/ Prior to that hearing, the parties shall complete discovery and file prefiled direct testimony on all remaining issues, including the underlying facts and evidence regarding the Atchison matter contained in CASE Exhibit 738, the Walsh/Doyle allegations, SSER No. 3, and unresolved Board Notification matters having a significant relationship to the issues in controversy. (Footnote 19/ Id. (Orders dated December 21, December 7, and September 22, 1982) See also Tr. 5408, 5412-14, 5426.)

Further, the Board may require further evidence if uncertainties arise from lack of sufficient information in the record. (See 10 CFR Part 2, App. A, V.g.(1).)

I. OVEREXCAVATION (ROCK OVERBREAK)

1. Testimony regarding the overexcavation is contained on the following transcript pages: 789-853; 915-958; 1030-1180; 1207-1216; and 1225-1258.

2. Applicants' Panel on both the Overexcavation and the Crack in the Base Mat were: Raymond C. Mason; John T. Merritt, Jr.; Kenneth L. Scheppele; Ralph E. McGrane; and Ronald G. Tolson. (Tr. 789 and 790.)

3. Applicants' witness Mason is Chairman of the Board and Principal Engineer of Mason, Johnston and Associates, Incorporated (tr. 791); his statement of educational and professional qualifications were admitted into evidence as Applicants' Exhibit 16 (tr. 791-792).

4. Applicants' witness Merritt is Manager of Engineering and Construction, Comanche Peak Steam Electric Station (tr. 793); his statement of educational and professional qualifications were admitted as Applicants' Exhibit 17 (tr. 793-794).

5. Applicants' witness McGrane is Assistant Chief of Structural Engineering for Gibbs and Hill, Incorporated (tr. 794); his statement of educational and professional qualifications were admitted as Applicants' Exhibit 18 (tr. 794-796).

6. Applicants' witness Scheppele is Senior Vice President, Gibbs and Hill, New York, N. Y. (tr. 797); his statement of educational and professional qualifications were admitted as Applciants' Exhibit 19 (tr. 797-798).

7. Applicants' witness Tolson is Construction Quality Assurance Supervisor, Texas Utilities Generating Company, Glen Rose, Texas (tr. 798); his statement of educational and professional qualifications were admitted as Applicants' Exhibit 20 (tr. 798-800). Second highest QA man (Finding 163).

8. Applicants' Mason described his involvement during the early stages of Comanche Peak construction (in the time frame of January 1975) (tr. 800-803).

9. He stated that he was involved in the excavation activity as a monitor and providing the services of engineering jobs, and that as a contractor, they did not move any material (tr. 800-801); he was employed by Texas Utilities Services Inc. (TUSI) (tr. 801-802), and his company's services consisted of geo-technical engineering, in which he was directly involved (tr. 802-803). The services included evaluation of the materials present at the site both from a geological standpoint, from the strength of the physical materials standpoint, from the engineering standpoing and from that formulating recommendations which were transferred to their client TUSI and then direct to the structural group of its affiliate (tr. 802-803). Mason and Johnston studied the geologic structures at Comanche Peak and did pre-construction activity surveys or site suitability surveys (tr. 803).

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

10. The Comanche Peak foundation is set on what is known geologically as Glen Rose limestone (a marine formation of crustaceous age), a type of rock (Applicants' Mason testimony, tr. 803-804).

11. Category One structures are structures which are safety related (Mason testimony, tr. 804). Category One relates to seismic activity, as well as floods, hurricanes, tornadoes, and any other phenomena which would impair the safety of the completed project (Mason testimony, tr. 804).

12. The actual excavation job was of no concern whatsoever to Category One or other non-safety related structures; the excavation procedures were the same regardless of whether the structure was Category One or non-Category One (Mason testimony, tr. 805, 807).

13. Applicants' witness Mason described the typography and excavations (tr. 805-825).

14. Excavation took place down to the top of the proposed excavation. The hilltop had been removed to a plane. From this newly established plane or plant grade all excavation for foundation for plants and anything on the ground then commenced. (Tr. 807.)

15. Mr. Mason's recollection was that the reactors were some 40 feet or so below the plant grade (tr. 808 and 813).

16. He stated that he no longer remembered the depth on the fuel building or any other of the lesser depths (tr. 808).

17. In Mason and Johnston's earlier geotechnical recommendations to the owners, who in turn provided them to Gibbs and Hill, it was recommended that all structures, Category One and others be founded on in situ (meaning intact) in-place materials and that no fills be constructed to support any portion of the plant; it was further recommended that in the case of safety-related or sensitive structures, the concrete that would comprise these structures be placed against intact rock. (Tr. 808-809, Mason testimony.)

18. For that reason, in the case of the nuclear reactor containment vessels themselves (which are circular in form) the contractor proposed an excavation scheme that would comply with this design requirement (tr. 809).

19. This excavation scheme consisted, as surveyed by the specifications, of a process called line drilling, which consists of a series of very closely spaced holes outlining the perimeter of the shape of the structure to be excavated (in this case, a circle). So the circumference of the circle was line-drilled by holes of two to four inches in diameter and placed probably two feet apart. (Tr. 809.)

20. In addition, a series of holes in the center from the excavation (in this case midpoint of the circle) was also drilled. Charges of dynamite were placed by the contractor in the holes from the line drilling operation and in the holes in the center of the planned excavation area. (Tr. 809.)

21. The planning of the line drilling and the determination of the dynamite charges were adopted as a result of a conference between the

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

contractor's management people, by (on one occasion) representatives of the DuPont Powder Company and (on another and distinctly different occasion) representatives of the Hercules Powder Company. These were all meetings relating to the size of the charge in the excavation for each unit. (Tr. 810.)

22. Those loaded blast-offs were detonated with or loaded with time delay caps or fuses, such that a limited number of the charges would be exploded and in the case of the plain drilling holes (those around the perimeter) would start, for example, at zero degrees and progress clockwise until they reached 360 degrees, with milli-delayed blasting caps at (to Mr. Mason's remembrance) four delay intervals, such that the total delay time was in the range of 16 milliseconds. This was an attempt to create a fractured, or a controlled crack totally around the perimeter of the material to the excavating, so as to prevent any cracks going beyond the intended limit and damaging rock. Had it been a simultaneous shot you would also have run that risk, since you run more risk with the volume of dynamite that goes off at any one time. (Tr. 811, emphasis added.)

23. The strength of the rock was such that a crack could be propagated by a series of closely spaced impacts rather than by one big jolt which would break up the whole smear. (Tr. 811.)

24. Following the detonation of the perimeter blasting, or the line drilling blast-offs, the central portion of the excavation containing several holes (Mr. Mason did not remember how many) was detonated. This was to create the first breaking of large volumes of rock to permit a load-out operation coming from the center of the circle, the center of the planned excavation. The intended function of the charges on the perimeter was only to crack the rock into a cylindrical pattern beginning at the surface and to the bottom of the planned excavation, to create by this blasting a separation of the rock to be removed from the rock to be retained. The shot in the middle of the area was subsequent to the perimeter shots by milliseconds. (Tr. 812.)

25. That portion of the rock that had been torn loose or removed from its in-place position in the central portion of the excavation was then removed by proper tools, probably a front-end loader. There was very little rock that could be removed by that technique, and additional blasting was required. This was done by drilling holes on the radii from the center of the circle approaching the previously split perimeter, and additional charges placed and additional blasting performed. Now the rock throw is from the newly created perimeter wall around the center of the excavation into the center portion of the excavation where it can be loaded out. This process continued until the excavation was deemed complete, meaning that it had its proper diameter and depth. (Tr. 813, emphasis added.)

26. The excavation depth was in the range of 40 feet. The holes drilled for the placing of the charges were approximately 40 feet, probably slightly deeper. (Tr. 814.)

27. So now the process involved removing the fractured rock, by front-end loaders. As the rock was removed, Mason and Johnston's engineering geologist came in for the first time to inspect the rock wall, the wall that was intended to have been left intact and undamaged. (Tr. 814, emphasis added.)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

28. In response to the questions: "Was the rock wall basically on the plane that you were seeking? Did you basically accomplish what you were after with regard to the circle you were trying to excavate?" Mr. Mason testified that a casual observer would agree that the excavating was in general in search of facts, and it was to the proper depth, but that it was not in such a way as to leave in place the quality of rock that they as engineers wanted to transfer the load to, so they were disappointed. (Tr. 814, 815, emphasis added.)

29. In regard to the walls of the excavation specifically, the upper portion of the 40 feet, for a distance of somewhat less than ten feet, looked as if all of the blasting charges had elevated the rock, had tilted it so that it was upward toward the center of the excavation. Distances of displacement were in inches. Void spaces were present. One could run his hand flatly into the previously intact rock that was then elevated up. There were vertical factors present that had not been present in situ, created by additional gases escaping toward the side walls. These conditions decreased with depth, and Mr. Mason testified that he believed they were totally confined to the thin upper ten feet of the excavation, so that the lower 30 feet of the 40 foot deep excavation were acceptable from his standpoint. (Tr. 815, emphases added.)

30. The upper ten feet had experienced these cracks. Cracks were present of both horizontal and vertical types, but by sheer majority they were present more in a horizontal direction as a result of rock masses being pushed up. As to the significance as to a vertical crack versus a horizontal crack, it's a question of the strength of the material; the material is broke, and when its shear strength is exceeded, it cracks. (Tr. 815, 816, emphases added.)

31. Mr. Mason testified that he observed the cracks first-hand. They were mapped by Mason and Johnston's staff geologist, photographed and documented. (Tr. 816, emphases added.)

32. Mason and Johnston did not recommend at that time that they proceed with the pouring of concrete. After a concurrence with a member of the firm of Gibbs and Hill, a solution was finally adopted from the several methods that could have been used to correct the problem. (Tr. 817.)

33. The method which Mason and Johnston recommended, and was eventually adopted, consisted of the total removal of all displaced rock, the removal radially until all cracks that were apparent from the then ground surface were removed, physically removed. The rock was excavated very carefully with a totally different method and hauled off. The rock was broom cleaned, air hosed, watered until they were all convinced that all evidence of cracks and/or displacements created by the blasting had been removed, and then the desired geometry required to contain concrete for the containment vessel was restored by means of dental concrete. (Tr. 816, 817, emphases added.)

34. Mr. Mason discussed the alternative measures they could have taken that they chose not to take (tr. 817-818). He stated that in his professional opinion, the best option to pursue from a structural standpoint was the one that they recommended; he stated that Mr. Ralph McGrane and their client owner concurred without a moment's hesitation. (Tr. 818.)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

35. At that point, what they had was a 40 foot or so high wall, the upper ten feet of which looked as if one had a deck of cards tilted upward with each card representing a layer of rock. The upper ten feet of the formation had been broken free from the lower 30 feet and each layer of rock pushed upward as it approached the perimeter of the excavation. This continued radially, horizontally, beyond the intended cut line for distances in the range of ten to twenty feet. (Tr. 819, emphasis added.)

36. The distances were determined by a very careful technique. First, all debris on the ground surface was removed by brooms, then by air and then by water, so that they could see precisely what was on the ground surface. They saw cracks. A trench was then excavated in a circular form around the perimeter wall and back a distance selected by the field geologist in the range of five feet. This trench was big enough that he could get in and look and see if there was a crack on the cut side and on the side away from the cut. In other words, if it continued across the trench that was declared bad, and a second trench was excavated, and so on, until the last trench was in total sound rock. That last trench was in the vicinity of 30 feet out from the excavation wall, which indicated that no fractures had been propagated beyond that distance. The trench was as shallow as they could make it, probably no more than three feet, because that is a most sensitive area, the area that had no restraint on it. (Tr. 819, 820, emphases added.)

37. In response to the question "Couldn't you have not found cracks in a three-foot trench yet found cracks had you trenched deeper?", Mr. Mason answered "No, not in that formation...because of the techniques of the crack propagations in a limestone containing clay stone layers." (Tr. 820, 821, emphasis added.) Through the previously described process, they determined the extent of the cracking. Then the entire area containing cracks and displaced material was removed and replaced with dental concrete. (Tr. 820, 821, emphasis added.)

38. The front-end loaders and hand tools were brought into play again in the removal of the material. The front-end loaders would operate only in a certain width; any width beyond that had to be done by hand tools, picks and shovels. (Tr. 821.)

39. Mr. Mason testified that there was only one other time that blasting was used to break that cracked rock free. There was a zone of crystalline rock, crystalline meaning somewhat harder than its surrounding neighbors, that as a result of the blasting fell into the excavation in such a way that the front-end loader's bucket was too small, or the rock was too big to fit into the bucket. That rock was capped, meaning that a small piece, or charge of dynamite with an electrical cap was detonated on it so that that one rock was split in two, which it did do. This was not rock which was contiguous with the underlying rock formation; it was rock that had previously been blasted and fell into the hole as it should have, but in a piece too big for the piece of construction equipment to remove it. (Tr. 821, 822.)

40. Mr. Mason testified that if there had been other blasting on the foundation itself he would have known about it, and there was none. (Tr. 822.)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

41. At this point, there was an open excavation. The cracked material had been removed. If you were on the top looking down on the excavation, you would see, with the upper ten feet, an excavation circular in form, but with a diameter approximately twice what you'd intended to get. As you progress down to perhaps a ten to twelve-foot level, your diameter suddenly decreases to what you wanted to get, so you have two cylinders with a common axis, one approximately twice as deep as you wanted and one about like you wanted. (Tr. 822, 823, emphases added.)

42. The walls of the larger ring were inspected; the vast majority of their detailed work was in that zone. Mr. Mason testified that they thought that all cracks had been excavated out of that area, but that as work progressed they found there were others. Those were treated as cracks to be filled with grout. He stated that this created a dilemma as far as time was concerned, because it was mandatort (sic), it was necessary to have concrete covering those cracks so as to provide a resistance to the escape of grout when the cracks were grouted in place. (Tr. 823, emphases added.)

43. Those cracks were in both containments and the Fuel Building foundations. Mr. Mason testified that those cracks were primarily in the walls, though there are, to his remembrance, two that penetrate both the wall and the base -- the wall of the excavation for the containments. He stated that the cracks were in the side walls as far as the containment is concerned; and in the base as far as the fuel building, both the walls and the base. He stated that there was one crack found in the base of the excavation for the containments (the bottom of the excavation for the containment structures). (Tr. 823-825, emphases added.)

44. Mr. Mason described the specific procedure employed for the placing of dental concrete in the area which they had excavated out of the upper ten feet of the containment (tr. 825-826).

45. The specifications as prepared by Gibbs and Hill provided for the placement of dental concrete, as used in the word (sic) specifications, to provide the strength of the concrete, mix designs, and so on. That concrete was mixed on site, placed on previously clean rock in a conventional manner, using an interior form to create the walls so that the fresh plastic concrete would not fall into the previously excavated hole.

46. The exterior form and the base of the concrete pour was the rock itself. (Tr. 825, 826.)

47. The term "dental concrete" is a construction term given to concrete that is used to repair a defect in rock. Its characteristics can be different from normal concrete used in construction of structures; and in this case they were. (Tr. 826.)

48. The strength of the concrete as used in structures is dependent on the intended use of the structure, and at Comanche Peak it was quite high. The dental concrete was used to repair a rock that had a strength requirement far less than the requirement of the concrete used in the plant. The strength of the concrete for dental uses was 2,500 pounds per square inch at an age of 28 days, which produced a material with strength and physical properties far greater than that possessed by the

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

limestone itself. (Tr. 826, 827, emphasis added.)

49. Mr. Mason stated that as far as any engineering significance to the fact that the dental concrete would be stronger than the rock below it, the concrete could have had a strength lesser than what it had because it was now (or would be when it cured) stronger than the rock. He stated that their philosophy was there is nothing to be gained by reducing the cement content such that it is equal only to the strength of the rock. Let's use a non-cement content, normal placing techniques, as called for in the previously adopted specifications. From the soils and foundation standpoint, it was quite adequate. (Tr. 827, emphasis added.)

50. Reinforcing steel was not placed in the area where dental concrete was placed. (Mason testimony, tr. 827-828, emphasis added.)

51. The reason reinforcing steel was not placed in the area where dental concrete was placed was that the mission in using dental concrete is to try and approximate what is in the ground. The Glen Rose limestone contains no reinforcing steel. They were attempting for uniformity, to reproduce by mankind a formation that is already present and is as near the reproduction as we can economically do so as to create a uniform system for the final structure. (Mason testimony, tr. 828, emphases added.)

52. Mr. Mason testified (tr. 828):

Q: "What in your opinion was the engineering significance of the repaired excavation, relative to the excavation as it would have been had there been no cracks?"
A: "In service people and construction costs, appreciably more."
Q: "In service equal?"
A: "Yes."

53. Mr. Mason stated that the procedure for excavation of the Unit 1 and Unit 2 containment building were both the same way. (Tr. 828.)

54. Mr. Mason testified that the excavations for Units 1 and 2 were not done simultaneously, that Unit 1 was excavated first, then Unit 2. (Tr. 829.)

55. He also stated that the excavation procedure was changed for Unit 2 after their experience with Unit 1; that the powder companies were changed, powder consultants were changed, and that the distance on the line drilling holes was reduced (meaning that they were then closer together) taking less of an explosion to perpetuate a crack. (Tr. 829.)

56. Even though all those changes were made, they nevertheless experienced basically the same amount of cracking. Mr. Mason attributed this to the mechanics and characteristics of the Glen Rose formation, which are such that he does not believe it possible to get an intact base resulting from line drilling and blasting; he stated that a different technique was called on, which was later employed on the site which worked fine. (Tr. 829-830.)

57. He stated that the prior technique for repair of Unit 1 was also used for Unit 2 and that it worked fine. (Tr. 830.)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

58. The extent of dental concrete placement for Unit 2 was about the same as for Unit 1, about ten feet deep and from 15 to 20 feet beyond the intended wall line. (Tr. 830, emphasis added.)

59. Applicants' witness Merritt testified that the Fuel Building joins Units 1 and 2 containments. (Tr. 831, emphasis added.)

60. The proximity of the wall of the fuel building to that on the reactor is relatively close, in the range of 50 feet or less. In the plan view there is a service water pipe tongue that parallels one wall of the fuel building. In the drilling and blasting of that operation, some substantial blocks of rock were displaced horizontally. (Mason testimony, tr. 831.)

61. Mr. Mason described the size of the substantial blocks of rock which were displaced: 50 feet in width, approximately 100 feet in length, and a depth of somewhere between 5 and 10 feet, which was physically moved horizontally a distance that you could put your fist through. It slid horizontally. (He identified a reproduction of their own photograph that shows that displacement in "Friday's paper.") (Tr. 832, emphases added.)

62. There were cracks in the bottom of the excavation of the fuel building which Mr. Mason does not consider significant of less than a quarter inch in maximum width, and the decay or beginning end of every crack was visible; they knew where it started and where it ended and its maximum width. (Tr. 832, emphases added.)

63. Mr. Mason described the criterion they used to distinguish between cracks which would be repaired by grouting and cracks which would have to be removed and replaced with dental concrete: Rock which had been displaced horizontally and was intended to give resistance to a wall, to be pushing against it, they considered worthless. It was removed. They did not want any stress on it. "The cracks that I'm alluding to, or describing in the fuel building were in place. as other places, but those in other places were immediately removed in the excavation process when we removed the rock mass. Those remaining had experienced no displacement and were best treated by means of the grout injection." (Tr. 832, 833, emphases added.)

64. The large block of displaced rock which Mr. Mason recommended be removed was in fact removed, and the repair procedure was what he had previously described around the containment building, dental concrete. (Tr. 833, emphasis added.)

65. He stated that forms were placed and the dental concrete poured; he felt sure that, with the volume that was there, it was not a continuous pour. (Mason testimony, tr. 834, emphasis added.)

66. The dental concrete was not reinforced with reinforcing steel, for the same reason as previously given (see Finding of Fact Nos. 50

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

67. and 51; also 47-49). (Tr. 834, emphasis added.)

68. Mr. Mason expanded on how the dental concrete was joined to the rock that was unbroken: "When I used the words displaced and fractured rock was removed down to sound rock, this means that in order to accomplish that, jackhammers or clay spades are used to make sure that all drummy rock, all loose rock is, number one, identified, and number two, removed, and the result is a reasonably horizontally plane that acts really as a continuous key way, it is rough, it shows undulations of two to six inches, all caused by the jackhammer tools and/or the clay spades, and gouged it out. So in that sense of the word there's intimate contact, shear resistant contact between the dental concrete and the underlying firm, undisturbed rock. (Tr. 834.)

69. Mr. Mason testified that upon repair of the area under discussion, the foundation was structurally as it would have been had there been no cracking in the rock; he stated that it definitely was. (Tr. 835, emphasis added.)

70. But when he was asked if it was stronger, he stated that "It was stronger." (Tr. 835, emphasis added.)

71. Mr. Mason testified that he had experience prior to the Comanche Peak excavation project, in the excavation or blasting in limestone of the quality of the Glen Rose limestone foundation (tr. 835).

72. He stated in response to the question "Did the Glen Rose limestone react consistent with your past experience in similar limestone deposits?": "In a very general sense, yes, in that it was blastable and we did fracture the rock. In a less than expected sense, inasmuch as it was a softer material, so far as the blast charge that was used, we were all surprised, including both representatives of the two major power (sic - should be powder?) companies." (Tr. 835, emphases added.) (Applicants' Attorney Reynolds suggested immediately after this statement that this would be a convenient time to break for lunch.)

73. Mr. Mason described the foundation of the excavation when it was completed and the repairs were effective: "...with respect to the view on the top of the completed excavation, the first thing to note is the observer is standing on concrete; approximately eight to ten feet beneath him is a vertical concrete wall. Then the wall, while continuing vertically, is composed of the limestone, the intact, unfractured rock. Then, due to the structural requirements, the diameter of the excavation decreases. One would see the intact, unfractured parts on the surface of the limestone, and thence the lowermost portion of the reactor excavation, which is a central, somewhat deeper section. It is composed of intact, unfractured limestone." (Tr. 837.)

74. Mr. Mason testified that there was no rock breakage in the deeper center excavation after the repairs were effected. (Tr. 837.)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

75. Mr. Mason testified (tr. 837, 838, emphasis added):

Q: "In your professional opinion, was anything done during the excavation in repair work that would or cause cracks in any structure to be placed upon the foundation?"

A: "No. Absolutely not. The condition at the completion of the excavation and remedial measures were equal to or superior to those that were intended in the design."

76. Applicants' witness Scheppele testified that he had heard Mr. Mason's testimony over the preceding one or two hours and that there were no aspects of that testimony with which he disagreed; he also stated that there was no clarification that he felt should be made to that testimony. (Tr. 838.)

77. Applicants' witness McGrane testified that he had heard Mr. Mason's testimony, that in his professional opinion it was accurate, and that he did not think any corrections should be made to it. (Tr. 838, 839.)

78. Mr. McGrane testified that he was present for some of the work described by Mr. Mason at the Comanche Peak site, that he was on site during the excavation when the excavations had been cleared of rock prior to repair. Asked whether he observed the cracks which were experienced as a result of the blast, he stated "At the time that I believe they're referring to, we had the excavation, or the fractured rock had been cleared." He stated that he had observed the cracks before that had been cleared, that he observed the technical approach to resolving this, and that he concurred in that technical procedure for repairs that were effected. (Tr. 839, 840.)

79. Mr. McGrane further testified that he discussed those with Mr. Mason. He stated that he is a civil structural engineer. (Tr. 840.)

80. Mr. McGrane stated that he observed the cracks in the fuel building excavation first-hand. (There were no structures that had been built at that time.) (Tr. 840.)

81. He stated that he concurred in the repair procedures devised for the repair work in the fuel building area, and that in his opinion as a structural engineer, there was nothing done during the excavation and repair work that could or would cause cracks in any structure placed upon the foundation. (Tr. 841.)

82. Applicants' witness Scheppele testified that in his opinion as a structural engineer, there was nothing done during the excavation and repair work that could or would cause cracks in any structure placed upon the foundation. (Tr. 941.)

83. Applicants' witness Tolson testified that the excavation work for Category 1 structures at Comanche Peak was not subject to Quality Assurance procedures and controls. (Tr. 841.) He stated the reason for this was that the specifications for the excavation work did not impose the requirements of 10 CFR 50, Appendix B. (Tr. 841.) (Emphases added.)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

84. Mr. Tolson further testified that the procedures for Quality Assurance did not come into play until the stage of construction which is at the end of the excavation stage and prior to the placement of the Category I structure. (Tr. 842, emphasis added.)

85. Mr. Tolson reaffirmed that there were no Quality Assurance or Quality Control procedures pursuant to which excavation was conducted, and that his Quality Assurance organization was not involved in inspecting, auditing and surveilling the excavation activities. (Tr. 842, emphasis added.)

86. Mr. Tolson testified that he was employed by Texas Utilities at the time of the excavation of Comanche Peak as a senior Quality Assurance engineer assigned to the corporate QA staff in Dallas. (Tr. 842.)

87. Mr. Tolson testified that he was familiar with the rock breakage that occurred during the excavation, and that he observed it first-hand. (Tr. 842, 843.)

88. He stated that the reason he observed it first-hand (since it was not subject to Quality Assurance procedures) was that it was of interest to him as a professional. He stated "My personal background is in the geophysical field, and therefore I have more than just a passing interest in the excavation work. As I stated previously, QA/QC function was to be applied prior to concrete placement, which is just immediately subsequent to the period of time that we're currently talking about." (Tr. 843.)

89. Quality Assurance procedures were employed for the repair work, because at that time the project specification was modified to impose 10 CFR 50, Appendix B, on the repair work. (Tolson testimony, tr. 843, 844.)

90. Mr. Tolson testified that the excavation and rock overbreak was reported to the NRC, "basically verbally and followed up in writing by an interim report in February '75, and a final report in December of '75." (Tr. 845, emphasis added.)

91. He stated in answer to the question "Was the excavation cleared of broken rock before the NRC was advised, or was the NRC advised immediately upon the shooting of dynamite?" (Tr. 845, 846, emphasis added.):

> "Let me try to answer it this way. I think we need to go back to part of Mr. Mason's testimony relative to the pre-splitting operation, the concentric blasting operation and the removal of the resulting rock, which occurred over a tremendous period of time, and I don't have the exact date in my mind. Evidence of the rock overbreakage, if you will, did not really become visually apparent until we had reached the final grade, if you will, thinking in terms of the excavation."

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

92. Mr. Tolson stated that it was at that point (see preceding Finding) that the NRC Staff was advised verbally and was notified in writing: "in accordance with the requirements of 10 CFR 50.55(e), we filed, as I mentioned earlier, both an interim and final report." (Tr. 846.)

93. Mr. Tolson testified that NRC principal inspector Bob Stewart came to the site to observe the excavation, based on Mr. Tolson's first-hand knowledge. He also stated that Mr. Stewart would have observed the excavation for the containments for Unit 1 and Unit 2 and for the fuel building, and that there was no way Mr. Stewart could not have seen the rock damage in the fuel building if he observed the excavations for the containment units, because (as Mr. Mason described) the rock fracturing in that particular area was quite visible so that one standing at the opening of the hole for a containment would have a view of the entire excavated area. He stated that the displacement of rock in the fuel building was very obvious and very pronounced. (Tolson testimony, tr. 846, 847, emphases added.)

94. Mr. Mason testified that, with regard to the length of displacement for the rock in the fuel building, "I recall an open crack, meaning that the rock was displaced in an amount that -- and I'm not very big, but I could squeeze my body through, let's say ten inches...Substantial." He also stated that it was very visible and that there was "daylight where it should be rock." (Tr. 847, 848, emphases added.)

95. Mr. Tolson stated that in his opinion the Applicants fully and completely fulfilled the requirements of reporting to the NRC, that nothing was withheld from the NRC, that the inspector was on site and observed all aspects of the overbreak. (Tr. 848, 849, emphasis added.)

96. Applicants' witness Scheppele testified that it would be fair to use the terminology foundation for the rock surface and the repaired concrete, and that this is the clean and repaired excavation, the rock surface on which the concrete foundation of the primary structure (in this case the containment structure) would rest. (Tr. 849.)

97. Mr. Scheppele stated that the containment structure for Unit No. 1 was placed immediately on top of that foundation first. "I think if you would bear in mind the description that has previously been given, what we basically have here is" two circles, a large circle that would be about 150 feet in diameter; then there would be a smaller circle within that larger circle, which would represent the depressed portion of the land itself which would be non-concentric with the center of the reactor building or the containment structure, slightly offset but nevertheless a smaller circular shape which would be roughly 20 to 24 feet below that.

"These would represent the concrete -- the rock surfaces which had been prepared for the placement then of the concrete foundation mat, which is the supporting element for the containment structure itself.

"Now, that mat is 12 feet in thickness. The construction sequence would be one in which the concrete would be placed first at the lowest depth. It would be placed entirely around the smaller circle at a depth which would be roughly 24 feet below the larger circle.

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

97. (cont.)

"Then the next point to be constructed after that lower mat was constructed would be the walls, the little wall going up which would in effect be a vertical surface to the foundation mat. That would be roughly 12 feet in height. The inside surface of that would be a steel arm added to the form...It would be 12 feet in thickness as well.

"Now...we have a 12-foot horizontal mat. We have a 12-foot cylindrical wall. On top of that then we would have a 12-foot thick concrete mat that would go out to the exterior of the larger circle.

98. "All of that concrete is heavily reinforced. That concrete...is the basic support element for the containment structure. On top of that liner, on top of that construction, that concrete construction there is eventually a liner placed at the proper surface of the horizontal concrete pours.

"So in effect what we have then is a steel liner at the top of the foundation mat, again in a shape that would be compressed in the center, vertical in the vicinity of the reactor, horizontal on the larger diameter circle, and that steel plate would extend to the cylindrical wall where the steel liner plate and the cylindrical wall would be joined and that in turn would go up over the hemisphere. So then in effect what we have is a complete steel envelope which is at the top of the foundation mat, which is the point now in question."

99. Regarding the purpose of the reinforcing steel in a structure such as that, which we could call a base mat, Mr. Scheppele testified that "This reinforcement was placed in that base mat, is designed to accommodate all the various loading combinations which that containment would realize during the course of its life and also during all of the environmental effects which that plant would have received.

"This would involve loading combinations, which would incorporate internal pressure, it would incorporate seismic conditions. It would incorporate the regular operating conditions of the plant. All of these factors in accordance with the generally recognized practice from the viewpoint of design of the containment structure.

100. In response to a question as to what function the concrete would serve in such a structure, Mr. Scheppele testified: "In the design of reinforced concrete, primarily they use concrete as a compression element. Concrete really is never used as tension because concrete in itself -- as a tension element because concrete as tension is a very weak material.

"As a consequence, we marry the compressive strength of concrete and the tensile strength of steel, and basically that's a marriage which has worked out well for many, many hundreds of years."

101. Mr. Scheppele defined compression element of concrete: "A compression element is one which we primarily have a situation where the forces are working towards one another, and that produces a compressive stress as opposed to a tensile stress, which would tend to pull things apart.

"If you can visualize something like concrete, which is a brittle material when it's subjected to a tension it would tend to crack, and basically the design of reinforced concrete structures does indeed involve cracking, because in order for the reinforcing steel to physically work it is necessary for the concrete in most instances to crack."

(Findings 97 through 101 preceding, tr. 849-853, emphases added.)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

102. Mr. Scheppele testified that "concrete is not used as a tensile resistant material, without the use of reinforcing steel, which, in effect, provides the tensile strength in reinforced concrete." (Tr. 866, emphasis added.)

103. He stated that the reinforcing steel in the reactor cavity wall "provides structural purposes, any loading combination that results in tension in the concrete, requires reinforcing steel and, generally speaking, in all reinforced concrete construction, we normally have all exposed concrete surfaces with reinforcing steel placed in two directions to minimize extensive cracking." (Tr. 866, emphasis added.)

104. He further stated that "when you get this tension force which I mentioned previously, concrete is not good at withstanding. When you get this tensile force resulting from the shrinkage, then the concrete does have hairline cracks" in the reinforced concrete "which seek out the most -- the weakest point in the concrete matrix." (Tr. 871, emphases added.)

105. He also stated in reference to shrinkage cracks that they were "cracks which I previously explained was due primarily because of the heating and then eventually the cooling of the concrete caused by the chemical reaction." (He was still referring to the shrinkage cracks in the reinforced concrete.) (Tr. 880, emphases added.)

106. And he testified (regarding the cracks in the base mat or radiation shield or whatever they were): "My viewpoint is that the strength is not impaired because we have made judicious use of reinforcing steel to account for situations in which the concrete cannot take tension." (Tr. 885, emphasis added.)

CROSS-EXAMINATION:

107. Applicants' witness Tolson testified that there was no QA/QC procedure developed subsequently to the rock overbreak for later blasting that occurred; that there would have been a construction procedure issued for the blasting activities that is therefore subject to monitoring and surveillance, which would have applied to the subsequent blasting. (Tr. 915, 916, emphasis added.)

108. Applicants' panel was asked if anyone of them knew of any construction procedure or QA procedure for the excavation for Unit 1 or Unit 2; Mr. Tolson indicated that there were none. (Tr. 916, 917, emphasis added.) (No one else on the panel responded.)

109. There were no construction procedures or QA procedures for the excavation of the fuel handling building (Tolson testimony, tr. 917, 918, emphasis added.)

110. There was no QA procedure for later blasting, but there was a construction procedure for monitoring and surveilling blasting subsequent to approximately November or December 1975. (Tolson testimony, tr. 918, emphasis added.)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

111. Applicants' witness Mason testified that their firm (Mason & Johnston Associates, Incorporated), R. A. Mason, or any of his employees did not develop a procedure for blasting. "The blasting sequence and blasting procedure was primarily developed by the contractor Brown and Root with input from this round-table discussion, from the then powder company and the powder companies changed --...That was for the entire reactor excavation, albeit there were two." He testified that his firm developed the recommendations to use this sequence and method "(o)nly to the extent of contributions to a round-table discussion, attended by the owners' representative, construction manager in that case, the contractor's administrative chief and superintendent of excavation, myself or my representative, Mr. Croft, and from that evolved specific instructions, I'm sure, that went from Brown and Root's administration to the field superintendent, to the people on the machines that were doing the work." (Tr. 919, 920.)

112. That was all for the first excavation for Unit 1. (Tr. 920.)

113. Mr. Mason discussed further the excavation for Unit 1. (Tr. 920, 921.)

114. There was a plateau at one level and then a smaller excavation in the middle of that plateau that goes down to a lower level and that is where the reactor will eventually go for Unit 1, as illustrated by Applicants' Exhibits 21 and 22. (Mason testimony, tr. 921.)

115. The reactor cavity excavation was done after the initial excavation through the first level. The first level was a uniform grade from which the cavity excavation was shown by the blue (sic) concrete fill in place. (Mason testimony, tr. 921.)

116. The total depth, 40 feet, would be approximately somewhere from the plant grade to the bottom of the cavity; so the first excavation was somewhat less than that. (Mason testimony, tr. 921, 922.)

117. The second excavation did not use the same process as in Unit 1. "In the second level, as in the first level, the reason being, with all of the pain and suffering that had gone on with the overbreak from the first blasting process. Now, my best memory of that one time was that there was no blasting at that lower level and that those walls were created by a different technique, permitted in the specification called drilling and broaching. The holes are now drilled tangent to one another to create the vertical walls. A series of vertical holes are drilled that close and then an expansion tool is lowered and creates a fracture. (Mason testimony, tr. 922.)

118. Mr. Mason testified that he did not know the date of the Unit 1 excavation from the original break. He also testified that he couldn't get within a year of the date when Unit 2 excavation was made. (Tr. 923.)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

119. When asked how long after the Unit 1 excavation was done, was the Unit 2 excavation, Mr. Jordan referenced CASE's Exhibit 4 (which had been originally marked Exhibit 22 in CASE's Answer to the Motion for Summary Disposition of Contention 5). (Tr. 923.)

120. Mr. Mason testified that "As I recall, the Unit 1 blasting operation occurred in the first few days of January, 1975." (Tr. 923, emphasis added.)

121. Mr. Tolson continued the testimony: "That excavation goes on for a tremendous period of time or a significant period of time subsequent to the blasting operations...My date refers to blasting as opposed to excavation. I do not have an end date in mind when the finish (sic) excavation...Again, the Unit 1 blast occurred around January 5th, 1975, as stated in the letter I just referred to, CASE Exhibit 22." (formerly CASE Exhibit 22; see Finding 119). However, CASE Exhibit 4 does not state that the Unit 1 blast occurred around January 5, 1975. (Tr. 924; CASE Exhibit 4, introduced and accepted into evidence tr. 924, 925.)

122. Mr. Mason testified that the same problem arose at both of the two units as a result of a blasting excavation, and that after blasting for Unit 1, the problem of the overbreak was discovered and the blasting was modified to some extent for the Unit 2 excavation. (Tr. 925, 926.)

123. Mr. Mason continued his testimony: "...the overbreak condition from the blast from Unit 1 was determined only after subsequent excavation. We were suspicious, however, that some similar condition that was actually found might have increased, and as a result, the contractor changed the pattern (sic) suppliers. The whole station was reduced approximately in half. Powder charges were reduced and other remedial measures that I do not now recall of that type. And in containment 2, we detonated during the same week that we had been able to see the side walls of reactor one, which Mr. Tolson mentioned but the impact of that I need to bring out. (Mason testimony, tr. 926, emphases added.)

124. "Replying to one hour and then the calendar, said you have blasted the second one. Of course, we'd only been blind two days when that event occurred. Yes, I need to repeat the time when we were able to confirm the conditions on Reactor No. 1 went off. It was only 24 to 48 hours before it went off in Reactor 2 and that was subsequently determined to have been only a half of a correction because it was destroyed also. ...I'm trying to emphasize that the blast that took place at Unit 2 was underway when we had the full story of what the walls looked like on Reactor 1...We had already reduced for discharges, changed arms supplies, powder suppliers, those precautions turned out to be inadequate to keep rock damage from occurring." (Mason testimony, tr. 926, 927, emphases added.)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

125. When asked a question as to how soon after the Unit 2 blasting was Unit 2 excavated, Mr. Mason stated that he did not know the time period, but "I can assure you it was a lot longer than a day." (Mason testimony, tr. 928.)

126. The rest of the panel was asked the same question; no one replied. (Tr. 928.)

127. Mr. Mason further testified that it was a lot longer than a day for the excavation of Unit 1 to reach the point where they knew how extensive the problem was, and as to a range of time, he stated that it was "Several weeks. Possibly longer." (Mason testimony, tr. 928, emphasis added.)

128. He further stated: "Before we got the full story of the wall appearance on Reactor One excavation, the blast for Reactor Two went off within ...probably two days, three days." (Mason testimony, tr. 929, emphasis added.)

129. In a discussion regarding CASE Exhibit 4 (Applicants initial letter of notification to the NRC about the overexcavation), Mr. Mason stated that "memory tells me that the blast for the Unit 1 occurred on January 5th, 1975" and that that the excavation for Unit No. 1 containment which was approximately at elevation 793 began (the actual digging out of materials) on January 23, 1975. (Tr. 929, 930, emphases added.)

130. Applicants' witness Tolson testified that he was involved in the reporting of the overexcavation to the NRC; he stated that "I reviewed the letter" (CASE Exhibit 4). (Tr. 930.)

131. In response to the question as to why the company reported to the NRC that after the blasted material was removed from Unit 2, visual inspection revealed little if any damage to the perimeter walls (in light of Mr. Mason's testimony that, in fact, the damage to Unit 2 was approximately equal to the damage on Unit 1), Mr. Tolson responded "Maybe we need to keep in mind that this is a report to the Commission after the facts as we understand them at that time. I have no feel for the magnitude of the or the depth of the excavation on Unit 2 that had occurred on February 4th. Intuitively I would believe that it would be very little because we're only talking about, at most, a couple of weeks between January 25th and February 4th when we sent the letter to the Commission." (Tr. 930, 931, emphases added.)

132. When CASE attempted to pursue this matter further and clarify the full picture of what went on when and why, Applicants' attorney made a comment and the Board told us to move along. (Tr. 931.) See further information under Timing.

133. No one on Applicants' panel had any details or knew about how the excavation of the fuel building was handled. (Tr. 932, 933, emphases added.)

134. Mr. Tolson testified that the fuel handling building is located approximately the center of the two excavations previously discussed, off to one side. (Tr. 933.)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

135. Mr. Mason testified regarding the fuel building foundation excavation: "Rock has been disturbed on the wall that was intended to remain intact by the fuel building...I could walk through the crack that had been created by impact rock being displaced horizontally, a gap of perhaps ten inches." He stated that this impact displacement "obviously had to have occurred during a blasting operation in connection with the excavation for the fuel building, which I've already replied in the negative that I do not have the details of it." (Tr. 933, 934, emphases added.)

136. CASE Exhibit 5 was introduced and accepted into evidence (tr. 934-938); this is a two-page memorandum from Herbert C. Crowder, Field Geologist for Mason-Johnston & Associates, Inc., Field Office, CPSES, to Raymond C. Mason, under Subject of "Blast Overbreak on Containments and Fuel Building Excavations," and a one-page attached titled "References."

Applicants supplemented the exhibit to complete it (Applicants Exhibit 24, tr. 936-940; Note: Applicants' Exhibit 24 was provided and accepted into evidence at tr. 1061-1062. Mr. Mason stated that there were additional geology sheets and photographs which had been a part of the original document. (Tr. 936.)

137. Mr. Mason testified that CASE Exhibit 5 had a date of November 26, 1975 (which was not clear on the copy CASE had and introduced into evidence). (Tr. 941.) He also stated that on December 2, 1975, by letter identified as MJT-185, CASE Exhibit 5 and Applicants' Exhibit 24 were transmitted to TUSI. (Tr. 942.) The December 2, 1975, was not in CASE's possession and it was not introduced into evidence by Applicants.

138. CASE Exhibit 6 was introduced and accepted into evidence (tr. 942, 943). It is the final report provided to the NRC by TUGCO with respect to the rock overbreak or overexcavation (tr. 943).

139. Mr. Tolson testified that to his knowledge there were no reports to the NRC on the subject between the report of February 4, 1975 (CASE Exhibit 4) and the report of December 12, 1975 (CASE Exhibit 6). He further testified that to his knowledge there were no supplements to the December 12, 1975 report. (Tr. 943, emphases added.)

140. The language of the final report to the NRC (CASE Exhibit 6) closely tracks the language of the internal memorandum from his geologist to Mr. Mason (CASE Exhibit 5), with some notable exceptions, including the fact that the following paragraph which was contained in the geologist's memorandum (next-to-last paragraph) was completely omitted from the letter to the NRC:

> "Major fracturing also occured in the Fuel Building foundation area when the Service Water Intake Pipe Tunnel was blasted. This rock is being removed and will be completed as stated above. Photographs (6) were taken and mapping (4 & 7) is basically complete at this time." (Emphases added.)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

141. Applicants' witness Tolson testified regarding the preceding (Finding 140). When asked if there were ever reports to the NRC under Section 50.55(e) of their regulations or under any other Commission regulations reporting that major fracturing had occurred in the fuel building foundation, he testified (tr. 943-945, emphases added):

A: "I've already referred to the letters, the two letters, the interim report and the final report that were submitted to the Commission under 50.55(e)."

Q: "And those, as I understand it, were reports on the over-break in Containment 1 and 2 excavations, correct?"

A: "It's not correct. Those are your words. The intent of the reports was to report over-break in the Category 1 structure."

Q: "And the fuel handling building is a Category 1 structure, is it not?"

A: "That is correct."

Q: "I see no reference to the fuel handling building in your December 12th of (sic - should be or) February 4th letter to the Nuclear Regulatory Commission, yet I see a separate paragraph in Mr. Mason's report that was sent to TUGCO. Your testimony is that there is no report from TUGCO to the Nuclear Regulatory Commission that specifically informs that agency of the major fracturing that occurred in the fuel building --"

MR. REYNOLDS: "Objection, Mr. Chairman. The witness already answered that question."

JUDGE MILLER: "What did he answer?"

MR. REYNOLDS: "He answered no."

JUDGE MILLER: "All right. It's been answered 'no.' If you'll accept that answer I believe we --"

MR. JORDAN (for CASE): "It wasn't clear to me that he answered 'no.'"

See further discussion of this matter under section titled Damage to Fuel Building was not reported, later in this pleading.

142. Applicants' witness Mason was ask if he and those who worked on it had taken into account his knowledge of geological structures in limestone in developing the proposal for the perimeter blasting for these containment excavations. He replied "We initially thought we had... We attempted to."

Q: "So apparently this limestone turned out to be different, or otherwise, or perhaps softer. I believe you used the term softer, is that correct?" A: "I think I used the generic term weak rock as opposed to hard rock." (Tr. 945, 946, emphases added.)

143. Mr. Mason testified that he was aware that there existed an aquifer below the Comanche Peak site. (Tr. 946, 947.)

144. He further testified that their problem was not caused by a difference in the limestone over-break in this case because the limestone is soluble and that it could involve sink holes and solution channels with the aquifer there. (Tr. 947.)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

145. Mr. Mason defined ribbing: "I used the term ribbing" (when talking about blasting and ribbing) "but in a way I think is common to construction industry to describe a chisel like tool that is pulled by a tractor." When asked if that was in the sense of a sharp heavy plow that is used to pull off the rock, he stated "It's a sharpened member that much more resembles a chisel than it does a plow." (Tr. 947, 948.)

146. When asked the question "in discussing this whole question of the blasting and the effects that it caused, I believe you said that the crack is worst from closely spaced impacts than from a single large jolt. Is that correct?"...Mr. Mason responded: "Let me try my version of your question in my terms. When I used that phrase we were describing modifications, or at least the principle of lime drilling and blasting so as to induce a perimeter crack, thereby separating one rock mass from another. The propogation of that crack from one hole to another is much more controllable by a sequence of charges, time delayed so as to propogate the crack in its intended direction." (Tr. 948, 949.)

147. Mr. Mason testified that, when testing to determine just how extensive the cracking was, they dug a three-foot trench and found a crack; then they dug out the rock down to ten feet and expanded that whole platform; then they looked at the bottom of the then resolving depth, until they got to a trench that had no crack on the other side. (Tr. 949-951.)

148. In discussing the cracks which were found after the initial excavations were examined and thought to be acceptable, Mr. Mason testified: "I do not have the coordinates of these 30-odd locations, but they are in existence...My positive statement is that there are none in the base of the reactor building. There might be one in Reactor 1 because of scale when I graphed, it's either there or it's in the safeguard room, and I cannot clarify that. There are others in the safeguard building, or Reactor 1, some in the safeguard building for Reactor 2, and a bunch in the field zoning." (Tr. 951-953.)

149. Mr. Mason testified that Mason and Johnston prepared work to be performed by others, "what I hopefully am correctly calling a construction procedure" for the repair of the cracks just discussed. He further stated "There's another input; a portion of that construction procedure called for an input from Gibbs & Hill for the very reason that in sealing an open crack by the grouting process you must have resistance on top of the crack to keep the grout from coming up and failing to go where it's supposed to, so the solution to this involved the two firms, with the structural people telling us what the confining pressure that would be produced by this structure was so that we in turn could monitor and hold the grout pressure, as measured at the ground, to a lower number so as to not in any way do anything except force the grout into the ground, not propogate a crack or left (sic) up a building." (Tr. 953, 954.)

150. He further stated: "The time dilemma was that we had to provide for something that could not be repaired until after the building mat was on. That was the dilemma in time. We could not repair the crack until the building mat had been completed..." (Tr. 955, emphases added.)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

151. Mr. Mason testified that the dental concrete strength was less than that which was used for the structural concrete. (Tr. 955, emphasis added.)

152. He also testified that "the ramifications of economy were simply stating that there was no point in exceeding the strength of the rock with the replacement concrete, but rather than go to the equal strength of the rock, which was less than what we used, we adopted 2,500 p.s.i. strength concrete, as measured in 28 days, as being a flexible, economical mix that was stronger than the rock, and the dental concrete is in fact stronger than the Glen Rose limestone." (Tr. 955, 956, emphases added.)

153. Mr. Mason testified that the data on the p.s.i. of the limestone is contained in both the PSAR and the FSAR. (Tr. 956.)

154. Mr. Mason testified (tr. 956-958, emphases added):

Q: "In makind (sic - should be making) the determination to go with the dental concrete, did Mason and Johnson (sic - should be Johnston), or anyone else, to your knowledge, do a seismic reanalysis of the foundation?"

A: "That was one of the items considered by Mason and Johnson. It was one of the items considered, to my personal knowledge, by Gibbs and Hill, and the conclusion to all of us that we had improved from the seismic standpoint in transmissibility of the foundation. So in essence by visual inspection and the thought process I just outlined, that was the re-examination. We had improved the conditions, and that's true."

Q: "You had improved the conditions by having two separate materials now that presumably shifted differently in the seismic event?"

A: "We had improved conditions in the foundation to the extent that the propogation of seiesmic (sic) forces, and the stronger material was more desirable than a weaker material. Concrete is stronger than the Glen Rose limestone."

Q: "But at the same time you've eliminated the uniformity of the Glen Rose limestone, correct?"

A: "We certainly introduced a different material, but by no means is the Glen Rose limestone a uniform material. It contains clay stones, hard crystalling limestone layers, and it's as far from being uniform as any material you could possibly have drug up. That's a terrible illustration. I'm sorry."

155. Mr. Scheppele interjected (tr. 958):

"I'd like to comment if I may, and that is that from the viewpoint of any reanalysis seismically, I think the only place that would have been warranted, frankly, I don't think it would have been seriously considered, would be if you put soils, for example, in quite an extended depth beneath the foundations, benerath (sic) the concrete foundations and above the limestone surface, which would indeed change the mathematical model to a degree on a containment structure.

"The basis hing (sic) we're talking about here is relatively

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

155. (continued):
small differences, I think, in materials, which really would have no impact whatsoever on any seismic analysis where we're considering, as Mr. Mason indicates, a non-homogenous material with regard to the limestone formations, so it should not have an impact on the seismic analysis, unless, I say, you introduce a very soft material such as soil, but certainly not concrete."

156. Mr. Tolson testified that he was familiar with Brown & Root quality construction procedure CP-QCP-12, titled excavation and soil backfill compaction, inspection and testing, issued in July of 1974. (Tr. 1030.) (This document was referenced in I&E Report 75-05, CASE Exhibit 15, in which the NRC cited Applicants for a violation of 10 CFR 50, Appendix B, Criterion V, because they had not developed and implemented an inspection procedure for activities related to the excavation for the reactor containment structures of CPSES, Units 1 and 2, in accordance with B&R Procedure CP-QCP-12.) (B&R Construction Procedure CP-QCP-12 was later introduced as Applicants Exhibit 25, tr. 1031

157 Mr. Tolson further testified that B&R Procedure CP-QCP-12 did not apply to all excavations, whether or not safety related and that it applied to excavations in primarily rock soils and did not involve rock excavations. (It was noted for the record that Mr. Tolson did not have the document before him at the time.) (Tr. 1032.)

158. Mr. Tolson reaffirmed that to his knowledge there was no similar quality construction procedure developed for foundation rock excavations. (Tr. 1032, emphasis added.)

159. Applicants' witness Merritt testified that he believed there were excavations taking place prior to June of 1975, but that none of those excavations were considered to be safety related by the Applicants (Merritt testimony, tr. 1033) or by its contractor, Brown & Root, or any of the other applicant agents (Tolson testimony, tr. 1033). (Emphases added.)

160. Prior to June 1975, Brown & Root and the Applicants had an inspection procedure for safety related excavations in soil but not in rock. (Tolson testimony, tr. 1033, 1034, emphasis added.)

161. Mr. Tolson identified the general format and purpose of CASE Exhibit 14, an office memo from P. L. Bussolini, Brown & Root, to C. L. Whitford, dated February 5, 1975. Mr. Tolson stated that he was not familiar with that specific memo, but was familiar generally with documents of that type. He stated that it was a monthly QA/QC report for CPSES, prepared by the Brown & Root project QA manager assigned at the site, to be submitted to his immediate supervisor, with apparently copies to a subordinate and a construction representative. (Tr. 1034-1036.)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

162. Mr. Tolson further testified that he had not reviewed all of the Brown & Root QA/QC monthly reports. (Tr. 1036.) He further stated that those reports, of which CASE Exhibit 14 is an example, are not reviewed as a matter of course by him personally, that they are available and on occasion, if time permits, "I may choose to look at them. It's not routine for me to pore (sic) over these type of reports." (Tr. 1038, 1039.)

163. Mr. Tolson is Construction Quality Assurance Supervisor (for TUGCO); he reports directly to the TUGCO Manager of Quality Assurance (so there is one QA person above him). (Tr. 1038.)

164. Mr. Tolson began his employment in October, 1974. (Tolson testimony, tr. 1040.)

165. In regard to any reconsiderations or re-evaluations of the decision that Category One Structure excavations should be considered non-safety related, Mr. Tolson testified: That he did not know who made the initial decision, at least not directly, that it is a decision that is typically an engineering decision. He stated that it was not the decision of Brown and Root, the contractor. He stated that "They say the engineering organization, which in this case, I would presume would be Gibbs and Hill." (Tr. 1040.)

166. Applicants' witness Merritt interjected "I believe it was a decision between Gibbs and Hill and Texas Utilities" and suggested that Mr. McGrane could possibly address that. (Tr. 1040, 1041.)

167. When asked, Mr. McGrane testified "The specifications for excavaction (sic) was prepared by Gibbs and Hill and Gibbs and Hill did not classify them at the time as safety-related." He stated that he did not recall the date the specification was first issued and that "All of our specifications were approved by Texas Utilities before they were issued to the field construction." (Tr. 1041.)

168. Applicants' panel was asked "Are you aware of a reconsideration, a re-evaluation of that decision (not to classify Category One Structure excavations as safety-related) in...late 1974 or early 1975?" (Tr. 1041.)

169. Mr. Tolson stated "I'm aware of the reconsideration in early 1975, yes." He further testified in response to questions that (referring to CASE Exhibit 4) "This matter of the decision to report this item, your 10 CFR 50.55(e) was the breaking gap route, if you will, for reconsideration of the classification of the excavations and 50.55(e) only applies to safety related activities" and that was the February 4, 1975, document. In response to the question of how long before February 4th this conclusion was reached that this was reportable, he stated "I think we have established that it was complete and had been reached at this point in time" (the conclusion that this was reportable). (Tr. 1041-1043.)

170. He stated that "The decision to report under 50.55(e) was made a few days to a week or so prior to the publication of the letter" (of February 4, 1975). (Tr. 1044.)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

171. In regard to the second page of CASE Exhibit 14, dated February 5, 1975, where it is indicated that an audit of excavation procedures was undertaken because a redesignation might occur and in later meetings, it was decided that only shotcrete work for plant site excavations would be considered safety-related, Mr. Tolson was asked "When was this decision with respect to shotcrete work made?" (Tr. 1044.) He stated that he did not recall attending that particular meeting and that therefore he really shouldn t try to answer that particular question. (Tr. 1044.)

172. Mr. Tolson defined shotcrete as "a concrete material excluding coarse aggregate...used as a protective membrane on intact rock slopes at Comanche Peak," pneumatically applied. (Tr. 1044, 1045.)

173. Mr. Tolson stated that "(s)ubject to lapse of memory" he believed that he was involved in the reconsideration of whether there was excavation that should be considered safety related or not in early 1975. (Tr. 1045.)

174. He further stated that Category One Structures were the excavations which were considered for reclassification. (Tr. 1045.)

175. Mr. Tolson further testified (tr. 1046):

Q: "Was the reason not to reclassify Category One excavations as safety related, based on the conclusion that the excavations of the Category One buildings, structures, did not affect the quality or safety of those structures?"
A: "That would be a reasonable conclusion."
Q: "You recall I'm asking you whether that was the reason?"
A: "Yes, sir. I will state -- as I tried to say yesterday, what's important from a quality standpoint is what the concrete placed against and not what created the hole in the ground."

176. Mr. Mason interjected: "I'd like to expand and perhaps disagree or amplify because there is one factor that is being omitted. I touched on it yesterday. It's important at this point for clarification of your understanding of what actually took place.

"I mentioned that from the very beginning we had an engineering geologist on site. In the original specifications, as prepared by Gibbs and Hill, as reviewed by us prior to issuance, it provided for the presence of the engineering jobs to verify the soundness of all materials in the excavation, upon which concrete was to be placed.

"Previously, there existed a committment (sic) from TUSI to the then Atomic Energy Commission and to the NRC, that this person would be present at all times. Would photograph, would perform engineering, be a project manager and photograph the sites of all excavations, as well as determine the quality of the rock handled base.

"That person was there. Those services were performed. At any time that a defect was noted, that was reported to the owner and the principal engineer, Gibbs and Hill and those reports did exist and did take place.

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

176 (continued):

"Now, at one point in time, which I personally believe is prior to 1975 and very likely in the early part of 1974, our QA Manual provided a job description in the engineering sense of the word, not as a performance directed at all, because it was a professional judgment.

"Procedure is the word I'm struggling to use here in QA terms, but our manual provided for the engineering applications of this person, and to the best of my knowledge, pre-dates the date that you (Mr. Jordan) and Mr. Tolson are talking about.

"I don't know if that clarifies the issue or not. But that's what took place, in the field."

(Tr. 1046-1048, emphases added.)

177. Mr. Mason was asked "the person you were talking about, the engineering geologist, was that one of Mason and Johnston people?"

Mr. Tolson (sic) answered "Yes. That's Mr. Herb Crowder, who was assigned at that time to that project." Asked "Is Mr. Crowder still on the premises?" Mr. Tolson answered "Yes, he is." (Tr. 1048, 1049.)

178. Mr. Mason asked the question "Mr. Tolson and Mr. Jordan, would you permit me to tie a couple of loose ends together and perhaps try to get to where I think you're going?...Refer to CASE Exhibit 6, please. On the second page, next to the last paragraph, it reads as follows: This is a letter from Texas Utilities to Region 4.

"'As outlined in your June 4, 1974 (sic - should be 1975) letter, all blasting operations have been implemented within the framework of the pertwnent (sic) requirements of Appendix B to 10 CFR 50.'

"Part of his responsibility is to spend thirty minutes trying to determine the decision not to impose the Appendix B requirements because it's very clearly stated here -- in the interest of time, can we come to grips with that particular issue?" (Tr. 1049, 1050.) (Mr. Jordan responded: "I'd like to come to grips with that particular issue.")

179. Mr. Tolson was asked if he was aware of whether NRC cited the Applicant for failing to develop and implement excavation procedures for activities related to the containment excavation. He replied "It's my recollection that we were, in fact, cited, yes, sir." (Tr. 1051.)

180. CASE Exhibit 15 was distributed and identified by Mr. Tolson as being the document wherein the NRC cited the Applicant for its failure to develop and implement safety procedures for containment excavation activity. (Tr. 1051, 1052.)

181. Applicants' panel was asked if the Applicants objected to the citation of a deficiency by the NRC. Mr. Tolson testified "We requested reconsideration that that would be more softening." (Tr. 1052, 1053.) Applicants' Exhibit 26 was introduced and admitted into evidence and identified by Mr. Tolson as a letter to the Region IV Nuclear Regulatory Commission from Texas Utilities Generating Company, relative to Inspection Report 75-05 in which Applicants were cited; it was dated April 3, 1975. (1053-1055.)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

182. Mr. Tolson testified that the deficiency identified in CASE Exhibit 15 (I&E Report 75-05) was resolved and that the resolution of the item included a new Brown & Root procedure titled Plantsite Rock Blasting and Surveillance in June of 1975: he also stated that in about June (of 1975), the NRC, responding to Applicants Exhibit 26, in essence classified the excavation as safety-related, so that from then forward all plantsite rock blastings for Category 1 structures were then considered safety related. (Tr. 1055, 1056, emphasis added.)

183. Mr. Tolson identified the Plantsite Rock Blasting and Surveillance procedure (CPS QCPS 35) as a QA/QC procedure. (Tr. 1056.)

184. CPS QCPS 35 was to be implemented in conjunction with B&R construction procedure CCP-25, titled Blasting for Plant Structures and SSI dams. (Tolson testimony, tr. 1057.)

185. Once the NRC's June 4, 1975, letter was received, and in an answer to those the appropriate requirements of Appendix B, then it was an internal mechanism that accomplished the rest of it (the development of the QA/QC procedure previously discussed). (Tolson testimony, tr. 1057-1058 and Applicants Exhibit 27, NPC June 4, 1975 letter.)

186. The NRC did not withdraw its citation (CASE Exhibit 15)(Tolson testimony, tr. 1058-1059).

187. CASE Exhibit 16, I&E Report 75-07, was identified by Mr. Tolson and accepted into evidence (tr. 1059-1061).

188. The start of blasting and excavation for the reactor containment structure was scheduled for late February at the time of the January 8-9, 1975 NRC inspection (CASE Exhibit 16, p. 6 of report).

189. Mr. Tolson testified that he did not think he was "in a position to answer that question (whether the blasting for Containment 1 and 2 originally scheduled for late February), because I'm beginning to get confused about some dates." (Tr. 1061.)

190. Mr. Mason read from a letter dated 1 February '75 to TUSI that alluded to an inspection that he was to make (tr. 1062) and stated "On January the 23rd, on Thursday, January the 24th, on Friday, of 1975, and again on Monday, January the 27th, 1975, Containments 1 and 2 were inspected to reveal the damages resulting from blasting and over-break. Therefore, they would have detonated at a prior date." He testified that he did not know about the scheduling or rescheduling. (Tr. 1063, 1064.)

191. No one else on the panel responded when asked if anyone else knows about the scheduling. (Tr. 1064.)

192. The control building was identified as also being called the lower auxiliary building, the control building being the building in which the control room is found, or located; it is a Category 1 structure (Merritt testimony, tr. 1064).

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

193. None of the members of Applicants' panel had any knowledge of any over-excavation with respect to the control or safeguard building (tr. 1066-1067).

194. Mr. Mason was questioned regarding the section in the FSAR (Final Safety Analysis Report, Applicants' Exhibit 3) dealing with the excavations and backfill, Section 2.5.4.5, beginning on page 2.5-121 (tr. 1069-1074).

195. Mr. Mason testified (tr. 1070-1075, emphases added):

Q: "...to your knowledge, is all the information about the over-excavations of Category One Structures contained in that section (2.5.4.5)?"
A: "All of the information?"
Q: "Yes. For example, all the photographs, does it fully describe all the overexcavations for Category One Structures?"
A: "I am of the opinon and I'm sure I'll be corrected if it's wrong, that there is a supplemental photographic file referred to repeatedly in here, which are not contained in the FSAR."
Q: "Okay, that is not contained in the FSAR. This particular FSAR contains at page...2.5-122. It refers to the photogrids or photographs taken at one containment of the outer excavation walls. The, if you know, would the remaining supplementary file which is not in the FSAR include the similar photogrids of other overexcavations?"
A: "That sentence in the paragraph that you are reading states that all other fracture mats (sic - should be maps) and photographs are part of the permanent construction records which are available for review from Texas Utilities Services, Incorporated."
Q: "Have you seen those permanent construction records?"
A: "No, I have not."
Q: "Has anyone on the panel seen them?"
A: "Yes, Mr. Jordan. I have."
Q: "Would there be a photogrid with those?"
A: "Yes, sir, I believe so. May I correct my answer?"
Q: "Sure."
A: "We prepared it."
Q: "Which? The photogrid --"
A: "The photogrid and the photographs obtained during the construction and excavation. My reply was meant, I had not seen it in its final form or in the possession now of Texas Utilities Services."
Q: "I understand. Now, these photographs were all taken by Mason and Johnston, I believe."
A: "Yes."
Q: "Now, are you aware of other -- of overexcavating related to other Category One structures, other than the Unit 1 containment?"
A: "Yes."
Q: "For the Unit 2 containment?"
A: "Yes."
Q: "The safeguard building No. 1?"
(No immediate response.)
"First, let me ask you, is that a Category One structure?"
A: "Yes, and to my knowledge, you're going to get maybe maxes (sic) from here on. I'm not aware of any other Category One excavation, overbreak."

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

195. (continued):

Q: "You know of no others but the containment for Unit 1 and Unit 2?"

A: "Well, let me define the terms, real quick. I have previously testified that the largest overbreak of all is the fuel building wall. That was the subject of yesterday's --"

JUDGE MILLER: "Pardon me. You're not being asked to recapitulate. Simply tell us what buildings, if any, other than those described, where there was an overbreak."

WITNESS MASON: "I have done that, sir. The reactors and fuel pumps."

Q (BY MR. JORDAN): "The reactors and fuel pumps. Were there photos taken of the reactor core area?"

A: "I would have to say yes. I do not personally know if there were orders out to photograph every square inch. I'm sure they were followed."

Q: "And you don't find an mention in the FSAR, do you, Mr. Mason, of overestimation (sic - should be overexcavation) as to either the containment or the fuel handling building in the FSAR?"

A: "On the lower portion of Page 2.5-122 is a complete paragraph. The tail-end of the second sentence states that blast fractured (sic - should be fracture) maps were developed by the site geologist. The FSAR states in Item 8, that material was fractured as a result of blasting and in that particular sentence, I submit that it does not state that that material was removed."

Q: "So you're making a distinction between, then, what one would call overbreak and what one might call fractured?"

A: "The overbreak resulted in fractures and the fractures were removed. The following sentence states -- at least to me -- at the time the geologist approved an excavation assuring the QA/QC program, became involved, assuring cleanliless (sic - should be cleanliness) prior to application, curing and testing of the protective coatings. That's a true statement."

Q: "I'll take it as a true statement."

JUDGE COLE: "You say protective coatings. What do you mean, sir?"

WITNESS MASON: "Shotcrete in this case, which was the -- the only reason shotcrete was applied was to protect wet ring from occurring on the excavations."

JUDGE COLE: "General concrete is the same category? Is that a protective coating, too, or is that something else?"

WITNESS MASON: "No. That's entirely different. That was a replacement of the broken and fractured rock."

JUDGE COLE: "So you used shotcrete on it possibly before you applied general concrete?"

WITNESS MASON: "No."

JUDGE COLE: "This was another area?"

WITNESS MASON: "Others where it was applied."

JUDGE COLE: "All right. Thank you."

JUDGE MILLER: "We will recess for lunch and return at 1:00 o'clock."

(Whereupon, the luncheon recess was taken...)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

196. Mr. Mason identifies and discusses the photographs (shown as slides) of overexcavations referenced on the third page of CASE Exhibit 5: Photo Nos. U 362187 - 2 thru 20 inclusive, U 362192 - 2 and 5, U 362193 - 1, 16, 17, and 20, Containment #1 Misc. Photographs; K 153774 - 10, 11, and 12, Containment #1 proof photographs of fracture removal; K 153774 - 30 and 31, Containment #2 proof photographs of fracture removal; Q 223556 - 24 thru 28 inclusive, photographs of fractures to be grouted; K 153772 - 30 thru 36 inclusive and K 153778 - 1 thru 8 inclusive, photographs of fractures in Fuel Building foundation area. These were admitted into evidence as CASE Exhibit Nos. 17A-Z, 17AA-II, and 18A-O, respectively. (Tr. 1076-1127.)

197. Mr. Mason stated, in part: CASE Exhibit 17A - The rod against the wall is marked in foot increments, he thinks. (Tr. 1080.) It was the intent that the wall be solid all the way to the top, as it is in the middle of the picture (tr. 1080-1081). Everything above what appears to be the 10' mark on the rod would probably have been cleared from that area. "I still do not know what's below the lowermost portion of that picture." The entire photograph is that of the Glen Rose limestone formation (tr. 1081-1082). Toward the bottom third of the photograph there appears what seems to be a rough area of rock; this is a clay stone layer or seam normally and naturally contained in the Glen Rose limestone (tr. 1081-1082); there is weathering that is obvious there throughout the areas that are clay stone -- that would be the one perhaps three or four or five feet above the base of the photograph, and one immediately below that, too. It would be removed back to firm material; that seam would be dug back inside the wall. (Tr. 1083.) The vertical lines are the lines resulting from the lime drilling operation, and each one indicates, on that particular scale, to be separated by I'd judge about three feet as compared with the rule. (Tr. 1032.) It is Containment #1.

198. CASE Exhibit 17B - Still Containment #1 Misc. Photographs. Everything above the clean-cut wall would be stripped away (similar to CASE Exhibit 17A), and same information applied regarding the clay stone layer (see Finding 197 above). (Tr. 1083-1084.)

199. CASE Exhibit 17D - Still Containment #1 Misc. Photographs. Regarding what appears to be a rather large crack that runs approximately through the center horizontally: "From what I see in the photograph... I'm going to make the assumption that this was our two crack situations. That was excavated back. There's also a horizontal crack with an air gap, I think, above the major one. I think this is the beginning of the area that was taken out to the depth of the lowermost crack. I'm not certain..." (Tr. 1085, emphasis added.)

200. CASE Exhibit 17E - Still Containment #1 Misc. Photographs. Assumed it was the same two-crack situation; certainly it's similar to the previous photo. (Tr. 1085-1086.)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

201. Mr. Mason's testimony (continued):
CASE Exhibit 17G - Still Containment #1 Misc. Photographs. A situation where the cracks got considerably worse across the horizontal area in the middle; the excavation would have been from the crack that is in the approximate center of that photograph. (Tr. 1086-1087.)

202. CASE Exhibit 17H - A multiple line crack, and we're also picking up areas of horizontal displacement where the upper rock, from about the midpoint of the photograph -- all the rock above that is moved radially into the excavation. As to the approximate distance that it moved into the excavation, "That information is a detail map. Yes, we have the information. I do not have it here, and it would depend entirely on where that is radially around the excavation." A rough guess would be maybe five inches or more. (Tr. 1087-1088, emphases added.)

203. CASE Exhibit 17I - The blast had not left a perfect wall up at the top and that continues to be the case. (Tr. 1088-1089.)

204. CASE Exhibit 17M - Another example of having been blasted out into the excavation, in effect, to create overhang. "We also have the first line that I have detected, the indication of the horizontal displacement within a given layer. Layer 1, 2, 3, 4 down from the top of the intact rock, has been horizontally displaced to the right," as indicated by the blast line drilling holes that have moved. (Tr. 1089-1090, emphasis added.)

205. CASE Exhibit 17N - Mr. Mason was unable to identify this exhibit other than to the extent that it was one of the numbers of the miscellaneous photographs that his firm provided. (Tr. 1090-1091.) Mr. Merritt stated that that may have been an access ramp, "But I don't know. I don't know where it was taken from or the location." (Tr. 1091.)

206. CASE Exhibits 17-O through 17S - Back on the Containment wall.

207. CASE Exhibit 17T - "It appears to show the view from the rim of Containment 1, according to the notes. At least I'm assuming that the camera is sitting on the rim. I'm not sure that that's a fair assumption. No, the original ground rim. I cannot positively identify that as the original ground, in the photograph. It has the excavation, has been cleaned to at least the floor to permit wheeled vehicles and the excavation and the inner circle appears to be under way." Mr. Mason thought that inner circle was then going to be the reactor cavity. (Tr. 1094.)

208. CASE Exhibit 17U - Q: "...is this apparently a different view of essentially the same thing?" A: "Well, it's certainly a different view, and I again believe that to be Containment 1." (Tr. 1095.)

209. CASE EXHIBIT 17V - Still Containment #1 Misc. Photographs. At the lower left corner or lower left side, where there appears to be an indentation in the lower excavation, that would be a portion of the wall of the reactor cavity and that indentation is undoubtedly the fracturing and/or weathering of the clay scheme (sic - should be seam?). (Tr. 1096.)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

Mr. Mason's testimony (continued):

210. CASE Exhibit 17W - The lower half or so of the photograph is the reactor cavity portion of the excavation and the upper half or so is the outer perimeter wall of the Containment excavation. The large amount of rock and rubble in the lower two excavations is there to be removed, as is the material up on the very top portion of the photograph and most likely down to the horizontal fracture on the upper wall, and continue down that one "right there." All of the upper rock, which has the appearance here of soil, would also have been removed. In the excavation for the reactor cavity itself, what appears to be a crack very similar to the cracks we've seen in the upper excavation, going across slightly below the top of that excavation, is a layer of clay stone, which is in the weathering stage there; and that clay stone was excavated back to weather under firm conditions. To Mr. Mason's knowledge, that was not the result of some overbreak or something of that sort in the excavation itself. (Tr. 1096-1098.)

211. CASE Exhibit 17X - "I truly think..." that we are looking into the reactor cavity excavation with the Containment excavation higher level behind it. "But that could be a remnant of a ramp that was used in getting the material out...In fact, I rather think it is a portion of a ramp that is as yet unexcavated. To be honest, I don't know." (Tr. 1098.)

212. CASE Exhibit 17Y - The reactor containment cavity, essentially cleared of all major rubble, and "I think I see the ramp that I was afraid (sic) as in a previous photograph, leading one out." (Tr. 1099.)

213. CASE Exhibit 17Z - Beginning of section marked proof photographs of fracture removal. Containment #1. A portion from Containment 1 to clean-up, removing the material, or in the process of removing the material and in the process of setting a form to contain replacement concrete from whatever the lower elevation of the rock is, to the original natural ground. That would be at least one more line of forms and perhaps one more excavation level to the left of the photograph. There would be some other work that's obscured in this photograph down the wall. (Tr. 1100-1101.)

214. CASE Exhibit 17AA - Essentially the same thing, still in Containment 1. The forms go down because the rock was removed to a different lower elevation. Forms will all be brought up eventually. (Tr. 1101-1102.)

215. CASE Exhibit 17BB - All part of the same excavation effort in Containment 1 (see CASE Exhibits 17Z and 17AA). (Tr. 1102.)

216. CASE Exhibit 17CC - First of two proof photographs of fracture removal, Containment #2. Mr. Mason was not sure he could explain it, and suggested that Mr. Merritt answer. Mr. McGrane testified that "This photograph would have been taken from the Unit 2 safeguard building. You're looking at the Unit 2 reactor excavation. At the point where you see this lift coming down in the front, the fore part of the photograph,

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

216. CASE Exhibit 17CC (continued):

Mr. Merritt's testimony (continued):
is where a portion of the safeguard building was replaced. The safeguard building is adjacent to the contrainment (sic - should be containment) structure at that point." (Emphasis added.) The hole where the scaffolding type structure goes down into a hole is a reactor cavity for Unit 2. There is a wall behind what in essence is a donut with some people standing just above it; that wall would form the outer limit of the containment mat and containment wall, also referred to as the perimeter. Q: "Since my impression is that the reactor cavity excavation was essentially below the level of the bottom of the containment excavation, or perimeter excavation, if you will, could you explain why that -- in effect that donut of unexcavated material is around the reactor cavity and apparently above the level of the excavation all the way to the perimeter?" A: (McGrane): "It is not above the level of the excavation. That perimeter is, or that flat portion that you see there around the reactor cavity is the bottom of the foundation mat or perimeter mat that we've been talking about." A: (Merritt): "That's your upper mat that shows back over here. It's a left-hand drawing which is blue and goes horizontally" (referring to Applicants' Exhibit 21). (Tr. 1102-1104.)

217. CASE Exhibit 17DD - Second of two proof photographs of fracture removal, Containment #2. (See also CASE Exhibit 17CC.) Mr. Mason stated: "Basically what that is, you're sitting over in the Unit 2 safeguard building looking essentially due east right across the top of the opening for the reactor vessel itself." (Tr. 1104-1105.)

218. CASE Exhibit 17EE - The first of five photographs of fractures to be grouted. In connection with something that is adjacent to either Containment 1 or Containment 2 and is in a Category 1 area. Mr. Mason stated that he thought the photograph illustrates by a fracture in the rock angling upward to the right from the base of the photograph. The existence of a fracture that "I'm assuming is open inasmuch as that is the reason that the photograph was included in our memorandum to start with. It would be relatively impossible to grout that fracture without first filling the area in the forefront of that fracture with concrete so as to close the fractures and that would later concline (sic) any introduction of grout into that open fracture. That is the purpose of the photograph and is the reason that it was included under the caption photograph of a fracture to be groute." (Tr. 1105-1106.)

219. CASE Exhibit 17FF through 17II - The other four photographs of fractures to be grouted (same area)(see CASE Exhibit 17EE also). CASE Exhibit 17GG - Shows the form work beginning to progress at the upper left. The fractures to be grouted are in that dark area along a 45-degree angle, Mr. Mason assumed. To grout that particular fracture, it is necessary to remove rock that is not intrically and structurally sound. When that has been done and there still persists an open joint, which may be natural, or open fracture which may be created by blasting, then a judgment call has to be made as to how it is repaired. If it is decided, on the judgment level, that that should be treated like grouting, then yes, it is necessary to clean it off and then replace concrete. (Tr. 1106-1108.)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

(Mr. Mason's testimony - continued):

220. CASE Exhibit 18A - The first of a series of photographs of fractures in Fuel Building foundation area (CASE Exhibits 18A through 18-O). Mr. Mason assumed that the rule or marker is marked in foot lengths (on this and all previous photographs). The fracture shown in this photograph is "one of many in the wall separating -- I shouldn't say separating because I don't know what's on the other side at the moment. I don't know the orientation of that photograph. One of the walls of the fuel building. I think I see daylight through the crack." The crack in the fuel building Mr. Mason stated yesterday that he could almost fit himself into was, Mr. Mason thought, larger than that one. (Emphases added.) (Tr. 1110-1111.)

221. CASE Exhibit 18B - (Appears to be slightly different angle of CASE Exhibit 18A; Mr. Mason did not specifically discuss it.)

222. CASE Exhibit 18C - Mr. Mason testified regarding this photograph (tr. 1111-1113), which is still of the Fuel Building foundation area:

Q: "Can you tell us what that's a picture of, Mr. Mason?"

A: "I can tell you what it's a picture of, but I can't tell you why it was taken. To me it's a picture of a pickup truck." (Laughter.)

Q: "Could it be a picture of overhand (sic - should be overhang) from the excavation?"

A: "I don't know what it is."

Q: "...You've testified and indicated in the slides that in fact in the containment excavation, at least for Unit 1, there were areas where the excavation blast resulted in the wall, in effect, moving forward somewhat radially, I believe you put it, into the excavation by some distance which you guessed at as around five inches or so, in a particular photograph that we looked at. Did that problem arise in the fuel handling building and could this be a picture of it?"

Q: "Truly, I do not know what that picture is intended to delineate to the observer. That's my best answer. Now, a problem did arise in the fuel building which hopefully you would reproduce some of the other photographs of those formations moving in, but this particular on (sic - should be one) I can't tell you why it was taken." (Emphasis added.)

Q: "Fine. Thank you..."

223. CASE Exhibit 18D - Mr. Mason indicated that this was an example of the movement into the excavation referred to in his previous answer. He stated: "...it's a three-dimensional movement. The intact rock, prior to blasting, had been drilled. The path of the drill has been highlighted by either red or orange paint to illustrate the offset. The eye can be used, or at least my eye can, to detect that the upper portion of the rock has been moved forward over the clay stone seam or, and equally probably, the lower portion of the rock has been moved away from the camera back from the upper rock, and I cannot, without orientation, tell you which way the movement was. I think we can all agree that there has been a relative movement on two axis...When there is an air gap on the back side of the rock mass that we are looking at, what

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

223. Mr. Mason's testimony (continued):

I'm saying is if a rock pedestal in horizontal thickness is not a substantial number we have all kinds of weird movements in the rock, in a three-dimensional, three-axis movement, so yes that (the lower parts as well in fact move backwards) can be possible under certain conditions."

224. CASE Exhibit 18E - "Obviously that's a crack in the rock with a horizontal displacement. I don't detect any vertical displacement. I see either a saw cut or concrete in the upper right-hand portion, and again without the photo log mat and the proper orientation, that's about all I can tell you." Mr. Mason stated that he didn't know (and rather doubted) that the upper left-hand or left quarter, approximately, of the photograph was looking into the fuel building excavation at that point. The rest of the panel was asked, and Mr. Merritt stated: "No. You get a unanimous no, we don't know where that is." (Tr. 1114-1115, emphasis added.) This is still part of the Fuel Building foundation area.

225. CASE Exhibit 18F - Continuing with the fractures in the Fuel Building Foundation area. Mr. Mason stated that he could not identify where this particular tract is and that he could not even differentiate this one from the previous one, that they could be the same, that he did not know, other than that it is in the area of the fuel building foundation. (Tr. 1115.) He further stated "Mr. Jordan, you are aware that there is a photo log we have that gives better descriptions, which we don't have at our availability." (See later discussion regarding this.) He stated that that crack appears to be extending away from some excavation, for whatever the distance of the crack is, that the foreground of the photograph appears to be disappearing from view, indicating some form of a near vertical wall. "I'm puzzled by what the second rise in the rock surface is. It seems to be a plateau and then it goes up again. I don't know what that is." (Tr. 1116.)

226. CASE Exhibit 18G - Another view of the fractures in the Fuel Building Foundation area. Mr. Mason initially thought that the big crack on the right was the one he previously described that he could get into up on top (tr. 1117); but later he stated that he had been misled by the scale of the photograph and that it was not that particular crack (tr. 1123-1124). He did, however, repeat his testimony that there was a crack in the wall or the foundation of the fuel handling building that was so large that he could get into it himself, that there was one approaching his body thickness; but that we did not have a picture of it in the photographs were shown as slides and admitted into evidence as CASE Exhibits series 17 and 18, photograph copies from the slides. (Tr. 1127.) He stated that this view was for the fuel building. "...the fuel building would be on the inside, or the foreground of the photograph, and again I'm puzzled by the orientation of what appears to be the crane housing coming up at a high elevation, indicating another excavation on the other side...That's the best that you're going to get from us here with that view. We don't know." (Tr. 1117.)

227. Mr. Merritt stated that "we may be looking to the southwest of the switch yard in the far, far background. That may be the rise back there, such that you would have that cherry-picker sitting over in the turbine

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

227. (Mr. Merritt's testimony - continued:)

hall, or even the auxiliary building." Mr. Mason: "It could be either." At this point, Mr. Reynolds suggested that perhaps the witnesses could state whether if this slide were in backwards the orientation would help, to which Mr. Mason responded "Our orientation would be totally wrong if that is the case. That's a serious point." (It should be noted, however, that there is nothing in the record to indicate that the slide was backwards, and the pictures correspond exactly to the way the Applicants provided them to CASE insofar as their facing correctly.) (Tr. 1117-1118.)

228. Mr. Mason testified in regard to the approximate size of the large block that begins about, not quite halfway down the crack, that he could not say from the data that's instantly available. "I can approximate it as something in the vicinity of a free length of around 50 or more feet." He defined free length: "If one would extend the plane -- well, first of all, I'm assuming I know what I'm looking at, and I've already tried to disclaim a positive identification. If we are correct, or approximately correct, I believe that that plane of the rock that is illustrated on the right-hand side of the photograph comes to a vertical face or daylight in about 50 more feet, representing a junction. That, I think, is the entire mass of rock that was, by judgment call, totally removed from the site and replaced with concrete." (Note: In view of the fact that Mr. Mason was mistaken about the scale of the photograph, it may be that his estimate of size and disposition was not correct for this particular photograph; however, he has clearly indicated that there was such an area, whether or not we had photographs of it.) (Tr. 1118-1119.)

229. CASE Exhibit 18H - Mr. Mason stated that CASE Exhibits 18H through 18-O (K-153778-1 through -8) are all a continuation of sequence but a change in numbers in the fuel building area, and that he thought CASE Exhibit 18H was the same view as CASE Exhibit 18G. (Tr. 1119.)

230. CASE Exhibit 18I - Mr. Mason stated that he did not recognize it, that there was no orientation, and the best we know is that it's in the fuel handling building area. "According to our records, it's in the same area and may possibly be a detail of the previous two. It appears that the cameraman is zeroing in on this." (Tr. 1120.)

231. CASE Exhibit 18J - Mr. Mason stated that he'd have to see the previous slide (CASE Exhibit 18-H), but that "I don't think it's that material at all. All I can tell you is that's somewhere in the fuel building. That's obviously a crack, yes. And there's also one on the left, and there's one halfway between the two." (Tr. 1120-1122.)

232. Mr. Mason was asked: "...there appears to be a wall behind, relatively in the background, above the man in the photograph. Is that an additional crack?" A: "That would be too far away for any crack to show up, I think. That would be from some other cause. What in reality is present, is an excavation behind the rock that the man -- well, let's start over. There is a man in the photograph and a reentrant corner. That is a corner of an excavation. Horizontally, away from the camera, there appears to be

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

232. (Mr. Mason's testimony - continued):

a rock surface. Then there must be -- there was another vertical wall where the excavation goes down because the cherry picker and the loading -- or the truck loaders or rock loaders, is at a lower elevation. Now, the black L-shaped mark on the far corner would not be visible, in my opinion, if the crack of the same size as that besides the man were present over there and I would suspect that to be something entirely different." Asked if we wouldn't be looking at the turbine building wall on this particular location, and if so, is there an excavation parallel to the wall on the left, with the loose rock on top, Mr. Mason stated "I'm not sure about that...I think we got the switchyard behind us, and if that's the case, then we're looking at the far wall of the turbine building." (Tr. 1122-1123.)

233. CASE Exhibits 18K and 18L - The best we know is that they are in the fuel building foundation area, and that they are photographs of fractures. (Tr. 1125.)

234. CASE Exhibit 18M - Still photograph of fractures in Fuel Building Foundation area. Mr. Mason was able to tell us "Nothing other than some effort has been made by someone to attempt to remove obscuring loose material on the top of a rock in order to determine the location of the crack" and that there is what appears to be a crack extending away from an excavation. (Tr. 1125-1126.)

235. CASE Exhibits 18N and 18-O - Mr. Mason was asked: "...just from reviewing this slide (CASE Exhibit 18-O) and the previous ones, you recall, it does appear that the crack we are looking at in the face of the wall extends across a plateau to another excavation. Is that correct?" A: "Yes. This is, as you correctly pointed out, another view of the same defect as the result of blasting and your assumption is correct that crack does extend and continue down the other side. We have had, with these slides, many such photographs. What we are looking at is three or four or more views of the precise crack, taken from different angles." (Tr. 1126-1127, emphases added.)

236. CASE Exhibits 19 through 36 are admitted into evidence (tr. 1129-1152).

237. Regarding CASE Exhibit 21 /1/ Mr. Mason testified to the following breakdown by number of the color code on page 1 of the Exhibit (tr. 1153-1164):

1/ Tr. 1153, lines 23 and 24, states: "MR. JORDAN: Well, I would propose to go with at least one of the facilities --" This has a typographical error; it should indicate that Mr. Jordan was proposing to ask some questions regarding CASE Exhibit 21.

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

237. CASE Exhibit 21, Mr. Mason's testimony (continued):
#1 - Red - horizontal surfaces
#2 - Red - vertical surfaces
#3 - Blue
#4 - Green
#5 - Yellow
#6 - Purple
#7 - Brown

238. Applicants' attorney Reynolds stipulated that (with Mr. Mason's consent that this is accurate) we can stipulate that this diagram represents the areas in the plant which required remedial work and that in accordance with the color code, the remedial work for each portion is described in the memorandum. (Tr. 1160; CASE Exhibit 21.)

239. Regarding CASE Exhibit 21, Mr. Mason, in using an example, stated: "For example, the very last one, Brown, which is a major portion of the coloring, happens to consist of the entire fuel building and it states: 'Rock requires further excavation to remove damaged rock.'" (tr. 1162, emphases added.)

240. Regarding CASE Exhibit 31, second page of Exhibit, Mr. Mason confirmed that the references listed under "I.D. No." are references to individual grout pipes that were used in the repair process of the buildings designated under "Building." (Tr. 1165.)

241. Regarding CASE Exhibit 32, Mr. Mason stated that the term "have not been grouted back" means that they have not yet been grouted, the work is incomplete, they need to be done. (Tr. 1166.)

242. The decision for excavation not to be included under safety related quality assurance was made by the engineer at Gibbs and Hill. (Tolson testimony, tr. 1172.)

243. Asked what sort of differences there might be with respect to having safety-related quality assurance activities with excavation and the absence of quality assurance, Mr. Tolson testified "The primary difference, or principal difference, would be the absence of what all of us have come to refer to as the independent verification surveillance or inspection effort over the contractor's procedures for blasting." He stated that records kept of the excavation were not much different than the records that would be kept if QA were involved, and that "The only difference would be the absence of the surveillance evidence" which "would be done by the contractor's organization; in this case, Brown & Root." (Tr. 1172-1173.)

Mr. Tolson testified that, in his opinion, any problems associated with the excavation would not stand a better chance of being discovered were the situation to be different than QA involved. He praised the QA program presented by Mr. Mason the previous day, and stated "I would

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

243. Mr. Tolson's testimony (continued):

have been hard pressed to add to what Mr. Mason established, the interface between the contractor and the power (sic - should be powder?) manufacturer, et cetera, in terms of resulting in no over-break. I don't know in my own mind, and for five years there's been nobody able to come up with a plain thing, if you will, where a formalized QA/QC group could contribute anything to the end product." (Tr. 1173-1174, emphases added.)

244. Asked with respect to those deficiencies that were uncovered, would the technical fixes have been any different than those that were proposed and realized by virtue of the absence of quality assurance, Mr. Tolson testified "Okay. Let me again clarify a point here, and it was a point I was attempting to make yesterday. The fixes were handled within the formalized QA/QC system...That was always our claim. Okay, but the point I tried to drive home yesterday was from the start it was planned, and I use that term within the broad concept of the definition of quality assurance, for the engineering geologist to clarify the adequacy of the finished excavation prior to placing concrete." He stated that the technical fixes would not have been any different. (Tr. 1174-1175.)

245. Mr. Mason commented as follows: "...The investigative process that is normal, the geotechnical group, was performed in close coordination with the structural group of Gibbs and Hill, which generated to the publication of certain specifications. Among those were that the usual excavation should be made to the lines and grades shown on the drawings. Excavations can be permitted by line drilling, roaching, blasting, and so forth, all perfectly normal, and it then stated that no concrete -- I'm sorry, that the geotechnical consultant's representative on site would immediately that defects and/or damage had not resulted. If they had resulted or an over-break occurred, these would be repaired.

"I have here earlier answered that over-breaks did occur in certain areas, but in reality I'm wondering if I haven't accidentally misled people. Over-breaks always occur in construction. No one excavates to a neat line and grade. So all my answers are that the process employed at Comanche Peak through our firm's activities, Gibbs and Hill's and the owner's, was a very tight control, resulting in good foundation work." (Tr. 1175-1176, emphasis added.)

246. Mr. Mason stated that he (and presumably his firm as well) has not participated in a similar activity on other jobs and other sites. He stated that they have participated in many jobs without a QA program, that this one is with a complete QA program after excavation. (Tr. 1176.)

247. Mr. Mason was asked by Dr. Cole "Now, when you say QA program, what do you mean, sir? The reason why I ask, let me tell you that I would assume that any contractor would want to make sure that the quality of his end product is acceptable in terms of his contract so he's going to have some quality control himself. Now, when you say quality control, quality assurance, what do you mean, sir?" A: "Basically the same thing, but better documented." (Tr. 1176, emphasis added.)

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

248. Asked if he thought the technical fixes would have been any different than those actually realized, Mr. Mason stated "Definitely not." Asked if he thought problems would have been better identified if the QA program had been installed, he stated "In my opinion, no, because I think we performed -- we performed the same before that. There was no distinguishable change in our activities." (Tr. 1176-1177.)

249. Asked if his level of participation was unusual for a typical project, Mr. Mason stated "Not in my opinion. We're all partners in trying to accomplish a common mission, and the cooperation was ideal. I don't call that unusual." (Tr. 1177.)

250. Mr. Merritt asked to address that for the utility and stated "The level of involvement that Mason and Johnson (sic) provided in the excavation process is what we at Texas Utilities have experienced on some sites in that because of the changing nature of the materials and soils and mechanics area, we have always leaned very strongly on the soils consultant in conjunction with our AB to help prepare a foundation, either for structures or dams or the like. As such, they give us that degree of independence from the contractor to assure that we do have a body or group that is working in the best interest of us, the final customer, so we believe that from the standpoint of the level of involvement, this is what I have experienced in 15 years, ten of which were on fossil plants with Texas Utilities. This is not abnormal for us." (Tr. 1177-1178, emphases added.)

251. Mr. Mason was asked if he knew how much dental concrete was used, if he had an estimate of the number of yards of dental concrete that was involved in restoring the overbreak back to the original. He testified "No, I personally don't. The dental concrete consisted primarily of the area that was exhibited in the last slides, where cleanup operations were under way, a thickness of perhaps 5 to 7 feet; the max perhaps 10.

"Horizontal distance with step configuration maxium (sic) of perhaps 20 feet. I think that was the largest volume of dental concrete.

"The only other application of the dental concrete would have been for the weathering of the clay stone required a dental application and, to the best of my memory, and someone here may be able to correct me -- I think all of that was placed by shotcrete mechanism because of the difficulty of conforming.

"So, the overbreak was more than we wanted. More than anybody wanted and I do not have a better answer for you. Perhaps members of the panel do as to the cubic yardage that was involved." (Tr. 1179, emphases added.)

252. Mr. Mason was asked "Now, what about the cracks in the rock in the area of the fuel building? You talked about a 10-inch crack and I believe you also testified how that crack was filled. Could you repeat that quickly and then -- do you have an estimate of the number of cubic yards of grout that were used there to fill up these kinds of things -- cracks?"

Mr. Mason testified "I have stated that and, again, left the wrong impression. That block of rock, whatever the yardage may have been, we

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

252. Mr. Mason's testimony (continued):

deemed it non-repairable. Let's remove the entire mass of rock if it contained that type of cracks, down to the face of the cracks. Let's in turn, build a new concrete wall, if you will, to replace this cracked and damaged rock with all the cracks. Now, I lean on somebody else here for testimony about the yardage. I do not know. That may have been the largest yardage of dental concrete, right there." (Tr. 1179-1180, emphases added.)

253. The rest of the panel was asked if they had an estimate of the number of yards of dental concrete which was used. Mr. McGrane testified that "If we look at the dimensions of the building and had that, we could figure the yardage. It's not that difficult." He stated that they could not supply an order of magnitude, as far as the scope of the activity, without a computer. (Tr. 1180.)

254. The following testimony regarding CASE Exhibit 21 was given by Mr. Mason (tr. 1207-1208):

Q. JUDGE COLE: "The original testimony that we had earlier where you were presenting your testimony, prior to cross-examination, I interpret as being almost entirely involving the location of the very large circles in the figure which amount to the containment vessels, Containment No. 1 and Containment No. 2 excavation. Is that correct?"

A. WITNESS MASON: "Yes. That is correct."

Q: "And so you did not go outside of that in your discussions or saying whether there was or wasn't other overbreaks that were a problem at that time? That didn't say that there wasn't some more over-break that you ran into as a problem as you went through all the other buildings?"

A: "I think that's a correct statement, yes."

255. Mr. Merritt interjected: "Let me add something...Throughout the majority -- well, throughout those building areas we did have cases of over-excavation or over-break, whichever the case may be. In some cases we used the blasting technique. In some cases we used the ripping technique. Whatever method we had used, there were cases where we had over-excavation beyond the neat lines called for on the prints, and the solution in those cases was to go back with the so-called dental concrete in those areas." (Tr. 1208-1209.

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

Timing

256. Applicants' witness Mason testified that based on his memory, the blast for the Unit 1 occurred on January 5th, 1975 (tr. 930).

257. Inspection and Enforcement (I&E) Report 75-01 (CASE Exhibit 16) was performed by R. C. Stewart, NRC Region IV's Reactor Inspector at the time, on January 8-9, 1975 (Exhibit page 1); it was signed by Mr. Stewart on 1/16/75 and reviewed and signed by W. A. Crossman, NRC Region IV's Senior Reactor Inspector at the time, on 1/17/75.

258. The report states that "The inspection was limited to the review of the site QA program implementation as it applies to safety related work activities in the initial Construction Phase. In addition, a review and examination was conducted of the activities associated with the construction of the SSI Dam." (Report page 4.) It is not clear whether or not this inspection was at the site; however, no mention is made in the report to the effect that the inspector was aware of any blasting having taken place around January 5. In fact, the report further states "The start of excavation and construction of the SSI Dam has been delayed. The B&R representatives indicated that construction of the SSI Dam is now scheduled to start the first week in February and that the delay would not affect the overall schedule." (Report page 6.) And the report also states "The start of blasting and excavation for the reactor containment structure is currently scheduled for late February." (Report page 6 - emphases added.)

259. An inspection of paperwork at the TUSI corporate offices (not at the plant site) was made on January 17, 1975 (I&E Report 75-02, CASE Exhibit). There is no indication that Applicants advised the NRC of any change in the schedule of late February for the start of blasting and excavation for the reactor containment structure, that Applicants advised the NRC that blasting and overexcavation had already occurred around January 5, or that the NRC had any knowledge that blasting and excavation had already occurred. Mr. Stewart is shown on the report as Principal Inspector, and Mr. Crossman reviewed and signed the report.

260. "On January 23, 1975 the structural excavation, to approximately elevation 793, for Unit No. 1 containment began." (CASE Exhibit 4, Applicants' initial letter to the NRC dated February 4, 1975, reporting the overexcavation under 10 CFR 50.55(e).)

261. Applicants' witness Mason testified that Unit 1 was excavated first, then Unit 2 (tr. 829). He also testified that for Unit 2 the distance on the drilling holes for the placing of the explosives was reduced, meaning that they were closer together, taking less of an explosion to perpetuate a crack, and that powder companies were changed, powder consultants were changed, procedures and method specifications were changed (tr. 829, 926-927).

262. Since the initial blast for excavation to elevation 793 on Unit

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

Timing (continued):

262. No. 2 was accomplished on 1/25/75 (CASE Exhibit 4), the holes in which (cont)the charges were placed had to have been made prior to 1/25/75. Although there is nothing in the record to indicate how long this would have taken, it is reasonable to assume that the drilling of the holes and the placing of the explosives would have taken a few days at least.

263. The initial blast for excavation to elevation 793 on Unit No. 2 was accomplished on 1/25/75 (CASE Exhibit 4).

264. Applicants' witness Mason testified that it was several weeks, possibly longer (following the blast for Unit 1 about January 5) for the excavation of Unit 1 to reach the point where they really knew how extensive the problem was (tr. 928-929). Using the minimum of three for the term "several" would bring this date to 1/26/75 or later.

265. He further testified that "before we got the full story of the wall appearance on Reactor One excavation, the blast for Reactor Two went off within...probably two days, three days." (Tr. 928-929.) He stated that after blasting for Unit 1, "the overbreak condition from the blast from Unit 1 was determined only after subsequent excavation. We were suspicious, however, that some similar condition that was actually found might have increased, and as a result, the contractor changed the pattern (sic) suppliers...I'm trying to emphasize that the blast that took place at Unit 2 was underway when we had the full story of what the walls looked like on Reactor 1." (Tr. 926-927.)

266. The initial Environmental Protection announced inspection of paperwork was made January 31, 1975 (I&E Report 75-03, CASE Exhibit); a site visit was not conducted as part of this inspection (Report page 6, item 8). Messrs. Stewart and Crossman were not shown to be involved in this inspection. There is no indication that Applicants advised the NRC of any change in scheduling of blasting and excavation or that blasting and overexcavation had already occurred, or that the NRC had any knowledge that blasting and excavation had already occurred.

267. Applicants' initial letter to the NRC dated February 4, 1975, reported the overexcavation under 10 CFR 50.55(e) (CASE Exhibit 4). It stated, in part:

> "On January 23, 1975 the structural excavation, to approximately elevation 793, for Unit No. 1 containment began...Following a meeting between representatives of Brown & Root, Inc., Mason-Johnston & Associates and Texas Utilities Generating Company, the blasting techniques which had been used on Unit No. 1 containment were modified. The initial blast for excavation to elevation 793 on Unit No. 2 was accomplished on 1/25/75."

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

Timing (continued):

268. NRC Staff witness R. C. Stewart testified that he was the "principal reactor inspector for the period June 1974 to January 1978, during which time I had responsibility for coordinating all safety related inspections of the Comanche Peak construction." (Tr. 1268.)

269. He testified that he was aware of detrimental rock overbreak which occurred during construction (tr. 1268) and that "the overbreak occurred, to my observation, in...February of 1975" (emphasis added).

270. An inspection of paperwork at the TUSI corporate offices (not at the plant site) was made on February 5, 1975 (I&E Report 75-04, CASE Exhibit) in regard to the Brown & Root QA Program Manual for Comanche Peak. The report states (Report page 4, Item 2) "At the conclusion of the review and discussions, the inspectors indicated that there were no substantive deficiencies observed during the review; however, the matter will remain unresolved pending the issuance of the final approved manual and subsequent IE review."

271. The report also states (Report page 5) "The inspectors discussed, with the Project staff, the TUSI system and format of reports to be submitted in accordance with 10 CFR 50.55(e). The licensee representatives stated that a standard format for the construction deficiency report (CDR) would be developed which would include such items as description, cause, evaluation, plant status, and corrective measures/actions to be initiated or completed." The discussion of reporting under 50.55(e) took place a day after Applicants' initial February 4, 1975, report to the NRC regarding the overexcavation (CASE Exhibit 4). Messrs. Stewart and Crossman were shown as the Principal NRC Inspector and Accompanying Inspector, respectively, on the report. There is no indication in this report that Applicants advised the NRC of any change in the schedule of late February for the start of blasting and excavation for the reactor containment structure, that Applicants advised the NRC that blasting and overexcavation had already occurred and been reported in their February 4 letter to the NRC, or that the NRC had any knowledge that blasting and excavation had already occurred. At the time of the February 5 I&E Report, there had been no indication that the NRC had been advised of any different circumstances from what was contained in I&E Report 75-01 (January 8-9, 1975) in any NRC-generated document in the record regarding the overexcavation. This is important because "It has been an accepted practice in NRC adjudicatory proceedings that the Staff's Inspection and Investigation Reports are admitted into evidence..." and "...in Comanche Peak, the Licensing Board has admitted into evidence numerous Inspection and Investigation Reports..."/1/ This will be discussed further later in this pleading.

1/ NRC Staff's Brief in Response to the Questions Raised by the Atomic Safety and Licensing Appeal Board at the Oral Argument of January 19, 1983, filed January 26, 1983, pages 3 and 4.

I. OVEREXCAVATION (ROCK OVERBREAK) (continued):

Timing (continued):

272. I&E Report 75-01 (January 8-9, 1975)(CASE Exhibit 16) states (page 6) that "construction of the SSI Dam is now scheduled to start the first week in February" and that "the start of blasting and excavation for the reactor containment structure is currently scheduled for late February."

273. On February 27-28, 1975, a routine, unannounced inspection was made by NRC Region IV inspectors at Comanche Peak (I&E Report 75-05, CASE Exhibit 15). R. C. Stewart, Reactor Inspector, was shown as Principal Inspector; W. G. Hubacek, Reactor Inspector, was shown as Accompanying Inspector; and W. A. Crossman, Senior Reactor Inspector, was shown as having reviewed and signed it for all three inspectors. It was signed on 3/6/75. (CASE clarified for the record that I&E Report 75-05 (CASE Exhibit 15) was Mr. Stewart's report, since it was signed by Mr. Crossman; see tr. 1360.)

274. As a result of that inspection, the NRC inspectors wrote up a QA/QC Procedural Deficiency because (Report page 2, Item I.A.3.a):

> "Contrary to 10 CFR 50, Appendix B, Criterion V, an inspection procedure was not developed and implemented for activities related to the excavation for the reactor containment structures of CPSES, Units 1 and 2, in accordance with Brown & Root Procedure CP-QCP-12."

275. There is nothing in I&E Report 75-05 to indicate that the NRC inspectors had any knowledge of the overexcavation prior to the February 27-28, 1975 inspection, either from their own personal knowledge or from having been informed by the Applicants, although clearly they knew from the Applicants' February 4 letter (CASE Exhibit 4). It is unclear whether or not any onsite inspection was made during the January 8-9, 1975, inspection (I&E Report 75-01, CASE Exhibit 16); this appears to be the only possible time an onsite inspection was made in 1975 prior to the February 27-28, 1975, inspection (I&E Report 75-05, CASE Exhibit 15), since it is specifically stated in I&E Reports 75-02, 75-03, and 75-04 that they were not onsite inspections (see Proposed Findings

276. CASE was attempting to clarify several matters, including the time periods involved in the overexcavating and reporting of the excavation and overexcavation, but were instructed by the Board to move along. Because of the unusual circumstances under which we were operating at the time, we were unable to complete the record regarding the timing regarding these matters, and there remain many unanswered questions in this regard. (See tr. 931.)

OVEREXCAVATION (ROCK OVERBREAK) (continued):

THE DAMAGE FROM OVEREXCAVATION (OR ROCK OVERBREAK) WAS EXTENSIVE.

277. The damage to Unit 1 foundation due to overexcavation was extensive. (See Findings 29, 30, 33, 35, 36, 41, 43, 148, 196-215.)

278. The damage to Unit 2 foundation due to overexcavation was extensive. (See Findings 43, 56, 58, 196 and 216.)

279. The damage to the Fuel Building foundation was extensive (Findings 43, 59-65, 80, 93-95, 134-135, 196, 220-235); and Applicants' witness Mason said the damage to the Fuel Building foundation was the most extensive of all (Findings 195, 239, 252).

280. There was also damage to the Safeguard Building foundation, although it was apparently not as extensive as the damage to the Fuel Building foundation (Mason testimony, Finding 148.)

281. Fractures were still being found in the Unit 1 Safeguard Building foundation as late as 5/12/76 (CASE Exhibit 20, page 8).

282. CASE Exhibits 5, 17A-I1 and 18A-O (pictures from slides)(see Findings 196-235), 19 through 36 (see Findings 236-241) deal with the overexcavation of foundations for Class I structures. (See also Findings 218-219.)

283. Applicants' witnesses McGrane and Tolson saw the damage to the foundations (Findings 80, 87-88.)

284. NRC inspector Stewart saw the damage to the containments for Units 1 and 2 and the Fuel Building foundations (Tolson testimony, Finding 93; see also Findings 268-269.)

OVEREXCAVATION (ROCK OVERBREAK) (continued):

ADEQUACY OF REPAIR REMAINS UNPROVEN

285. The foundation for Unit 1 was excavated first, then Unit 2 was done (Findings 54, 55, 122).

286. Even though many changes were made, they nevertheless experienced basically the same amount of cracking in the Unit 2 foundation as in Unit 1 (Finding 56, 58).

287. Applicants' witnesses would have the Board believe that the overexcavation has all been repaired correctly and that everything's all right now (Findings 37, 49, 52, 62, 68-70, 73-75, 143-144, 154-155, 176-178, 243-250).

288. However, there were many times during the course of the overexcavating when they thought they had corrected previous problems and that they knew what they were doing and could do it correctly, but they were constantly surprised by the results they got (Findings 17, 18, 22, 27, 28, 42, 56, 60, 72, 124, 135, 142, 148, 150, 251).

289. Applicants' witnesses McGrane and Scheppele agreed with Mr. Mason's testimony (through Finding 75 - see Finding 76-82).

290. After having experienced the surprisingly extensive overexcavations, Applicants would have the Board believe that the overexcavation was not really their fault, but was rather due to the mechanics and characteristics of the Glen Rose formation which are such that it is not possible to get an intact base resulting from line drilling and blasting (Findings 56 and 154).

291. ...Even though Mason Johnston and Associates had been studying the site since 1970 or 1971 (Tr. 803).

292. ...And even though line drilling and blasting was the preferred, agreed-upon method (Findings 17-22).

293. Dental concrete was used to replace the rock which was removed as a result of the extensive overexcavation (Findings 33, 37, 64, 255).

294. Applicants were in a time dilemma because they had to provide for something that could not be repaired until after the building mat was on; they could not repair the crack until the building mat had been completed (Finding 150).

295. There was a great amount of weight to be placed on the dental concrete used to replace the rock which had been removed due to the overexcavation (Findings 96-98).

296. There was even what amounted to a new wall built to replace damaged rock in the Fuel Building overexcavation (Finding 252).

OVEREXCAVATION (ROCK OVERBREAK) (continued):

ADEQUACY OF REPAIR REMAINS UNPROVEN (continued):

297. The strength of the dental concrete is not the same as the strength of the rock (Findings 47-49, 51, 69-70, 75, 152, 154).

298. Although Mr. Mason stated that the strength of the concrete for dental uses was 2,500 pounds per square inch at an age of 28 days and that this produced a material with strength and physical properties far greater than that possessed by the limestone itself (see preceding Finding), a review of the FSAR (Applicants' Exhibit 3) indicates that there are wide variations in the strength and physical properties of the limestone and other materials which formed the foundation of Category I structures. (See Finding 153.)

299. No reinforcing steel was used in the dental concrete used to replace the rock which had been removed due to the overexcavation (Findings 50-51, 66).

300. Dental concrete is not as strong as concrete used in structures (Findings 48, 151).

301. In his testimony regarding the crack in the base mat/radiation shield/ wherever, Applicants' witness Scheppele testified that "All of that concrete is heavily reinforced...This reinforcement was placed in that base mat, is designed to accommodate all the various loading combinations which that containment would realize during the course of its life and also during all of the environmental effects which that plant would have received. This would involve loading combinations, which would incorporate internal pressure, it would incorporate seismic conditions...In the design of reinforced concrete, primarily they use concrete as a compression element. Concrete really is never used as tension because concrete in itself -- as a tension element because concrete as tension is a very weak material. As a consequence, we marry the compressive strength of concrete and the tensile strength of steel...If you can visualize something like concrete, which is a brittle material when it's subjected to a tension it would tend to crack, and basically the design of reinforced concrete structures does indeed involve cracking, because in order for the reinforcing steel to physically work it is necessary for the concrete in most instances to crack." (Findings 97-101.)

302. He further stated: "concrete is not used as a tensile resistant material, without the use of reinforcing steel, which, in effect, provides the tensile strength in reinforced concrete." He stated that the reinforcing steel in the reactor cavity wall "provides structural purposes, any loading combination that results in tension in the concrete, requires reinforcing steel and, generally speaking, in all reinforced concrete construction, we normally have all exposed concrete surfaces with reinforcing steel placed in two directions to minimize extensive cracking. (Findings 102-103.)

OVEREXCAVATION (ROCK OVERBREAK) (continued):

ADEQUACY OF REPAIR REMAINS UNPROVEN (continued):

303. Mr. Scheppele also stated: "when you get this tension force which I mentioned previously, concrete is not good at withstanding. When you get this tensile force resulting from the shrinkage, then the concrete does have hairline cracks" in the reinforced concrete "which seek out the most -- the weakest point in the concrete matrix." He explained that such cracks were "due primarily because of the heating and then eventually the cooling of the concrete caused by the chemical reaction" -- still referring to the cracks in the reinforced concrete. He stated that in his view the strength is not impaired "because we have made judicious use of reinforcing steel to account for situations in which the concrete cannot take tension." (Findings 104-106.)

304. Yet here we have a massive amount of concrete being used to replace what should have been solid bedrock, which will have Category I safety-related structures built on top of it which will have a tremendous amount of weight. The strength of the dental concrete which was used is not as strong as concrete used in structures, had no reinforcing steel added to it, while at the same time the dental concrete does not have the same strength and physical properties as the limestone which it is replacing. (See previous findings.)

305. Applicants did not have an estimate of the amount of grout and dental concrete used to repair the overexcavation (Findings 252-253).

However, from the amount of damage which was done to the foundations of the Category I structures, it was a massive amount.

306. The mission in using dental concrete was to try and approximate and reproduce as closely as possible the original strength and physical properties of the rock as possible. (Findings 51, 69; but see also 70.)

307. Category I relates to seismic activity, as well as floods, hurricanes, tornadoes, and any other phenomena which would impair the safety of the completed project (Finding 11).

308. In a letter dated May 26, 1975, to TUSI, Mr. Mason discussed two basic remedial measures which were available and stated:

> "Since the block has been moved on a claystone seam, and since the block is required to support both vertical and lateral loads, it appears that only two basic remedial measures are available..."

309. In discussing the second measure, which would consist of the installation of vertical rock bolts grouted in pre-drilled holes and the plugging of all vertical air gaps by a pressure grouting system whereby the grout would also develop a minimum compressive strength of 2500 psi at 28-day age, Mr. Mason stated:

> "While no evaluation of the depth and number of rock bolts that would be required has been made at this time, and no cost analysis

OVEREXCAVATION (ROCK OVERBREAK) (continued):

ADEQUACY OF REPAIR REMAINS UNPROVEN (continued):

309. (cont.)

of the rock bolt and pressure grouting technique has been made or obtained from the contractor, it is apparent that any such procedure will have to be proven to be the equivalent of the adjacent undisturbed rock mass. The procedure of making such a proof would undoubtedly include additional seismic work to verify that the shear wave velocity across the restored block would be the same as or superior to that of the undisturbed and surrounding rock and that the vertical loading of the block of the imposed structural loads would react identically to that of the undisturbed natural rock formation. The exact cost, investigative procedures, and time delay involved in such a procedure would have to be added to the cost of the physical rock bolting and pressure grouting.

"In view of the preceding imponderables, it appears that the more logical remedial measure would consist of the physical removal of the displaced block and replacement therewith with adequate strength concrete."

(CASE Exhibit 34, emphases added.)

310. Mr. Mason stated that rock which had been displaced horizontally and was intended to give resistance to a wall, to be pushing against it, they considered worthless and it was removed. They did not want any stress on it. (Finding 63.)

311. No one did a seismic reanalysis of the foundation. (Findings 154-155.)

312. Thus, Applicants have not complied with the requirements of 10 CFR Part 100, V. SEISMIC AND GEOLOGIC DESIGN BASES, (d)(i)(*b*), which states, in part:

"The following geologic features which could affect the foundations of the proposed nuclear power plant structures shall be evaluated, taking into account the information concerning the physical properties of materials underlying the site pursuant to paragraphs (a)(1), (3), and (4) of section IV and the effects of the Safe Shutdown Earthquake:

"(i) Areas of actual or potential surface or subsurface subsidence, uplift, or collapse resulting from:

"...(*b*) Man's activities such as withdrawal of fluid from or addition of fluid to the subsurface, extraction of minerals, or the loading effects of dams or reservoirs..."

313. There may also be other requirements or regulations which Applicants have violated in this regard. At a minimum, they should be ordered to do a sophisticated, in-depth analysis to determine whether or not the foundation as repaired meets all applicable NRC criteria and regulations; they should also prove that the analysis which is used is capable of dealing with the variations in strength and physical properties of the different types of rock as well as the differences between the types of rock and the dental concrete used to repair the overexcavations. Any computer program used should be sophisticated enough to deal with all such variations.

We believe they may also be in violation of ACI (American Concrete

OVEREXCAVATION (ROCK OVERBREAK) (continued):

313 (cont.) Reported by ACI Committee 207, "Effect of Restraint, Volume Change, and Reinforcement on Cracking of Massive Concrete."

APPLICANTS DID NOT REPORT THE FULL EXTENT OF THE DAMAGE TO CATEGORY I FOUNDATIONS, EITHER IN THE FSAR OR IN WRITING TO THE NRC

314. Applicants' witness Mason saw the cracks in the foundations due to the overexcavations; they were mapped, photographed and documented. (Findings 31, 176, 195, 224-225.)

315. Mr. Mason stated that "there is a photo log we have that gives better descriptions, which we don't have at our availability." (Finding 225.)

316. Applicants did not introduce this photo log into evidence.

317. Mr. Tolson saw the damage from the overexcavations (Findings 87-88).

318. NRC inspector Stewart saw the damage from the overexcavations (Findings 93 and 268-269).

319. No one on Applicants' panel had any details or knew about how the excavation of the fuel building was handled. (Finding 133, 135.)

320. Mr. Mason testified several times that there was rock which was disturbed on the wall that was intended to remain intact by the fuel building and that "I could walk through the crack that had been created by impact rock being displaced horizontally, a gap of perhaps ten inches." (Findings 94, 135, 220, 226, 252.)

321. However, there was no photograph either contained in the photographs presented by CASE from the slides (CASE Exhibits 17A-II and 18A-O) or presented into evidence by Applicants (Finding 226).

322. CASE Exhibit 5 (third page) lists by number photographs of overexcavations; these photographs are numbered in sequence, but there are numbers which were missing from the listing. Mr. Mason stated that "If they existed, they were provided to the Applicant in the photo log and my assumption is that they do exist, because, to my knowledge, there is not interruption in our photographic sequence. That's my best memory." (Tr. 1095-1096.)

323. Mr. Mason also stated that his engineering geologist "would photograph, would perform engineering, be a project manager and photograph the sites of all excavations...That person was there. Those services were performed. At any time that a defect was noted, that was reported to the owner and the principal engineer, Gibbs and Hill and those reports did exist and did take place." (Finding 176.)

324. It is not logical to believe that photographs were taken of the Fuel Building foundation overexcavation without there being a photograph taken of that 10" crack which made such an impression on Mr. Mason.

325. There is no mention in Applicants' Final Safety Analysis Report (FSAR) of the damage to the Safeguards Building foundation or to the Fuel Building foundation, even though such damage did occur and even though the Fuel Building foundation was probably damaged most of all. (FSAR Section 2.5.4.5 Excavations and Backfill, Applicants' Exhibit 3; Findings 279-280, 195.)

OVEREXCAVATION (ROCK OVERBREAK) (continued):

APPLICANTS DID NOT REPORT THE FULL EXTENT OF THE DAMAGE TO CATEGORY I FOUNDATIONS, EITHER IN THE FSAR OR IN WRITING TO THE NRC (continued):

326. The photographs and fracture maps contained in the FSAR are very misleading as an indication of the extent of damage to Category I foundations as a result of the overexcavations. (See FSAR Section 2.5.4.5, Applicants' Exhibit 3; Finding 195.)

327. Had there been no Intervenor in the proceedings for Applicants to obtain their operating license for Comanche Peak, a decision would probably have been made based largely on the information contained in the FSAR.

328. Applicants' failure to include any information regarding the damage to the Safeguards Buildings or the Fuel Building foundations would appear to be a material false statement.

329. "A license or construction permit may be revoked, suspended, or modified, in whole or in part, for any material false statement in the application for license or in the supplemental or other statement of fact required of the applicant..." (10 CFR 50.100.)

330. 10 CFR 50.55(e) sets forth the requirements for reporting significant breakdowns in QA/QC programs or significant deficiencies or deviations.

331. Under the requirements of 10 CFR 50.55(e), "The holder of a construction permit shall also submit a written report on a reportable deficiency within thirty (30) days to the appropriate NRC Regional Office shown in Appendix D of Part 20 of this chapter. Copies of such report shall be sent to the Director of Inspection and Enforcement, U. S. Nuclear Regulatory Commission, Washington, D.C. 20555. The report shall include a description of the deficiency, an analysis of the safety implications and the corrective action taken, and sufficient information to permit analysis and evaluation of the deficiency and of the corrective action. If sufficient information is not available for a definitive report to be submitted within 30 days, an interim report containing all available information shall be filed, together with a statement as to when a complete report will be filed." (Emphasis added.)

332. The NRC has a section regarding reporting of deficiencies under 10 CFR 50.55(e) contained in its NRC Guidance (CASE Exhibit 300).

333. Applicants' witness Tolson was involved in the reporting of the overexcavation to the NRC; he stated that "I reviewed the letter" (CASE Exhibit 4). (Finding 130.)

334. The overexcavation was reported to the NRC in writing on February 4, 1975 (CASE Exhibit 4); a final report was sent to the NRC on December 12, 1975 (CASE Exhibit 6). These were the only two reports made in writing to the NRC; there were no supplements to the December 12, 1975 report. (Findings 90-92, 138-139.)

OVEREXCAVATION (ROCK OVERBREAK) (continued):

APPLICANTS DID NOT REPORT THE FULL EXTENT OF THE DAMAGE TO CATEGORY I FOUNDATIONS, EITHER IN THE FSAR OR IN WRITING TO THE NRC (continued):

335. Mr. Tolson stated that in his opinion Applicants fully and completely fulfilled the requirements of reporting to the NRC, that nothing was withheld from the NRC, that the inspector was on site and observed all aspects of the overbreak. (Finding 95.)

336. He further testified that the intent of the two letters reporting the overexcavation (CASE Exhibits 4 and 6) "was to report over-break in the Category 1 structure." (Finding 141.)

337. However, there is nothing in either of the letters to the NRC (CASE Exhibits 4 and 6) to the effect that the intent was to notify the NRC of over-break in any Category I building foundations other than Units 1 and 2

338. reactor buildings. In fact, the February 4, 1975, initial notification states that "in the interest of conservatism, we are submitting the following description of a possible deficiency which was observed during the base mat excavation for Units 1 and 2 Reactor Buildings." (Emphases added.) There was nothing else contained in that letter which referred to any other buildings except Units 1 and 2 Reactor Buildings.

339. Further, it is stated regarding the excavation for Unit No. 2: "After the blasted material was removed, visual inspection revealed very little, if any, damage to the perimeter walls," although the damage to Unit 2 was about the same as to Unit 1. (CASE Exhibit 4; Findings 43, 56, 58, 196 and 216; see also Finding 131-132, discussion with Mr. Tolson in this regard.) There is no mention of the Safeguard or Fuel Buildings.

340. Clearly, the implication of the February 4, 1975, initial notification letter to the NRC is that there was probably nothing much wrong anyhow, but "in the interest of conservatism," Applicants were submitting this information about overexcavation of Unit 1 and of Unit 2 (which wasn't even as bad as Unit 1 and had "very little, if any, damage to the perimeter walls"). (See Findings 337-340.)

341. Similarly, there is nothing in the December 12, 1975 final report to the NRC to indicate that there had been damage to the foundations of any buildings other than Units 1 and 2 reactor cavities (although there is some small mention of the Safeguard Building excavation: "The areas containing the most damage were removed as part of the safeguard building excavation"; "All the fractures were tight and radiate out from the center of the containment excavation with the exception of those described below which occurred when the safeguard buildings were blasted"; "There is one fracture in Unit No. 2 which is on the north side and runs from the northeast corner of the safeguard building, curving around from an easterly trend to a southerly trend, intersecting the containment excavation near the north-south centerline. This fracture is open 1/8 of an inch in the referenced corner and tight at the excavation intersection. A grout pipe is to be installed and grout placed after placement of the Containment No. 2 foundation and the walls in the No. 2 safeguard building."). (CASE Exhibit 6.)

342. There is no mention of any damage to the Fuel Building foundation although it was probably damaged most of all. (CASE Exhibit 6; Findings 195, 239, 252.)

OVEREXCAVATION (ROCK OVERBREAK) (continued):

APPLICANTS DID NOT REPORT THE FULL EXTENT OF THE DAMAGE TO CATEGORY I FOUNDATIONS, EITHER IN THE FSAR OR IN WRITING TO THE NRC (continued):

343. Mr. Tolson confirmed that there was no report to the NRC about the Fuel Building foundation overexcavation. (Finding 141.)

344. Further, the December 12, 1975 letter to the NRC (CASE Exhibit 6) closely tracks the language of the internal memorandum from his geologist to Mr. Mason (CASE Exhibit 5), with some notable exceptions, including the fact that the next-to-last paragraph of CASE Exhibit 5 was completely omitted from the letter to the NRC. That paragraph states, in part: "Major fracturing also occurred in the Fuel Building foundation area when the Service Water Intake Pipe Tunnel was blasted." (CASE Exhibit 5, emphasis added.)

345. In addition, the following sentence from the first paragraph of CASE Exhibit 5 (the geologist's letter to Mr. Mason) was also completely omitted: "The removal of damaged rock from the Fuel Building foundation area is approximately 80% complete and is scheduled to be completed immediately after completion of the placement of Containment #1 foundation." (Emphasis added.)

346. Thus, although the wording of the letter to the NRC (CASE Exhibit 6) closely tracks the language of the geologist's memorandum to Mr. Mason (CASE Exhibit 5), all references to the overexcavation of the Fuel Building foundation -- which was more badly damaged than any of the other foundations -- were deleted from the letter to the NRC.

347. The true extent of the damage to the Unit 2 Containment foundation was not contained in the December 12, 1975 letter to the NRC.

348. In the geologist's memorandum to Mr. Mason (CASE Exhibit 5), the second sentence of item 4 (top of page 2) states: "The horizontal fractures around Unit #2 Containment excavation were removed in the same manner as in Unit #1. Photos were taken with 35 mm camera showing the referenced areas after the rework was complete (3)." (Emphases added.)

349. The statement regarding the horizontal fractures around Unit #2 Containment excavation (see Finding 348 above) was completely omitted from the December 12, 1975 letter to the NRC. (CASE Exhibits 5 and 6.)

350. Thus, the only information contained in the December 12, 1975 letter to the NRC regarding the horizontal fractures around Unit #2 Containment excavation are in the second paragraph on the first page: "As previously reported, horizontal fractures were discovered when excavation of Units 1 and 2 reactor cavities were completed." (CASE Exhibit 6, emphasis added.)

351. Since what was previously reported was that "After the blasted material was removed, visual inspection revealed very little, if any, damage to the perimeter walls", the omission of the other reference to the horizontal fractures (see Finding 350 above) left the impression that there was very little damage to the Unit #2 Containment foundation; the only other reference to the Unit #2 is regarding one vertical fracture which is open 1/8 of an inch (CASE Exhibit 6, first paragraph of page 2).

OVEREXCAVATION (ROCK OVERBREAK) (continued):

APPLICANTS DID NOT REPORT THE FULL EXTENT OF THE DAMAGE TO CATEGORY I FOUNDATIONS, EITHER IN THE FSAR OR IN WRITING TO THE NRC (continued):

352. Applicants' failure to include any information regarding the over-excavation of the Fuel Building foundation (although it was probably damaged most of all) and to give a false impression regarding the extent of damage to the Unit #2 Containment foundation would appear to be material false statements. (See also Findings 328 and 329.)

TESTIMONY OF APPLICANTS' WITNESSES REGARDING OVEREXCAVATION OF SAFEGUARDS BUILDING FOUNDATIONS IS INCONSISTENT

353. Applicants' panel of witnesses was asked if any of them had any knowledge of any over-excavation with respect to the control or safeguard building (Tr. 1066-1067); the response was as follows, as shown in the transcript:

> "(No response.)"
> JUDGE MILLER: "Responses, please. I take it that was a question."
> "(Panel members indicate 'no.')"
> JUDGE MILLER: "Each of you has responded no, or no, sir. Thank you."
> (Emphasis added.)

354. Mr. Mason was asked if he was aware of overexcavating related to the Safeguard Building or other Category 1 structures. He reiterated what he had stated the previous day regarding the Fuel Building foundation overexcavation. Then, as shown in the transcript (Tr. 1070-1075, Finding 195):

> JUDGE MILLER: "Pardon me. You're not being asked to recapitulate. Simply tell us what buildings, if any, other that those described, where there was an overbreak."
> WITNESS MASON: "I have done that, sir. The reactors and fuel pumps."
> (Emphasis added.)

355. Mr. McGrane testified regarding CASE Exhibit 17CC: "At the point where you see this lift coming down in the front, the fore part of the photograph, is where a portion of the safeguard building was replaced." (Finding 216, emphasis added.)

356. CASE Exhibits 19-36 were admitted into evidence (Finding 236.)

357. CASE Exhibit 34 is a 5/26/75 letter from Mr. Mason to TUSI discussing the condition of the "block" of rock adjacent to Reactor #1 location which was moved as a result of blasting operations (see Findings 308-309).

OVEREXCAVATION (ROCK OVERBREAK) (continued):

TESTIMONY OF APPLICANTS' WITNESSES REGARDING OVEREXCAVATION OF SAFEGUARDS BUILDING FOUNDATIONS IS INCONSISTENT (continued):

358. CASE Exhibit 36 is DDR (Deficiency and Disposition Report, predecessor to NCR or Nonconformance Report) C-216, reported 2/9/76: "Blasting operations conducted on Feb. 4, 1976, resulted in damage to implaced reinforcing bar and possible damage to the Category I concrete in the southwest corner of the safeguards building. This occurred due to a distance violation of existing specifications; the southwest face of the safeguards building excavation being cut off above its floor dropping large amounts of rock directly on the seal slab concrete and steel. It is noted that similar pipe ditches are proposed in the future and it is requested that an evaluation be made to prevent future damage. See attached photos and drawings." (Emphases added.)

(Attached drawing shows location, but not clear exactly where it is in regard to Safeguard Building. Attached letter (page 4) gives details of blasting tests. Gibbs & Hill inspected, observed no indication of cracking which would be expected had the slab been damaged (page 21).)

359. CASE Exhibit 21 is a February 19, 1976 letter from Mason-Johnston & Associates (MJA) geologist Herbert C. Crowder to TUSI (with copy to Mr. Mason), containing a sketch of the Category I section of the plant, with a colored and numbered breakdown of the areas which require some type of repair and/or protective concrete and the location, elevation, and rework required. Mr. Mason testified regarding this Exhibit (Findings 237-239), which included details about overexcavation of Safeguard Buildings #1 and #2.

360. CASE Exhibit 20 is a Field Interpretation/Clarification Request dated 2/19/76: "Contractor requests approval to pressure grout fractured rock in the Safeguard Building (Unit 1) as noted on FDCR No. 0189 (attached)." (Emphasis added.) Approved by MJA geologist (with copy to Mr. Mason). Attachment shows fracture lines.

361. CASE Exhibit 19 is a Design Change-Design Deviation Request dated 2/25/76: "Request waiver of protective concrete slab in Safeguard Bldg. (#1) areas designated on attached FDCR-0188...The geologist has stated, per MJF-GH-5 (attached), that the areas in question have not been damaged by weathering or construction traffic and concurs that protective concrete may be deleted." Design engineer's (Mr. McGrane's) comments: "Request is acceptable per the geologists certification but we do not understand how placing of rebar could progress without noting the absence of the specified mud mat. Before placing concrete G&H field engineer should confirm adequacy of rebar supports on rocks."

362. CASE Exhibit 35 is a 5/6/76 letter from MJA geologist Crowder to TUSI (with copy to Mr. Mason) requesting "that plantsite coordinates of the presently installed grout pipes, in Category I Structures, be supplied to me for documentation purposes." Included in the list were pipes in Safeguard Building #1 and #2.

OVEREXCAVATION (ROCK OVERBREAK) (continued):

TESTIMONY OF APPLICANTS' WITNESSES REGARDING OVEREXCAVATION OF SAFEGUARDS BUILDING FOUNDATIONS IS INCONSISTENT (continued):

363. CASE Exhibit 20 had attached to the back of it (pages 8 and 9) two documents which probably should have been separate exhibits. One was a 5/12/76 Request for Information or Clarification from Brown & Root to TUSI, stating, in part: "During inspection of rock in SG #1 (Safeguard #1) ...two fractures were detected by the Geologist of M-J today..." (emphases added). The second of the two documents was a 5/13/76 letter from MJA geologist Crowder to TUSI: "By copy of this letter to Brown & Root, I am informing them that two fractures have been found in the rock exposed at elevation 778'-4", ref. sheet 2 of FDCR #0188, in Unit 1 Safeguard Building during final cleanup. The repair called out in FDCR #0189 is to be followed in this case also." (Emphases added; see Ex. 23.)

364. CASE Exhibits 22-27, 29, and 32 are letters and memos regarding grouting, grout pipe locations, etc. for Category I structure foundations, including Safeguard Buildings #1 and #2.

365. CASE Exhibit 28 is a 5/12/77 memo from Gibbs & Hill to TUSI (with copies to Messrs. Tolson and Mason): "In response to the referenced letter requesting engineering concurrence with the proposed pressure to be used in grouting fractures in the Unit 1 Safeguard Building, be advised that the design engineer, (R. E. McGrane) visually inspected the area in question and agrees that the minimum head pressures noted are acceptable." (Emphases added.)

366. CASE Exhibit 30 is an 8/2/77 letter from MJA geologist Crowder to John Merritt (with copies to Messrs. Tolson and Mason), asking that Brown & Root's QA group monitor the grout pipes installed in various Class I foundations. Attached sketch shows locations of grout pipes, including Safeguard Buildings #1 and #2.

367. CASE Exhibit 31 is a 2/23/78 letter from MJA geologist Crowder to John Merritt (with copy to Mr. Tolson), notifying TUSI of completion of grouting of Safeguard #1 and #2 and Fuel Building pipes. Attached 2/23/78 letter from Mr. Crowder to Mr. Merritt (with copies to Messrs. Tolson and Mason) includes table and drawings of locations in Fuel Building and Safeguard Buildings #1 and #2.

368. CASE Exhibit 33 is an office memorandum to John Marshall (TUSI) from J. T. Merritt, Jr., Manager, Engineering & Construction, attaching inspection reports by Brown & Root QC Department "to document completion of pressure grouting at the following grout pipe locations: SG1-F, G, and H, C1-A; SG2-A, B, C, and D; and FBC-A, B, C, and D. This completes all pressure grouting of fractured rock at the plantsite and should provide the documentation you need, (when added to the information you have on hand) to close out the referenced NRC question..." (Emphases added.) Attachments show list and drawings of locations.

OVEREXCAVATION (ROCK OVERBREAK) (continued):

TESTIMONY OF APPLICANTS' WITNESSES REGARDING OVEREXCAVATION OF SAFEGUARDS BUILDING FOUNDATIONS IS INCONSISTENT (continued):

369. After CASE's Exhibits 19 through 36 were admitted into evidence (see Finding 236), Judge Cole discussed the matter of Mr. Mason's previous testimony regarding overexcavation of buildings other than Containments 1 and 2. Mr. Mason's testimony appears to be inconsistent with his previous testimony (Finding 254), as does the testimony of Mr. Merritt (Finding 255).

370. CASE was not able to complete its analysis of all of the witnesses' testimony regarding the overexcavation; however, it appears that there are several inconsistencies in the testimony of Applicants' witnesses and the documents admitted into evidence. It appears that most of Applicants' witnesses (contrary to their testimony discussed in Finding 353) did have knowledge of (or should have had) of over-excavation with respect to the safeguard buildings.

THE CRACK IN THE BASE MAT/RADIATION SHIELD/WHEREVER

371. No one can say with certainty exactly what and where the crack was (or is), whether it was adequately repaired, and whether Comanche Peak can be operated so that it will not pose an undue and unacceptable risk to the public and/or (if the crack actually is in the radiation shield) to workers at the plant.

372. Nowhere in any of the documents introduced into evidence is there documentation that the crack in question was not a vertical crack that extended completely through the seven (7) foot thick mat near the center of its midspan across the reactor cavity.

373. Nowhere in any of the documents introduced into evidence is there documentation that the crack is in the radiation shield and not in the base mat. In fact, although there was an original and four revisions of the NCR (C650), covering a period of about two years, the wording on that NCR was never changed to show that the original wording was not correct and that the cracks were actually in the radiation shield instead. (See CASE Exhibits 8-12.)

374. Applicants had not planned for this type of crack, although it was allegedly only a shrinkage crack and a very common occurrence. It was stated that the job specifications do not address cracks relative to any acceptance criteria. (CASE Exhibits 8-12.)

375. This was an unusual situation in that a copy of the memo was hand-carried to Mr. R. G. Tolson, the TUSI Site QA Supervisor on 4/26/77. (CASE Exhibits 8-12.)

376. A review of NCR's and their predecessors, DDR's, reveals that usually a drawing is made of the problem area, even on relatively minor items. There was no drawing or photograph made of the crack(s). (CASE Exhibits 305-570.)

377. It is also most unusual, based on a review of NCR's and DDR's, that no other dimensions other than those as indicated on the documents CASE introduced into evidence were indicated anywhere on any documents introduced into evidence.

378. No study or analysis was introduced into evidence regarding this crack(s).

379. The original concrete pour card for the pours in question (101-2812-001 and -002) was lost and another card replaced it. (CASE Exhibit 13.)

380. There was an allegation before that there was general cracking of floor slab concrete in the plant buildings (CASE Exhibit 253, I&E Report 79-26/79-25; see also CASE's 10/18/82 Response to Board's Directive Regarding CASE Exhibits, at page 14, for further details).

381. The allegations made about the cracking of the floor slab concrete in plant buildings was never investigated by the NRC. The I&E Report states: "Without specifics, the alleger was advised that these could not be pursued...The search (for data by Applicants) was not posyible due to the lack of specificity." (CASE Exhibit 253.)

THE CRACK IN THE BASE MAT/RADIATION SHIELD/WHEREVER (continued):

382. A seven-foot crack would not normally be considered a hairline surface crack or a shrinkage crack, as defined by the NRC. The Resident Reactor Inspector (RRI) states his definition of cracks that he would consider significant in terms of possible structural failure, then his definition of hairline surface cracks: "...caused by thermal expansion...usually very tight...extends only into the concrete to the most exterior layer of reinforcing steel, typically one to two inches below the surface..." (CASE Exhibit 253, item (4.a), emphasis added.)

383. There is no indication in the NCR's on the crack to indicate that proper measures were taken to keep moisture from damaging the rebar during the nearly two-year period it took to repair the crack(s). (CASE Exhibits 8-12.)

384. Based on the documentation which is in the record, it is impossible to prove the horizontal extent of the crack, the width of the crack, that the crack was properly repaired, that the rebars were not damaged by moisture prior to sealing the crack, or that the QA/QC program was functioning properly with regard to this matter.

385. The quality of the concrete around and under the Unit 1 reactor itself is indeterminate.

386. Testimony in the record (which CASE does not have time to look up at the moment insofar as giving a citation) indicates that there is at this time no method by which the true extent, location, and adequacy of repair of the crack(s) can be determined.

387. The crack in the foundation could not be repaired until the building mat had been completed. (See Finding 150.)

388. See also CASE Exhibits 529, 533, 479, and 534 (NCR's regarding the same area as the crack(s) in the base mat). We do not have time here to discuss them at length, but see CASE's 10/18/82 Response to Board's Directive Regarding CASE Exhibits, at pages 27, 28, 32, 33, and 34.

389. There is nothing in the record to indicate that anyone has ever done any analysis of the possible tie-in between CASE Exhibits 479 and 534 and the crack in the base mat. Neither is there any indication that anyone has ever done a comprehensive stress or seismic analysis based on the deletion of rebar, etc., in various locations, especially Containment #1. (See CASE's 10/18/82 Response to Board Directive Regarding CASE Exhibits, at 34.)

CASE'S DOCUMENTS

390. We do not have time here to discuss at length what we expect to prove with our documents. However, see tr. 724/24-729/17, 726/23-727/3 and CASE's 10/18/82 Response to Board's Directive Regarding CASE Exhibits for further details, which sets forth many of our goals and concerns.

CREDIBILITY OF THE NRC

391. The NRC's ability and/or willingness to adequately investigate allegations of whistleblowers has been called into strong question by events and testimony in these proceedings. (See CASE's 12/21/82 Brief in Opposition to the NRC Staff's Exceptions to the Atomic Safety and Licensing Board's Order Denying Reconsideration of September 30, 1982; CASE's 1/11/83 Written Argument on Issues; CASE's 1/18/83 letter to Appeal Board under Subject of Affidavit of Jack Doyle; CASE's 1/24/83 Motion for Protective Orders for Roy Combs, Lester Smith, and Freddy Ray Harrell; and CASE's 2/3/83 Supplement to that motion; and CASE's 2/21/83 Motions to (1) Respond to Applicants' Charges of Misconduct by CASE; (2) Strike Applicants' February 8, 1983 Answer to CASE Motion (and Supplement) for Protective Orders; and (3) Impose Sanctions Against Applicants.)

392. NRC inspector Stewart saw the damage to the containments for Units 1 and 2 and the Fuel Building foundations, and apparently was well aware of the extent of damage to the Category I foundations (Tolson testimony, Finding 93; Stewart testimony, Finding 268-269.)

393. In addition to the preceding, CASE will have further findings of fact following the close of the record. The Licensing Board in its January 4, 1983, Memorandum and Order has stated that "Clearly further evidence on these issues will be required when the evidentiary hearing resumes./9/ Footnote /9/ Tr. 2669-70."

CASE regrets that we were unable to complete the impossible task of preparing provisional proposed findings of fact in time to meet the Licensing Board's deadline of having them in the hands of the Board by February 25. We believe the information contained in the instant pleading and which will be contained in future pleadings should the Board allow it, is significant and of such importance that the record should not be deprived of it.

Respectfully submitted,

Juanita Ellis

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING APPEAL BOARD

'83 FEB 28 P2:13

In the Matter of APPLICATION OF TEXAS UTILITIES GENERATING COMPANY, ET AL. FOR AN OPERATING LICENSE FOR COMANCHE PEAK STEAM ELECTRIC STATION UNITS #1 AND #2 (CPSES)	Docket Nos. 50-445 and 50-446

CERTIFICATE OF SERVICE

By my signature below, I hereby certify that true and correct copies of CASE's 2/24/83 Provisional Proposed Findings of Fact

have been sent to the names listed below this 24th day of February, 1983 by: ~~Express Mail~~ Federal Express where indicated by * and First Class Mail elsewhere.

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