REGULATORY OPERATIONS

KERR-McGEE CORPORATION

KERR-McGEE CENTER • OKLAHOMA CITY, OKLAHOMA 73102

January 18, 1973

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FEB 16 1973
U.S. ATOMIC ENERGY COMMISSION
REGULATORY
MAIL SECTION

U.S. Atomic Energy Commission
ATTN: Mr. J. E. Rothfleisch
Materials Branch
Directorate of Licensing
Washington, D. C. 20545

Dear Mr. Rothfleisch:

Please refer to your letter of December 6 raising certain questions or requesting additional information in regard to our Revised Environmental Report of November 1971 and our Supplemental Environmental Report of June 1972.

The questions raised have been answered and additional detailed data or explanation furnished in the attached Environmental Report-Supplemental #2 dated December 1972. In accordance with our discussion, the report is answered in the order of your questions and additional information included immediately thereafter where appropriate. In some cases your questions have coincided with those of others who have examined these reports and, if one answer covers both subjects, appropriate reference will be made.

In accordance with our previous arrangement, I have included five copies of the report and am shipping to you separately the balance of 195 copies for your distribution. We would be pleased to discuss all or part of this report at your convenience.

Sincerely,

Parker S. Dunn

Parker S. Dunn
Group Vice President
Nuclear Operations

PSD:WJS:srj
Enclosures
Applicants Environmental Report
Dec. 1972
Supplemental #2

1124

B/16

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

RECEIVED JAN 2 197?

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ENVIRONMENTAL REPORT
SEQUOYAH FACILITY
KERR-McGEE CORPORATION

SUPPLEMENTAL #2

(1) Current and projected plant capacity is not clearly stated. We assume that license is for 5,000 TPY operation, yet 10,000 TPY rate is discussed in text. Please clarify.

Design and current plant capacity is 5000 tons per year (4536 MTU) and operation will eventually reach that level. The wet end of the plant was built for a capacity of 10,000 tons per year and the dry end of the plant from boildown through fluorination was designed for 5000 tpy with sufficient space for addition of another module of equipment to raise the total to 10,000 tpy. In earlier exchanges, the AEC requested that we discuss 10,000 tpy, especially in regard to possible effluent effects in terms of the life of the plant. Therefore, this discussion is included where appropriate.

(2) Maps provided (Figure 1 in particular) are not very clear. Suggest substituting following 8 x 10 1/2" drawings:

(a) General map of State of Oklahoma pointing out plant site (scale about 50 miles per inch),

(b) Second map showing general area details i.e., towns, roads, rivers, etc. (scale about 10 miles per inch)

(c) Third map similar to insert in present Figure 1. (scale about 4 miles per inch)

(d) Plant area map (scale about 1500 feet per inch) up-dated to show all existing ponds, monitoring points, residences, etc. alone with distances from air-borne effluent release point to possible critical exposure points; e.g., school, homes, roads.

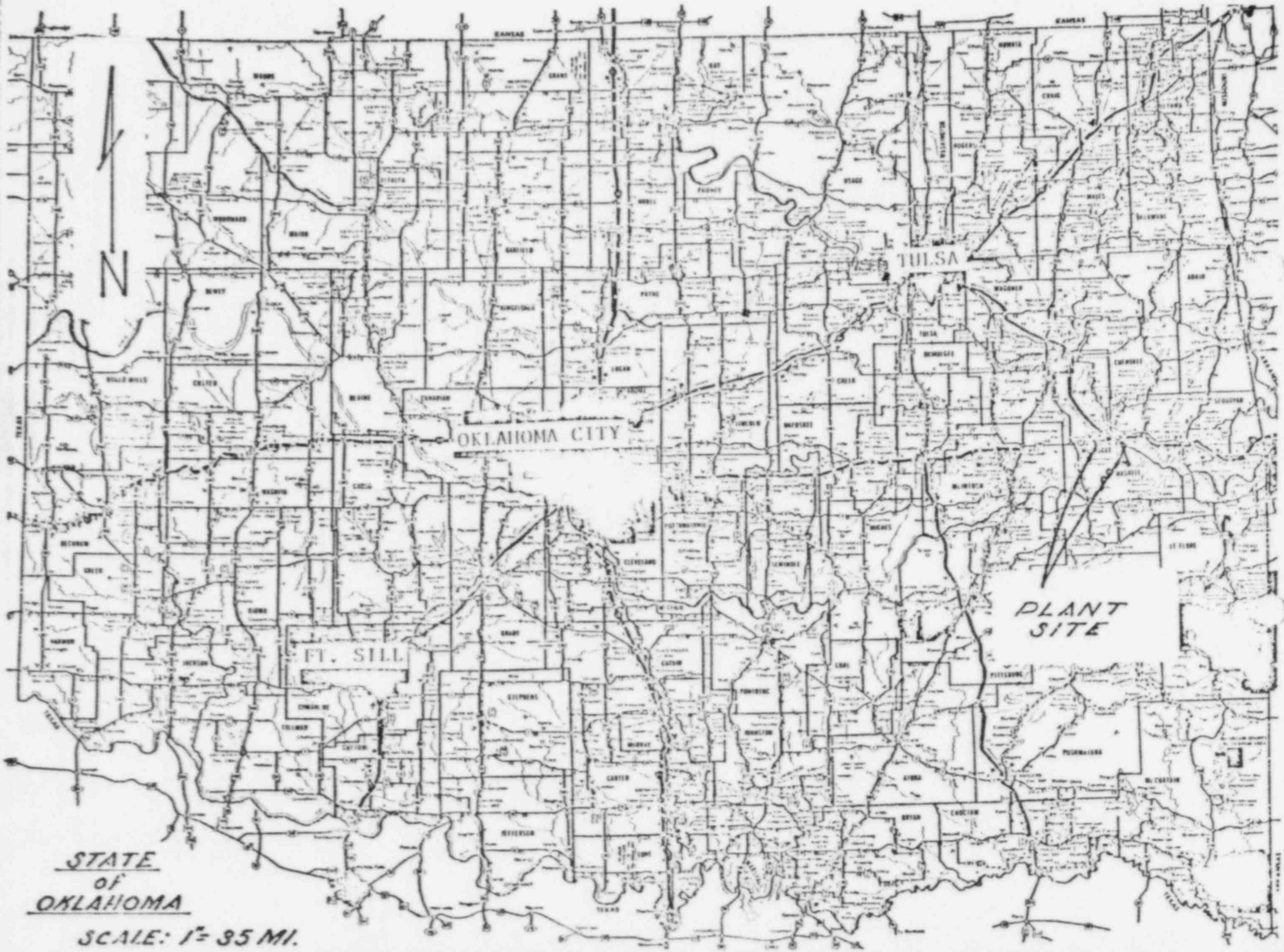
The maps requested are enclosed. We feel, however, that this request, if such fixed criteria for such reports exists, should be included in the guidelines for such reports. Figure 1 is a reduction of Drawing 110-C-151 included with the Revised Environmental Report. The location of the houses and school are circled and the distances tabulated.

(3) Page S-45. Process description covers disposal of sodium hydroxide solution used to wash lean organic. What is done with the ammonium sulfate solution used in the first stage lean organic wash?

The ammonium sulfate solution used in the first stage of organic washing is returned to the pumper decanters and the aqueous solution combined with the raffinate for discard at that point. We are currently experimenting with the use of this ammonium sulfate solution to provide sulfation of the UNH instead of using sulfuric acid. Initial results appear favorable.

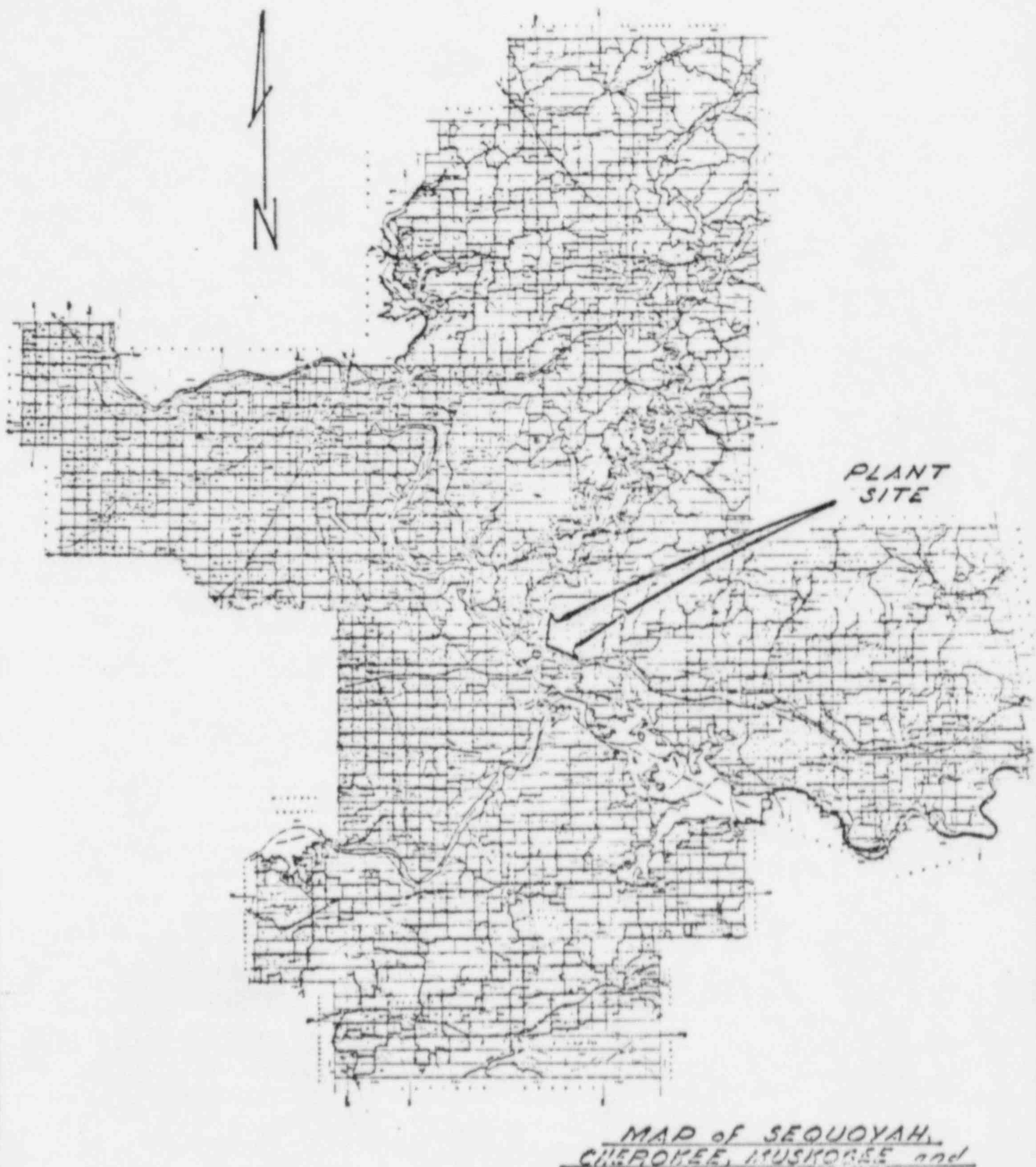
(4) Page S-45. Claim is made that raffinate stream is neutralized with ammonia and impounded for permanent storage while Revised Environmental Report (November 1971), page R-5, states that raffinate stream is neutralized with lime slurry precipitating U and daughter products, Th-230, Th-234 and Ra-226 along with heavy metals. Which procedure is used?

Initially, the raffinate stream was neutralized with lime slurry as described in the Revised Environmental Report and subsequently changed to ammonia in December 1971 in order to take advantage of the ammonia economics, more nearly stoichiometric neutralization, and to prevent filling the pond prematurely with solid calcium hydroxide. Pond No. 1 was essentially all neutralized with lime slurry while Pond No. 2 has only been neutralized with ammonia solution.



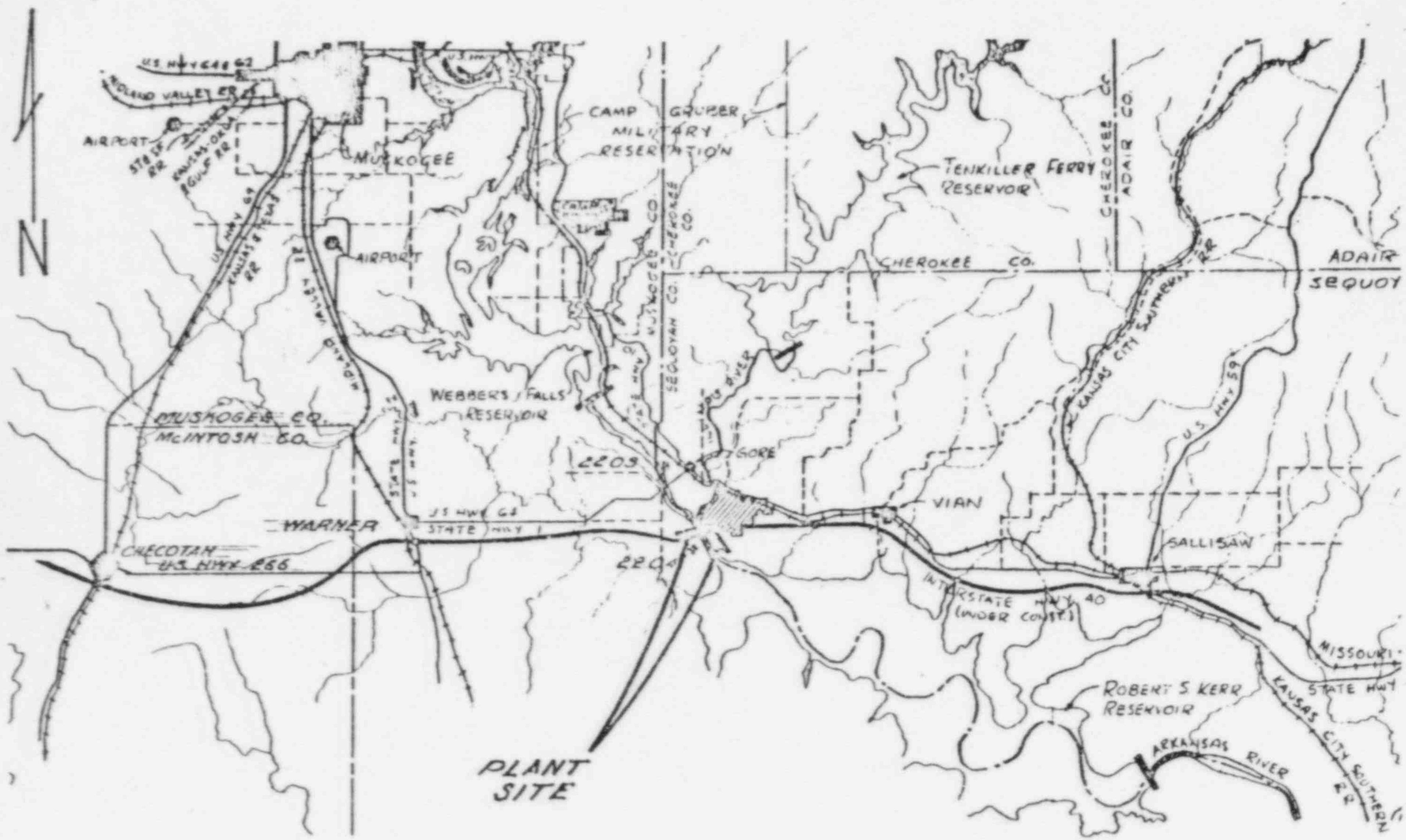
STATE
of
OKLAHOMA

SCALE: 1" = 35 MI.



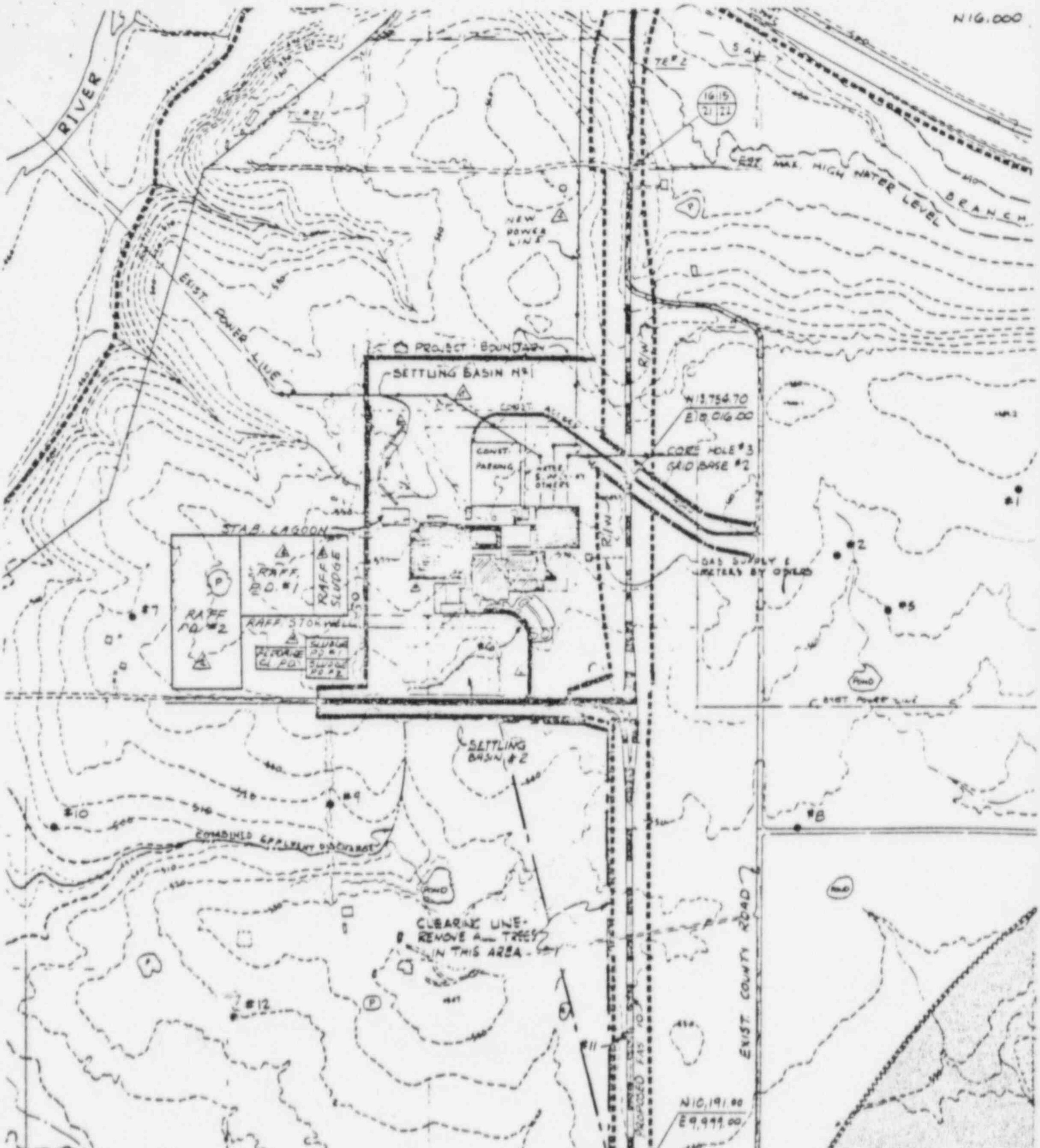
MAP of SEQUOYAH, CHEROKEE, MUSKOGEE and HASKELL COUNTIES

SCALE: 1"=10 MI.

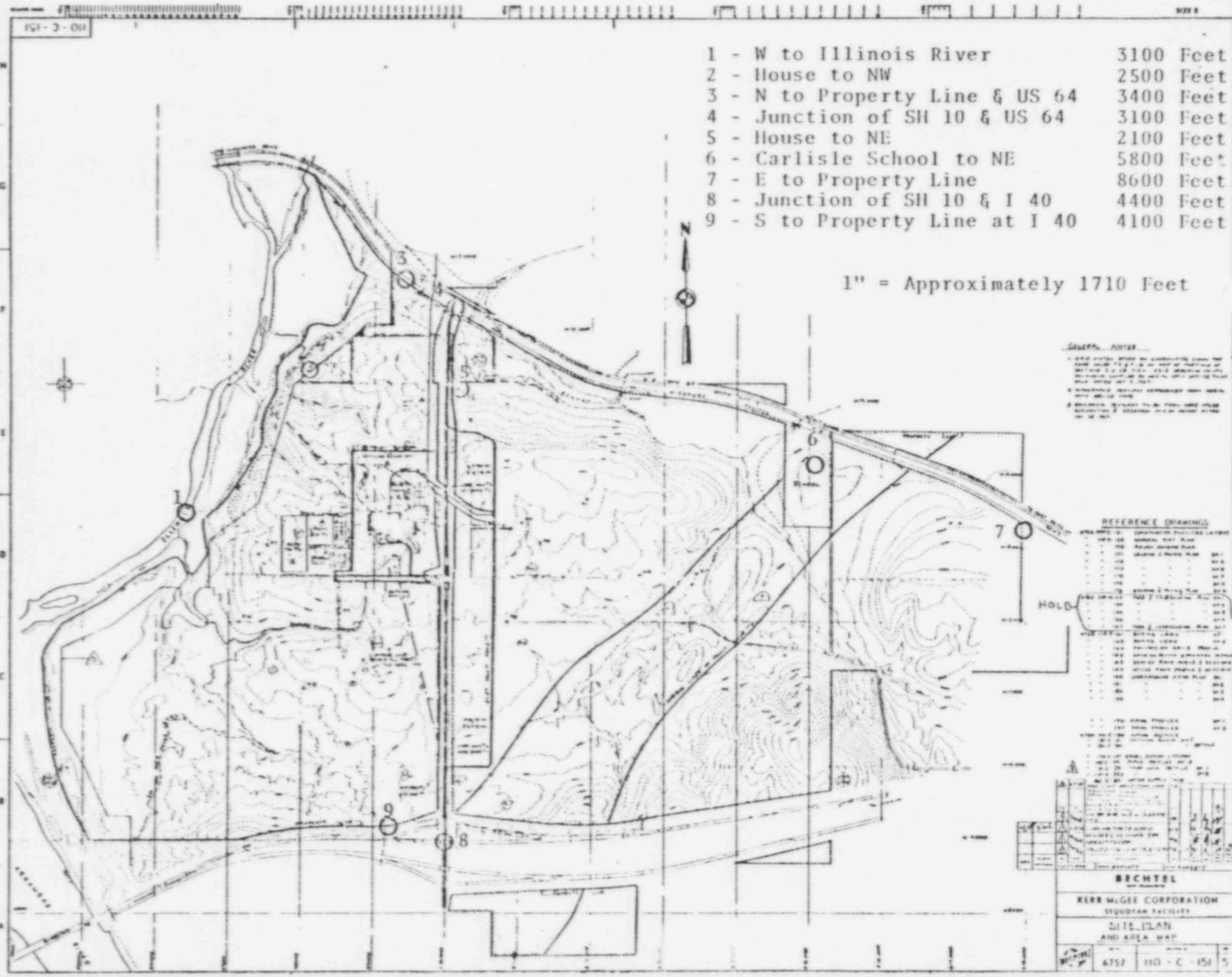


AREA MAP

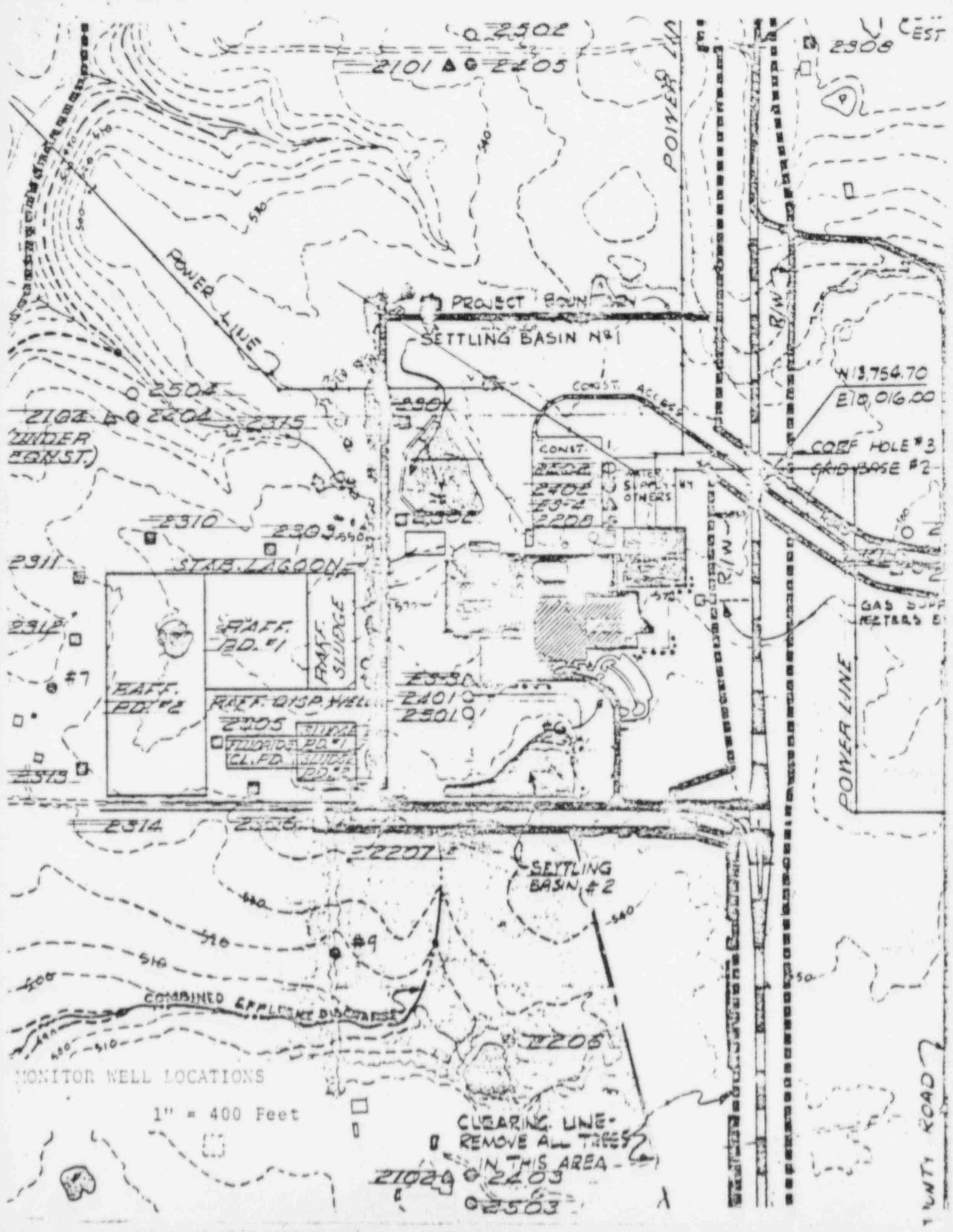
SCALE: 1" = 4 MI.



ENLARGEMENT OF PLANT AREA 1" = Approx. 670 F



1 - W to Illinois River 3100 Feet
2 - House to NW 2500 Feet
3 - N to Property Line & US 64 3400 Feet
4 - Junction of SH 10 & US 64 3100 Feet
5 - House to NE 2100 Feet
6 - Carlisle School to NE 5800 Feet
7 - E to Property Line 8600 Feet
8 - Junction of SH 10 & I 40 4400 Feet
9 - S to Property Line at I 40 4100 Feet
1" = Approximately 1710 Feet
N
REFERENCE DRAWINGS
HOLD
BECHTEL
KERR McGEE CORPORATION
SEQUOYAH FACILITY
SITE PLAN
AND AREA MAP
6757
110-C-151
5



MONITOR WELL LOCATIONS

1" = 400 Feet

(5) Page S-47.

(a) Equation (iii) is not balanced; needs $\underline{3}$ U_3O_8.

(b) Equation is not balanced; insufficient oxygen and no hydrogen on right-hand side of equation. Expression "8 NO_3 not understood.

(Table IV) - Totals from ore digesters do not appear compatible with previous data, i.e., 5280 lb/day release rate of NO_2 for 2 shift operation processing 1717 lb/hr U does not appear to equate to 8350 lb/day release for 3 shift operation at 2686 lb/hr rate. Please clarify.

As you noted, (a) equation (iii) omitted $\underline{3}$ in front of U_3O_8. The corrected equation is given below:

$$3U_3O_8 + 20HNO_3 \rightarrow 9UO_2(NO_3)_2 + 2NO + 10H_2O$$

(b) Equation is not balanced. The corrected equation is given below:

$$UF_4 + 4Al(NO_3)_3 \rightarrow UO_2(NO_3)_2 + 4AlF(NO_3)_2 + 2NO_2$$

The data shown on Table IV is the design data to establish the maximum offgas rate produced during two rates of operation to provide a basis for the design of offgas handling and absorption equipment. It does not correlate with the rate of uranium throughput quoted in your question and appearing earlier in the report since the rate of uranium digestion exceeds the feed rate to the solvent extraction plant on an instantaneous basis. The uranium rate shown earlier and quoted above is the average flow rate from the digestors.

(6) Page S-48, Paragraph 2. At 0.2 to 1.2% losses, the amount of NO_2 lost would range from ∿ 36 to 216 lb per day at the 5,000 TPY rate and from ∿ 68 to 406 lb per day at the 10,000 TPY rate based on values given in Table IV. Should specify 9 lb/hr loss is at 5,000 TPY rate. Letter WJS to CRB 1/21/72 indicates loss of 24.1 lb/hr NO_2. Please report measured or best estimate of NO_2 release at 5,000 TPY rate.

NO_2 released from the stack varies with several plant activities. Rate of generation is controlled by the rate of digestion and composition of feed material and the rate of denitration. The degree of absorption is controlled by the efficiency of the

absorber at any given instant. In our total material balance, we show 4.6 metric tons released per month at 5000 tons per year or a rate of 14 pounds per hour which is our current best estimate. The measurements reported to Mr. Buchanan have not been redone though we now have a sampler in the stack which has measured from 100 to 300 ppm NO_2 in the stack effluent. This exact concentration, of course, may vary by the steam demand of the boilers.

(7) Page S-55, Paragraph 2. Claim is made that plant site is a licensed burial ground. We do not find this authorization in the license, license application or environmental reports. Please clarify.

Burial of plant generated solid waste material on the site is done in accordance with 10 CFR 20.304 which provides a general license for such disposal. Describing the plant site as a "licensed burial ground" should be eliminated. As stated, cumulative burials through November 1 have totalled 304 Kgs of natural uranium. In 1971, Mr. J. Hyder of Region IV Compliance Office answered certain questions as a routine part of his inspection, a copy of which is enclosed for your information.

(8) Pages S-61 and S-62. Tables X and XI should indicate that quantities are in metric tons per month. Please clarify method used to scale up losses.

Tables X and XI show quantities in metric tons per month. Losses were scaled up on an item by item basis since the higher production rate of 378.8 metric tons per month of uranium would permit higher efficiencies in handling of certain off-gas streams. Generally, it is a well-known fact that plants designed for continuous operation produce their best efficiencies at the design rate rather than approximately 50% of design rate. The earlier exchange of information, however, exphasized that these data should be based upon measured experience

QUESTIONNAIRE

BURIAL OF WASTE PURSUANT TO § 20.304

I. Licensee Name: Kerr McGee
Address:
Sequoyah Facility
License No. SUB - 1010
Date of Inspection: 9/20-22/71

II. Does licensee generate radioactive waste during normal operations? Yes ✓ No__

III. Does licensee bury waste pursuant to § 20.304? Yes ✓ No__

If No, disregard rest of questionnaire.

IV. What were the principal types of waste buried?

- Chemical laboratory waste ____
- Animal carcasses ____
- Contaminated equipment & scrap ✓
- Other (describe briefly)

V. What were the principal isotopes and estimated amount of activity buried during 1970?

Nat U. 3960 uci in 22 ? lb
(12,000 gm U Nat)

VI. What alternative disposal methods were considered?

- Transfer to a commercial disposal firm ____
- Incineration ____
- Storage for decay ____
- Other (describe briefly) None

VII. What were the bases for choosing burial pursuant to § 20.304?

Economics ✓ Convenience ✓

Other (describe briefly)

VIII. In the licensee's opinion, would deletion of § 20.304 present a hardship?

Yes ✓ No__

J. Hayden CO IV
Inspector
A.E.C.

quantities and expanded with the best engineering estimates which was the procedure followed. As mentioned, October 1972 provided one month of operation at slightly in excess of rated capacity. Additional measurements of effluents were made and Table XI has been reconstituted based upon these measurements. Table XIA is attached immediately following.

(9) Page S-65, Table XII. Design criteria used for a number of constituents appear substantially higher than EPA ambient air quality standards.

Constituent	Design Value Maximum Ground Level Beyond Site Fence	EPA Air Ambient Quality Standard (40 CFR 50)
Hexane	500 ppm	0.023 ppm (Hydrocarbon) maximum 3-hour concentration
SO_2	0.2 ppm	Primary Standard: (a) 0.03 ppm annual arithmetic mean. Secondary Standard (a) 0.02 ppm annual arithmetic mean.
NO_x	2 ppm	0.05 ppm nitrogen dioxide - annual arithmetic mean
Particulates	0.3 grain/ft^3 at point of release (equivalent to 6.87×10^5 µg/m^3)	Primary Standard: (a) 75µg/m^3 annual geometric mean Secondary Standard: (a) 60µg/m^3 annual geometric mean

$\frac{687 \times 10^3}{75}$ = 9160 minimum dilution required before reaching site boundary.

UF_4 concentration of 0.006 mg/m^3 ($\sim 1.15 \times 10^{-12}$µCi/ml) and UF_6 concentration of 0.009 mg/m^3 ($\sim 2.03 \times 10^{-12}$µCi/ml) appear to be slightly below the 10 CFR 20 allowable limits in unrestricted areas of 2×10^{-12}µCi/ml and 3×10^{-12} µCi/ml for insoluble and soluble natural uranium respectively.

While not stated in the report, the data given on Table XII was design criteria targets compiled from applicable standards at the time these criteria were set, July 1968, so as to provide the goal for the design contractor to perform calculations and select optimal processing methods. These criteria were generated (1968) well before the establishment of EPA ambient air quality standards. Effluent air quality is being monitored continuously to seek control methods to insure that offsite emissions never exceed air quality standards.

TABLE XI REVISED
ACTUAL, OCTOBER 1972
METRIC TONS OF EFFLUENTS IN ALL PROCESS STREAMS AT A PRODUCTION RATE OF 387.8 METRIC TONS PER MONTH OF URANIUM CONTENT AS URANIUM HEXAFLUORIDE[a]

	Stored					A	B	Air Stream					C	
	Neutralized Raffinate	Fluoride Retention Basin	Fluoride Cell Sludge	Emergency Basin No. 1	Burial	TOTAL STORED	Aqueous Combination Stream	Absorber Tail Gas	Reduction Off-Gas to Plant Stack	HF Scrubber	F_2 Cell Hood Rework Exhaust	Miscellaneous	TOTAL AIR STREAM	TOTAL LOSSES A+B+C
Uranium	0.05	0.05		.04	.004	0.14	.43			$2x10^{-4}$		.006	.006	.73
Hexane												8.8	8.8	8.8
Nitrate	180.1					180.1	.54							180.6
Water[b]	397.2	180				577.2	186,000	276	91	62			429	188,000
Ammonia	43.3					43.3								43.3
Fluoride	0.6	13.6	.06			14.3	.20			.006	.030	.047	.083	14.8
Hydrofluoride			.43			.43								.43
Nitrogen Oxide								4.6					4.6	4.6
Sulfur Dioxide									1.51				1.51	1.51
Fluorine												.048		.048
Nitrogen[b]								543.5	1690	3741				
Oxygen[b]								164.2	472	1104				
TOTAL						1815	186,000							

a. Matter such as sodium, potassium and calcium that is present in small amounts and is relatively innocuous has been left off this table.
b. These are diluents that serve to dilute pollutants.
c. 46 million cubic feet (930 metric tons) of natural gas are assumed to be burned in stoichimetric air, yielding 2557 metric tons of CO_2, 1278 metric tons of H_2O and 7958 metric tons of nitrogen. This is not a process stream but it contributes to dilution at the stack.
d. This effluent results from air exhausts from sample preparation, hexane vents, fluorine emergency vents, and roof vents.

(10) Page S-69, Table XIII

Combination stream at plant, average for last 12 months indicates:

$$\begin{aligned} & 18.6 \times 10^{-7}\ \mu Ci/ml\ \alpha \\ & \underline{12.6 \times 10^{-7}\ \mu Ci/ml\ \beta} \\ \Sigma\ \alpha + \beta = \ & 31.2 \times 10^{-7} = 3.12 \times 10^{-6}\ \mu Ci/ml \end{aligned}$$

Maximum allowable concentration for unidentified radioactive material (10 CFR 20, Appendix B, Note 3C, Table II, Column 2 (unrestricted) is given as 3×10^{-6} µCi/ml indicating 12 month average was in excess of MPC with monthly values of 4.48×10^{-6} for 4/71; 7.38×10^{-6} for 5/71; 4.80×10^{-6} for 10/71 and 5.10×10^{-6} µCi/ml for 11/71 all above MPC.

The observation made as to the data on Table XIII is correct. However, the interpretation of the use of 10 CFR 20, Appendix B, Note 3C, Table II, Column 2, is not in accordance with our understanding. This Table is only used for unidentified radioactive material not containing $Radium_{226}$ which is separately recorded on Table XIII. The uranium component of this stream is also measured and is tabulated in the data submitted in answer to paragraph 11 below.

(11) Page S-71, Table XV and following tables:

While well Nos. 1, 2 and 3 do not show any significant trend in α and β levels with time, the Gross α in well Nos. 5 and 6 appears to have taken a sharp rise in the last two months reported. This trend is not seen in fluoride and nitrate analyses reported for these wells in Table XVI.

Page S-73, Table XVII indicates a significant increase in gross α and β in the Fault Well and Residence Well 1 while Table XVIII shows a rise in F and N concentrations in the Fault Well and a jump in fluoride in both the Carlisle School well as well as Residence Well 1.

In addition, as pointed out by Dr. Warner, the average nitrate concentrations and radioactivity in the six monitor wells appear to be substantially higher than in the four background wells indicating possible contamination of the ground water.

In view of these apparent anomalies, we are most interested in seeing more recent analyses for all of these wells and for monitor wells Nos. 10 through 15 if these data are available. Please resubmit data furnished on 11/20/72 in a form and using units that will permit direct comparison with analytical results provided in Tables XIII thru XXII of the Supplemental Environmental Report.

The additional data requested is attached. Additional information as to the construction, subsurface structure, analysis and conclusions as to the integrity of the storage ponds will be covered in detail later in this report.

It should be noted that in January 1972 we changed independent analysts from Controls for Environmental Pollution, Albuquerque, New Mexico, to U.S. Testing Company, Richland, Washington, on the basis that control data could be furnished by UST thereby providing more reliable results at these extremely low levels. However, these data have not been furnished and we currently plan to use the analysis of the Sequoyah Laboratory and the Kerr-McGee Technical Center upon certification by the Oklahoma Water Resources Board as an environmental laboratory. This certification is now being processed.

(12) Page S-71, Table XV. Well No. 1 on several occasions indicated Radium-226 concentrations of 3×10^{-8} µCi/ml and once (July 1971) showed 4×10^{-8} µCi/ml. MPC (unrestricted) 10 CFR 20 value is 3×10^{-8} µCi/ml.

It should be noted that this analysis has varied widely. In addition, Well No. 1 is not an unrestricted area and application of 4×10^{-7} µCi/ml is considered the appropriate 10 CFR 20 limit.

(13) Page S-72, Table XVI. Well No. 1 NO_3 as N avg. last 12 months reported as 14.0 ppm with 6 of 12 values exceeding recommended maximum of 10 ppm quoted in Table XXV Page S-84.

While Well No. 1 shows an average value of 14 ppm N as nitrate, you can see it is primarily due to high levels in April, May and June of 1971 and March of 1972. The data supplied under paragraph 11 again shows high levels from March through July. You will note that these levels are not accompanied by an increase in uranium levels which leads us to the conclusion that the nitrate is due to fertilizer applied to slopes of the watershed and, apparently, we can continue to expect such levels each spring and summer. Well No. 15, which is down slope from No. 1, shows the same pattern. Other wells which have no large amount

1972 ENVIRONMENTAL WATER SAMPLES
SURFACE
UNITED STATES TESTING RESULTS
RADIOACTIVE UNITS-$\mu Ci/ml \times 10^{-6}$
CHEMICAL UNITS-ppm[1]

LOCATION	ANALYSIS	JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.
2201	Nitrate	.1	< .1	.1	.3	.1	1.0	.3	.1	.2	< .1
	Fluoride	.4	.5	.6	.5	.8	.3	< .1	1.0	.6	1.1
Ill. River	Gross α	1.06	.41	1.67	.66	.38	.49	.41	.23	< .23	< .23
Upstream	Gross β	.87	.57	.92	.84	1.18	.51	.65	5.47	1.71	.53
	Uranium	.31	.32	.80	.26	.72	.84	.50	< .17	< .17	.50
	^{226}Ra			< .02			< .02			< .02	
2202	Nitrate	.2	.1	.4	< .1	.4	.5	.2	.1	.3	< .1
	Fluoride	.6	.5	.6	.4	1.0	.7	.2	1.1	.7	2.4**
Ill. River	Gross α	2.08	11.20	7.40	3.63	1.81	1.10	1.15	3.60	5.39	1.94
Downstream	Gross β	1.99	4.58	4.76	2.39	1.74	.97	.56	1.30	3.60	1.57
	Uranium	1.76	6.22	3.25	2.13	.72	1.13	.75	2.72	6.03	3.72
	^{226}Ra			< .02			< .02			< .02	
2203	Nitrate	.7	< .1	.1	.1	.1	.8	.3	.1	.4	< .1
	Fluoride	.6	.6	.7	.7	1.0	.6	.4	1.2	.9	1.4
Ark. River	Gross α	.30	.42	.34	.48	.48	.32	.74	.26	< .23	< .23
Upstream	Gross β	1.51	1.62	.53	2.30	2.46	1.30	1.52	.71	3.43	1.14
	Uranium	.14	.27	.11	.31	1.29	.54	.02	< .17	< .17	< .17
	^{226}Ra			< .02			< .02			< .02	
2204	Nitrate	.1	< .1	.3	< .1	.4	.4	.1	.1	.1	< .1
	Fluoride	.5	.8	.8	.6	1.0	1.0	.3	1.1	.9	1.0
Ark. River	Gross α	< .19	.60	.34	.96	.98		< .23	< .23	< .23	.39
Downstream	Gross β	.81	5.40	1.03	1.05	1.54	.55	.50	.41	4.18	.68
	Uranium	.19	.60	.13	.45	.67	.64	.54	.37	.91	1.93
	^{226}Ra			< .02			< .02			< .02	
2205	Nitrate	.1	< .1	.1	< .1	.1	1.1	1.2	.3	.5	.4
	Fluoride	.4	.5	.8	.6	.8	.6	.3	.8	1.0	1.0
Farm Pond	Gross α	.50	1.06	.64	1.45	.33	.28	< .23	< .23	< .23	.33
East	Gross β	1.67	2.93	1.90	2.91	1.46	1.26	1.32	1.86	4.64	2.29
	Uranium	.18	1.01	.20	.65	.43	.39	.18	< .17	.31	< .17
	^{226}Ra			< .02			< .02			< .02	

SURFACE-CONTINUED

LOCATION	ANALYSIS	JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEPT	OCT.
2206	Nitrate	.2	.3	.1	< .1	.1	.8	.2	.3	.3	[illegible]
	Fluoride	.7	.7	1.0	.8	1.0	1.1	.6	1.0	1.0	1.3
Farm Pond	Gross α	3.94	2.87	8.17	4.07	2.00	2.58	1.39	.23	.37	.25
South	Gross β	6.21	6.64	5.83	2.41	2.92	1.76	1.69	1.68	2.66	1.18
	Uranium	3.39	3.57	2.72	2.00	3.57	.24	.04	.05	.32	.02
	^{226}Ra			< .02			< .02			< .02	
2207	Nitrate	.1	< .1	3.1	1.0	.9	2.4	.8	1.0	1.9	2.3
	Fluoride	1.1	1.1	.4	17.6*	.6	1.1	.4	.7	.7	.7
Facility	Gross α	130.92	186.57	173.17	69.01	22.44	115.72	90.96	100.42	101.03	123.24
Effluent	Gross β	80.05	115.27	90.97	84.63	83.02	58.09	22.57	11.52	18.36	14.37
	Uranium	70.88	164.29	30.62	61.15	94.54	102.38	86.71	63.62	92.15	72.90
	^{226}Ra			< .02			< .02			.05	
2208	Nitrate	.8	< .1	.3	.3	.6	1.1	.4	.1	.2	< .1
	Fluoride	.5	.6	.7	.5	.5	.6	.1	.7	.6	2.3**
Tenkiller	Gross α	15.02	.68	.71	1.07	.54	< .23	.46	.28	.83	< .23
Raw Water	Gross β	15.39	.62	.49	1.57	.75	.31	< .23	< .23	2.04	2.41
	Uranium	15.65	.46	.19	1.49	1.07	.22	.17	.28	.53	.58
	^{226}Ra			< .02			< .02			< .02	
2209	Nitrate	.1	< .1	.1	< .1	.2	.9	.7	.1	.2	< .1
	Fluoride	.2	.5	.6	.6	.5	.8	.2	.9	.8	2.2**
Salt Fork	Gross α	< .09	.70	< .15	1.17	.43	.65	.44	8.54	< .23	< .23
River	Gross β	1.24	1.49	1.06	1.59	.89	1.08	1.52	1.14	2.81	.96
	Uranium	.18	< .12	< .07	3.51	.85	.53	< .17	< .17	.89	< .17
	^{226}Ra			< .02			< .02			< .02	

*This sample was the composite of a continuous sampler for the month analyzed by U. S. Testing. Grab samples are taken each shift and analyzed by the Sequoyah lab. The average for the month was 1.4 ppm. On April 25, one high sample of 32 ppm was recorded when the acid addition system went out of control resulting in a pH of 5.5 for the same sample.

**These results are determined by U. S. Testing. Aliquots measured by Sequoyah lab tested < .1 ppm. Apparently, an example of sample contamination at some stage of handling.

[1]Nitrate reported as nitrogen on all tables.

1972 ENVIRONMENTAL WATER SAMPLES
SEEPAGE WELLS
UNITED STATES TESTING RESULTS
RADIOACTIVE UNITS-μCi/ml x 10^{-8}
CHEMICAL UNITS-ppm[1]

LOCATION	ANALYSIS	JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.
2301	Nitrate	.2	.1	24.0	212.0	273	200.0	180.0	15.5	14.0	66.0
	Fluoride	1.2	1.0	1.0	7.0	2.0	1.3	1.3	4.5	3.1	1.4
Basin No. 1	Gross α	1.34	14.04	13.85	21.61	51.61	65.84	6.86	166.27	5.26	[illegible]
[illegible]	Gross β	9.24	5.20	5.28	17.26	26.17	.15	9.18	25.57	8.50	[illegible]
	Uranium	8.38	.17	3.09	4.42	134.21	39.44	38.25	109.40	6.79	2.17
	^{226}Ra			< .02			< .02			< .02	
2302	Nitrate	< .1	1.0	.3	.7	.6	1.3	3.7	4.8	6.5	5.5
	Fluoride	1.0	1.1	1.2	6.8	1.3	1.1	.8	.7	.6	.6
Basin No. 1	Gross α	5.10	10.52	4.89	17.19	5.22	12.84	9.55	5.21	2.00	2.60
South	Gross β	4.29	4.54	2.66	13.19	3.55	3.61	2.36	1.38	1.78	1.37
	Uranium	4.36	5.86	.65	3.95	5.94	4.80	5.91	2.18	2.04	.86
	^{226}Ra			< .02			< .02			< .02	
2303	Nitrate	.1	< .1	.9	1.0	.1	.6	.6	2.3	1.1	5.1
	Fluoride	.9	.9	1.1	1.1	2.0	.9	.7	.8	.5	.5
[illegible]	Gross α	4.11	8.25	12.10	26.78	4.95	52.14	6.05	6.58	2.09	1.64
Pond No. 1	Gross β	.66	6.62	1.22	21.67	5.30	17.49	4.18	2.05	2.95	11.44
North	Uranium	3.64	6.49	3.37	8.61	7.44	9.97	3.93	3.04	1.52	.73
	^{226}Ra			< .02			< .02			< .02	
2305	Nitrate	.6	1.1	1.0	.9	.7	.8	.9	5.5	5.9	2.4
	Fluoride	1.2	.7	.8	1.4	1.1	1.0	1.1	.8	.5	.2
[illegible]	Gross α	3.34	10.18	13.95	21.02	6.86	10.46	9.47	9.43	1.07	[illegible]
Pond No. 1	Gross β	.50	6.13	6.34	22.80	3.11	9.38	3.24	2.10	2.53	5.42
South	Uranium	3.37	3.97	2.33	4.52	5.22	17.10	3.88	1.41	.56	.51
	^{226}Ra			< .02			< .02				

SEEPAGE WELLS-Continued

LOCATION	ANALYSIS	JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.
2306	Nitrate	.2	< .1	.2	.5	0.2	< .1	.3	.1	< .1	.1
	Fluoride	1.0	.7	.5	2.6	1.2	.5	.3	.3	.2	< .1
Carlisle R.	Gross α	1.30	11.56	14.57	13.40	.87	1.36	3.02	5.67	1.96	1.51
Pond South	Gross β	9.44	6.25	2.24	3.88	1.21	1.49	.49	.89	1.40	5.07
	Uranium	7.25	5.88	3.61	5.16	1.59	2.12	.59	1.37	5.94	.90
	^{226}Ra			< .02			< .02			< .02	
2307	Nitrate	.9	.5	.5	< .1	.4	.5	.6	.3	.3	.3
	Fluoride	4.0	4.2	4.2	4.0	5.4	6.2	4.6	2.7	3.3	4.0
Fault Well	Gross α	3.27	7.08	4.15	5.39	4.18	< .23	3.21	3.25	2.74	< .23
	Gross β	.53	6.79	4.04	5.29	5.71	4.48	2.04	2.05	4.35	14.70
	Uranium	.23	.21	.12	1.18	.59	.38	.20	.18	.22	.21
	^{226}Ra			< .02			< .02			< .02	
2308	Nitrate	< .1	< .1	.1	< .1	< .1	.1	.1	.1	< .1	< .1
	Fluoride	1.1	.7	1.0	.8	1.1	.7	.4	.5	.4	.4
Residence	Gross α	2.09	4.23	3.83	4.76	1.34	1.38	2.51	.34	2.38	.72
Well	Gross β	1.46	1.84	2.97	4.50	1.21	1.25	.90	.34	2.56	.67
	Uranium	.62	1.48	1.52	.38	1.16	1.12	.62	.22	< .17	.36
	^{226}Ra			< .02			< .02			< .02	
2309	Nitrate	< .1	< .1	.3	.1	1.3	1.8	.7	.2	.1	< .1
	Fluoride	.9	.5	.6	.5	1.0	.6	.2	.2	.2	.2
Carlisle	Gross α	.09	.24	.17	< .23	.43	< .23	.23	< .23	.23	< .23
School Well	Gross β	1.24	.81	.96	.74	.89	.62	.65	.73	3.13	.91
	Uranium	.18	.12	< .06	3.51	.49	.12	< .17	< .17	< .17	< .17
	^{226}Ra			< .02			< .02			< .02	
2310	Nitrate	.1	1.1	2.4	1.3	.4	.8	1.2	.2	.2	.1
	Fluoride	1.3	1.0	1.1	1.2	2.0	1.1	1.0	.2	.8	.9
Raffinate	Gross α	3.11	2.06	11.98	9.31	3.31	6.93	2.58	< .23	2.52	.84
Pond No. 2	Gross β	4.26	5.06	6.05	4.81	1.62	2.17	.60	.67	1.70	.59
	Uranium	2.68	3.93	4.30	3.33	2.11	4.32	1.22	< .17	2.46	1.11
	^{226}Ra			< .02			< .02			< .02	
2311	Nitrate	.5	3.5	4.7	3.4	.1	1.3	.4	.3	.2	< .1
	Fluoride	1.0	.6	1.0	.9	2.2	.8	.5	.6	.5	.5
Raffinate	Gross α	4.01	4.49	4.82	13.24	4.99	3.06	7.05	3.24	3.05	3.39
Pond No. 2	Gross β	1.37	.15	3.87	10.05	2.47	3.53	1.69	1.25	1.32	1.22
	Uranium	3.37	2.95	3.46	6.52	6.83	4.52	3.30	1.16	2.10	1.75
	^{226}Ra			< .02			< .02			< .02	

SEEPAGE WELLS-Continued

LOCATION	ANALYSIS	JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.
2312	Nitrate	< .1	.3	.1	.8	1.0	1.2	1.8	.5	.7	.5
	Fluoride	1.0	.8	1.0	.7	1.0	.4	.4	.8	.3	.4
Raffinate	Gross α	7.34	1.79	6.45	17.77	2.45	5.24	2.43	10.67	2.53	3.80
Pond No. 2	Gross β	3.67	.24	5.81	11.15	2.34	1.21	.47	1.60	1.10	.74
	Uranium	3.37	1.95	2.74	4.58	8.74	2.39	.72	1.96	1.28	1.55
	^{226}Ra			< .02			< .02			< .02	
2313	Nitrate	.3	< .1	.1	.1	.2	.7	.4	4.5		.1
	Fluoride	.9	.6	1.1	.9	1.0	.6	.5	.6		.5
Raffinate	Gross α	1.89	.35	22.97	111.18	6.96	18.61	6.27	6.09		4.58
Pond No. 2	Gross β	2.09	2.09	10.67	116.12	5.52	3.17	1.22	1.79		1.33
	Uranium	.85	.98	3.93	52.69	3.93	7.10	2.88	2.32		1.78
	^{226}Ra			< .02			< .02				
2314	Nitrate	.3	1.6	1.9	.4	.3	10.4	.3	1.0	.2	< .1
	Fluoride	1.0	.9	.9	4.1	2.0	.7	.7	.7	.6	.6
Raffinate	Gross α	1.92	12.79	12.57	34.32	4.74	12.67	8.15	5.22	4.01	16.58
Pond No. 2	Gross β	2.23	6.60	5.83	21.26	4.74	4.19	1.80	.87	1.70	2.13
	Uranium	2.04	6.83	4.23	1.16	7.85	8.09	4.73	3.27	6.08	2.58
	^{226}Ra			< .02			< .02		.02		
2315	Nitrate	.1	16.0	48.0	97	.5	91.0	42.0	15.5	42.0	15.5
	Fluoride	.9	.7	.8	.3	2.4	.2	.2	.2	.3	.2
Raffinate	Gross α	1.23	1.63	1.44	9.85	1.90	1.64	6.66	2.40	.30	.61
Pond No. 2	Gross β	.89	1.74	1.92	2.43	1.89	.33	1.96	.82	1.73	< .23
	Uranium	1.01	.90	1.29	4.62	2.90	1.40	.79	.44	< .17	.34
	^{226}Ra			< .02			< .02			< .02	

[1]Nitrate reported as Nitrogen on all tables.

1972 ENVIRONMENTAL SOIL SAMPLES

UNITED STATES TESTING RESULTS
ALL UNITS-ppm

LOCATION	ANALYSIS	JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.
2401	Uranium			16.6							
South Security	Fluoride			230.0							
Fence	Nitrate			57.0							
2402	Uranium			23.8							
North Security	Fluoride			224.0							
Fence	Nitrate			20.0							
2403	Uranium			< 1.2			7.2			3.8	
South	Fluoride			116.0			96.0			44.0	
1000 Feet	Nitrate			8.0			35.0			45.0	
2404	Uranium			20.0			39.6			43.4	
West	Fluoride			160.0			91.0			73.0	
1000 Feet	Nitrate			3.0			55.0			8.5	
2405	Uranium			< 2.6			11.9			6.1	
North	Fluoride			176.0			71.0			96.0	
1000 Feet	Nitrate			5.0			4.0			1.0	
2406	Uranium			< 2.7			8.7			3.3	
East	Fluoride			100.0			70.0			86.0	
1000 Feet	Nitrate			2.0			6.0			16.5	

1972 ENVIRONMENTAL VEGETATION SAMPLES

UNITED STATES TESTING RESULTS

ALL UNITS-ppm

LOCATION	ANALYSIS	JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.
2501	Uranium			2025.0		69.2					
South	Fluoride			43.3	70.0*						
Security Fence	Nitrate			700.0	< 1.0*						
2502	Uranium			141.3		33.4					
North	Fluoride			11.9	90.7*						
Security Fence	Nitrate			200.0	< 1.0*						
2503	Uranium			33.21		51.27	< 5.0		< 5.0	22.13	< 5.0
South	Fluoride			11.7	19.5*	13.0	28.0	20.0	10.1	11.8	19.0
1000 Feet	Nitrate			700.0	< 1.0*	100.0	< 10.0	100.0	30.0	1200.0	475.0
2504	Uranium			607.8		7.0	< 5.0		< 5.0	18.3	5.0
West	Fluoride			326.0	147.0*	58.0	95.7	103.0	96.0	61.7	33.0
1000 Feet	Nitrate			400.0	60.0*	520.0	100.0	50.0	100.0	1200.0	515.0
2505	Uranium			13.1		5.2	< 5.0		< 5.0	4.0	209.0
North	Fluoride			11.2	20.9*	11.0	44.3	17.4	18.9	3.5	8.0
1000 Feet	Nitrate			500.0	< 1.0*	40.0	< 10.0	< 25.0	25.0	100.0	5.0
2506	Uranium			13.7		< 5.0	< 5.0		< 5.0	3.4	< 5.0
East	Fluoride			6.7	20.0*	7.0	30.5	11.8	19.1	12.7	6.0
1000 Feet	Nitrate			400.0	30.0*	180.0	< 10.0	< 25.0	25.0	300.0	5.0
2507	Uranium					5.5	< 5.0		< 5.0	6.6	< 5.0
South	Fluoride				8.9*	177.0	30.9	7.3	11.0	8.7	15.0
6000 Feet	Nitrate				10.0*	40.0	50.0	< 25.0	40.0	300.0	15.0
2508	Uranium					< 5.0	< 5.0		< 5.0	9.4	< 5.0
West	Fluoride				15.1*	13.1	11.5	14.4	10.4	17.9	9.0
6000 Feet	Nitrate				10.0*	100.0	< 10.0	< 25.0	80.0	800.0	7.0

1972 ENVIRONMENTAL VEGETATION SAMPLES-Cont.

LOCATION	ANALYSIS	JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.
[illegible]	Uranium					< 5.0	< 5.0		< 5.0	2.9	< 5.0
North	Fluoride				10.7*	22.4	35.7	24.5	20.8	26.7	14.0
[illegible] Feet	Nitrate				30.0*	40.0	< 10.0	< 25.0	30.0	100.0	30.0
2510	Uranium					< 5.0	< 5.0		< 5.0	4.6	< 5.0
[illegible]	Fluoride				15.4*	19.0	32.5	21.0	15.9	38.1	15.0
[illegible] Feet	Nitrate				10.0*	40.0	< 10.0	< 25.0	25.0	400.0	40.0

*Samples were taken on May 5 and May 9, 1972

of watershed do not exhibit this tendency. Again, we believe that these wells should not be considered available for public access and certainly not sources of drinking water to which the standard on Table XXV applies.

(14) Pages S-78 and S-78A, Table XXII. Analytical results reported indicate erratic control of fluoride emissions with a number of values at the security fence exceeding recommended maximum concentration of vegetation of 40 ppm. Please provide more recent data. (See Comment (11))

More recent data is supplied under paragraph 11. The data given on Table XXII is erratic and, as yet, we cannot completely comprehend the cause. As you can see by comparison of the results from two laboratories in January 1972, results between the two laboratories vary significantly. Fence line sampling was discontinued since none of the foliage at the security fence is subject to grazing by cattle. We hope that this erratic data will be eliminated through the Oklahoma certification program.

(15) Page S-79 - Effective stack height is reported as 170 feet (∿ 51.8 meters) while calculated value shown in Appendix IV, Page 3 is 56.6 meters. Calculation shown in Appendix IV fails to clarify whether stack diameter is 8 feet or 3.25 feet. Calculation is also unclear as to whether barometric pressure is 960 mb or 920 mb.

Effective stack heighth is 54.82 meters based upon recent calculations of rate of discharge and using 960 for the pressure in milibars. The number on Page S-79 should be corrected. The confusion on stack diameter is due to the fact that the OD of the stack is 8 feet. However, it has a liner that restricts the effective diameter to 7 feet and also has a restriction at the discharge to 3.25 feet.

(16) Appendix IV, Page 3 indicates 475 ft/minute velocity out of 8 ft diam. stack for total flow of $(.785)(8)^2(475) = 2.38 \times 10^4$cfm. License application 9/3/69 Page V-11 indicates stack discharge volume of 1.9×10^5 cfm (normal) and 8.85×10^4 cfm during low loads. Letter, W. J. Shelley to C. R. Buchanan dated 1/31/72 estimates flow with two boilers operating at 25,000 cfm.

The measurement of 475 feet per minute should, of course, be used in conjunction with the 7 foot effective diameter resulting in a flow of 18,207 cubic feet per minute. The license application discharge volume was made based upon estimates during the design of the plant. The data supplied to Mr. Buchanan on 1/31/72 was based upon the gas consumption of the boilers as of January 1972.

Recent data calculated from gas consuption during an extended period and temperature measurements in the stack result in a calculated discharge of 24,200 cubic feet per minute.

(17) Page S-80, Table XXIII. Data presented are not clear or consistent with Figure 3.9 of "Workbook" Page 29. Table headings are confusing.

Table XXIII is mislabeled in the second column and should be labeled "Maximum XU/Q".

(18) Page S-81, Table XXIV. Off-site concentrations presented do not appear to be consistent with dilution of 10.4 Values indicate dilution of 10 rather than 10,000. Headings on right should read <u>ppb</u>. Also, see comment (25) below:

Observation is accurate that the off-site levels assuming 10^4 dilution should be in ppb.

(19) Page S-84, Table XXV. Footnotes b and c are not shown in body of table. You compare concentrations in rivers with recommended maximum concentrations. Please note that 10 CFR Part 20.106 limits concentration of radioactive materials in the effluent stream and requires considerable additional information if Appendix B, Table II limits are to be exceeded.

Footnotes b and c apply to recommended maximum levels of fluoride and nitrate. We understand the application of 10 CFR 20.106 limits to effluent streams and do not intend to request exception to Appendix B, Table 2, limits.

(20) Page S-85, Paragraph 1. Dilution factor implies process water flow of 240,000/150 or 1600 gpm. Table VII indicates process water of 345,000 gal/metric ton of U. With production of 5,000 short tons/year (4.55×10^2 metric tons/year), total water used = $3.45 \times 10^5 \times 4.55 \times 10^3 = 15.7 \times 10^8$ gallons per year. This is equivalent to 2990 gpm. Please explain.

1600 gpm is the design capacity of the process water system. Actual flow varies from 1100 to 1450 gpm due to variations of the level of water in the lake, i.e. the static head on the pipe withdrawal system located in the dam penstock; the condition of the pipeline, i.e. scale or algae present; and the resistance of flow through the receiving station valves and meter. The amount of water received from the lake is metered and fed into a stilling and treatment basin shown on Figure 11, Page 54. At

this point, water needed for the processing is withdrawn in three streams. The first is an emergency cooling water stream which feeds certain sensitive cooling needs in order to protect the plant equipment. If cooling water flow was accidentally discontinued on such critical uses, irreparable harm to the equipment would occur. This emergency cooling water flow is then fed to the cooling tower supply basin and a secondary cooling water system is used for less critical service and returned to the cooling tower basin. The second stream is a bypass stream which is excess to the needs of the plant and joins discard from the cooling water system and flows to the point of discharge into the natural drainage channel. The third stream is potable water which is treated by settling, filtering and chlorination. As a result, the quantity of water discharged from the plant does not vary significantly with processing rates.

(21) Page S-86, Paragraph 2. Ra-226 level of 1×10^{-8} µCi/ml is 33% of MPC which still provides some leeway but not a great deal. Also, 14 ppm nitrate level is in excess of recommended maximum per Table XXV, Page S-84.

Please see the answer to question 13 on nitrate level in Monitor Well No. 1. While $Radium_{226}$ is 33% of the MPC, it can be recognized from Table XV that this level is approximately the level of detection and reliable values would only be seen above this level.

(22) Page S-86, Paragraph 3. Should refer to Table XVIII rather than XVII. Also fluoride level in Carlisle School well has also "increased slightly."

Your correction is noted. Paragraph 3 on Page S-86 should refer to Table XVIII instead of XVII. Fluoride analysis in these

wells has shown very erratic data, especially between the two laboratories. We hope that with the certification program of the Oklahoma Water Resources Board this erratic variation will decrease.

(23) Page S-86, Last Paragraph. Please explain more fully how the data obtained establishes the potential path of pond seepage.

A complete description of the pond construction, the monitoring wells and the strata in the immediate area is attached as a separate report.

(24) (deleted)

(25) Page S-97, Table XXVI - The data presented in this table represent releases to the atmosphere during plant operation at throughputs significantly below those expected at the normal production rate of 5000 tons per year. To permit an assessment of the environmental impact of the Sequoyah facility under normal operating conditions, the release data must be scaled up (with the bases for the calculations clearly shown) and as a minimum requirement, the annual average significant organ doses to individuals exposed to radioactive pollutants at the off-site point of maximum ground level concentration must be estimated. In addition, organ doses and chemical pollutant concentrations should be estimated for each of the following off-site locations: (a) Residence northwest of plant site. (b) Residence northeast of plant site. (c) Carlisle School. (d) Points of maximum ground level concentration on Oklahoma Highway 10, U. S. Highway 64, Interstate Highway 40, and the Missouri Pacific railroad, and (e) Other nearby points of permanent and transient habitation.

Total dosages attributable to radioactive effluents out to a distance of ten miles from the site should be estimated for both the transient as well as the permanent population.

Please see attached report on airborne effluents.