Bill Shelly -
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ENVIRONMENTAL IMPACT APPRAISAL

BY THE

DIVISION OF FUEL CYCLE AND MATERIAL SAFETY

RELATED TO THE

SOURCE MATERIAL LICENSE RENEWAL

OF THE

KERR-MCGEE NUCLEAR CORPORATION

URANIUM HEXAFLUORIDE FACILITY

SEQUOYAH COUNTY, OKLAHOMA

DOCKET NO. 40-8027

LICENSE NO. SUB-1010

OCT 1977

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1.0 Introduction

By letter dated January 24, 1975, Kerr-McGee Nuclear Corporation (K-M) requested renewal of Source Materials License No. SUB-1010 covering operation of the Sequoyah UF_6 Conversion Facility located in Sequoyah County, Oklahoma. On June 27, 1975, Kerr-McGee submitted a revised renewal application requesting, in addition, authorization to increase the plant capacity from 5,000 short tons of uranium per year as UF_6 to 10,000 short tons per year. In conjunction with the revised application, the applicant also submitted environmental information relating to operation of the plant at its expanded production capacity. As a result of extensive revisions required in responses to questions and request for additional information, a completely rewritten version of the June 27, 1975 application was submitted with forwarding letter dated January 12, 1977. Further modifications to the license application were submitted dated May 20, June 14, and August 19, 1977.

Additional environmental information and responses to questions related to estimated impacts at the proposed expanded production rates were provided by the applicant in submittals dated September 11, 1975, November 20, 1975, and January 3, January 11, August 13 and September 16, 1977.

In connection with such license renewals or issuance of a substantive and significant amendment (from the standpoint of environmental impact), Part 51 of Title 10 of Code of Federal Regulations requires that an environmental impact appraisal be performed to determine whether an environmental impact statement should or should not be prepared for the contemplated action. Part 51 further states that the determination shall be guided by the Council on Environmental Quality Guidelines, 40 CFR 1500.6. In accordance with these regulations, the Division of Fuel Cycle and Material Safety (the staff) of the NRC conducted an assessment of the environmental impact of the proposed licensing action. Upon completing the environmental impact assessment and evaluating the findings, the staff independently prepared this appraisal on environmental considerations associated with the proposed licensing action in accordance with 10 CFR Part 51, implementing the requirements of the National Environmental Policy Act of 1969 (NEPA) and the President's Council on Environmental Quality Guidelines. Because the facility is an operating plant and a detailed environmental review was completed in accordance with NEPA requirements culminating with the issuance of a Final Environmental Statement - NUREG-75/007 (FES) in February 1975, the staff, in performing the environmental assessment of the proposed action concluded that the

principal items to be addressed in this environmental appraisal should include all authorized and proposed modifications in the plant operations since the FES was issued, along with a detailed evaluation of the incremental environmental impacts associated with the proposed increase in plant production.

2.0 Description of Proposed Action

The proposed action for which this environmental impact appraisal is performed is the major amendment and renewal of Source Materials License No. SUB-1010 for the Kerr-McGee Nuclear Corporation Sequoyah Uranium Hexafluoride Plant to authorize continued operation over the next five years at the increased production rate of 10,000 short tons of natural uranium as uranium hexafluoride. As described in detail in the FES, the facility produces high purity UF_6 using uranium concentrates as the starting material. The manufacturing process used includes wet chemical purification to convert the ore concentrates to pure uranium trioxide followed by dry chemical reduction, hydrofluorination, and fluorination techniques to produce uranium hexafluoride. A schematic flowsheet of the manufacturing process is shown in Figure 2.1. The plant has been in operation since February, 1970, without significant environmental incident or discernible offsite effect.

2.1 Bases for Staff Appraisal

This appraisal is based primarily on the following considerations:

- Information contained in the Environmental Report and supplements submitted by the applicant which provided the major data base for preparing the Final Environmental Statement issued February 1975.
- Environmental information and supplements submitted by the applicant in support of his application for major modification and renewal of his license.
- Information supplied by State and Federal agencies regarding compliance with regulations other than those issued by NRC.
- Site visits by NRC staff September 27 and 28, 1976 and September 26, 1977.
- Results of facility inspections by the Office of Inspection and Enforcement.
- Discussion with USNRC Region IV staff on September 27, 1977.
- Discussion with USEPA Region VI staff on September 28, 1977.

On the basis of this appraisal, it was concluded that the potential environmental impact created by the plant modification and the license renewal is of a magnitude that does not warrant the preparation of an additional environmental impact statement for the proposed action.

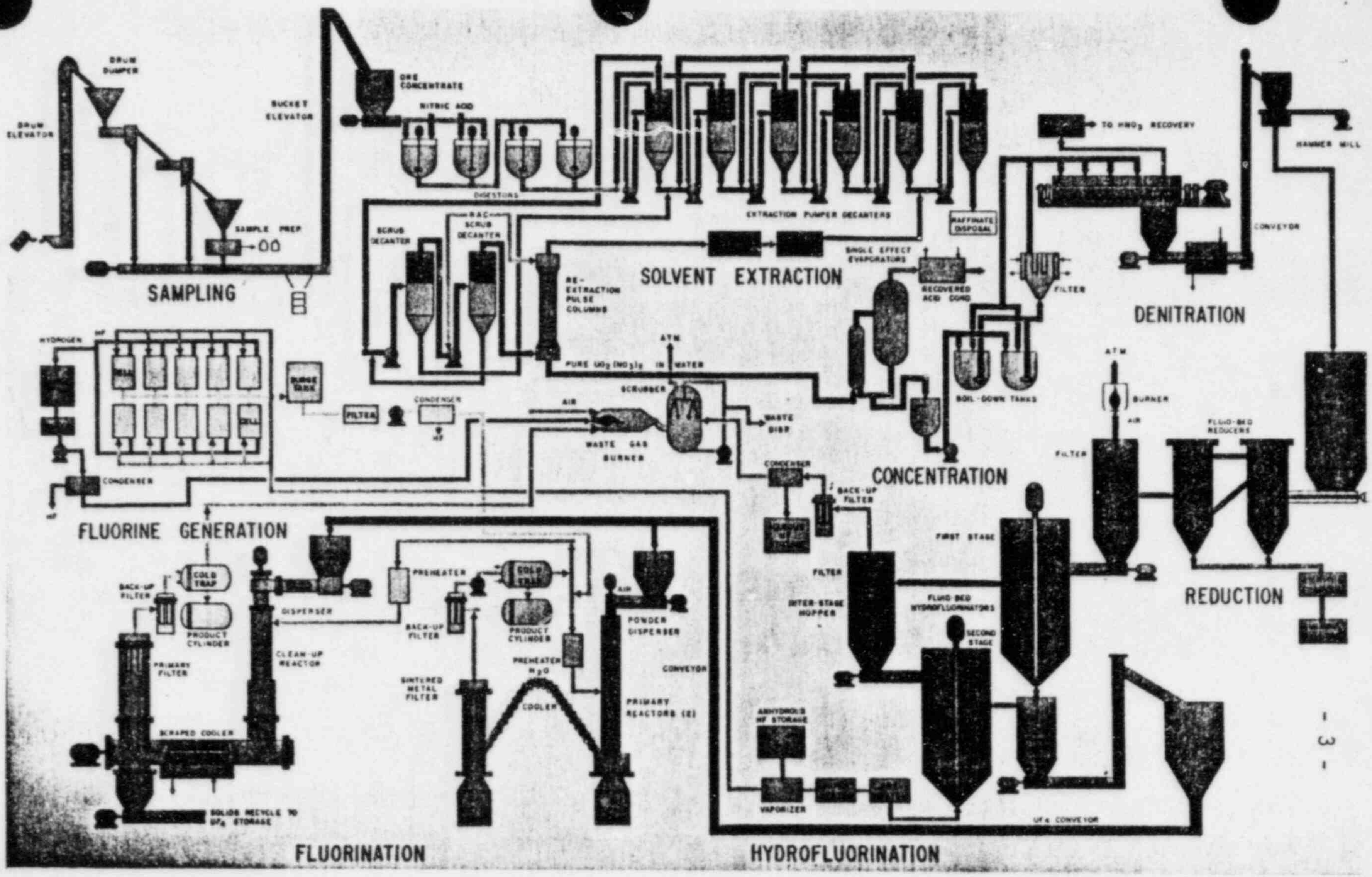

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FIGURE 2.1

SCHEMATIC PROCESS OUTLINE - SEQUOYAH CONVERSION FACILITY

3.0 Description of the Site Environment

3.1 Site Location and Land Use

As described in detail in the FES, the Kerr-McGee Sequoyah UF_6 Plant is located in Eastern Oklahoma about 150 miles east of Oklahoma City, 40 miles west of Fort Smith, Arkansas and 25 miles southeast of Muskogee, Oklahoma. The immediate plant site, 75 acres of a 2,100 acre site tract, is a fenced-in restricted area with access provided by Oklahoma Highway 10 which is adjacent to the eastern boundary and runs north-south to connect Interstate Highway 40 with U.S. Highway 64.

In accordance with Amendment No. 8 (dated May 4, 1977) to the current license, subject to certain specific conditions, the license is authorized to utilize an additional 160 acres of the site tract immediately south of the fenced area for the test distribution of barium treated neutralized solvent extraction raffinate during the 1977 growing season.

The plant area and surrounding site is a mixture of rolling pasture and timberland with some steep slopes and some cultivated fields. About one-third of the site is open while the remainder is moderately to heavily wooded. Before the plant was built, the immediate area was used partly for the cultivation of wheat with the balance in pasture and woodland. Further details of land use are presented in the FES.

3.2 Regional Demography

As reported in the FES, the area in the vicinity of the plant site is relatively sparsely populated and experienced a growth of only 3% in the period 1960 to 1970. Population data from the 1970 census for the general plant area are presented in Table 3-1.

Based on the results of a detailed population density study, there were an estimated 54 permanent residents within one mile of the plant site, 988 within three miles, 5,472 within 10 miles, 28,764 within 20 miles, 112,277 within 30 miles, 229,067 within 40 miles and 309,094 residents within a 50 mile radius of the plant. Estimated future permanent resident population within the 10 mile radius is projected at 7,026 in 1980 and 21,583 in the year 2000 based on optimum growth factors. The two residences that are closest to the plant are each about one-half mile away northeast and northwest of the site. Presently, the residence to the northeast is the only one that is occupied.

TABLE 3-1

1970 Census Population Data for Plant Area

County or City	Direction	Distance, mi	Population
Sequoyah County			23,370
Vian	East	4	1,137
Sallisow	East	19	4,888
Gore	Northwest	2	478
Muskogee County			59,542
Muskogee	Northwest	25	37,331
Warner	West	15	1,217
Webber Falls	West	3	485
Fort Smith, Arkansas	East	40	62,802

3.3 Meteorology

The climate in this part of Oklahoma is one of ample rainfall in the spring and fall and dry weather with high temperatures during the summer months. The average annual precipitation is about 43 inches and the mean temperature is 62°F. Winds in the area are somewhat variable and tend to be lighter than those experienced farther west in the state. Sequoyah County is in a zone with a probability of having a tornado in any given year of about 1.66×10^{-6} (once every 600 years).

There is no official weather station in the immediate plant vicinity. Consequently, the meteorological data used for calculating the atmospheric dispersion of airborne effluents were obtained at Fort Smith, Arkansas which is the closest first-order weather data station having similar topographic and climatologic characteristics as the plant site. Data used for dispersion calculations in the FES and in the current appraisal are based on about 44,000 hourly observations covering the period January 1960 through December 1964.

Other environmental features of the plant site such as the surface and ground water hydrology, geology, seismology and ecology are presented in detail in the FES and in the licensee's environmental report and supplements.

4.0 The Facility and Modifications

4.1 External Appearance

A plot plan of the immediate plant site as presently licensed is shown in Figure 4.1. The total area under roof comprises about 75,000 square feet of manufacturing, warehousing and office space housed in three separate buildings. A plant expansion is currently in progress in accordance with an exemption to 10 CFR 40.31(f) granted on July 3, 1975 which authorized the construction needed to increase the plant capacity from 5,000 to 10,000 tons of uranium per year as UF_6. Upon completion of the required construction the plant appearance will be altered by the indicated additions as shown in Figure 4.2. An additional modification not shown in Figure 4.2 involves the construction of a one story 1400 square foot building about 200 feet due west of the main process building for the establishment of a special yellowcake slurry receiving area. Here, facilities and equipment will be provided for dissolving the yellowcake, unloading the shipping tank, and sampling the resulting uranyl nitrate solution. A comparison of the two plot plans shows that the plant expansion does not result in any major change in the external appearance of the facility.

4.2 UF_6 Production Process

The present production process used at the Sequoyah Facility involves receipt of feed as dry ore concentrates (yellowcake) in 55 gallon drums followed by: (a) feed preparation, (b) dissolution of the ore concentrates in nitric acid, (c) purification of the uranyl nitrate solution by solvent extraction, (d) denitration of the purified uranyl nitrate to uranium trioxide, (e) hydrogen reduction of the uranium trioxide to uranium dioxide, (f) conversion of the uranium dioxide to uranium tetrafluoride by reaction with anhydrous hydrogen fluoride, and (g) formation of uranium hexafluoride by reacting the uranium tetrafluoride with elemental fluorine. As indicated above, a proposed minor process modification involves provision for receipt of plant feed as a yellowcake slurry and dissolution of the contained solids by circulating nitric acid through the stainless steel shipping container to produce the uranyl nitrate solution feed to the Sx circuit.

The major part of the plant expansion activities involve the installation of facilities, equipment, piping, instrumentation and other apparatus that are identical to existing equipment. Since the plant was originally

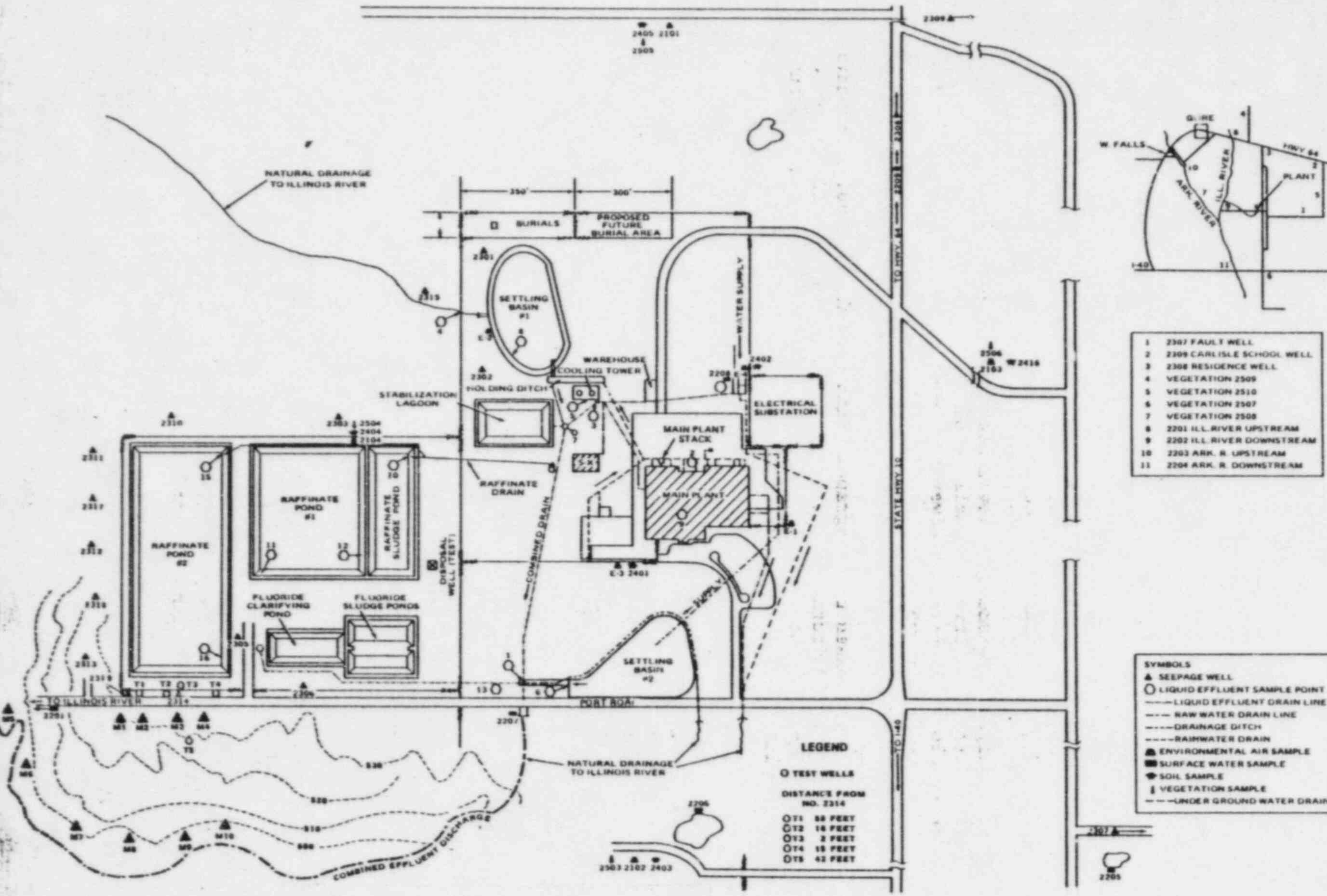

FIGURE 4.1 KERR-MCGEE UF_6 PLANT PLOT PLAN

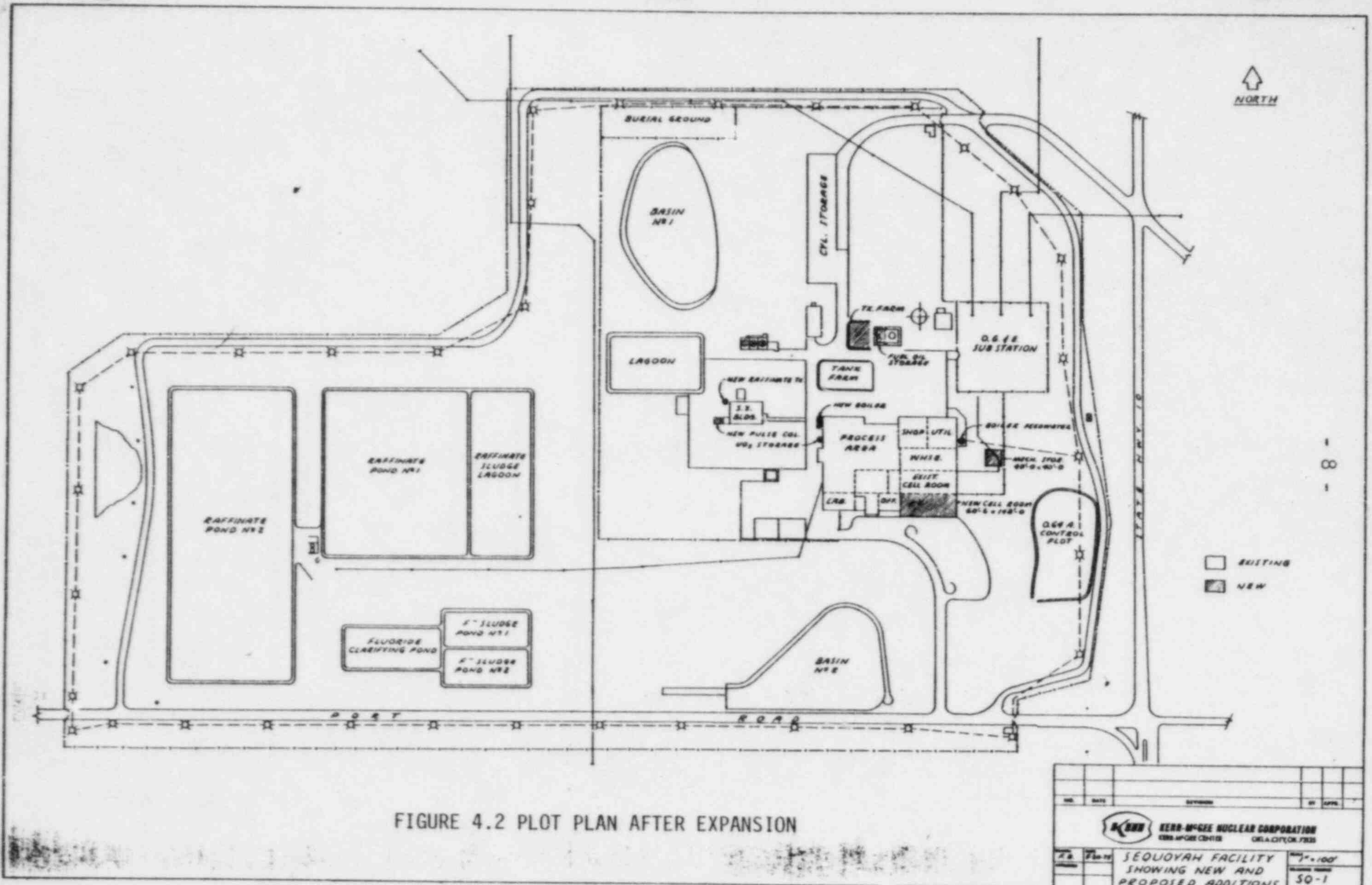

FIGURE 4.2 PLOT PLAN AFTER EXPANSION

designed and constructed to provide for additional capacity, most of the modifications involve the addition of process equipment in spaces provided for in the initial plant construction. Following is a listing of the required additions:

1. Installation of a new 8.5 foot diameter by 9 foot high 4,000 gallon digestion tank to be used for dissolving the dry ore concentrates. This tank is the same as two existing digestors.

2. Installation of a new pulse column measuring 30 inches in diameter with 25 feet of contacting height. The column will be used for re-extracting uranyl nitrate from loaded organic in the solvent extraction circuit and is located adjacent to an existing column.

3. Installation of an additional 9 foot diameter by 9 foot high 4,500 gallon raffinate hold tank adjacent to the two existing units. The design and function of the new tank, piping instrumentation, etc. is identical to existing equipment.

4. Installation of an additional 10 foot by 10 foot stainless steel boil-down tank having the same design and function as two existing tanks.

5. Installation of two additional trough-type denitrators for decomposing uranyl nitrate to uranium trioxide. These units and supporting equipment are identical to the two denitrators currently in service.

6. Installation of two additional 18-inch diameter fluid-bed reduction reactions together with auxiliary equipment for reducing uranium trioxide to uranium dioxide.

7. Duplication of the present hydrofluorination system by the installation of two additional 30-inch diameter fluid-bed hydrofluorinators and auxiliaries for the conversion of uranium dioxide to uranium tetrafluoride.

8. Doubling the plant capacity for converting uranium tetrafluoride to uranium hexafluoride requires the addition of the following equipment:

    a. Two additional fluorination towers installed in parallel with the three existing units.

    b. An additional fluorine cleanup reactor installed in parallel with the existing one.

    c. Three additional cold traps installed to augment the capacity of the existing three units plus an additional refrigerated water system to service the three new cold traps.

d. Bins, conveyors, piping and instrumentation associated with the processing equipment.

9. Installation of two additional steam chests identical to the existing unit for blending the uranium hexafluoride product in the shipping cylinders prior to sampling.

10. Construction of a new fluorine cell building measuring about 60 feet wide by 147 feet long and 17 feet high providing 8820 square feet of floor space contiguous with and immediately south of the existing cell room. The building design is identical to the existing cell room, containing 30 fluorine production cells and providing the same chemical flows, piping, instrumentation, and other auxiliaries as the original fluorine production system.

11. Installation of a new 15000 gallon ammonia storage tank (8 feet in diameter by 40 feet long) adjacent and identical to the existing tank with piping and instrumentation duplicating the existing facilities.

12. Addition of a new tank farm approximately 50 feet by 50 feet on which are installed a total of four 15000 gallon, 8-foot diameter by 40-foot long horizontal storage tanks. These include two stainless steel tanks for nitric acid storage, one steel tank for anhydrous hydrofluoric acid and one polyvinyl chloride lined steel tank for aqueous hydrofluoric acid service. All new tanks are provided with limestone pits, concrete containment dikes, piping, instrumentation and other appurtenances similar to those in the original facilities.

13. Possible installation of an additional 30,000 gallon fuel oil storage tank, 18 feet in diameter by 18 feet high, identical in all respects to the existing fuel oil storage facilities.

14. Possible installation of a new 35,000 pound per hour steam boiler identical in appearance, instrumentation, and piping to the existing system.

The additional plant modification not covered by the previous request for exemption from the requirements of 10 CFR 40.31(f) involves the installation of the new 48 feet by 30 feet building, a 1000 gallon calibration and general purpose tank, a 10,000 gallon receiving and weigh tank, a 10,000 gallon storage tank, transfer pumps and the assorted piping required to enable the licensee to receive plant feed as yellowcake slurry, dissolve the solids in nitric acid and obtain a representative sample of the uranyl nitrate before feeding it into the plant circuit.

5.0 Environmental Impact of Plant Construction

5.1 Original Construction

Although installation of the Sequoyah plant facility had a substantial effect on the appearance of the previously undeveloped immediate plant site, the environmental impact was relatively minor. During construction which was completed early in 1970, the 75 acre plant area was subjected to the customary grading and clearing required for erection of the buildup and construction of the storage pads, the power station, parking lot, roads and retention ponds. Upon completion of the construction phase, the area was landscaped, seeded in grass, and trees and shrubs were planted. The remainder of the 2100 acre site has been retained in its natural state with some of the land leased to farmers for intermittent pasturing of cattle.

5.2 Expansion and Plant Modification Construction

Based on a previous review of the environmental considerations related to the licensee's request for an exemption from the requirements of 10 CFR 40.31(f) to authorize the start of construction for the plant expansion, it was concluded that the required activities would produce only a minor impact on the environment since most of the work would involve adding new equipment inside existing structures. Except for the removal of about 500 cubic yards of earth for piers and foundations and its disposal within the present plant area, no other significant environmental disturbances were anticipated since there was no requirement for blasting or other major dust producing operations. Similarly, the minor activity involved in the installation of the yellowcake slurry receiving, dissolution and sampling system is not expected to produce any measurable adverse environmental impact.

6.0 Environmental Impacts of Plant Operation

6.1 Land Use Effects

As indicated in the FES, the primary impact associated with use of the land at the Sequoyah UF_6 plant site occurred during the initial construction phase of the project. In addition to the effects described in the FES, Amendment No. 8 to the current license results in the removal from agricultural use an additional 160 acres of land for at least as long as this area located south of the 75 acre immediate plant site is used for the test distribution of treated solvent extraction raffinate.

All additional land used in the plant expansion for the new fluorine cell room building, the fuel oil storage tank, the new tank farm, etc. is within the confines of the original 75 acre plant site and consequently, is not considered to have any added impact on land use.

6.2 Water Use Effects

The plant water supply is obtained from Tenkiller Ferry Reservoir located about seven miles north of the site on the Illinois River. Use of the water is covered by a permit from the Oklahoma Water Resources Board as well as a contract with the U.S. Army Corps of Engineers both of which provide for adequate quantities to meet requirements at the expanded plant capacity. After the water is used in the plant process for cooling, boiler feed or sanitary purposes most of it is returned through a natural water course to the headwaters of the Robert S. Kerr Reservoir which is now backed up into the Illinois River above the plant outfall. The plant is authorized to discharge wastewater in accordance with National Pollutant Discharge Elimination System (NPDES) Permit No. OK0000191 issued by the USEPA. This permit is effective for the period August 31, 1976 through August 30, 1981 and covers operation of the plant at the current as well as at the expanded production rate. Actual water consumption due to evaporation was previously estimated at about 150 gpm. The consumption of several times this quantity at this site is not considered to have any measurable effect on water supplies or to create any significant environmental impact.

6.3 Impacts of Non-Radiological Effluents

6.3.1 Airborne Effluents

Non-radiological airborne effluents discharged to the atmosphere during normal operation of the facility include the following:

(a) Oxides of Nitrogen (NOx) are generated at three points in the process as well as in the combustion of natural gas for the production of steam. The process sources are the primary digesters where the ore concentrate feed is dissolved, the miscellaneous digester used for dissolution of recycled solids and the denitrators where purified uranyl nitrate hexahydrate is decomposed to uranium trioxide. The off-gases from these operations are processed to recover nitric acid which is returned for reuse in the process. Regular measurements of NOx concentrations in stack gases in 1974 indicated an average level of 317 ppm. Increasing plant production from 5000 to 10,000 tons of uranium per year is assumed to double the NOx release to the environment.

(b) Sulfur Dioxide (SO_2) originates from the need to add sulfuric acid to the purified uranyl nitrate hexahydrate prior to denitration to obtain optimum reactivity of the reduced uranium oxide. The SO_2 is released when unreacted hydrogen and hydrogen sulfide from the reduction reactors are burned in air to water vapor and sulfur dioxide before being discharged to the plant stack. With the sulfuric acid addition ranging from 1,500 to 3,000 ppm, the release at the expanded production rate has been conservatively estimated using the upper addition level and assuming that 10 percent of the sulfur remains with the uranium dioxide product from the reduction reactors.

(c) Fluorides released to the environment originate from reacting the waste hydrogen generated in the fluorine plant with fluorine and UF_6 from the product cold trap system in a waste gas burner. This burner product along with off-gases from the HF condenser on the hydrofluorinator gaseous product stream are scrubbed with water before being vented through the main plant stack. Additional hydrogen fluoride and fluorine is discharged periodically from the fluorine plant emergency vent. The fluorine is converted to hydrogen fluoride by reaction with the water vapor in the air. Stack releases of fluorides at the expanded production rate are scaled up directly from the losses encountered in 1974 while the ground level losses are based on doubling the number of emergency vent releases but eliminating the previous purging of the fluorine vent header after each emergency release or extended shutdown.

(d) Hexane losses are based on the assumption that all hexane consumed is lost to the atmosphere by evaporation, with the rate proportional to the solvent extraction circuit on-stream time. The projected release rate at the expanded plant production capacity was estimated conservatively by direct scale-up of the 1974 losses, while neglecting to take credit for installation of a condenser treating the vent gases from the hexane building.

A summary of the non-radioactive airborne effluents at the current plant design production level (5,000 short tons U per year) and the expanded production level (10,000 short tons U per year) along with the estimated maximum ground level concentrations based on dispersion calculations is presented in Table 6.1. These results indicate that all of the estimated maximum concentrations or release rates are below the ambient air quality standards or permissible release rates. Consequently, the probability of any adverse impacts resulting from the projected emissions at the expanded plant production is considered by the staff to be extremely low.

TABLE 6.1

AIR-BORNE EFFLUENT SUMMARY
Level of Production
Present Level = 5000 Short Tons U/Yr., Expanded Level = 10,000 Short Tons U/Yr.

	Metric Tons per Month Level of Production		Grams per second Level of Production		Highest Concentration, $\mu g/m^3$ Distance: 1/2 mile Level of Production		Ambient Air Qty. Stds.
ITEM	Present	Expanded[1]	Present	Expanded	Present	Expanded	$\mu g/m^3$
NOx	10.4[3]	18.6	3.96	7.07	1.98	3.54 WSW	100[4]
SO_2	1.51[2]	4.13	0.574	1.56	0.287	0.78 WSW	80[5]
Fluoride	0.101[2]	0.174	0.12	0.066	Combined 0.115	0.252 SW	.5[6]
Fluoride (Ground)	0.030[2]	0.032	0.004	0.012			
Hexane	8.8[2]	14.0	3.69	5.33	N/A*	N/A*	15.88g/sec[7]

*Not applicable.

(1) Information Source: November 20, 1975, Environmental Information on Expansion.
(2) Information Source: Table XI(Revised) - page 12 Jan. 1973 App. Environmental Report Supplemental #2.
(3) Information Source: Historic Records - 1974 - No Allow. for Boiler Gen.
(4) EPA National Primary and Secondary Ambient Air Quality Standard. (Annual arithmetic mean)
(5) EPA National Primary Ambient Air Quality Standard (Annual arithmetic mean)
(6) State of Washington Ambient Air Fluoride Standard
(7) Oklahoma State Health Department, Air Quality Services, Environmental Service - Guidelines for Interpretation and Enforcement of Regulation No. 15 (15.33)

6.3.2 Liquid Effluents

The Sequoyah plant process generates two major liquid waste streams which are treated to remove contaminants from solution before either being impounded in earthen-walled retention basins or being discharged to the Illinois River Channel of the Robert S. Kerr reservoir via a natural water course. The composition of the waste streams is variable due to processing ore concentrates supplied by different uranium mills and the fact that the wastes comprise a number of separate plant streams some of which flow only intermittently. The two primary process waste streams are the solvent extraction circuit raffinate and waste hydrogen fluoride scrubber product which are joined by additional small waste streams generated in the process. Other plant streams which are combined with the treated fluoride effluent before being discharged to the river include sanitary and domestic wastes, blowdown from the steam boilers and the recirculating cooling water system as well as the excess plant intake which bypasses the water treatment facility and serves to dilute the effluents.

6.3.2.1 Raffinate Stream

This material is the major liquid waste stream generated in the production process and (based on a licensee rule of thumb estimate of about 1.3 gallons of raffinate per kilogram of uranium processed and assuming a 90% on-stream time) consists primarily of about 12 gpm of "uranium free" aqueous solution rejected from the solvent extraction circuit at the 5,000 short tons of U per year production rate or about 25 gpm at the expanded rate. The raffinate solution contains nitric acid, ammonium nitrate, and metallic salts along with small quantities of uranium and the radioactive daughter products of normal uranium decay entering the plant with the ore concentrate feed. The raffinate is combined with spent sodium hydroxide from solvent treatment and the miscellaneous digester off-gas scrubber system as well as recovered weak acid from the nitric acid absorber. The mixed stream is neutralized with ammonia which precipitates most of the contained radionuclides and other heavy metal impurities and the resulting slurry is impounded in storage ponds.

Although the storage ponds were designed to prevent seepage of the impounded liquid, a small but measurable leak from Raffinate Storage Pond No. 2 was detected in May 1974. Investigations conducted by the licensee regarding the leaking raffinate were discussed in the FES. Additional studies by the licensee were covered in detail in two documents entitled "Report on Waste Retention Ponds - Sequoyah Facility - Kerr-McGee Nuclear Corporation" dated January 5, 1976 and a supplement this report submitted January 11, 1977. Based on a review of the information presented, it was concluded by the staff that leakage from the raffinate

pond is minor and that the resulting ground water contamination is restricted to the immediate vicinity of the pond. Although it is estimated that the raffinate seep may eventually be transmitted to the surface water system, this will occur at some time far into the future after substantial dilution has occurred. Studies and monitoring efforts are being continued to assure that the amount entering the ground water system is small enough that the eventual effect on surface water will be minor. To date, no satisfactory method has been proposed by the licensee for the permanent disposal of the solvent extraction raffinate waste stream. Consequently, it is recommended that as a condition for license renewal, the licensee be permitted to use the existing surface ponds for storage of neutralized raffinate only through December 31, 1980, and that in the interim period, the licensee shall continue his efforts to develop a permanent solution to the raffinate disposal problem that is acceptable to USNRC. It is the staff conclusion that continued temporary storage of raffinate in the existing ponds for a period of about three years while maintaining close surveillance of the seepage rate does not represent an appreciable risk of contamination of the area water resources.

6.3.2.2 Fluoride Stream

Most of this waste stream is initially a weak solution of hydrofluoric acid resulting from operation of the off-gas scrubber system serving the hydrofluorination and fluorination processes. Other components of the fluoride waste stream include laboratory wastes, fluorine cell rework sludges and waste from the anhydrous hydrogen fluoride vaporizer sump. The combined fluoride stream pH is raised to a value of about 12 by treatment with slaked lime and the neutralized slurry flows to a fluoride sludge pit where the bulk of the excess lime and precipitated calcium fluoride settles out. The overflow solution from the sludge pit is neutralized to a pH of 6 to 8 by the addition of sulfuric acid with the resulting liquor fed to a clarifying lagoon where the remaining suspended calcium fluoride and precipitated calcium sulfate settle out. The neutral clarified waste overflows and is combined with "clean" waste water and sewage lagoon overflow after which the combined stream is discharged to the Illinois River. A concrete stilling basin provided at the point of combination allows for mixing, sampling, and metering the discharge which represents the total liquid effluent from the plant.

In accordance with the current NPDES permit, the facility discharge pH must be within the range of 6.0 to 9.0 and must not contain more than 840 lb/day total suspended solids, no more than 42 lb/day fluoride and no more than 170 lb/day nitrate (as N) with pH monitored three times per day and 24-hour composite samples collected three times per week to monitor TSS, F, and NO_3. USEPA reports that over the period August 1, 1976 through mid August, 1977 Kerr-McGee has reported only two excessive TSS values (9/76 and 4/77) both of which occurred after resuming flows following treatment to remove algae, and two minor excursions in discharge pH (slightly in excess of 9.0) which occurred in January and February 1977.

Table 6.2 presents a summary of the range and average values of liquid effluent parameters determined on a routine basis at current production levels along with projected values for the expanded production, the range of values in the receiving waters and the permissible limits. It should be pointed out that the combined effluent stream now discharges directly into the back-up of the Robert S. Kerr Reservoir rather than into the flowing Illinois River. As a consequence, the projected levels of all indicated parameters of the effluent stream at the expanded plant production rate fall well within the normal range of the existing corresponding values of the receiving waters.

6.3.3 Solid Wastes

Non-radioactive combustible materials such as boxes, crates, paper and rags are burned in an approved open pit incinerator. Other combustibles not suited for open-pit burning may be disposed of by treatment in an enclosed incinerator discharging the combustion products to the boiler stack. No radioactive materials or chemicals capable of releasing noxious vapors are processed in this unit. Uncontaminated noncombustible wastes are buried in accordance with the solid waste disposal regulations of the State of Oklahoma. The added quantity of uncontaminated solid wastes resulting from operation of the expanded plant is not considered by the staff to create any appreciable environmental impact.

6.3.4 Sanitary Wastes

Domestic wastes generated from toilets, lavatories, showers and laundry facilities are piped to waste collection and treatment facilities of a design approved by the Oklahoma State Department of Health. Although the facility permit was based on use by 80 persons on the swing and night shifts, the system provided a minimum average detention time of 43.8 days (70.2 days at normal operating depth) at the design flow of 10,000 gallons per day. Comparing these values with the 7 to 30 days detention time recognized as acceptable in current practice, it appears that the present system will provide adequate treatment for the estimated expanded plant population of about 150 persons. The applicant has applied to the State Department of Health for a permit to operate at the increased throughput.

6.4 Impacts of Radiological Effluents

6.4.1 Airborne Effluents

Airborne radioactive effluents are discharged to the atmosphere during normal plant operation in the form of both soluble and insoluble uranium

TABLE 6.2

LIQUID EFFLUENT SUMMARY

Level of Production
Present Level = 5000 Short Tons U/yr, Expanded Level = 10,000 Short Tons U/yr.

ITEM	UNITS	AVG. ($\bar{X}$) RANGE (R)	PRESENT(1)	EXPANDED	ILL ppm(4)	ROBERT S. KERR(5)	LIMITS	UTL(3) ILL	UTL(3) ARK
Temp	°F	R	49°-78°	49°-78°	*	43.8-80.5	+5.0 entire stream(3)		
pH		R	7.1-8.1	7.1-8.1	7.1-8.4	7.6-8.2	6.5 to 8.5(3)	6.5-8.5	6.5-8.5
TDS	mg/l	$\bar{X}$ R	121 104-152	127 (2)	220-731	197-434	127 Ill.(3) 1487 ARK.(3)	144	1876
$D-O_2$	mg/l	R	6.4-11.2	(2)		7.6-11.6	>6(3)		
$CACO_3$	mg/l	R	55-80	(2)	92-410	88-102			
Cl	mg/l	$\bar{X}$ R	7.5 1.05-20	(2)	1.2-300	48-150	12.1 Ill.(3) 665 Ark.(3)	17.2	860
SO_4	mg/l	$\bar{X}$ R	15.83 11-21	22.8	3.2-33.0	29-56	12.5 Ill.(3) 139 Ark.(3)	15.9	172
NH_3	mg/l	R	0.2-0.7						
NO_3	mg/l	$\bar{X}$ R	1.4 0.8-2.0	1.4	* 0.0-7.8	* 1.7-17	10.16(6)		
F	mg/l	$\bar{X}$ R	.72	.88	 *	 *	1.7(6)		
U	μCi/ml	$\bar{X}$ R	$.05x10^{-5}$	$.13x10^{-5}$		*	$3X10^{-5}$(7)		

*Information not available.
(1) Actual measurements, reported monthly to OWRB
(2) No increase is present due to nature of plant operations. Contaminants levels due to raw water concentrations.
(3) State of Oklahoma Standards, Okla. Water Quality Standards, 1976
(4) Appraisal of the water and related land resources of Oklahoma, Region Nine, OWRB Report 1971
(5) Water Resources Data for Okla., USGS, 1974.
(6) USPHS Drinking Water Standards 1962.
(7) 10 CFR 20, App. B, Table II.

and uranium-daughter particulate matter generated at a number of points in the manufacturing process. These include uranyl fluoride produced by hydrolysis of trace quantities of uranium hexafluoride passing through the product cold trap system as well as particles of yellowcake, uranium trioxide, uranium dioxide and uranium tetrafluoride released as a result of spills, leakage through packing glands or passing through the filters used in the vacuum cleaning and transfer systems. These uranium compounds, which also contain small quantities of radium and thorium entering the plant with the ore concentrate feed and not removed completely in the solvent extraction circuit, are discharged to the environment as elevated releases from the main plant stack, the HF scrubber, various roof vents or hatches, the sample plant, and the main plant dust collector. The four latter sources are conservatively considered as ground releases in calculating ground level concentrations and corresponding radiological dose commitments based on atmospheric dispersion estimates. Uranium releases encountered in 1976 with the plant operating at 322 MT/month (about 4,250 ST/year) and estimated releases at the expanded plant capacity (10,000 ST/year) are summarized in Table 6.3. The 1976 releases were determined by direct measurement of stack discharges and by calculating quantities released through the roof hatches based on monthly average air concentrations in the manufacturing building and calculated air flows. Discharges from the roof vents were calculated from the rated exhaust capacity and measured monthly average airborne concentrations. Projected releases at the expanded rated plant capacity were estimated by direct scale-up of 1976 discharges from the main stack, the scrubber and sample preparation and the assumption that doubling plant throughput would increase losses through the roof vents, the roof hatches and the main plant dust collector by 25 percent due to possible increased frequency of minor releases.

An additional source of minor quantities of airborne radioactive effluents is the discharge from the stack of a submerged combustion burner located between the two raffinate ponds and operated periodically to increase raffinate evaporation and thus avoid the immediate need to construct an additional raffinate storage pond. A summary of analyses of the burner stack effluents for uranium, thorium and radium covering the period from August 1974 through December 1975 is presented in Table 6.4. It should be noted that thorium concentrations ranging from <0.35 to <1.79 E-14 μCi/ml were reported between January and July, 1974 before analytical sensitivity was improved. The results show the concentrations in the stack to be a fraction of one percent of the 10 CFR 20 permissible limits in the unrestricted area. On the basis of these values and the intermittent operation, the staff considers the environmental impact of the submerged burner stack effluents to be of little consequence.

TABLE 6.3

Summary of Airborne Uranium Releases

Source of Release	1976 Total	Expanded Plant Total	Release Rate, grams U/month — Distribution: Soluble	Insoluble
ELEVATED				
Main Stack	12	28		28
Scrubber	1980	4633	4633	
			4633	28
GROUND LEVEL				
Sample Plant	111	260		260
Roof Vents (1)	1750	2301	230	2071
Roof Hatches (1)	1414	1852	185	1667
Dust Collector (1)	308	403	40	363
		9477	455	4361

(1) Assumed 30% UO_3, 30% UO_2, 30% UF_4, 10% UO_2F_2

TABLE 6.4

Submerged Combustion Burner Stack Effluent
August 1974 thru December 1975

Material	Stack Concentration µCi/ml x 10^{-14} Range	Stack Concentration µCi/ml x 10^{-14} Average	Percent of Lowest Unrestricted 10 CFR 20 Limit (1)
Uranium	0.03 - 2.75	0.78	0.16
Thorium	0.002 - 0.18	0.07	0.23
Radium-226	0.09 - 2.52	0.42	0.21

(1) 10 CFR 20 unrestricted limit is 5E-12 µCi/ml for U (natural), 8E-14 µCi/ml for soluble thorium-230 (3E-13 µCi/ml insoluble), and 3E-12 µCi/ml for soluble radium-226 (2E-12 µCi/ml insoluble).

The radiological impacts were assessed by calculating annual doses to individuals located at a number of points of interest surrounding the plant site as well as the doses to the population living within a 50-mile radius of the plant. The calculations were based on the airborne uranium effluents shown in Table 6.3 along with the isotopic analyses shown in Table 6.5 which were performed by the licensee in order to determine the individual radionuclide source terms for use in the dose calculations. The term dose as used in this appraisal is actually a 50-year dose commitment; that is, the total dose from one year of intake of radionuclides that will accrue during the remaining lifetime (50 years) of an individual. Chi/Q values used for determining ground level concentrations at the points of interest are the same as those reported in the FES.

TABLE 6.5

Sequoyah Isotopic Analyses
April 1977

Isotope	UF6 pCi/gm as UF6	Plant Dust pCi/gm as Received
U-238	2.25E+5* ± 2%	2.44E+5 ± 3%
U-235	6.47E+3 ± 2.5%	1.11E+4 ± .53%
U-234	2.29E+5 ± 2.2%	2.30E+3 ± 3%
Th-230	4.78E+1 ± 2.4%	1.58E+2 ± 1.2%
Ra-226	3.70E0 ± 18%	1.77E+1 ± 15%

U-238 values calculated from chemical analysis for uranium.
Ra-226 includes any Ra-224 present.
Th-230 and U-234 determined by alpha pulse height analysis.
U-235 determined by gamma pulse height analysis.

*Read as 2.25×10^5.

6.4.1.1 Individual Dose Commitment

Individual doses were calculated from estimated ground level concentrations following the procedures described in the Oak Ridge National Laboratory document ORNL-4992, "A Methodology for Calculating Radiation Doses from Radioactivity Released to the Environment." Since preliminary calculations indicated that contributions to individual doses from inhaled resuspended radionuclides and from submersion in air were inconsequential these pathways were disregarded in calculating the total doses.

It should be pointed out that the ORNL-4992 methodology uses the extremely conservative assumptions that the individuals spend all of their time outdoors at the reference location and that all of the food consumed is produced at the reference site. The doses reported reflect the total release of the major radionuclides from the plant while operating at the expanded rated production capacity, i.e., 10,000 short tons of uranium per year as uranium hexafluoride.

A detailed breakdown of the annual whole body and critical organ dose commitments to the closest resident (about 0.5 mile NE) contributed by the major radionuclides is presented in Tables 6.6 and 6.7. Dose commitments to individuals located at other points of interest surrounding the plant site are presented in Table 6.8.

TABLE 6.6

Estimated Maximum Annual Doses[(a)] from Airborne Effluents to Closest Resident[(b)]

	Millirems per Year[(c)]			
Pathway	Total Body	Bone	Kidney	Lung
Inhalation[(e)]	4.9E-2[(d)] (2.0E-3)[(g)]	8.1E-1 (2.7E-2)	1.9E-1 (7.8E-3)	1.68E0 (9.3 E-1)
Ingestion[(f)]	1.2E-2	1.9E-1 (5.6E-4)	4.0E-2 (1.3E-4)	--
Exposure from Ground	2.2E-2	7.0E-2	3.0E-2	3.0E-2
Total	8.3E-2	1.1E0	2.6E-1	1.71E0

(a) 50-year dose commitment from one year of intake.
(b) Located about 0.5 mile NE of main stack.
(c) Assuming a 30-year plant operating life.
(d) Read as 4.9×10^{-2}.
(e) Daily intake assumed to be $20 m^3$ of air.
(f) Daily intake assumed to be 0.25 kg vegetables, one liter milk, and 0.3 kg beef with all food consumed being produced at the residence site.
(g) Values shown in parens represent annual doses to individuals located between 0 and 1 mile NE calculated by the licensee's consultant using the "Airem Program Manual, A Computer Code for Calculating Doses and Ground Depositions Due to Atmospheric Emissions of Radionuclides," EPA-520/1-74-004, J.A. Martin, Jr., et. al., May 1974 and dose conversions based on USNRC Regulatory Guide 1.109 dated March 1976. The results reflect the greater conservatism of the ORNL-4992 methodology.

TABLE 6.7

Major Contributors to Airborne Dose
to Closest Resident

Radionuclide	Total Body	Bone	Kidney	Lung
	Millirems per Year			
U-234	4.1E-2	4.8E-1	1.2E-1	8.4E-1
U-235	4.1E-3	6.6E-2	2.6E-2	6.3E-2
U-238	3.6E-2	4.7E-1	1.1E-1	8.0E-1
Th-230	1.6E-3	5.8E-2	1.3E-2	6.8E-3
Ra-226	3.5E-4	3.5E-3	1.0E-6	1.0E-4
Total	8.3E-2	1.1E0	2.6E-1	1.7E0

TABLE 6.8

Estimated Maximum Airborne Doses at
Nearby Points of Interest

Location			Millirems per Year			
Designation	Distance (miles)	Compass Direction	Total Body	Bone	Kidney	Lung
Closest Residence	0.5	NE	8.3E-2	1.1E0	2.6E-1	1.7E0
Carlile School	1.0	NE	4.7E-2	6.4E-1	1.6E-1	1.0E0
State Highway 10	0.14	E	7.0E-2	8.6E-1	1.4E-1	1.3E0
Vian	4.0	E	6.8E-3	3.2E-2	6.6E-3	4.IE-2
On-Site[(a)]	0.5	SW	3.4E-1	3.6E0	8.6E-1	5.9E0
Site Boundary[(a)]	1.0	SW	2.0E-1	2.1E0	5.1E-1	3.5E0
Highway I-40	1.5	SW	4.8E-2	6.4E-1	1.6E-1	9.8E-1
Webber Falls	3.0	W	8.0E-3	1.1E-1	2.9E-2	1.3E-1
Residence	0.5	NW	7.0E-2	8.6E-1	2.1E-1	1.4E0
Gare	2.0	NW	9.0E-3	1.8E-1	2.9E-2	1.6E-1

(a) Maximum ground level concentrations in direction of prevailing wind.

All of the estimated dose commitments, including the on-site location in the direction of the prevailing wind, are well below the permissible USEPA limit of 25 millirems to the total body and 25 millirems to other organs of any member of the public. As a result, the staff concludes that airborne releases of radionuclides from the Sequoyah facility at the projected expanded production rate will have no measurable effect on the health of any individual member of the public in the vicinity of the plant.

6.4.1.2 Population Dose Commitments

Doses to the total population residing within a 50 mile radius of the plant resulting from airborne radioactive effluents were calculated using the AIREM Code and Regulatory Guide 1.109 dose conversion factors along with population projections for the year 2000 obtained from estimates by the University of Oklahoma Center for Economic Research and Management Research and by the University of Arkansas Industrial Research and Extension Center. Table 6.9 presents the total population dose from inhalation and ingestion for the whole body as well as the kidney, bone and lung in the year 2000 with the plant operating at 10000 STU per year. The results include both elevated and ground level releases using projected soluble emissions as source terms in calculating the kidney, bone and whole body doses and using insoluble emissions in calculating lung dose. The projected population whole body dose is 4.73 E-03 man-rem and represents about 8.8 E-05 percent of the population dose of about 5.5E04 man-rem from natural background radiation which is assumed to be 130 mrem per person. The maximum estimated population organ dose is 1.35 man-rem to the bone or an average of 3.2 E-03 mrem to an individual within the 50 mile radius. This dose represents about 2.1E-04 percent of the ICRP maximum permissible bone dose to the public.

6.4.2 Liquid Effluents

The licensee reports that in 1974 a total of 2.623 x 10^6 kg of uranium was fed to the plant as yellowcake. During this period, 2,545 kilograms of uranium or 0.097 percent of the feed was discharged from the plant as liquid effluent at an average flow rate of 1,598 gallons per minute

Table 6.9

Estimated Annual Doses to the Population[a] from Airborne Effluents in the Year 2000

Organ	Population Dose (man-rems)		
	Inhalation	Ingestion	Total
Whole Body	4.7E-03	(negligible)	4.7E-03
Bone	5.0E-02	1.3	1.35
Kidney	2.0E-02	0.29	0.30
Lung	4.3E-02	N.A.[b]	4.3E-02

[a]Total projected 2000 population within 50 miles of the Sequoyah Facility (4.2×10^5 persons).

[b]Not applicable.

resulting in an average uranium concentration of 5.42×10^{-7} µCi/ml. Assuming that the same ratio of uranium loss in the liquid effluent to the uranium feed will continue at the expanded production rate and the total volume is increased to 2,500 gallons per minute to limit the rise in cooling water temperature, the projected concentration of uranium in the liquid effluent is estimated at 1.2×10^{-6} µCi/ml or about 4 percent of the permissible limits specified in Appendix B, Table II of 10 CFR 20.

The estimated potential maximum doses to an individual from the liquid effluent emptying into the Illinois River are shown in Table 6.10. The doses are based on calculated concentrations of uranium in the river downstream of the plant outfall after complete mixing with the effluent assuming a river flow of 1,400 cfs (actual average river flow for a 33-year period through 1971 was 1,464 cfs) and using the 1974 average upstream river uranium concentration of 1.3×10^{-8} µCi/ml. The dilution factor of about 250 is extremely conservative since the actual dilution obtained with the Illinois River emptying into the Arkansas River channel immediately below the plant outfall will provide considerably higher dilution. The isotopic distribution of Ra-226, Th-230, U-234, U-235, and U-238 in the plant effluent were assumed to be the same as was determined in the isotopic analysis of the plant dust.

TABLE 6.10

Estimated Maximum Annual Dose from
Sequoyah Plant Effluent After 250:1 Dilution with Illinois River

	Dose[a] (millirem per year)		
Pathway	Total Body	Bone	Kidney
Submersion in water[b]	1.0E-5	1.6E-5	6.9E-6
Consumption of fish[c]	7.1E-2	1.1E0	2.5E-1
Consumption of drinking water (d)	4.5E-4	6.3E-3	1.5E-3
Total	7.1E-2	1.1E0	2.5E-1

(a) 50-year dose commitment from one year's intake of radionuclides.
(b) Swimming in water; 1% of year.
(c) Daily intake of 20 g of fish.
(d) Daily intake of 1.2 liters of water.

The indicated doses from the liquid effluents are quite low with all values below one millirem per year except for the dose to the bone from consumption of fish. The uranium radionuclides in all case contributed most of the doses shown.

6.4.3 Solid Wastes

Radioactive waste materials such as scrapped equipment, drums, gloves, respirators, and other contaminated solids are buried on-site in accordance with the provisions of 10 CFR 20.304 which permits up to 12 burials per year of as much as 100 mCi of natural uranium, 100 mCi of natural thorium, and 10 μCi of radium-226 per burial at a minimum depth of four feet and spaced at least six feet apart.

Additional solid wastes generated at the facility include contaminated calcium fluoride-calcium hydroxide sludge produced by lime neutralization of the weak hydrofluoric acid resulting from operation of the off-gas scrubber system serving the hydrofluorination and fluorination processes. An added component of this sludge is calcium sulfate formed by adusting the pH of the liquid overflow with sulfuric acid. This sludge will contain as much as 1.0E-4 μCi/g natural uranium plus about 6.0E-9 μCi/g Ra-226, 1.1E-8 μCi/g Th-230 and 1.5-10 μCi/g Th-232. The licensee has requested a special exception to the provisions of 10 CFR 20.304(a) and (c) that would permit the burial of larger quantities of contained

radionuclides at less frequent intervals but would not permit more than 12 times the allowable monthly quantity to be buried in one year. The staff recommends that this exception be granted following this procedure with the stipulation that documented surface radiation measurements above the burial sites must not be more than 50% higher than the background level for the off-site area after implementation of an approved decommissioning plan.

A third source of radioactive solid wastes is the sludge produced by neutralizing the solvent extraction raffinate stream with ammonia to precipitate most of the uranium, thorium, and other heavy metal oxides and hydroxides. These precipitates along with any insoluble materials in the ore concentrates passing through the Sx circuit settle to the bottom of the raffinate storage ponds. Additional treatment of the remaining liquid with barium chloride precipitates a mixture of barium sulfate-radium sulfate which is also allowed to settle thus eliminating most of the residual radioactivity from the liquid. As described previously in paragraph 6.1, a portion of the treated liquid is currently being disposed of by the test application over 160 acres of the plant site. The licensee hopes to dispose of the settled sludges by transportation to a Kerr-McGee uranium mill site where the material will be disposed of with the mill tailings. An alternative method being considered by the licensee involves the solidification of the wet sludge with cement and disposal in a licensed low-level activity burial site.

6.5 Compliance with State and Federal Regulations

Currently the Sequoyah facility is being operated in accordance with the following State and Federal permits and approved plans:

Permits and Certifications

1. Oklahoma Water Resources Board - Waste Disposal Permit IW-70-011 (No time limit provided Water Quality Standards are met.)

2. Oklahoma Water Resources Board - Permit to Appropriate Surface Water No. P67-765 (No time limit.)

3. Oklahoma State Dept. of Health - Sanitary Waste Treatment Permit (No time limit.)

4. NPDES Permit No. OK-0000191 (August 30, 1981)

5. Oklahoma Air Pollution Control Division - Open Pit Incinerator (No time limit.)

6. Oklahoma Water Resources Board - Certification for Waste Discharges (No time limit.)

Approved Plans and Reports

1. U.S. Army Corps of Engineering - Contract No. DACW56-70-C-0083

2. Engineers Report on Waste Treatment Plant

3. Wastes Disposal Technical Provisions and Specifications

4. Oklahoma State Dept. of Health - Open Pit Incinerator Evaluation Tests

5. Environmental Protection Agency - Spill Control Countermeasure Plan - Provision of 40 CFR 112 (Three-year update required October 1977.)

The Oklahoma State Department of Health, Air Quality Service, indicates that as of October 21, 1976, the Kerr-McGee facility was in compliance with all State air regulations (Appendix A). As a result of discussions with USEPA Region VI staff on September 28, 1977 regarding the proposed license renewal, the licensee was instructed on September 29, 1977 to formally notify the Okalahoma State Department of Health, Air Quality Service of the proposed expansion of plant production and to request authorization for increasing the facility airborne effluents to the levels indicated in Table 6.1 and 6.3.

As indicated by USEPA in November 1976 (Appendix A) and more recently, as reported in paragraph 6.3.2.2, the Sequoyah facility has been in essentially total compliance with their NPDES permit.

7.0 Environmental Monitoring Program

An environmental surveillance program is conducted by the licensee on a routine basis to monitor the effectiveness of the various emission control systems in minimizing the release of dangerous or noxious materials to the environment.

7.1 Airborne Effluent Monitoring

Ambient air samples are taken along the restricted area fence line at the cardinal points of the compass and the particulate matter is counted daily for total alpha radioactivity. In addition, one week continuous air samples are collected at these points each month for fluoride analysis. Air samples are also collected weekly at points 750 feet east of the plant,

1/2 mile southwest of the plant, at the Carlile School, north of the plant at Highway 64, and south of the plant at Interstate Highway I-40 and counted for alpha activity. The weekly samples collected at State Highway 10, 750 feet east of the plant and one-half mile southwest of the plant, are composited and analyzed quarterly for gross alpha, uranium, Th-230, and Ra-226 for use in calculating airborne emissions required by 10 CFR 40.65.

Soil and vegetation samples are collected at 1000 foot and 6000 foot distances from the plant at the cardinal points of the compass each April and October and are analyzed for uranium and fluoride as indicators of fallout from airborne effluents.

7.2 Liquid Effluent Monitoring

The combined liquid effluent stream consisting of the fluoride treatment effluent, the sanitary water treatment system discharge, the overflow from the recirculating cooling water system, and the by-passed plant intake water are sampled continuously at the point where it leaves the immediate plant area. Daily grab samples are checked for temperature, pH, and analyzed for uranium, nitrate, and fluoride for control purposes. Monthly composite samples are analyzed for uranium, gross alpha, gross beta, nitrate, and fluoride. Quarterly composite samples are analyzed for Ra-226 and Th-230. In addition, the four individual streams are sampled and analyzed every two weeks to monitor the major contamination source.

The Illinois and Arkansas Rivers are sampled monthly upstream and downstream of the plant outfall and are analyzed for the constituents listed above. Two on-site natural ponds are sampled quarterly and are analyzed for the same components. Samples are taken from three water wells as well as from thirty-five monitoring wells located near the raffinate and fluoride treatment storage ponds and analyzed for gross alpha, gross beta, nitrate, fluoride and uranium. Radium is analyzed quarterly. Currently eight monitor wells, showing abnormal nitrate values, are sampled weekly while the remaining wells showing no abnormal trends are sampled monthly. Sampling frequency is adjusted as the need is indicated by the analytical results.

Currently, the licensee does not monitor the effects of the plant effluent on aquatic biota. As a condition of the license renewal and modification, the staff recommends that the licensee obtain samples of bottom sediments above and below the plant outfall with initial samples taken as soon as practicable and at semi-annual intervals thereafter until conclusive results are available. Samples should be analyzed for uranium and other heavy metals, Th-230, Ra-226, gross alpha, gross beta, and fluoride. In addition, organism population and distribution measurements should be made. Reports of initial findings should be submitted for evaluation as soon as available while subsequent results should be made available during regular facility inspections.

Except as indicated above, the facility monitoring programs appear to be adequate for measuring the impact of plant effluents on the environment during normal plant operations or following an accident situation; and the staff recommends its continuance without alteration after starting the bottom sediment sampling program.

8.0 Impact of Accidents

Through incorporation of all practicable safety features in the design, construction, and operating procedures for the UF_6 conversion facility, the potential for the occurrence of accidents in the plant has been minimized. The effectiveness of these measures is supported by the fact that during more than seven years of operation, there have been no accidents having any off-site environmental effects. Due to the plant expansion consisting mainly of duplicating existing equipment and operations, it is the considered opinion of the staff that while the probability of an accident occurring might be increased, the consequences of any of the following postulated accidents having the potential for off-site effects would not differ materially from those described in the FES.

- Rupture of waste retention pond embankment.
- Acid storage tank rupture.
- Fire in the solvent extraction circuit.
- Rupture or valve failure of a hot UF_6 product cylinder.

No accident occurring during operation of the proposed new yellowcake slurry unloading and dissolution system is considered to be capable of creating an off-site impact on the environment.

9.0 Reclamation and Restoration

Upon cessation of the plant operations, it is unlikely that the entire 75 acre site would be restored to the condition existing before the plant was built since the area would be more beneficial as an industrial site than as a pasture. The licensee has committed to removal of any radioactive sludges resulting from treatment of the Sx raffinate and does not expect any contaminated liquids remaining on the site when operations are terminated. Chemical wastes can be removed if necessary and moved to another location. The process buildings and other facilities can be decontaminated to a level consistent with other industrial uses so that part of the 75 acres as well as the rest of the 2,100-acre site can be used for any one or more additional purposes after the useful life of the existing plant is terminated. However, a preliminary estimate by the

licensee of the cost for reclaiming and restoring the site of about $75,000 is not considered by the staff to be realistic. Consequently, it is recommended that as a condition for license renewal and modification, the licensee be required to submit a decommissioning plan, including a realistic cost estimate for its implementation, as well as a plan for financial arrangements to insure that adequate funds will be available cover the decommissioning and site reclamation costs.

10.0 Summary of Environmental Impacts of Operation

A summary of the environmental impacts produced by construction and operation of the expanded Sequoyah conversion facility by Kerr-McGee Nuclear Corporation under the proposed licensing action is presented below:

(a) The minor modification in land use resulting from the plant expansion is not significant and does not preclude the acceptance of the proposed licensing action.

(b) Since the major part of the plant expansion activities involve the installation of facilities that are identical to the existing ones, no materials other than those currently being emitted will be released.

(c) A minor increase in water consumption resulting from operation at the expanded plant capacity will have no measurable effect on area water supplies.

(d) The release of non-radioactive airborne effluents NOx, SO_2, fluorides, and hexane at the expanded plant production are sufficiently diluted at even the maximum estimated ground level concentrations to meet all ambient air quality standards or permissible release rates.

(e) Non-radioactive liquid effluents of the Sequoyah facility are regulated by an NPDES permit issued by the United States Environmental Protection Agency. Satisfactory compliance with this permit has been demonstrated by the facility and projected concentrations at the expanded production rate are within the acceptable limits of the permit, the State of Oklahoma Water Quality Standards, or the USEPA Drinking Water Standards. No significant adverse ecological impacts on the surrounding aquatic environment are expected by the discharge of nonradiological wastes at the expanded plant operation. The staff has similarly concluded that except for neglecting to collect and analyze bottom sediments, the present aquatic monitoring program is adequate.

(f) The staff concludes that the radiological impacts of the Sequoyah plant on the closest resident, on other nearby individuals, or on the general population are not significant. The estimated annual doses that would be received by the closest resident from all sources of radionuclide release at the expanded production rate are well below the limits set by the United States Environmental Protection Agency of 25 millirems to the total body, 75 millirems to the thyroid, and 25 millirems to all other organs. In addition, it is concluded that the present monitoring procedures for air, water, soil, and vegetation, except for river bottom sediment sampling, are adequate to monitor the impacts of plant effluents on the environment and to reveal any unusual operating difficulties or accidents situations.

Based on these findings, the staff concludes that the potential environmental impact created by the plant modification and operation at the expanded plant production rate is not of sufficient magnitude to warrant the preparation of an additional environmental impact statement for the proposed action; and as provided in 10 CFR 51.5c(c), a negative declaration will be prepared pursuant to 10 CFR 51.7.

APPENDIX A

LETTERS REGARDING COMPLIANCE OF KERR-MCGEE'S SEQUOYAH FACILITY WITH EFFLUENT DISCHARGE REGULATIONS