

DML:MB:DPH  
40-8027

OCT 26 1970

Dr. Don L. Warner  
University of Missouri-Rolla  
School of Mines and Metallurgy  
Department of Geological Engineering  
Norwood Hall  
Rolla, Missouri 65401

Dear Dr. Warner:

Enclosed is a copy of a letter we recently sent to the Kerr-McGee Corporation concerning their proposed disposal of liquid waste containing radioactive materials by deep well injection. Please accept my thanks for your assistance in this matter.

Sincerely,

Original Signed by  
Lyll Johnson

Enclosure:  
As stated

Lyll Johnson  
Acting Director  
Division of Materials Licensing

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DML:MB:DH  
(40-8027)

OCT 26 1970

Mr. Robert Schneider, Chief  
Office of Radiohydrology  
Geological Survey  
U.S. Department of Interior  
Washington, D.C. 20242

Dear Mr. Schneider:

Enclosed is a copy of a letter we recently sent to the Kerr-  
McGee Corporation concerning their proposed disposal of liquid  
waste containing radioactive materials by deep well injection.  
Please accept my thanks for your assistance in this matter.

Sincerely,

Original Signed by  
Lyall Johnson

Lyall Johnson  
Acting Director  
Division of Materials Licensing

*Enclosure:*  
*As stated*

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40-8027

OCT 15 1970

USGS

Kerr-McGee Corporation  
ATTN: Mr. G. E. Wuller  
Nuclear Division - Staff Engineer  
Licensing and Regulation  
Kerr-McGee Building  
Oklahoma City, Oklahoma 73102

Gentlemen:

This refers to your application dated April 10, 1970, for AEC approval to dispose of liquid wastes containing natural uranium, thorium, and other radioactive constituents by injection into your Sequoyah disposal well.

You estimated that the injected waste fluid will be restricted to a distance of 460 feet in five years and 930 feet in 20 years. This estimate was based on a calculation which assumes that the formation porosity and permeability are homogeneous and isotropic and that the flow from the injection well is uniformly radial. Carbonate rock aquifers are notably heterogeneous, and the core analysis provided in your application (Exhibit K) demonstrates this. For example, the data show that permeabilities determined from cores taken in the Arbuckle range from less than 0.1 to 768 millidarcies, and that vuggy porosities range from 0.9 to 13.4 percent. From these data, it can be expected that the rate of movement from the well bore will be extremely variable, from low rates of movement in beds of low permeability to high rates of movement in beds of high permeability. Therefore, we are unable to agree, based on the data provided, with your estimate on fluid movement.

Furthermore, the data presented show mapped faults throughout the area surrounding the disposal site. While the nearest known fault appears to be about one mile east-southeast of the disposal well, the complexity of the site geology is such that other faults or fracture zones closer to the disposal well could exist. Should such faults exist, waste liquids could migrate to an unanticipated and presently unpredictable location, such as an aquifer used for domestic purposes. Such unknown faults or fracture zones would lead to unpredictable fluid movements.

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OCT 15 1980

While it is recognized that a monitoring program has been developed to determine, insofar as possible, the hydrological influence of the proposed waste injection, it is important to note that a pollutant in ground water could bypass an array of monitoring wells and escape detection in view of the complexity of the pattern of ground-water flow in the area of your well. Therefore, negative monitoring information on movement of radioactive liquid waste would not necessarily demonstrate containment of the waste. Also, in the absence of a demonstration supporting such a conclusion, we are unable to agree with your statement that corrective action could be taken if radioactive material, above background, were detected at a monitoring location.

Our analysis of the geologic and hydrologic information and data provided in your application indicates that it is probable that the Arbuckle Formation, the proposed disposal horizon, is hydrologically connected with the overlying Simpson, Hunton and Spiro formations. The data further show that the present fluid pressure in all these formations is sufficient to cause formation water to flow to the surface where elevations are low enough at outcrops or where the formations are cut by permeable fault zones that reach the land surface at elevations that are below the potentiometric surface of the confined saline water-bearing aquifers. Therefore, it appears that the injection of additional fluids into the proposed well will cause a further pressure buildup and, as a minimum, force additional formation water, which is reported to contain about 140,000 parts per million total dissolved solids as well as naturally occurring radium, upward along faults or fracture zones to the land surface. The data presented in your application are insufficient to determine precisely when or where the formation water may be forced to the surface by the liquid waste injection. However, because the potentiometric surface is about 550 to 600 feet above sea level, it is possible that this would occur shortly after continuous injection has begun.

In summary, the geologic and hydrologic data and analysis presented in the application do not support a conclusion that waste fluids containing radioactive materials will remain confined. Rather, our analysis of the data indicates that fluids containing radioactive material could enter aquifers used for domestic water, thereby constituting a potential hazard. Additionally, the injection of waste fluids of any type would build up the pressure head in the Arbuckle Formation and result in formation water moving along faults and fracture zones and discharging at or near the land surface.

OCT 15 1970

In view of the foregoing, we are unable to make the findings called for by 10 CFR Part 40, § 40.32. Therefore, your application for deep-well disposal of liquid wastes containing radioactive materials is hereby denied. Pursuant to the provisions of the Commission's regulation 10 CFR Part 2, "Rules of Practice," you may request a hearing on this matter within thirty (30) days from the date of this notice.

FOR THE ATOMIC ENERGY COMMISSION

Original Signed by  
Richard B. Cunningham

*for*  
Lyall Johnson  
Acting Director  
Division of Materials Licensing

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C. Buchanan, DML

L. Johnson, DML

R. Cunningham, DML

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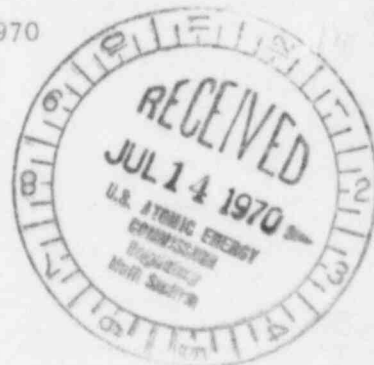
UNITED STATES  
DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY  
WASHINGTON, D.C. 20242

DOCKET NO. 40-8027

Regulatory

File Cy.

July 13, 1970



Mr. Donald A. Nussbaumer, Chief  
Source & Special Nuclear Materials Branch  
Division of Materials Licensing  
U.S. Atomic Energy Commission  
Washington, D. C. 20545

Dear Mr. Nussbaumer:

Reference is made to your letters of April 21 and June 2, 1970, requesting assistance from the Geological Survey in reviewing the additional data submitted to your office by the Kerr-McGee Corporation in connection with their Sequoyah Uranium Facility in Oklahoma (Source Material License SUB-1010, Docket 40-8027), and to my letter to you dated December 19, 1969, in which we reviewed parts of Kerr-McGee's application for Source Material License.

Our review efforts with respect to the additional data were concentrated mainly on the geology and hydrology as they might affect the movement of radioactive wastes from the proposed waste-injection well, and the hydrologic effects of the proposed injection scheme. In general, the additional information given by the applicant does not provide a sufficient amount of geologic and hydrologic data to provide a basis for judgment as to whether the wastes to be injected, including thorium-230 (half life, 80,000 years) and radium-226 (half life, 1,622 years), will be contained by the Arbuckle Formation.

The applicant states on page IV-5 that after five years the injected fluid is estimated to move only 460 feet from the disposal well. This estimate is based on a calculation using the equation given on page 18 (Appendix B) which assumes that the formation porosity and permeability are homogeneous and isotropic and that flow from the injection well is uniformly radial. Carbonate rock aquifers are notably heterogeneous and the core analysis data in exhibit K demonstrate this. For example, the data show that permeabilities determined from cores taken in the Arbuckle range from less than 0.1 to 768 millidarcies, and that vuggy porosities range from 0.9 to 13.4 percent. From these data, it can be expected that the rate of movement from the well bore will be extremely variable, from low rates of movement in beds of low permeability to high rates of movement in beds of high permeability. It is believed therefore that the estimate of the amount of movement of the injected fluid is not based on valid assumptions.

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The applicant states on page 8 (Appendix B) that the depth to saltwater in the Arbuckle in the proposed disposal well is 50 feet below land surface, or 513 feet above sea level. On page 6, it is stated that the saltwater potentiometric surface is about 550 to 600 feet above sea level. This surface is above much of the land surface in the area and considerably above the elevations of the Illinois and Arkansas Rivers. On page 5 (Exhibit M) the consultant to Kerr-McGee states and geologic cross sections H and I show that this surface appears to be common not only to the Arbuckle, but also to the overlying Simpson, Hunton, and Spiro Formations. In addition, the consultant suggests that the chemical quality of the brine in the Arbuckle and overlying formations is essentially the same. The uniform head and chemical quality of the formations suggest a hydraulic connection between them. Because of the impermeable nature of the uppermost part of the Arbuckle and of several horizons in the overlying formations, the only apparent feature that could provide such a hydraulic connection is a fault or fracture zone cutting across the beds. Several faults of this type are shown on the map of Exhibit B, the State Geologic Map, and on geologic cross sections Exhibits H and I. In addition, along one of the faults about 8 miles west of the proposed site, highly mineralized water (containing about 110,000-115,000 parts per million total dissolved solids) is discharging at the surface (Marcher, 1969<sup>1</sup>; Exhibit M, p. 6). Therefore, any type of fluid injected in the proposed well will cause a pressure buildup in the injection zone and will eventually force brine (containing about 140,000 parts per million total dissolved solids) upward along faults or fracture zones to the surface. The available data are not adequate to determine when brine may be forced to the surface by the waste injection; however, because the potentiometric surface is about 550 to 600 feet above sea level, it is possible that this may occur shortly after continuous injection has begun.

The applicant's consultant has stated on page 6 (Appendix B) that a pollution hazard could be created if sufficiently large volumes of waste were injected at high pressure causing the waste fluid front to reach the nearest fault zone. It is apparent from the description of the planned monitoring program (p. 16-17, Appendix B) that the applicant considers the most probable path for the upward movement of radioactive wastes to be along the Carlile School fault, about 1 mile east-southeast of the disposal well. The statement is made (p. 17) that the site of the monitoring well on this fault was selected to detect a change in either the water quality or the static water level. The available hydrologic and geologic data are inadequate to predict the precise paths along which brines or radioactive waste solutions might rise and discharge at or near the surface or the time when this might occur.

Although several faults have been mapped, the possibility exists that there may be other faults or fracture zones closer to the disposal well site. Of most concern is the possibility that the waste solutions or brines will emerge in the Arkansas River Valley. The alluvium in the Arkansas River Valley downstream from the site is a source for domestic water supplies and, in Arkansas, the alluvium is considered to be the most consistently productive aquifer in that state.

<sup>1</sup>Marcher, M. V., 1969, The Water Resources of the Ft. Smith Quadrangle: Oklahoma Geol. Survey Hydrologic Atlas 1.



Regarding the proposed monitoring program, it should be mentioned that such a program would be desirable, but it is important to note that in view of the complexity of the pattern of ground-water flow, a pollutant in ground water could bypass an array of monitoring wells and escape detection. Therefore, negative monitoring information on the movement of waste radioactive liquids would not demonstrate containment of the waste, as stated on page 17 (Appendix B). Also, if radioactivity were detected in a monitoring well along the fault line, or anyplace else, it would be impracticable or impossible to take corrective action as indicated on page 17.

On page 17 (Appendix B), the applicant states that two retention basins of 5.5 million gallons capacity are provided for temporary impoundment of the waste liquids in the event of malfunction of the disposal well. Details concerning the construction of embankments for the retention basins are given in Drawing no. SK-C-53; however, the details for construction of the floors of the basins are not given. The floor of the basin should be made as impermeable as possible in order to prevent the downward percolation of waste fluids, which conceivably could migrate offsite and enter the alluvium of the Illinois or Arkansas Rivers. In addition, shallow core holes should be drilled beneath each basin. From the cores, permeabilities should be determined in order to properly evaluate the possibility of downward percolation through the bottoms of the basins. On page IV-6.8, the applicant states that a massive leakage through stop logs in Basin no. 1 drainage structure is believed unlikely since the basin will not be used continuously, and that Basin no. 2 has no built-in drainage system. If the basins are to be used continuously, it may be necessary to construct the drainage structure of Basin no. 2 in a manner similar to that of no. 1, or to redesign both basins.

On page IV-5 the applicant refers to experimental data on a disposal well in which 99 percent of the thorium was precipitated at the interface of the waste water and the formation water. Although this may be desirable in preventing the movement of thorium, the precipitation of thorium would tend to reduce the porosity and permeability and restrict both the amount and rate of movement of fluid into the formation.

In summary, the injection of waste fluid of any type would build up the pressure head in the Arbuckle Formation and result in brine moving upward along faults and fracture zones and discharging at or near the land surface. The available geologic and hydrologic data are inadequate to predict the flowpaths or the time when radioactive waste solutions might reach the surface. However, it is possible that these wastes eventually will discharge in the Arkansas River Valley where, in addition to entering the river, they could enter the alluvial aquifers which are sources for domestic water supplies.

If you should have any questions regarding these comments, please let us know.

Sincerely yours,

*Robert Schneider*

Robert Schneider  
Chief, Office of Radiohydrology

cc: W. G. Belter, AEC, Germantown  
Assistant Chief, Research and Tech. Coord.  
Chief, Ground Water Branch  
District Chief, Oklahoma City  
D. G. Metzger

COLLECT  
R

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JUL 9 1970

LYALL JOHNSON  
ACTING DIRECTOR  
DIVISION OF MATERIALS LICENSING  
U. S. ATOMIC ENERGY COMMISSION  
WASHINGTON, D. C. 20545

KERR-McGEE CORPORATION  
KERR-McGEE BUILDING  
OKLAHOMA CITY, OKLAHOMA 73102

ATTENTION: MR. GEORGE PARKS  
EXECUTIVE VICE PRESIDENT

THE PROPOSED WASTE HANDLING AND TREATMENT CONCEPT DESCRIBED IN YOUR TWX  
DATED JULY 7, 1970 APPEARS SATISFACTORY SUBJECT TO OUR REVIEW OF THE DETAILS  
OF DESIGN AND OPERATION YOU PLAN TO SUBMIT IN THE NEAR FUTURE. THE CONCEPT  
SHOULD HAVE THE OBJECTIVE OF REDUCING THE CONCENTRATION OF URANIUM IN THE  
EFFLUENT TO THE LOWEST PRACTICABLE LEVEL. IN VIEW OF YOUR REFERENCES TO  
YOUR PENDING DEEP WELL PROPOSAL, WE FEEL YOU SHOULD CLEARLY UNDERSTAND THAT  
WE ARE IN NO POSITION TO PROVIDE YOU ANY DEGREE OF ASSURANCE THAT AEC ACTION  
ON YOUR DEEP WELL PROPOSAL WILL BE TAKEN WITHIN THE NEXT TWELVE MONTHS OR  
THAT, <sup>WHEN</sup> ~~WITHIN~~ ACTION IS TAKEN, IT WILL NECESSARILY BE AFFIRMATIVE.

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L. Johnson, DML

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SURNAME ▶	Nussbaumer/mad	LJohnson			
DATE ▶	7/9/70	7/9/70			

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ACTING DIRECTOR  
DIVISION OF MATERIALS LICENSING  
U. S. ATOMIC ENERGY COMMISSION  
WASHINGTON, D. C. 20545

OFFICIAL BUSINESS

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KERR-McGEE BUILDING  
OKLAHOMA CITY, OKLAHOMA 73102

ATTENTION: MR. GEORGE PARKS  
EXECUTIVE VICE PRESIDENT

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THAT, <sup>WHEN</sup> ~~WHEN~~ ACTION IS TAKEN, IT WILL NECESSARILY BE AFFIRMATIVE.

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**Continuation Page:** Use plain paper for continuation pages.

**Originator:** Type name of originator, initials of typist, and the telephone and room number of the originating office.

03

FROM:

Kerr-McGee Corp.  
Oklahoma City, Okla.  
(G. B. Parks)

DATE OF DOCUMENT

7-7-70

DATE RECEIVED

7-8-70

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TVX

TO:

L. Johnson

ORIG.:

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CC:

OTHER:

ACTION NECESSARY ☐CONCURRENCE ☐

DATE ANSWERED

NO ACTION NECESSARY ☐COMMENT ☐

BY:

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DOCKET: 40-8027

DESCRIPTION: (Must Be Unclassified)

TVX ref. our 6-30-70 letter and  
advising with regard to their plans  
for handling liquid effluents.....

REFERRED TO

DATE

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DATE

Harmon: 7-8

w/file cy.

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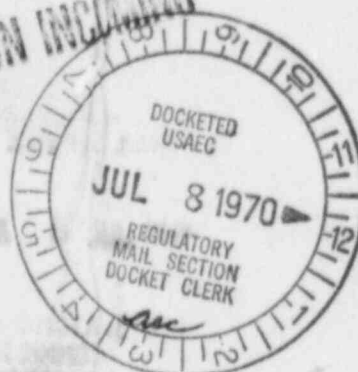
LYALL JOHNSON, ACTING DIR.

DIV. MATERIALS LICENSING

U.S. ATOMIC ENERGY COMM.

WASH., D.C.

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1970 JUL 7 PM 6 49

U.S. ATOMIC ENERGY COMM.  
TWX UNIT

DOCKET NO. 40-8027

☒ Regulatory

☐ File Cy.

REFERENCE IS MADE TO YOUR LETTER OF JUNE 30, 1970. IT WAS OUR UNDERSTANDING AT THE MAY 26, 1970 MEETING IN YOUR OFFICE THAT, SINCE YOU COULD NOT AT THIS TIME RESOLVE THE QUESTION OF DEEP WELL DISPOSAL OF OUR SEQUOYAH WASTES, WE COULD CONTINUE TO OPERATE WITH THE TEMPORARY PONDING SYSTEM WITHIN THE SCOPE OF OUR LICENSE. WE POINTED OUT THEN THAT IT WOULD BE NECESSARY FOR US TO EXPAND OUR PONDS IN ORDER TO COVER US PENDING YOUR EVENTUAL DECISION ON THE DEEP WELL.

SINCE THAT TIME WE HAVE DEVELOPED PLANS AND ARE PROCEEDING WITH A \$300,000 PROGRAM TO HANDLE OUR LIQUID EFFLUENTS SAFELY WITHIN THE SCOPE OF OUR PRESENT LICENSE FOR THE NEXT YEAR. WE ARE STILL

C

CONVINCED THAT DEEP WELL DISPOSAL WILL BE THE ULTIMATE SOLUTION TO THE SEQUOYAH DISPOSAL PROBLEM AND ARE PROCEEDING ON THE BASIS OF AN INTERIM PONDING SYSTEM PENDING RESOLUTION OF THE DEEP WELL APPROACH.

2113

4507310319

ESSENTIALLY THE SYSTEM WE ARE NOW DEVELOPING CALLS FOR SEGREGATION  
OF OUR LIQUID PLANT EFFLUENTS INTO TWO STREAMS - SOLVENT EXTRACTION  
RAFFINATE AND HF SCRUBBER. EACH STREAM WILL BE TREATED WITH LIME  
AND OTHER CHEMICALS AND THE RESULTING SLURRIES WILL FLOW TO PONDS.  
ALL RAFFINATE SLURRIES WILL BE RETAINED IN AN ON SITE POND. THE  
OTHER SLURRIES WILL BE FED TO SETTLING BASINS FROM WHICH THE CLEAR  
FLUORIDE FREE SOLUTION OF THE PROPER ACIDITY WILL FLOW TO THE RIVER  
WITH CONCENTRATIONS OF RADIOACTIVE MATERIAL WELL BELOW MPC LEVELS.  
PONDS WILL MEET AEC STANDARDS. THEY WILL BE PROPERLY POSTED AND  
FENCED. MONITOR WELLS WILL BE STRATEGICALLY PLACED TO ASSURE NO  
POND LEAKAGE.

WE ARE NOW IN THE FINAL STAGES OF TAKING BIDS ON THE WORK AND WE  
EXPECT THAT WITHIN A MONTH THE RAFFINATE TREATMENT AND RETENTION  
SYSTEM WILL BE IN OPERATION AND THAT THE ENTIRE SYSTEM WILL BE IN  
OPERATION WITHIN 3 MONTHS.

WE WILL SUPPLY YOU WITH DETAILS OF DESIGN AND OPERATION IN THE NEAR  
FUTURE.

G. B. PARKS  
EXECUTIVE VICE PRESIDENT

WESTERN UNION INCOMING

TKS END

2113

40-8027

JUN 30 1970

U S G S

Mr. George Parks  
Executive Vice President  
Kerr-McGee Corporation  
Kerr-McGee Building  
Oklahoma City, Oklahoma 73102

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H. Shapar, OGC  
M. M. Mann, DR  
H. L. Price, DR  
L. Johnson, DML

Dear Mr. Parks:

This letter will confirm our May 26, 1970 discussion with you and other Kerr-McGee representatives concerning Kerr-McGee's request to dispose of liquid waste from the Sequoyah Plant by deep-well injection.

After careful consideration of your application, it has become clear that questions related to public health and safety raised by deep-well disposal will not be resolved in the near future. We cannot, therefore, act on your request at this time.

During the discussion you indicated that several alternative waste handling and treatment methods for the Sequoyah Plant liquid waste were under study. As we pointed out, an objective of the study should be to identify methods which will reduce to the lowest practicable level the radiological constituents of any waste released to unrestricted areas. Also, we understand the study will consider methods of dealing with the raffinate waste other than storing it in ponds. Please provide us with a proposal describing the scope and schedule for actions to be taken in this regard.

This letter will also acknowledge the telegram of May 13, 1970, from your Mr. George Waller advising of the status of liquid effluent plans for start-up of UF<sub>6</sub> production operations. We view the information in the telegram as representing interim measures for dealing with liquid waste pending outcome of the study mentioned above.

Because of the importance of this matter we would appreciate your reply within 30 days from the date of this letter.

Sincerely,

Original Signed by  
Lyll Johnson

Lyll Johnson, Acting Director

Division of Materials Licensing

OFFICE ▶	DML	OGC	DR	DR	DML
SURNAME ▶	Nussbamer/vjh	HShapar	MP	HLPrice	LJohnson
DATE ▶	6/25/70	6/25/70		6/30/70	6/30/70

40-8027

Mr. George Parks  
Executive Vice President  
Kerr-McGee Corporation  
Kerr-McGee Building  
Oklahoma City, Oklahoma 73102

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Public Document Room

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*deleted*  
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Sincerely,

Lyall Johnson, Acting Director  
Division of Materials Licensing

OFFICE ▶	DML	OGC	DR	DR	DML
SURNAME ▶	Nussbaumer/mad	HShapar	MMann	HLPrice	LJohnson
DATE ▶	6/11/70	6/23/70			

## SIGNATURE MAIL ROUTING SLIP

(Director's Office)

Mr. Price 6/26 concurrence gh 6/30  
 Dr. Beck : concurrence CKB 6/26  
 Dr. Mann : concurrence TV  
 Mr. Henderson : concurrence gh

Is notification to the  
 JCAE recommended? \_\_\_\_\_

Concurrences received from:

Compliance \_\_\_\_\_ ( )  
 Materials Licensing \_\_\_\_\_ ( 6/11/70 )  
 Nuclear Materials Safeguards \_\_\_\_\_ ( )  
 Radiation Protection Standards \_\_\_\_\_ ( )  
 Reactor Licensing \_\_\_\_\_ ( )  
 Reactor Standards \_\_\_\_\_ ( )  
 State & Licensee Relations \_\_\_\_\_ ( )  
 Office of General Counsel \_\_\_\_\_ ( 6/23/70 )  
 Others \_\_\_\_\_ ( )

Remarks: Ltr to George Parks, Kerr-McGee Corp. fm LJohnson confirming  
 discussion of 5/26/70 concerning disposal of liquid waste from  
 the Sequoyah plant by deep-well injection and ack. tel of 5/13/70

Date 6/23/70Originator Nussbaumer