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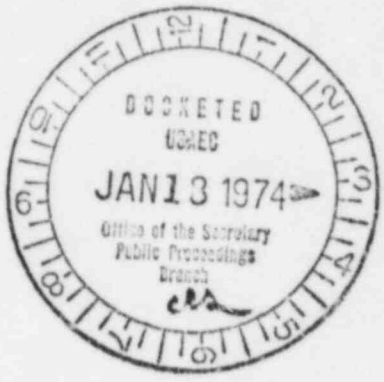
UNITED STATES OF AMERICA
ATOMIC ENERGY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD



John B. Farmakides, Chairman
Dale F. Babcock, Member
Lester Kornblith, Member

In the Matter of Kerr-McGee Corporation Kerr-McGee Building Oklahoma City, Oklahoma	Amendment to Source Material License SUB-1010

January 18, 1974

INITIAL DECISION

Appearances

Francis S. Irvine, Esq., on behalf of the Applicants

Roy E. Kinsey, Jr., Esq. and James P. Murray, Jr., Esq., on behalf of the Regulatory Staff

Karin Sheldon, Esq., on behalf of Natural Resources Defense Council (Prehearing Conference only)

I. PRELIMINARY MATTERS AND BACKGROUND

1. The Kerr-McGee Corporation (Applicant), is a Delaware Corporation having its principal office in Oklahoma City, Oklahoma. Upon an application for same submitted on September 25, 1969, the Atomic Energy Commission issued a Source Material License SUB-1010 on February 20, 1970 authorizing the Applicant to undertake an operation for the purification and conversion of "yellow cake" to uranium hexaflouride at its Sequoyah facility near Gore, Oklahoma.

2. The operation of this Sequoyah facility produces as a by-product a liquid acidic raffinate containing low level radionuclides as a waste product.[1/] While the initial design of the facility contemplated the discharge of such waste product in a deep disposal well, such disposal was not permitted when License SUB-1010 was issued. Accordingly, holding ponds were constructed and equipment installed to treat and neutralize the acidic raffinate; initially with lime slurry, and later with ammonia. The treated raffinate has been stored in such ponds.[2/]

1/ Applicant's Exhibit 1; hereinafter "App. Ex."

2/ App. Ex. 3E (Supp. No. 3).

3. In May, 1970, Kerr-McGee made application for amendment to its License No. SUB-1010 to permit the injection of Sequoyah Facilities' entire liquid waste remaining after treatment into the Arbuckle Formation. On October 15, 1970, the Atomic Energy Commission ("Commission") refused such amendment, but asserted that Kerr McGee could appeal said decision. Kerr-McGee requested, and the Commission granted, permission to withdraw its application for amendment without prejudice to any future application.3/

4. On May 10, 1972, the Applicant again filed an application to amend said license SUB-1010 to permit deep well disposal of low level liquid radioactive wastes generated from its process. By letter, dated September 29, 1972, the Regulatory Staff advised the Applicant that its request for amendment had been denied. Representatives of Applicant met and supplied additional information to the Staff on November 20, 1972 for consideration. By letter dated March 14, 1973, the Staff affirmed the denial of September 29, 1972. On April 5, 1973, Applicant then requested a hearing on the matter pursuant to the provisions of 10 CFR 2.103. On July 10, 1973, the Commission

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3/ App. Ex. 1.

issued a Notice of Hearing directing that a hearing be held to consider said application.[4/]

5. Inter alia, said Notice of Hearing directed this Board to consider and decide, pursuant to the Atomic Energy Act of 1954 as amended ("Act") and in accordance with 10 CFR 40.32(c) and (d) whether:

(1) The licensee's equipment, facilities and procedures proposed for use pursuant to the requested amendment are adequate to protect health and minimize danger to life or property; and

(2) The issuance of the amendment will be inimical to the health and safety of the public.

6. The Notice further directed that if, upon consideration of the record developed in this proceeding, the Board, with respect to paragraph 5, above, makes an affirmative finding on item (1), and a negative finding on item (2), then the application should be remanded to the Deputy Director for Fuels and Materials for such further action as may be required by 10 CFR 40.32(e) on environmental matters.

7. The Board, designated by order entitled "Establishment of Atomic Safety and Licensing Board" issued by the

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4/ 28 Fed. Reg. 18,921, July 16, 1973.

Atomic Safety and Licensing Board Panel on July 17, 1973, held a prehearing conference on August 14, 1973 in Washington, D. C. pursuant to a Notice for same.[5/] At said conference, Karin Sheldon appeared on behalf of the Natural Resources Defense Council, submitted a "Petition to Require Publication of Proper Notice of Hearing" and alleged, in essence, that the published Notice of Hearing as issued by the Commission was deficient in that it did not explicitly state that petitions for leave to intervene would be accepted. In view thereof, and with agreement of the parties, this Board issued a "Prehearing Conference Order and Notice of Extension of Time"[6/] advising that the Board would consider petitions for leave to intervene if filed pursuant to 10 CFR 2.714 within thirty (30) days. No petitions were received. Accordingly, by Memorandum and Order issued on September 21, 1973, the Board declared the Applicant and the Regulatory Staff to be the only parties in this proceeding.

5/ 38 Fed. Reg. 19,853, July 19, 1973.

6/ 38 Fed. Reg. 22,175, August 14, 1973.

8. At the request of the Board, a Joint Statement of Proposed Issues, dated September 21, 1973, was prepared by the Applicant and the Staff and submitted to the Board. Thereafter, the Board accepted the following issues as matters in controversy:

A. Whether the Webbers Falls fault exists and, if it does, at what distance is it located northeast of the proposed disposal well?

B. Whether the South fault exists and, if it does, at what distance is it located southwest of the proposed disposal well?

C. Whether additional faults exist within the disposal formation (fault block) that may act as either barriers to fluid movement within the fault block or conduits for fluid movement within the formation?

D. Whether the nature of the faults comprising the fault block are such that the faults will act as barriers to fluid movement under increasing fluid pressure?

E. Whether the five disposal zones composing the Arbuckle Formation can be assumed to be homogeneous, isotropic, and constant in thickness, porosity, and permeability, thereby permitting the calculation of the movement of the disposed waste fluid from the well bore?

F. Whether a three dimensional analysis of geohydrologic problems by the finite difference method, based on test data obtained from a single well, can accurately predict the nature and performance of the injection horizons?

(a) Kerr-McGee has drilled a well about 3,100 feet deep near its Sequoyah Chemical Plant. It is proposed that the chemical waste solutions from the plant be injected through the well into the porous strata of the Arbuckle limestone formation some 1,760 to 2,860 feet below the surface.[8/] These waste solutions will contain primarily nitric acid partially neutralized with ammonia together with small quantities of uranium and larger quantities, on a curie basis, of the radioactive disintegration products of uranium.[9/] These wastes will be injected into the porous strata at a rate of 20gpm and are expected to move to no farther than 900 feet from the well during a five year injection period.[10/] If this prediction is correct, the wastes will remain on Kerr-McGee property. The

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8/ App. Ex. 3, p. 1; App. Ex. 1-Attach. A, Fig. 3.

9/ App. Ex. 1, Rev. IV-1, IV-4, May 10, 1972.

10/ App. Ex. 1-Attach. A, p. 3.

G. Whether monitoring by pressure testing at the well head is adequate to detect fluid movement, or whether there is a need for direct monitoring of the recipient formation?

H. Whether in the event of a demonstrated leak in the retention reservoir or fault block the waste fluid can be recovered?

9. The record in the proceeding consists of all the material pleadings filed herein, all the evidence offered and received,[7/] and the manuscripts of testimony presented at the Evidentiary Hearings on 15, 16 October 1973 as corrected by Order Approving Transcript Corrections issued by the Board on December 14, 1973.

10. Each of the issues set forth in paragraph 8 above will be considered and discussed, seriatim, commencing in paragraph 12 below.

Description of Proposed Kerr-McGee Waste Disposal System and Monitoring Method

11. A brief description of the waste disposal system and the monitoring method proposed by Kerr-McGee appears necessary to a full understanding of the issues presented:

7/ See Tr. 48, 48A, 218, 218A. See Appendix I attached hereto.

primary method proposed for monitoring the waste disposal operation in order to determine whether the wastes are indeed within the 900 feet zone, is to stop periodically the injection of waste, and to measure in the well the fall-off of pressure with time. Kerr-McGee believes that abnormalities in the pressure fall-off curve can be used to predict changes in the pattern of the underground flow of waste.[11]/

(b) A theoretical, three dimensional model of the proposed underground waste disposal field was predicted based on analyses of well cores, water injection profile tests that incorporated both radioactive tracers and temperature surveys, electric well logs, surface geologic surveys,[12]/ and a short term (one week) injection[13]/ of water into the well followed by a measurement of the

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11/ App. Ex. 3B, pp. 20-21.

12/ App. Ex. 3B, p. 12; App. Ex. 1-Attachments B and D.

13/ App. Ex. 1-Attach. B.

fall-off[14/] of the water pressure at the bottom of the hole during the following week. Pressure time data were obtained during the one week of water injection, and the one week during pressure fall-off after injection stopped.[15/]

(c) Data from the above described tests were used to produce an initial model of the waste storage field.[16/] Five porous strata were found and their thickness, porosity, and effective permeability were determined.[17/] The location of the various boundaries that limit migration of water from the field were then predicted. Also these boundaries were assumed to be impermeable to the passage of water.[18/] These predictions and the data mentioned

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14/ App. Ex. 1-Attachments B and D.

15/ Supra, see footnotes 13, 14.

16/ App. Ex. 3B, p. 17.

17/ Id.; see also App. Ex. 1-Attach. A, Fig. 3.

18/ App. Ex. 1-Attach. A, p. 12; Tr. 233, 237, 240.

above were fed to a computer that calculated the pressure fall-off curve that would have been obtained had water been injected into this model well for one week at the same rate used in the actual test described above. New predictions were made as to the location of the boundaries of each of the five porous strata and another pressure fall-off curve computed.[19/] After thirty or so successive new predictions and calculations of pressure fall-off, boundary locations were obtained that gave a pressure fall-off curve that was judged to be a reasonably close approximation to the measured pressure fall-off data.[20/]

(d) The water tightness of the boundaries was expected to be determined by changing the original assumption that none of the boundaries leaked to an assumption that the nearest boundary had a given permeability.

19/ App. Ex. 3B, pp. 4, 5, 17, 20.

20/ Id., at p. 18.

A new pressure fall-off curve for this assumed condition was calculated.[21] Kerr-McGee concluded that for assumed leakage rates greater than 40 barrels per day,[22] the new calculated fall-off rate differed sufficiently from the calculated no leakage rate to indicate that the initial leakage through the boundary of the actual well would be less than 40 barrels per day.[23]

(e) The success of this computational method in determining the location of the waste disposal field boundaries, in determining that the boundaries are initially leak tight, and in determining that they remain leak tight depends, among other things, on both the fidelity to which the model corresponds to the actual disposal field and on the accuracy of the pressure read-out data.[24] Kerr-McGee gives the standard

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21/ App. Ex. 1-Attach. A, pp. 11, 12.

22/ Approx. one gallon per minute; 1gpm.

23/ App. Ex. 1-Attach. A, p. 13.

24/ Id., at p. 14.

deviation of the precision of their pressure measurements as 0.55psi.[25/] To this figure must be added an uncertainty for the resetting of the pressure readout following a removal of the gage from the well and for pressure uncertainties that are related to changes in temperature of the fluid in the well.

(f) In the actual well pressure fall-off measurements, the gage was removed and reinserted into the well about half way through the run.[26/] Following the reinsertion of the gage, the pressure readings were determined to be too high by 2.2psi[27/] based on comparisons of the pressure readings just before and just after the gage was removed.[28/] The uncertainties in this pressure correction were not discussed.

25/ Id., at p. 9.

26/ App. Ex. 1-Attach. D, p. 30937.

27/ Tr. 266.

28/ Tr. 258-266.

(g) It would appear to the Board that uncertainties in the temperature of the water column of the well introduces further uncertainties in the pressure measurements. This item is particularly important during the first several hours of the pressure fall-off measurement period. During injection, the temperature of the fluid going down the well does not rise as fast as does the increase in well temperature with depth. After flow stoppage, however, the temperature of the fluid eventually reaches the local well temperature. It is, therefore, probable that uncertainties in the pressure measurements can be greater than $\pm$ 1.0psi. Because the total increment of pressure fall-off that was used for analyses was only 18psi, an uncertainty of the amount predicted above casts doubt on the ability of a calculation to predict that leakage was or was not occurring at the well boundaries.

II. FINDINGS OF FACT

Issue A. Whether the Webbers Falls fault exists and, if it does, at what distance is it located northeast of the proposed disposal well?

12. The area proposed for waste disposal is more or less rectangular, and the Applicant asserts that it is bounded by four faults.[29/] Two of these, the South fault of the Warner Uplift to the northwest and the Marble City fault and its offshoot, the Carlile School fault, to the southeast, appear to be generally recognized and agreed to by the parties.[30/] The boundary to the northeast is claimed by the Applicant to be the Webbers Falls fault, the existence and location of which are the subject of the first issue. The boundary to the southwest is claimed to be the South fault. This is the subject of the second issue.

13. The Webbers Falls fault is an "inferred" fault -- that is, one located by inference or deduction.[31/] The

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29/ Tr. 71.

30/ Staff's Ex. A, p. 8; App. Ex. 3A, p. 13.

31/ Tr. 75.

existence of a fault is predicated by the Applicant on the fact that the Wapanucka layer of limestone, which is a readily recognized shallow formation about 400 feet below the surface at the well site,[32] slopes upwards to the northeast at about 200 feet per mile and should emerge at the surface within about two miles.[33] In fact, it does not emerge within six miles[34] and may not emerge for 12 miles.[35] From this, the Applicant infers that the layer is offset by a fault within two miles northeast of the well. Within this area, the Applicant concluded that the surface expression of the fault was indicated by certain topographic features which appear to be aligned about 3,000 to 3,500 feet northeast of the well.[36] The Applicant has assumed without indicating its reasons that this fault is not strictly vertical but dips to the southwestward an angle such that at the level of the Arbuckle layer where disposal is proposed it is only about

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32/ Ex. C-H of App. Ex. 3A.

33/ Tr. 101-102.

34/ App. Ex. 3A, p. 15.

35/ Ex. C-E to App. Ex. 3A.

36/ App. Ex. 3A, p. 15 and Ex. C-D to App. Ex. 3A.

1,200 feet from the well.[37/] As discussed in Paragraph 11, above, the Applicant has carried out modeling studies to determine the boundaries of the disposal area and has concluded therefrom that the 1,200 foot location is confirmed.[38/]

14. The Staff contended that the geological studies of the Applicant do not conclusively establish the existence of the fault;[39/] and that the modeling studies are also inconclusive.[40/]

15. After carefully considering the entire record and the conflicting evidence presented by the expert testimony on this point, the Board finds that a barrier to fluid flow exists in the general area identified by the Applicant and that there is a high probability that the Webbers Fall fault is this barrier. The precise location of the Webbers fault at the level where disposal is proposed is not known, although it appears to be 1,000-3,000 feet northeast from the well.

37/ Supra, footnote 11.

38/ App. Ex. 3A, p. 15.

39/ Staff's Ex. B, pp. 6-8.

40/ Supra, footnote 39; see also Staff's Ex. C, pp. 3-5.

Issue B. Whether the South fault exists and, if it does, at what distance is it located southwest of the proposed disposal well?

16. The issue on the so-called "South" fault is the counterpart of the Webbers Falls fault issue. The existence of a fault between the Kerr-McGee well and a well (known as Harris No. 1 Standifer) about eight miles to the southwest was inferred from the known regional slopes and the depths of two identifiable layers - the Viola and the Arbuckle.41/

17. The Viola layer which was expected to be found at 1,500 feet below sea level was found at 2,700 feet, and the top of the Arbuckle layer, which was expected at 1,800 feet was found at about 3,000 feet.42/ There are surface features indicating to the Applicant a possible fault location; namely, the channel of Dirty Creek, about 20,000 feet to the southwest, an abrupt escarpment slightly beyond, and a major change in the outcrop of a local sandstone formation.43/ Again, the Applicant infers that the fault

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41/ App. Ex. 3A, p. 14; Ex. C-E to App. Ex. 3A.

42/ Id.

43/ App. Ex. 3A, p. 14.

dips to the southwestward so that it is about 8,000 feet farther from the well at the top of the Arbuckle than at the surface.44/

18. The Applicant's witness, Chenoweth, testified that "the location of this fault almost precisely fits the pressure data determined by Gruy and Associates: it is 29,500 feet from the Webbers Falls fault at the proposed injection level."45/ Contrary to the quoted statement, the modeling studies did not establish a boundary, but rather indicated that this approximate distance was the closest distance at which the boundry could exist.46/

19. The Staff has taken the position that from the evidence available the fault could have any orientation, could be located in any direction from the well, could have an irregular shape rather than a linear one or might not exist at all.47/

44/ Ex. C-E to App. Ex. 3A.

45/ App. Ex. 3A, p. 14.

46/ Ex. A to App. Ex. 1, pp. 4-5 and Fig. 1; Tr. 157; in essence, Dr. Chenoweth agreed to this latter observation during questioning on cross examination, Tr. 75-77.

47/ Staff's Ex. B, p. 6.

20. After a careful review of the evidence before us, the Board finds that the existence of the South fault has not been established with reasonable assurance. This fault may exist, but if it does, its location is at least 29,500 feet southwest of the well.

Issue C. Whether additional faults exist within the disposal formation (fault block) that may act as either barriers to fluid movement within the fault block or conduits for fluid movement within the formation?

21. A map adapted from one prepared by the Oklahoma Geological Survey shows several inferred faults in the areas of interest.[48] Two of these are parallel faults perpendicular to and crossing the Carlile School fault. These, if extended, would pass very close to the Kerr-McGee well. A third curves away from the Carlile School fault towards the northwestward slightly to the south of the well.[49] Applicant's field surveys fail to show evidence to support all these postulated faults.[50] The Applicant believes that these inferred faults are lines of vegetation

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48/ App. Ex. 3A, pp. 15-16 and Ex. C-F thereof; Staff's Ex. B, pp. 7-8 and map attached to letter of 6/28/72 in App. Ex. B.

49/ Ex. C-F to App. Ex. 3A.

50/ App. Ex. 3A, pp. 15-16.

probably controlled by jointing rather than faults.[51/] Applicant also agreed that in an area such as the one under consideration one might expect to find additional faults;[52/] in fact Applicants field surveys reveal other possible faults not mapped.[53/] Both parties agreed that such faults, if they exist, could either act as barriers to, or conduits for, fluid movements.[54/] However, there is little or no support for either conclusion in the well testing or model studies conducted.

22. After review of the entire record and considering the conflicting evidence presented, the Board concludes that it is likely that other faults exist within the disposal block. Apparently, the Applicant disregarded the presence of such faults in its evaluation of the area.

Issue D. Whether the nature of the faults comprising the fault block are such that the faults will act as barriers to fluid movement under increasing fluid pressure?

51/ Id.

52/ Tr. 80-81.

53/ App. Ex. 3, p. 16.

54/ Tr. 81-87.

23. Faults, in general, can act as barriers to fluid movements, but do not necessarily do so.[55/] Evidence as to whether or not the particular faults bounding this fault block are impermeable is limited to results of the model studies carried out by the Applicant. The model is based almost entirely on studies carried out at, or within, the well.[56/] From these studies, the Applicant concluded that the boundaries were impermeable and that leakage of 40 barrels per day (about 5% of the proposed injection rate) would be readily detectable, but that one-tenth this amount would not be detectable.[57/] This calculation, however, was made only for the Webbers fault boundary.[58/] The Applicant also acknowledged that a definite answer to whether or not the other boundaries leaked could not be made without further studies.[59/] Considerable conflicting oral testimony was presented covering the adequacy of the model (as it relates to boundary leakage) and the accuracy of the conclusions drawn from it.[60/]

55/ Tr. 81-87; Staff's Ex. B, p. 8.

56/ App. Ex. 3B, pp. 12-20; App. Ex. 1-Attach. A, pp. 7-11.

57/ Attach. A to App. Ex. 1, pp. 12, 13; Tr. 232-233.

58/ Tr. 361.

59/ Tr. 361.

60/ For example see Tr. 181-184, 204-206, 232-249, 341-349, 360-363.

24. On the basis of the entire record and after evaluating such conflicting testimony, the Board finds that the permeability or impermeability of the boundaries has not been established with sufficient precision to permit a conclusion that the faults comprising the fault block will act as barriers to fluid movement under increasing fluid pressure.

Issue E. Whether the five disposal zones composing the Arbuckle Formation can be assumed to be homogeneous, isotropic, and constant in thickness, porosity, and permeability, thereby permitting the calculation of the movement of the disposed waste fluid from the well bore?

25. The Applicant presented testimony showing that, although the Arbuckle formation, overall, is heterogeneous, certain zones and layers are highly homogeneous. Apparently this is caused by the method of formation of the layers -- basically, the deposition of blankets of sediments when a shallow sea covered this area, periodically withdrew and returned.61/ The testimony, however, also shows that the continuity of the permeable zones might be limited by factors other than faults. This is so because much of the porosity and permeability are the result of alteration of

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61/ App. Ex. 3A, pp. 8-10.

limestone to dolomite and the size and location of the pore spaces depends on the vagaries of the dolotomizing agents.62/ The witness further testified to his belief that, within a particular layer, he would expect the porosity and permeability to be uniform within a few percent over a radius of a hundred yards,63/ but, when questioned did not project this degree of uniformity to points separated by a half-mile.64/

26. The assumption of uniformity in porosity, permeability, and layer thickness was made in constructing the model studied by the Applicant.65/ This assumption would lead to uniform radial flow out from the well. The Applicant's witness testified that deviations from uniform radial flow would have been detectable during the well tests.66/

62/ Id. at p. 10; Tr. 90-91.

63/ Tr. 111-112. Applicant's witness Chenoweth.

64/ Tr. 113-114.

65/ Tr. 172; Attachment A to App. Ex. 1, pp. 2, 4 and Fig. 1.

66/ Tr. 172, 181, 201-202.

27. The Staff took the position that the reservoir is likely to be extremely nonhomogeneous, anisotropic, and variable in thickness.[67] The Staff further pointed out that the tests made to determine porosity and permeability related only to distances of a few inches to a few feet around the well and that only one well was used for these tests and that, since limestone-dolomite reservoirs are generally quite heterogeneous, data from only one well cannot be considered representative of the entire reservoir.[68] They further stated that the well-test data were suspect because in each injection test the permeability properties of the well seemed to change and that drastic further changes could take place when actual waste was injected.[69] The Staff also noted a situation involving a disposal well at another site (New Johnsonville) where the geological structure was similar to the Arbuckle at Sequoyah and uniform radial flow was expected, but did not occur. The lack of uniformity was detected through data obtained from two other wells drilled subsequently in the vicinity of

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67/ Staff's Ex. B, p. 10.

68/ Staff's Ex. B, p. 3; Tr. 330-331.

69/ Staff's Ex. B, p. 4.

the disposal well. In that situation, it was anticipated that the waste would extend to a radius of 500 feet;[70] however, the data indicated that the waste had traveled at least 2,700 feet, more than five times the distance predicted.[71] The tests made on the disposal well were similar to those made at the Sequoyah well, but more detailed in that each layer was tested separately. Apparently, because the rock was not homogeneous, which was contrary to the assumptions used in predicting uniform radial flow, the waste traveled in one direction preferentially.[72] The Staff was of the opinion that such a situation is a "common occurrence" and that there is a "reasonable possibility" of it occurring in this case.[73]

28. After carefully considering and weighing all the evidence of record, the Board finds that the evidence does not support Applicant's assumptions that the five disposal zones comprising the Arbuckle formation are homogeneous, isotropic and constant in thickness, porosity and permeability.

70/ Staff's Ex. B, p. 11.

71/ Staff's Ex. B, p. 11.

72/ Tr. 327-329.

73/ Tr. 329-330.

Accordingly, conclusions regarding movement of the waste should not be based on such assumptions of uniformity.

Issue F. Whether a three dimensional analysis of geohydrologic problems by the finite difference method, based on test data obtained from a single well, can accurately predict the nature and performance of the injection horizons?

29. The Board interprets this issue to relate only to the Sequoyah injection reservoir and to the analyses thereof as carried out by the Applicant. The finite difference method of solving many equations can be completely valid, and, when the difference intervals are small enough, the accuracy provided approaches that obtained by more exact methods. However, when the finite difference method or other calculational methods are applied to actual geohydrologic problems, the solution to the problem is influenced more by the accuracy of the input data than by the calculational method used. In the case of the Sequoyah reservoir, the Applicant assumed that the thickness, porosity, and effective permeability were the same over the entire reservoir as at the well hole. As shown in discussion of Issue E above, the Board does not agree that uniformity of the well has been proved.

30. The Applicant did not provide any examples or other precedents showing that such a complex reservoir (five layered with differing boundaries) had been successfully analyzed previously using the finite difference method with data taken from a single well. The Board concluded that the finite difference method can be acceptable for use in the Sequoyah well calculations, but other factors such as the degree of uniformity of the thickness, porosity and effective permeability of the waste accepting strata must be proved, or clearly taken into account, before the nature and performance of the injection horizons can be accurately predicted.

Issue G. Whether monitoring by pressure testing at the well head is adequate to detect fluid movement, or whether there is a need for direct monitoring of the recipient formation?

31. The Applicant quoted the standard deviation of the precision of pressure measurement as $\pm$ 0.55psi.[74/] Over and above this uncertainty in the gage precision, there was an admitted error in the absolute value of the pressure readout for the last half of the Sequoyah pressure

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74/ App. Ex. 1-Attach. A, p. 4.

fall-off test. This error was corrected by adjusting all pressure measurements during this period downward by 2.2psi.[75] These and other uncertainties cloud any predictions that are made in changes in flow pattern, particularly when the portion of pressure change during the fall-off test that was analyzed was only 18psi.

32. The Board was given no basis for determining what degree of precision is required in the data in order to make accurate findings as to changes in flow pattern when the data are taken from a single well. It is possible that the required precision cannot be attained by presently used methods.

33. After careful review of the evidence of record, the Board finds that monitoring from a single well is inadequate to determine the pattern of the movement of a fluid in a reservoir when the degree of uncertainty of the pressure measurements in the well is as great as in the Applicant's Sequoyah tests.[76] The Board, therefore, concludes that methods other than the one used by the Applicant are necessary, particularly if it is required that indications of leakage from the reservoir be detected when the point of leakage may be at a possible boundary several miles from the well.

75/ Tr. 262.

76/ Tr. 347, 349.

Issue H. Whether in the event of a demonstrated leak in the retention reservoir or fault block the waste fluid can be recovered?

34. The Applicant stated that 85 percent of the injected liquid could be recovered by withdrawing from the reservoir a volume of liquid equal to the volume of the injected fluid.[77/] It was admitted, however, that most of the uranium and thorium would precipitate in the well by reaction with the limestone. These precipitated materials would not be recovered by normal pumping methods[78/] nor would they escape from the reservoir in the case of leakage.

35. Accordingly, the Board concludes that, if required, a major portion of the injected waste liquid can be recovered from the Sequoyah well reservoir.

36. All of the proposed findings and conclusions submitted by the parties which are not incorporated directly or inferentially in this Decision are herewith rejected as being unsupported in law or fact, or as being unnecessary to the rendering of this Initial Decision.

77/ Tr. 223; 220-225.

78/ Tr. 224.

III. CONCLUSIONS

A. Although the general principle of deep well disposal of liquid waste matter, which may be acceptable in some cases, is not an issue in this proceeding, the Board did consider and conclude that with respect to the deep well disposal of the type of liquid wastes involved here there must be a showing constituting reasonable assurance of the safety of such disposal to the public.

B. After a careful review of all the evidence of record, the Board concludes:

1. The Applicant was not able to show that the Applicant's equipment, facilities and procedures proposed for use pursuant to the requested amendment are adequate to protect the health and minimize danger to life or property.

2. The Applicant was not able to show that the issuance of the amendment would not be inimical to the health and safety of the public.

IV. ORDER

In accordance with the foregoing, IT IS HEREBY ORDERED that the application made by Kerr-McGee Corporation on May 10, 1972 for amendment to Source Material License No. SUB-1010, be, and it hereby is, denied. In accordance with Sections 2.760, 2.762, 2.764, 2.785 and 2.786 of the Commissions Rules of Practice, this Initial Decision shall be effective immediately and shall constitute the final action of the Commission in accordance with, and subject to the Commissions Rules of Practice. Exceptions to this Decision must be filed in accordance with Section 2.762 of said Rules.

IT IS SO ORDERED.

THE ATOMIC SAFETY AND
LICENSING BOARD

Dale F. Babcock, Member

Lester Kornblith, Jr., Member

John B. Farmakides, Chairman

Issued at Washington, D. C.
this 18th day of January, 1974.

UNITED STATES OF AMERICA
ATOMIC ENERGY COMMISSION

In the Matter of	)	
	)	
KERR-McGEE CORPORATION	)	Amendment to Source
Kerr-McGee Building	)	Material License
Oklahoma City, Oklahoma	)	SUB-1010

APPENDIX I

Exhibits	Identification	Offered	Received
App. Ex. 1	Application and Attachments A through I submitted May 10, 1972	61	61
App. Ex. 2A	Regional structure map, southeast Gore area	64	64
App. Ex. 2B	Regional structure map, top of Arbuckle	64	64
App. Ex. 2C	Five (5) overlays	64	64
App. Ex. 2D	Diagrammatic cross-section showing relationship of Morrow limestone to ground surface	64	64
App. Ex. 2E	Diagrammatic cross-section showing relationship of Spiro sandstone to ground surface	64	64

Exhibits	Identification	Offered	Received
App. Ex. 2F	Brochure of services offered by Gruy & Associates, 11/20/72	64	64
App. Ex. 3A	Testimony & Qualifications of Philip Chenoweth	66	66
App. Ex. 3B	Testimony & Qualifications of H. J. Gruy	66	66
App. Ex. 3C	Testimony & Qualifications of H. K. van Poollen	66	66
App. Ex. 3D	Testimony & Qualifications of Charles J. Sterhagen	66	66
App. Ex. 3E	Testimony of William J. Shelley	148	148
App. Ex. 3F	Qualifications of John S. Rodgers	141	141
App. Ex. 4	Graph showing the plotting of pressure versus the log of time function	258	258
App. Ex. 5	Letter to W. J. Shelley, Director, Regulation and Control, Kerr-McGee Corporation from Oklahoma State Department of Health, Northeast 10th and Stonewall, Oklahoma City, Oklahoma, signed by R. L. Craig, Engineer, dated 8/8/73	365	365

Exhibits	Identification	Offered	Received
Staff Ex. A	Testimony & Qualifications of Donald A. Nussbauer	66	66
Staff Ex. B	Testimony & Qualifications of Donald L. Warner	66	66
Staff Ex. C	Testimony of John B. Robertson	66	66
Staff Ex. D	Qualifications of George DeBuchananne	66	66

UNITED STATES OF AMERICA
ATOMIC ENERGY COMMISSION

In the Matter of	)	
	)	
KERR-MCGEE CORPORATION	)	Docket No. SUB-1010
(Amendment to Source Material License)	)	
	)	

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Office of the Secretary of the Commission in this proceeding in accordance with the requirements of Section 2.712 of 10 CFR Part 2 - Rules of Practice, of the Atomic Energy Commission's Rules and Regulations.

Dated at Washington, D. C.
this 18th day of January 1974.

Peggy A. Downing
Office of the Secretary of the Commission

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	)	
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