SAFETY EVALUATION REPORT

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

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1.0 BACKGROUND

1.1 General

The Kerr-McGee Nuclear Corporation UF_6 conversion facility is located on a 2,100 acre tract of land in Sequoyah County, Oklahoma about 150 miles east of Oklahoma City, 40 miles west of Fort Smith, Arkansas and 25 miles southeast of Muskogee, Oklahoma. The site perimeter is formed by U.S. Highway 64 to the North, the Illinois and Arkansas Rivers to the West, Interstate Highway 40 to the South and by the eastern boundary of Section 22 to the East. Plant operations are conducted in a fenced-in, restricted area covering about 75 acres in Section 21, Township 12 North; Range 21 East Sequoyah County with access to the area provided by Oklahoma Highway 10 adjacent to the eastern boundary.

The function of this facility is to convert uranium ore concentrates to the volatile pure uranium hexafluoride (UF_6) used as the feed material to the USERDA gaseous diffusion plants where enrichment of the U-235 isotope is accomplished. At present the plant is one of only two commercial conversion facilities operating in the United States and is currently licensed to produce up to 5,000 tons of uranium per year as uranium hexafluoride. In the Kerr-McGee process, the ore concentrate feed is dissolved batchwise in hot nitric acid and the resulting uranyl nitrate solution is purified by solvent extraction. The pure solution is concentrated to uranyl nitrate hexahydrate by boiling off liquid and the salt is decomposed to uranium trioxide (UO_3) in a trough type denitrator. The uranium trioxide is carried through reduction and hydrofluorination in fluid bed reactors to produce uranium dioxide (UO_2) and uranium tetrafluoride (UF_4) respectively after which the UF_4 is reacted with elemental fluorine in a series of fluorination towers to produce high purity gaseous UF_6. The UF_6 gas is cooled and condensed in cold traps as a solid which is periodically melted by heating with steam and the liquid drained into approved 10 ton cylinders for shipment to the gaseous diffusion plants. A schematic flowsheet of the manufacturing process is presented in Figure 1.1.

Pursuant to 10 CFR Part 40, on September 23, 1969, Kerr-McGee Corporation filed an application for a license to operate the Sequoyah facility and Source Material License SUB-1010 was issued on February 20, 1970, authorizing the use of source material for the production of UF_6. The current license under which the facility is being operated was scheduled to expire on February 28, 1975. However, the license has been in effect since that time in accordance with the timely renewal provisions pursuant to subsection 40.43(b) of 10 CFR 40 by virtue of the licensee submitting a renewal application dated January 24 and received January 28, 1975. 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. As a result

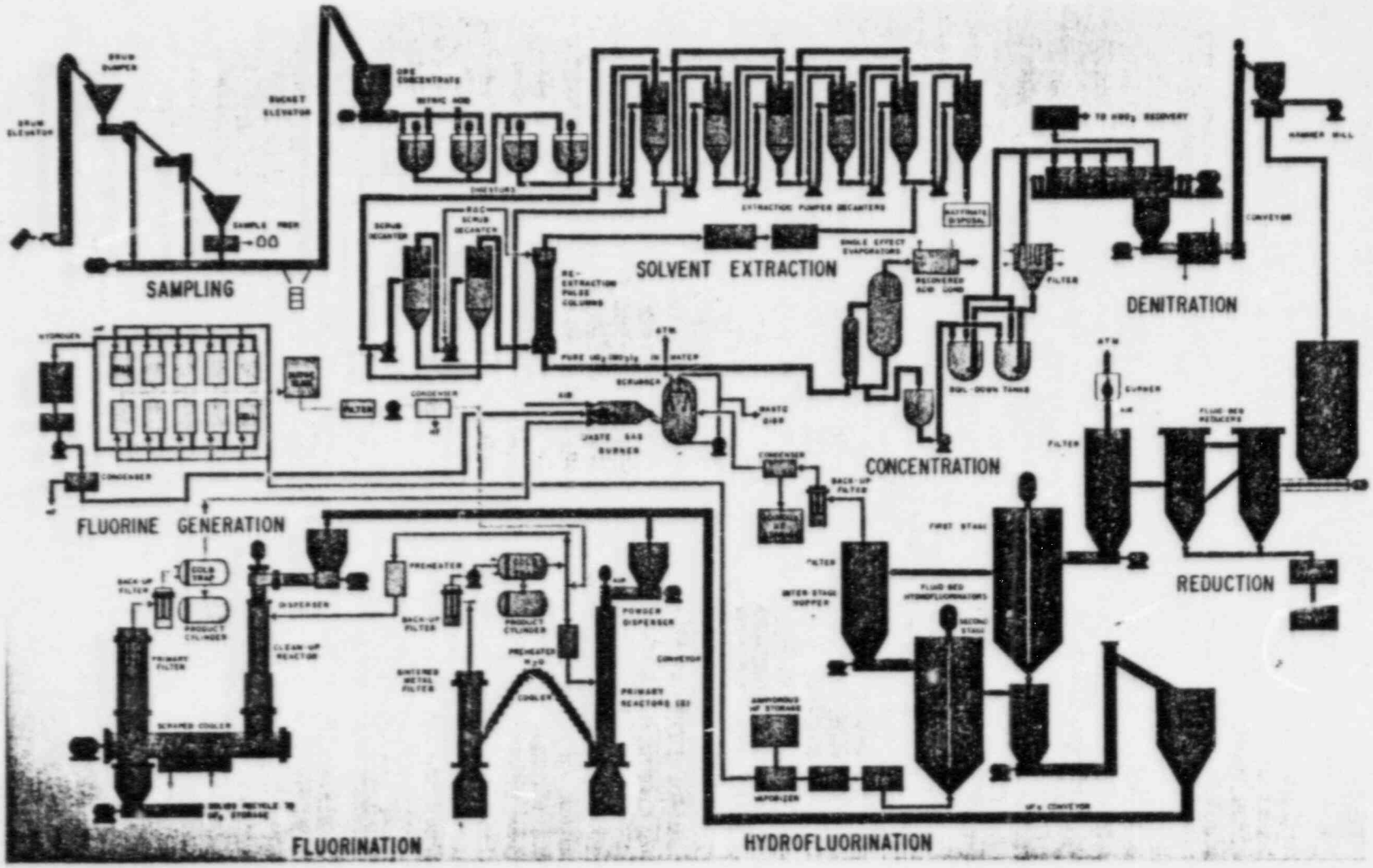

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FIGURE 1.1

SCHEMATIC PROCESS OUTLINE – SEQUOYAH CONVERSION FACILITY

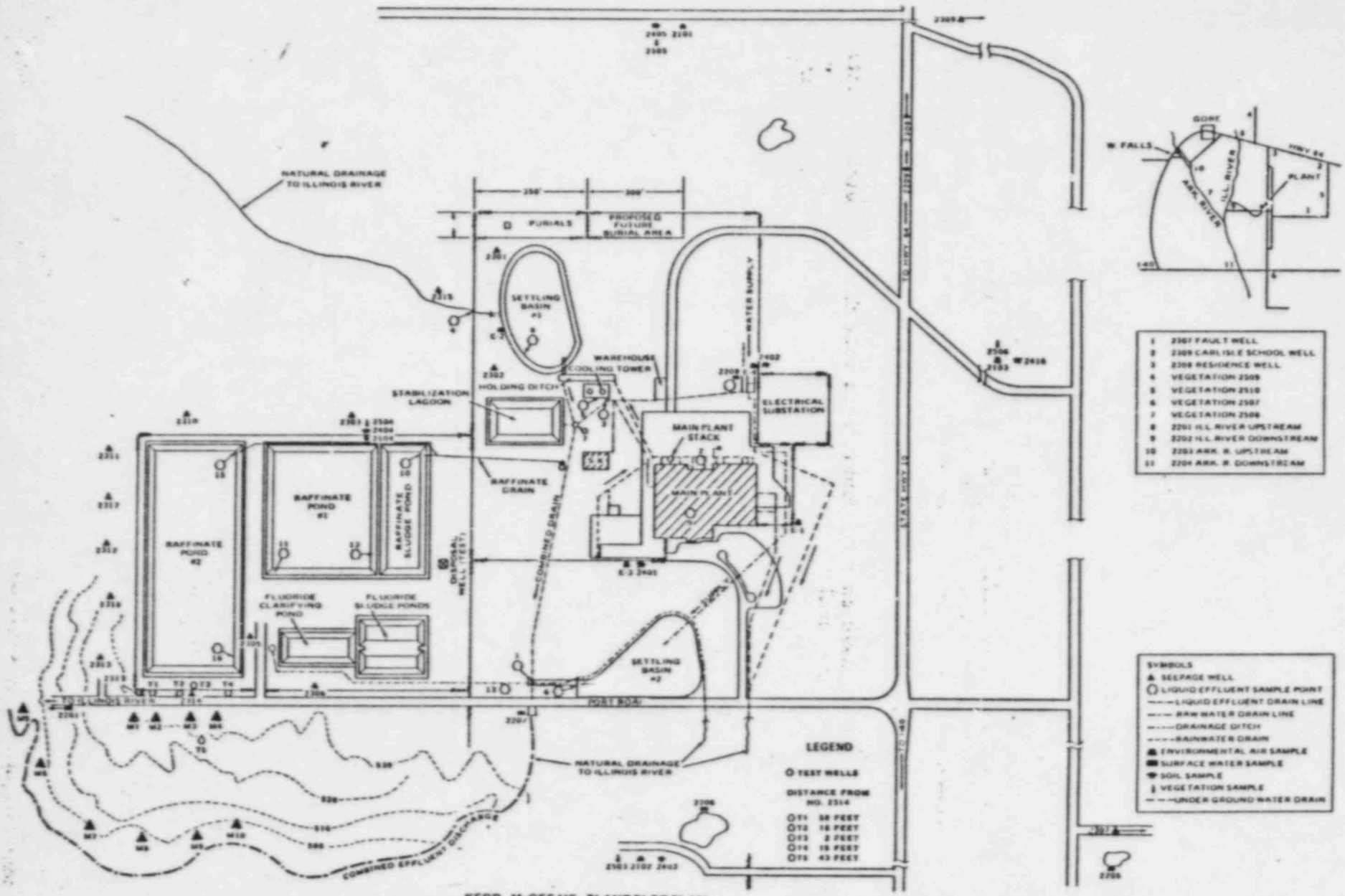
of extensive revisions required in response to USNRC questions and requests for additional information, a totally revised version of the June 27, 1975 application was submitted with forwarding letter dated January 12, 1977. Further modifications to the license application were submitted dated May 20, June 14 and August 19, 1977.

Kerr-McGee Nuclear Corporation is currently licensed to produce uranium hexafluoride by processing source material received as uranium ore concentrates in accordance with procedures described in their application dated September 23, 1970 as supplemented January 14 and February, 1970 and as modified by Amendment Nos. 1 through 8 issued over the period January 15, 1971 through May 4, 1977. In addition to requesting renewal of the existing license and authorization to double the plant production capacity, the current application as modified, requests authorization to receive plant feed as a yellowcake slurry and to dissolve the contained solids by circulating nitric acid through the stainless steel shipping container to produce the uranyl nitrate solution feed to the solvent extraction circuit.

1.2 Facilities

A plot plant of the immediate plant site as presently licensed is shown in Figure 1.2. The total area under roof comprised 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 the provisions of 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 uranium hexafluoride. Upon completion of the construction, the plant will be altered by the indicated additions shown in Figure 1.3. An additional modification not shown in Figure 1.3 is the proposed 1440 square foot building housing the slurry unloading system which will be located about 200 feet due west of the main process building. As shown, the major structures include the main building, occupying about 78,000 square feet (including the new fluorine cell room addition) containing the administrative offices and laboratory along with the ore concentrate sampling plant, the major processing and fluorine generation facilities, as well as utility and maintenance areas. The 150 foot main plant stock is located near the northwest corner of the building.

The solvent extraction facility is located in a separate 4,000 square foot building about 150 feet west of the main structure and north of the proposed yellowcake slurry unloading facility. A single story



KERR-McGEE UF_6 PLANT PLOT PLAN

FIGURE 1.2

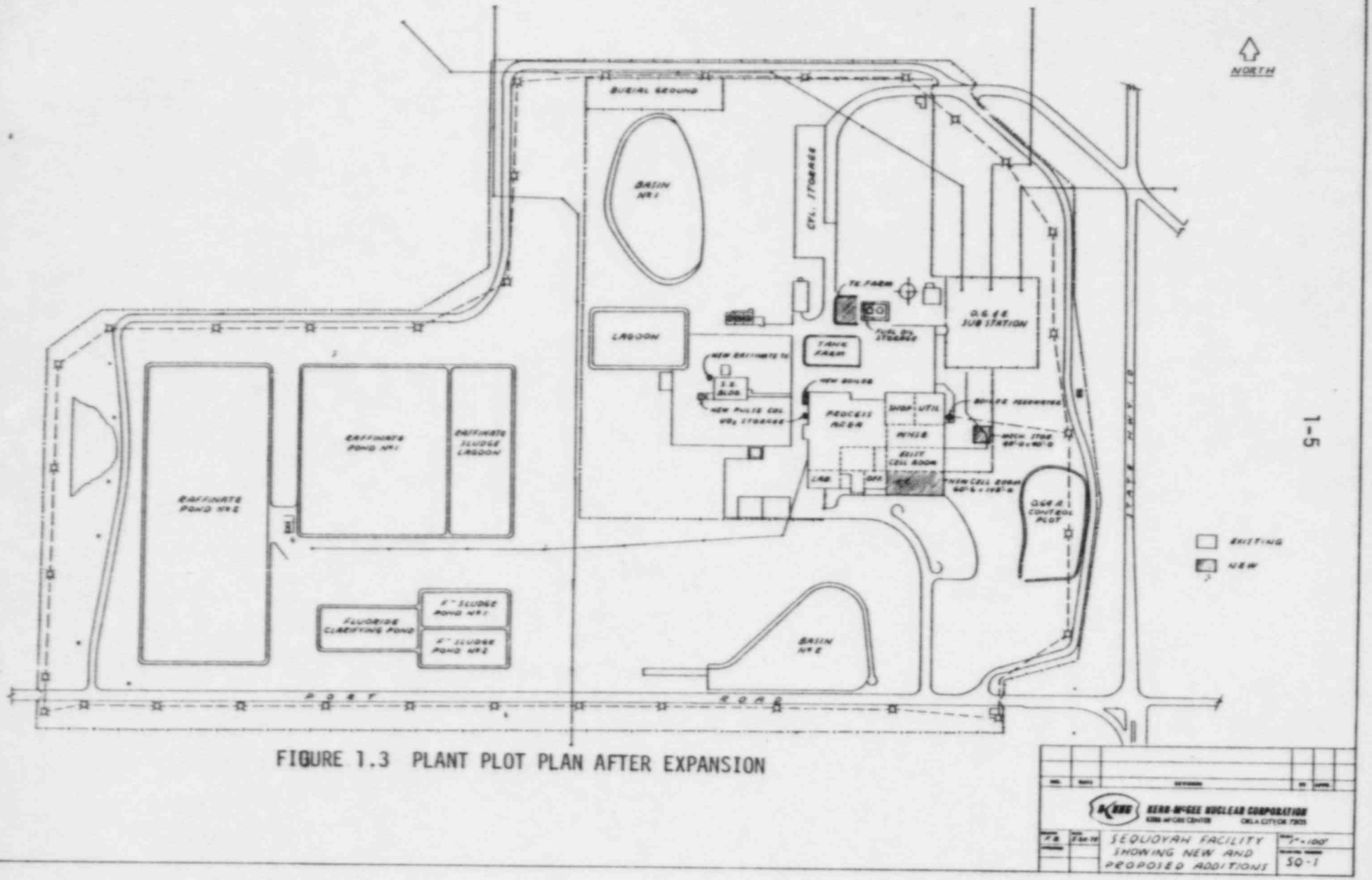


FIGURE 1.3 PLANT PLOT PLAN AFTER EXPANSION

warehouse is provided about 200 feet north of the main building and additional storage of mechanical spares will be provided by a new 1,600 square foot structure east of the building. There is a cooling tower about 150 feet north of the solvent extraction building and retention ponds for sanitary sewage, fluoride treatment and clarification and for raffinate storage are located to the west of the plant buildings.

Additional plant facilities include a large electrical sub-station, a UF_6 cylinder storage area and a chemical tank farm north of the main building and a drum storage area at the southwest corner of the building.

2.0 DISCUSSION

The safety review of Kerr-McGee's license renewal application included an evaluation of the revised application dated January 12, 1977 and supplements dated May 20, June 13 and August 19, 1977, a review of the facility compliance history, and a detailed review of the Kerr-McGee organization, administration and waste management and radiological safety programs. A listing of documents considered in conducting the safety review is presented in Appendix A.

All licensee submittals concerning the renewal application have been transmitted to R. J. Everett of the USNRC Office of Inspection and Enforcement Region IV staff for review and suggestions and comments discussed in telephone conversations on August 2 and September 19, 1977 have been incorporated in the present document. Further discussion in a meeting with Region IV, I&E staff on September 27, 1977 regarding the proposed license renewal action produced agreement between NMSS and I&E staffs that the proposed license would be readily enforceable and that it responded adequately to the requirement that it insure the health and safety of the employees and the general public.

Detailed review of the facility compliance history indicated that a total of seven formal inspections were conducted by USAEC and USNRC over the period April 1970 through June 1, 1977. In general, following the initial inspection in April 1970 and the follow-up inspection in October, 1970 when a number of non-compliance items were found, the compliance record has been reasonably good over the subsequent seven year period. No instances of non-compliance were found during the September 1971 and April 1973 inspections and a total of only six minor items of non-compliance were found during the July 1975, the July 1976, and the June 1977 inspections. Of these, two involved failure to provide required posting, two involved failure to conduct required audits and the two remaining violations involved failure to collect all required bioassay samples and using canisters on full facemask respirators that had not been approved by the U. S. Bureau of Mines.

In addition to the reviews reported above, the Sequoyah site was visited in September 1976 by J. B. Martin, J. E. Rothfleisch, and F. J. Witt (ODS) and again on September 26, 1977 by J. E. Rothfleisch to discuss safety and environmental matters related to the ongoing plant expansion and renewal of the facility license.

In their application, Kerr-McGee has demonstrated that they have the necessary technical staff with adequate qualifications to administer an effective and safe radiological safety program. The following

sections of this document present a description of Kerr-McGee's organization, administrative procedures and waste management and radiological safety programs as conducted by Kerr-McGee as well as additional conditions developed by the FCPF staff.

3.0 CONDUCT OF OPERATION

3.1 Management Organization

The Sequoyah UF_6 conversion facility is owned and operated by the Kerr-McGee Nuclear Corporation which is a wholly owned subsidiary of Kerr-McGee Corporation with headquarters in Oklahoma City, Oklahoma. The parent corporation is a fully integrated natural resource company which operates through its divisions and subsidiaries in oil and gas, contract drilling, uranium and nuclear fuels, plant foods, minerals and preserved wood products.

Responsibility for the safe, efficient operation and for the control of all materials at the Sequoyah Facility rests with the Facility Manager who reports to the General Manager, Manufacturing, Kerr-McGee Nuclear Corporation. The line authority for the operation of the facility flows from the Board of Directors through the President, Kerr-McGee Nuclear Corporation; the General Manager, Manufacturing and to the Sequoyah Facility Manager. At the plant site, the line authority is extended to the Production Manager for Operations and finally to the plant Shift Supervisors.

Operations at the Sequoyah Facility are administered by the General Manager through his immediate staff which includes the Manager of Production, the Manger of Conversion Engineering, the Manager of Maintenance and Construction, the Laboratory Manager and the Manager, Health Physics and Industrial Safety. Two additional staff members having no line functions are the Manager of Industrial relations and the Manager of Administration and Accountability. The Manager of Production has three area Supervisors and five Shift Supervisors reporting to him with the former responsible for the overall operation of a specific area of production and the latter responsible for activities of one shift of production operations. The Manager, Health Physics and Industrial Safety together with five Health Physics Technicians constitute the on-site group directly responsible for carrying out the facility health and safety program.

Administration of the health and safety program is directed at the corporative level by the Director, Regulation and Control through the Coordinator, Radiation Health and Safety. Thus the organizational structure provides for separate, independent, and parallel lines of authority for the production and the safety functions. To discharge these functions, the following responsibilities and personnel qualification requirements have been established:

- The General Manager, Nuclear Manufacturing who is also the Manager Sequoyah Facility, reporting to the President, Nuclear Corporation, has responsibility for all safety and all manufacturing and associated activities. He shall have had at least five years in management of manufacturing activities.

- The Manager of Conversion Engineering, reporting to the Sequoyah Facility Manager, provides and supervises engineering services to safely, efficiently and economically convert yellowcake to UF_6 through process design modification, process evaluations and the monitoring of operating conditions.

  Incumbent shall hold a degree in science or engineering with broad experience in chemical processing, uranium processing and chemical materials handling.

- The Manager of Production who reports to the Sequoyah Facility Manager is responsible for all operational activities at the Sequoyah Facility. Operating procedures, which specify operating steps within the approved health and safety standards and process and equipment criteria shall be prepared and maintained under his direction. He shall hold a bachelor degree in science or engineering demonstrated a proficiency to manage the operations of the Sequoyah Facility and to identify process changes which require health physics analysis.

- The Area Supervisor, reporting to the Production Manager, coordinates various activities within an assigned production area, providing technical assistance to shift supervisors and performing short and long range planning involving the overall operation of the assigned production area.

  Incumbent should have broad supervisory industrial chemical processing experience or a degree in science or engineering with a general background in the production and handling of uranium materials.

- Shift Supervisors report to the Manager of Production and it is their responsibility to assure that the operating procedures are followed in the performance of the production activities. Shift Supervisors shall have a bachelor degree with two years' experience in working with radioactive materials or a high school diploma with five years' experience in chemical plant processing. The

Sequoyah Facility Shift Supervisors shall be thoroughly familar with the uranium production activities and have thorough knowledge of the approved operating procedures.

- The Manager, Health Physics and Industrial Safety reporting to the General Manager, shall have at least two years' experience in radiation monitoring and personnel exposure evaluation. He shall have demonstrated a proficiency to: 1) conduct specified radiation safety programs, 2) recognize potential radiation safety problem areas in the operations, and advise operation supervision on radiation protection matters. He must also be capable of directing the surveillance activities of
- health physics technicians.

Responsibilities and required qualifications of corporative level personnel concerned primarily with health physics and industrial safety include the following:

- The Director of Regulation and Control, reporting to the General Manager, Engineering and Regulation, is responsible for establishing general guidelines for the criteria, standards and procedures of the nuclear health and safety subjects; for approving and recommending details of the criteria, standards and procedures developed under his supervision; for administering the health and safety audit and inspection activities; for the general policies of liaison with the regulatory agencies of the local, State and Federal governments; and for coordinating with operating Facility Managers matters concerning health and material safeguards. He shall hold an advanced degree in engineering or science, or its equivalent, with at least eight years in technical management, five of which involved nuclear activities where understanding of nuclear health and safety problems would have been developed.

- The Health and Safety Coordinator is responsible for preparation of detailed standards dealing with prevention of the spread of contamination, control of radiation, monitoring of personnel and facilities, and auditing the operations in the health physics area. He reports to the Director, Regulation and Control. He shall be professionally qualified with a bachelor degree in science or engineering and shall have had five years experience in assignment involving radiation protection. He shall be capable of providing authoritative advice and counsel in matters of health physics, industrial hygiene and industrial safety.

As borne out by past plant performance with respect to the facility safety record and compliance with licensing regulations, the indicated staff positions are filled by individuals qualified by education and experience to carry out their assigned duties.

3.2 Administrative Procedures

The following procedures have been developed and are currently in use by the licensee in efforts to ensure that operations at the Sequoyah Facility are conducted in a safe and efficient manner.

3.2.1 Work Permit System

The Sequoyah Facility utilizes a strict work permit system to ensure safe performance during all non-routine maintenance operations. No maintenance work is performed on process systems until approval is provided in writing by a duly authorized employee. All hazardous work permits issued by the Shift Supervisors involving potential releases of radioactive materials or other industrial safety hazards must be approved by the Manager, Health Physics and Industrial Safety or his designated Health Physics Technician. The maintenance work is not considered completed until it is inspected, checked out, and approved in writing by both maintenance and supervisory personnel.

3.2.2 Process and Equipment Control

Process and equipment design criteria which designate critical parameters are prepared under the direction of the Manager, Conversion Engineering. These are reviewed by the Manager, Health Physics and Industrial Safety, the Health and Safety Coordinator and the Manager, Sequoyah Facility and require approval by the President, Nuclear Corporation. The Manager, Sequoyah Facility or his designee may approve (in writing) minor modifications to facility procedures and instructions regarding installed equipment.

Experimental and developmental work performed at the Sequoyah Facility is described in writing by the Manager, Conversion Engineering, reviewed by the Manager, Health Physics and Industrial Safety and must be approved by the Facility Manager as well as by the President, Nuclear Corporation.

3.2.3 Operating Procedures

All operations at the Sequoyah Facility are conducted in accordance with written procedures covered in plant operating manuals. The Manager of Production is responsible for formulating, developing, and maintaining detailed plant operating procedures within approved criteria and standards. The operating procedures are reviewed by the Manager, Health Physics and Industrial Safety for conformance with the health and safety standards and must be approved by the Manager, Sequoyah Facility. Modifications to the operating procedures follow the same review and approval paths as original operating procedures. Independent audits of procedures are conducted quarterly by the Health and Safety Coordinator through the Director of Regulation and Control to assure compliance with license conditions and health and safety criteria and standards.

The Director of Regulation and Control is responsible for determining when operational changes fall outside the scope of the license conditions and to initiate license amendment applications to cover such changes.

3.2.4 Personnel Training

The facility training program is designed specifically to teach all operating and maintenance personnel the safe procedures for handling uranium containing materials and for operating the plant equipment. The training provided consists of both classroom instruction and on-the-job training with demonstrations of four basic program elements: (a) Radiation Safety, (b) Plant Circuit Operations, (c) Equipment Operation, and (d) Emergency Procedures.

Initial training for new employees includes a minimum of six hours of instruction relating specifically to health and safety presented in the form of lectures and demonstrations by health and safety personnel. Following the initial training phase and before the new employee receives his work assignment, the General Manager or his designee (Manager of Production or Manager of Conversion Engineering) discusses with the employee the importance of following radiation and industrial safety rules. A safety orientation check list is maintained as part of the employee's personnel file.

The Kerr-McGee employee safety handbook is reviewed with new employees and additional training in radiation safety, protective equipment, and emergency procedures is provided by Health Physics Technicians. Shift supervisors provide on the-job instruction for newly assigned personnel and emphasize safety hazards related to the new employee's specific job assignment. In addition, during the first month of in-plant training or after ten days in a specific job assignment, the Manager, Health Physics and Industrial Safety further instructs the new employees in contamination control, the respiratory protection program, the plant emergency warning system and in industrial safety matters.

Monthly safety meetings are conducted by the first line supervisor and/or Health Physics personnel to repeatedly remind employees of the importance of job safety. The Manager, Health Physics and Industrial Safety maintains a check list to ensure employee attendance and a record of the subject matter covered at each meeting.

3.2.5 Audits and Inspections

The licensee's procedure for internal inspection of the plant operations includes essentially continuous observation by cognizant supervisory personnel on multiple daily visits through the plant facility to ascertain that operations are conducted in accordance with standard procedures. In

addition, weekly housekeeping inspections are conducted by Health Physics Technicians whose reports include any health physics or safety problems observed during their inspections. The plant health physics programs and facilities are inspected quarterly by the Health and Safety Coordinator and the Manager, Health Physics and Industrial Safety with written reports of the inspections made to the Facility Manager and copies furnished to other involved management levels.

As part of the Sequoyah Facility commitment to maintain occupational radiation exposures as low as is reasonably achievable (ALARA), the Corporate Radiation Health and Safety Coordinator performs a quarterly formal audit, reviewing operating procedures, emergency procedures, survey and monitoring records, bioassay data, training records, past exposure records including incident reports, plant inspection reports, proposed plant or operational changes and environmental data. In addition, the activities of the Health and Safety staff are reviewed and the Health Physics monitoring instruments are inspected. One or more other ALARA committee members may accompany the Health and Safety Coordinator during this audit. The audit findings are written into a report which is distributed for comment to the committee members and others with a "need to know."

3.3 Radiation Safety

3.3.1 Radiation Safety Administration

The radiation protection program for the safe handling and processing of uranium materials as well as the control of all activities, personnel and equipment for radiation protection are the responsibility of the Sequoyah Facility Manager who reports to the President, Nuclear Corporation.

At the plant level, the Manager, Health Physics and Industrial Safety, reporting to the Sequoyah Facility Manager is responsible for administering all programs involving radiation safety, industrial safety, monitoring and surveillance of plant activities and environmental impact studies. Additional responsibilities include auditing health and safety activities, supervising the work of the five Health Physics Technicians implementing the facility health physics and industrial safety programs, and maintaining all radiation exposure and other required health and safety records.

At the corporate level, the Director, Regulation and Control through the Health and Safety Coordinator carries out an independent review function with the following responsibilities:

1. To establish the criteria and standards for contamination control and radiation protection for manufacturing processes and equipment.

2. To establish the standards for procedures to be followed by operations management in assuring that processes and equipment are operated in a way to prevent spread of contamination and radiation exposure.

3. To make periodic routine and non-routine inspections against the criteria, standards and procedures of the program.

4. To maintain technical liaison with regulatory agencies of local, State, and Federal governments.

5. To offer expert professional advice and counsel to Corporate and Facility Management in health and safety matters.

6. To procure as required special audit services, inspections or calculational capability for problems from qualified consultants or other divisions of Kerr-McGee when it appears that an adequate solution definition exceeds the capability of the staff.

All activities involving uranium materials are conducted in accordance with written and company approved health and safety standards. These standards specify the rules, principles and measures used at the Sequoyah Facility in the health physics safety program. They are prepared by the Health and Safety Coordinator under the direction of the Director, Regulation and Control who reviews them for license compliance. The standards are reviewed for operability by the Facility Manager and submitted for approval by the President, Nuclear Corporation. Changes to the health and safety standards require the same administrative procedures as the initiation of new standards. These standards serve as a guide for the Facility Health and Safety Manual prepared by the Manager, Health Physics and Industrial Safety, concurred in by the Production Manager and approved by the Manager, Sequoyah Facility. This manual provides operating procedures and instructions specifying contamination and radiation limits as well as safety requirements for the Sequoyah Facility and covers the entire health physics program.

3.3.2 "ALARA" Commitment

A ten man ALARA committee consisting of the Director, Regulation and Control (Chairman), the Health and Safety Coordinator (Secretary), the Corporate President, the Corporate General Manager, an engineer from the Physical Science and Measurement Department, the Sequoyah Facility Manager and his principal line staff meet as required to implement the Regulatory Guide 8.10 operating philosophy for maintaining occupational radiation exposures as low as is reasonably achievable. Meeting frequency is dictated by the findings of the quarterly audits conducted by the Health and Safety Coordinator and other committee members as described in paragraph 3.2.5 above with meetings scheduled by the committee chairman.

The ALARA philosophy is a written company policy which, together with the corporate radiation protection standards and facility instructions and procedures emphasizes the management objective to keep personnel exposure to a minimum.

Examples of recent improvements resulting from application of the "ALARA" philosophy include increasing the frequency of collecting air samples in processing areas from one per day to one per shift thus providing more rapid detection of minor leaks and more prompt repairs which should reduce the degree of exposure to airborne radioactivity. A second plant change that should produce decreased exposures to airborne activity is a recent decision to install more convenient, permanent breathing quality air pipelines in the main processing area in place of presently used bottled air which provides only limited use time for maintenance personnel.

These activities combined with the ongoing inspection and audits of plant operations, employee training, and the administrative procedures for frequent review of all operating procedures involving radiological safety matters, demonstrates the commitment of the Kerr-McGee management to the ALARA philosophy.

4.0 WASTE MANAGEMENT PROGRAM

4 1 Summary

In the staff evaluation of the Sequoyah Facility waste management program, the following areas were considered: (1) the capability of the liquid and gaseous waste treatment systems to maintain the levels of radioactive materials in effluents "as low as reasonably achievable," (2) the capability of these systems to maintain radioactive releases below the limits specified by USNRC in Part 20 of Title 10 of the Code of Federal Regulations, and (3) the provisions for monitoring and controlling waste materials in process and effluent streams.

Based on the staff evaluation of the plant facilities and procedures described below it was concluded that the above aspects of the gaseous, liquid and solid radwaste systems and associated process and effluent monitoring systems are acceptable at the present time and should be adequate under the expanded plant operations.

4.2 Waste Management Description and Evaluation

4.2.1 Gaseous and Airborne Particulate Waste Treatment

Operating areas having the potential for producing dusts, mists, or fumes containing radioactive or other toxic materials are provided with state-of-the-art pollution abatement or ventilation equipment designed to reduce occupational and off-site exposures to levels as low as reasonably achievable.

4.2.1.1 Plant Ventilation

Ventilation systems are provided throughout the manufacturing facility with special attention given to those areas having the potential for contamination with radioactive materials. Process areas in the manufacturing building are ventilated by forcing air into the building at a rate sufficient to provide 10 air changes per hour as the air is exhausted through eleven 3000 cfm powered vents as well as through non-powered roof hatches. Both vents and hatches are sampled to evaluate radioactive discharges to the atmosphere in accordance with 10 CFR 40.65.

Fumes from the fluorine cell maintenance area are discharged directly to the atmosphere by means of a 15,900 cfm exhaust fan.

The exhaust from each laboratory fume hood is conveyed to the sampling area roof through separate sampled ducts.

4.2.1.2 Dust Collection Systems

Equipment used to remove particulates from gas streams include cyclones, bag filters and porous carbon or porous metal filters. A central, all-purpose dust collection system is provided to service all dry-processing areas within the plant. Dust collection hoods are installed around packing glands, routinely-opened equipment, solids transfer areas and the discharge from special-duty dust collectors or vacuum systems. The size and shape of the hoods and the exhaust air velocities are all designed to obtain efficient collection of the generated dust. The dust collector is a 27,750 cfm, 5-zone plenum pulse (reverse jet), bag-type filter which discharges to the atmosphere through a monitored stack. Collected solids are drummed and recycled to process. The stack sampler operates continuously with a 24-hour sample collected and analyzed daily.

Four additional vacuum cleaning and dust collection systems providing separate vacuum sources, cyclone separators and bag filters are used in specialized plant areas. The sampling plant has separate vacuum cleaner and dust collection systems for recovery and direct recycle of spilled yellow cake with the filtered air from the vacuum cleaner discharged to the sample plant dust collector. Filtered air from this system in turn discharges to the main plant dust collector thus providing three stages of filtration. Two additional vacuum recovery systems each consisting of a cyclone, bag filter and vaccum pump in series are provided with both bag filters discharging to the main plant dust collector for backup filtration. One system termed the "Main Plant Vacuum System" services all areas after yellow cake sampling through the reduction area and discharges collected solids to the miscellaneous digester. The second unit, the "UF_4 Ash Vacuum System" services the hydrofluorination and fluorination areas with collected solids drummed for transfer to the Ash Grinding System. Both sytems are used for general plant clean-up in their respective service areas and for removal of uranium materials from equipment components prior to maintenance operations.

The entire ash grinding system provided for all-purpose crushing, pulverizing and screening of fluorination tower ash or other materials capable of direct recycle is housed in an enclosure which is vented to the Main Plant Dust Collection System.

4.2.1.3 Treatment of Off-Gases

The primary vent sytem for the digesters provides for removal of entrained dust and liquid from the off-gas vapor with return to the digestion tanks. The vent system discharges to the nitric acid recovery system where oxides of nitrogen are removed. The system is maintained at a slight negative pressure to prevent leakage to the atmosphere. Off-gas from the miscellaneous digester is processed through a water scrubbing system

and a caustic scrubber to remove nitrogen oxides, HF vapor, and entrained uranium or fluoride bearing liquids or solids. After scrubbing, the off-gas is routed to the nitric acid recovery system. Spent scrubber liquids are disposed of with the raffinate. Denitrator off-gases are scrubbed with nitric acid and then cooled before being fed to the nitric acid absorber.

Off-gases from the reduction system are vented through a sintered metal filter and a backup filter for 98% removal of 0.7 micron particles. Excess hydrogen is burned and vented to the steam boiler stack.

Gases passing through the hydrofluorinator back-up filter and HF condenser are combined with the off-gases from the waste gas burner servicing the fluorine plant and the fluorination system off-gases and are scrubbed with water before being vented to the atmosphere. The scrubber liquor is discharged to the fluoride treatment ponds.

As shown in Figure 1.1, the fluorination system uses a once through fluorine process with the UF_6 leaving the primary reactor through sintered metal filters and passing through a back-up filter before entering a primary cold trap. Residual gas is fed to a cleanup reactor with the UF_6 leaving this unit passing through two sintered metal filters and then into the secondary cold trap. Any gases leaving this unit are burned with hydrogen from the fluorine plant and treated as described above.

4.2.2 Liquid Waste Treatment

The Sequoyah facility plant process generates two major liquid waste streams. The raffinate stream leaving the solvent extraction circuit is primarily a solution of ammonium nitrate, nitric acid, heavy metal salts, and small quantities of uranium and the radioactive daughters of normal uranium decay. This liquid is combined with spent sodium hydroxide from the solvent treatment and the miscellaneous digester scrubber systems along with recovered weak acids. The liquid is neutralized with ammonia and impounded in two raffinate storage ponds.

The second liquid waste stream is generated primarily by the hydrofluorination system off-gas scrubber. This fluoride stream is combined with various other plant waste liquids and treated with slaked lime to neutralize the contained acid and precipitate the fluoride as calcium fluoride. The resulting sludge is allowed to settle in a retention pond, and the overflow is treated with sulfuric acid to adjust the pH and precipitate excess calcium as calcium sulfate. The clarified treated waste liquid overflows and is combined with clean intake water, sanitary wastes, and sewage lagoon

overflow in a concrete stilling basin before being discharged through a metering weir to the Illinois River via a natural watercourse. The total liquid discharge of about 1,600 gallons per minute at the present plant design capacity is expected to be increased to about 2,500 gallons per minute at the 10,000 STU/year production rate.

4.2.3 Solid Waste Disposal

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 treated in an enclosed incinerator discharging the combination products to the boiler stack. Uncontaminated non-combustible wastes are buried in accordance with the solid waste disposal regulations of the State of Oklahoma.

Radioactive waste materials such as scrapped equipment, gloves, respirators, and other contaminated solids are currently buried on site in accordance with the provisions of 10 CFR 20.304 or, in the case of drums, are being accumulated for disposal through a licensed steel scrap dealer.

Additional solid wastes generated include the contaminated calcium fluoride-calcium hydroxide-calcium sulfate sludge produced by lime neutralization of the HF scrubber products and pH adjustment with sulfuric acid. This material is disposed of by on-site burial.

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 metals. This sludge settles to the bottom of the raffinate storage ponds. Additional treatment of the supernatant liquid with barium chloride precipitates a mixture of barium and radium sulfates which is also allowed to settle, thereby removing most of the residual radioactivity from the liquid. Currently, a portion of the treated liquid is being disposed of by the test application as fertilizer over about 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 would 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.

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, the licensee shall continue his efforts to develop a permanent solution to the raffinate disposal problem that is acceptable to USNRC.

5.0 PERSONNEL MONITORING AND BIOASSAY PROGRAMS

5.1 Internal Exposures

Internal exposure of personnel is evaluated by a bioassay program based on analyses of urine samples by an independent laboratory. Routine samples are collected semi-monthly from personnel assigned to the process areas after periods of at least 24 hours away from the plant to determine slowly transportable uranium exposure. Additional special samples are collected after suspected or known exposures to excessive airborne uranium concentrations with samples collected during the 20-hour period after exposure to transportable uranium such as uranium hexafluoride or uranyl fluoride. Standard fluorometric techniques are used for sample analyses.

Employees submitting a routine or special sample (known to be non-transportable uranium) analyzing more than 100 µg uranium per liter are placed on work restriction until a subsequent sample analyzes less than 20 µg per liter. Employees whose urinary excretion concentration exceeds 20 µg uranium per liter are required to submit a second sample. If the second sample is found to contain more than 20 µg per liter, the employee is assigned to work not involving exposure to uranium and additional samples are taken daily until the level drops below 20 µg uranium per liter after which he may return to his regular work assignment.

Special samples are obtained in the event of accidental exposures to soluble uranium compounds such as UF_6 or UO_2F_2. In these cases, multiple voiding samples are taken over the 20-hour period following the exposure with voiding times recorded and uptake of uranium by the blood calculated. In the event that the maximum allowable uptake of 2.7 mg uranium is reached or exceeded during a seven-day period, medical examinations are conducted to determine whether kidney damage has occurred. All urine sample results in excess of the action levels are investigated by the Manager, Health Physics and Industrial Safety, to determine the cause and appropriate corrective action is taken.

Data presented by the licensee for the year 1974 covering routine samples taken from four classes of personnel; i.e., sampling plant operators, processing personnel, maintenance personnel, and all others, showed average urine uraniums ranging from 10.6 µg per liter for the "all others" category to 16.5 to 17.7 for the three other categories. These levels are considered to be well below the point at which one would expect a significant body burden of natural uranium. A review of bioassay data during the June 1977 inspection by I&E indicated no intakes exceeding those specified in 10 CFR 20.103(2).

Additional data presented by the licensee on urine sample data for persons involved in incidents in the years 1973, 1974, and 1975 (total persons 51, 22, and 32, respectively) indicated only two instances where the analyses indicated uranium concentrations in excess of 100 µg per liter and no cases in 1975 where analyses showed concentrations greater than 20 µg per liter.

In addition to the urine sampling program, the licensee conducts an in-vivo program where whole body counting is performed by contract to a specialist in these measurements on an annual basis for employees falling into the following categories:

1. Routine urinalysis shows consistently elevated concentrations of uranium.

2. Exposure to aerosols of Class Y uranium chemical forms (not present at the Sequoyah facility).

3. Previous in-vivo history shows a significant fraction of a body burden of natural uranium or U-235.

All other employees who normally work in radiation areas are counted once every two years. Office employees, or casual visitors who rarely enter the processing areas, are not normally counted unless they are accidentally exposed to a significant quantity of non-transportable airborne uranium.

In-vivo counting results in 1975 for 51 sampling plant operators, processing personnel, and maintenance employees indicated lung burdens ranging from 0 ± 0.5 to 14.3 ± 1.1 mgm U-Natural (average 2.5 ± 0.9 mgm U-natural) except for one employee whose lung burden from previous employment exposure to five percent enriched uranium masked the lung count for natural uranium. In 1976, the results for 52 employees ranged from 0 ± 0.2 to 8.8 ± 1.0 mgm U-natural (average 0.5 ± 0.5). The in-vivo data showed that in 1975 about 30 percent of the employees counted and in 1976 about ten percent of the employees counted had lung burdens greater than ten percent of the maximum permissible lung burden of about 25 mgm U-natural.

5.2 External Exposure Monitoring

Personnel whole body exposure to photon and beta radiation is measured using film badges and standard film evaluation techniques. The film badges, required to be worn by all personnel while in the plant, are supplied and evaluated at least monthly by an independent laboratory.

Review of personnel whole body exposure data for the years 1973, 1974, and 1975 involving 102, 103, and 113 employees respectively showed that the exposure to external radiation at the Sequoyah facility is not a significant

problem. The data showed that no doses in excess of 10 CFR 20 permissible limits (1.25 rem per quarter) were found with the maximum annual doses for the three-year period within the range of 0.5 to 0.75 rem per year and almost 97 percent of the monitored personnel receiving 500 mrems per year or less over the entire period.

In compliance with the provisions of 10 CFR 20.201, random field measurements of photon exposure rates are performed on a monthly basis, or more frequently if deemed necessary, in seven plant processing areas. Review of the licensee gamma survey records for the year 1973 through 1975 showed consistently low readings three feet from equipment surfaces in the solvent extraction, denitration, reduction and hydrofluorination areas and maximum readings of 80 millirems per hour on one occasion each in the digestion and equipment decontamination areas. On three out of 31 occasions, maximum readings in excess of 80 millirem per hour were obtained in the fluorination area; but based on the whole body dose records, employee occupancy time in the high radiation areas must be extremely low.

5.3 Airborne Radioactivity Monitoring

The licensee follows an air monitoring program that provides 36 air sampling stations at strategic work locations in the processing areas. Samples are collected at each station and airborne radioactivity is determined by total alpha emission measurements after a four-hour delay period. Sampler locations are selected as representative of work areas where the potential exists for exposing personnel to airborne contamination levels greater than 50 percent of the 10 CFR 20 maximum permissible concentration of uranium. All samplers are located at a height of four to seven feet above the floor and within six feet of work locations normally occupied for two or more hours per shift.

An independent vaccum system is used to pull the air samples through filter paper media at a nominal flow rate of at least one cfm. Samples are collected at each station every eight or 24 hours, and the papers are counted for alpha activity in a Nuclear Measurements Corporation Model PC-3A gas proportional counter after a four-hour delay period. Each worker is required to tabulate his work time in each area, and his MPC-hour exposure is then calculated for a seven-day exposure period.

In addition, the licensee supplements the working area air samples with breathing zone samples to evaluate individual exposures during the performance of specific jobs when it is estimated that peronnel exposures could exceed 25 percent of the applicable 10 CFR 20 limits.

When abnormal conditions occur which have the potential for causing high airborne concentrations, the air sample filter papers are changed and the affected area is posted for respirator use. Concentrations are calculated assuming that all of the particulates collected by the sampler were deposited during the abnormal period. After correcting the abnormality, the respirator use requirement is canceled.

The annual average airborne concentrations of natural uranium in the various plant operating areas for the years 1973, 1974, and 1975 are presented in Table 5.1. These data indicate that under normal operating conditions, the air activity throughout the UF_6 facility ranges from about 10 to 20 percent of the 10 CFR 20 maximum allowable concentration for natural uranium except for the miscellaneous plant areas such as the fluorine cell and cell repair areas, the shops, and the warehouse areas where the average concentration is about two percent of the 10 CFR 20 MPC.

TABLE 5.1

ANNUAL AVERAGE AIRBORNE RADIOACTIVITY
BY OPERATING AREAS

Operating Areas(s)	Sampler Numbers	Fraction of 10 CFR 20 MPC[1]		
		1973	1974	1975
Sampling Plant	1-5	.074	.056	.158
Digestion	6-9	.110	.125	.178
Denitration	10-12	.160	.103	.150
Reduction and Hydrofluorination	13-19	.107	.136	.183
Fluorination	20-30	.083	.136	.119
Misc. Areas[2]	32-36	.016	.026	.024
Plant Average	All	.086	.105	.133

(1) 10 CFR 20 MPC for U-natural = 1.0E-10 µCi/ml.

(2) Includes shops, stores and warehouse areas, fluorine cell and fluorine cell repair areas.

The staff review of tabulated monthly average and maximum airborne radioactivity at each of the 36 fixed air sample points for the same three year period indicate that while the maximum permissible limit of 1.0 E-10 μCi/ml was exceeded in numerous individual samples, on only one occasion did the average monthly level exceed MPC.

This occurred in December 1974 on the fourth floor of the fluorination area when the monthly average attained a value of 1.12 E-10 μCi/ml as the result of a UF_6 release due to failure of a pressure gauge on December 22, 1974.

A review of abnormal incidents causing airborne concentrations to exceed MPC by a factor of three over the period 1973 through 1975 showed a total of 6 incidents in the sampling plant ranging up to 5.4 times MPC; 7 incidents in the digestion area ranging up 5.1 times MPC; 5 incidents in the denitration area ranging up to 3.8 times MPC; 4 incidents in the reduction area ranging up to 4.8 times MPC; 8 incidents in the hydrofluorination area ranging up to 15 times MPC and 17 incidents in the fluorination area of which 13 ranged up to 10 times MPC. The remaining four abnormal incidents produced airborne concentrations equal to 640 times MPC for 10 minutes on 9/12/73; 760 times MPC for 6 minutes on 12/22/73; 264 times MPC for 30 minutes on 4/25/74; and 95 times MPC for 30 minutes on 5/21/75, The most serious exposures resulting from these incidents were 10.7 MPC-hr. to each of 4 employees during the September, 1973 incident and 7.6 MPC-hr to one employee during the December, 1973 incident.

From the staff review and I&E inspection of the airborne radioactivity monitoring program, it is the opinion of the staff that the program being conducted by the licensee is fully adequate to define the air activity levels in all working areas occupied by personnel where a potential exists for inhalation of airborne radioactivity.

5.4 Contamination Surveys

Routine measurements of surface contamination are made weekly throughout the plant to determine the degree of contamination control being obtained. Contamination measurements are performed using appropriate direct alpha survey techniques and standard smear surveys. The action level for plant operating areas is 2000 dpm/100 cm^2 "smearable" alpha contamination at which point prompt cleanup and decontamination is undertaken. Clean locker rooms, the plant lunchroom, offices, control room and the reception areas are maintained below 1000 dpm/100 cm^2 by direct alpha survey and below 500 dpm/100 cm^2 smearable. These values may be compared with the acceptable removable surface contamination level of 1000 dpm/100 cm^2 specified in USNRC Regulatory Guide 1.86, "Termination of Operating License for Nuclear Reactors" for the release of decontaminated equipment to unrestricted area.

5.5 Personnel Contamination Protection

All maintenance, operating, and laboratory personnel engaged in operations where possible contamination may be encountered are supplied with protective clothing. Coveralls, hard hats, safety shoes and safety glasses are worn routinely. Respirators, acid suits, shoecovers, hoods and face shields are available for work where special hazards exist. Gloves are worn routinely throughout the plant area.

The facility is divided into three control zones to prevent the spread of contamination: The Restricted Area includes the process buildings, the service and storage yards, the sanitary lagoon and settling basin #1 bounded by a security fence with access limited to employees and authorized visitors. Entrances are posted with appropriate signs and contamination and radiation levels are maintained low enough to permit personnel and vehicle entry with no special precautions such as protective clothing, film badges, etc.

Radiation Areas include contaminated or potentially contaminated areas within the restricted area to which access is controlled administratively and work is closely monitored by health physics and by supervisory personnel. Protective clothing and film badges are required in these areas. Personnel working here follow procedures designed specifically to confine contamination. These procedures include requirements to change clothing and washing exposed skin surfaces (or a hand and shoe survey) with decontamination to less than 500 dpm before leaving the area.

Controlled Zones are maintained within radiation areas in which handling of uranium powders or where maintenance on contaminated equipment and clean-up operations are performed. Temporary controlled zones may be set up in the event of accidental spills or when work is being done on contaminated equipment in the maintenance shop. Upon completing a task or work period in a controlled zone, workers vacuum clean their protective clothing before leaving the area if there is visible evidence of contamination.

In order to insure that contamination is not spread beyond the radiation area, before leaving the plant, personnel are required to remove their protective clothing on the "hot" side of the locker room and deposit it in special containers for delivery to the plant laundry where the coveralls are washed and dried and returned for reuse. Safety shoes are also removed and stored in "hot" lockers before the employee enters the "clean" side. Locker rooms are equipped with sinks and showers to provide for personnel

decontamination. All employees are indoctrinated in the procedures to be followed in the locker room and good personal hygiene practices are emphasized by the management. Plant visitors are required to put on a protective smock and shoe covers before entering the processing area and these are removed and left in the locker room before leaving the area.

Health Physics Technicians periodically conduct surveys and inspections at the end of the work shifts to check employee compliance with locker room procedures. The Manager of Health Physics and Industrial Safety schedules these unannounced inspections at monthly intervals. Inspection results are documented and employees violating procedures are reported to a supervisor and reindoctrinated.

In addition to the above, a respiratory protection program is conducted at the facility to assure compliance with the provisions of 10 CFR 20.103. Since Kerr-McGee was previously authorized to make allowance for respiratory protective equipment in computing exposures to airborne radioactivity, the requirement to bring the program into conformance with the requirements of paragraph (c) of this section is deferred until December 29, 1977.

During the June 1977 inspection of the facility, the respiratory protection program was reviewed and found to be in total compliance with the present license requirements. In addition, it was learned that on March 15, 1977, the facility manager had documented and issued a detailed policy statement covering all aspects of the new respiratory protection program and that a DOP aerosol test system had been purchased.

5.6 Airborne Effluents

Small quantities of radioactive effluents are released routinely during normal facility operations in the form of both soluble and insoluble uranium and uranium-daughter particulate matter generated at a number of points in the manufacturing process. These include uranyl fluoride produced by hydrolysis of traces of UF_6 passing through the product cold traps, as well as particles of yellow-cake, UO_3, UO_2 and UF_4 resulting from spills, leakage through packing glands or passage through the filters used in the vacuum cleaning and transfer systems.

Plant losses are determined from sampling data obtained daily from the laboratory sample preparation stack, the HF scrubber stack and the main dust collector stack with exhaust volumes from these sources measured at

least semiannually. The main plant stack is sampled twice each week and losses are calculated based on the design flow. Losses through the eleven powered roof vents are based on rated capacity of the fans and air samples obtained from one of the powered vents daily. Additional losses through the roof hatches are based on calculated air flows through the hatches and a daily sample taken from the centermost roof hatch. Air effluent samples are counted for gross alpha.

Ambient air samples are collected weekly, at the closest unrestricted area to the plant at State Highway 10 about 750 feet east of the main process building and at an on-site location in the direction of the prevailing wind one-half mile south west of the plant. Samples collected at these points are composited quarterly and analyzed for gross alpha, uranium, Th-230 and Ra-226. Ratios of these nuclide concentrations to the gross alpha concentrations are applied to the gross alpha values obtained in the stack samples to calculate the plant releases of the individual radionuclides.

Additional sources of minor quantities of airborne radioactive effluents are the discharges from the chemical laboratory hoods and from a submerged combustion evaporator located between the raffinate ponds and operated periodically to increase raffinate evaporation. Analyses of the stack effluents showed the concentrations to be about 0.2 percent of the 10 CFR 20 allowable limits for uranium, thorium and radium.

The licensee also takes ambient air samples along the restricted area fence line at the cardinal points of the compass and particulate matter is counted daily for total alpha activity. Average monthly concentrations of these 24 hour ground level fenceline samples for the years 1974 and 1975 showed all values to be well below the 10 CFR 20 unrestricted area MPC of 5×10^{-12} µCi/ml with the highest level for the two year period occurring at one sampler in July 1975 indicating a concentration of 7.5×10^{-13} µCi/ml or 15% of MPC.

Data furnished by the licensee indicated that the total emissions of airborne uranium from plant operations in 1976 with the plant operating at about 4250 STU/year amounted to about 1.5×10^{-3} µCi/sec. Releases at the expanded plant rate of 10,000 STU/year are estimated at about 2.5×10^{-3} µCi/sec U-natural which, together with the estimated Th-230 and Ra-226 releases would produce a calculated whole body dose of .083 millirem per year and a maximum organ dose of 1.71 millirem per year to the closest resident located about one-half mile northeast of the plant stack compared with the USEPA permissible doses of 25 millirem per year.

5.7 Liquid Effluents

The Sequoyah facility 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 two primary process waste streams are the solvent extraction circuit raffinate and the waste hydrogen fluoride scrubber product which are joined by other small waste streams generated in the plant process.

Of the two, only the treated fluoride stream is discharged off-site. Most of this stream is initially a dilute solution of hydrofluoric acid produced in the hydrofluorinator off-gas scrubber system. Other constituents include laboratory wastes, fluoride cell rework sludges and wastes from the anhydrous HF vaporizer. The combined fluoride stream is treated with lime to raise the pH to about 12 and the neutralized slurry flows to a sludge pit where most of the excess lime and precipitated calcium fluoride settles out. The sludge pit overflow is treated with sulfuric acid to obtain a pH of 6 to 8 and the resulting slurry is fed to a clarifying lagoon where any remaining suspended calcium fluoride and the precipitated calcium sulfate settle out. The neutral clarified waste overflow is then combined with plant cooling water, bypassed plant water intake and sewage lagoon overflow and the combined stream is discharged to the Illinois River. A concrete stilling basin provided at the combination point allows for mixing and sampling, and a calibrated flume is provided for metering the total plant discharge.

A continuous sampler is used to collect 8-hour samples at a rate of 5 ml/min. The 8-hour samples are composited daily for chemical analyses required under the NPDES permit and are composited into monthly samples for gross-alpha counting and fluorometric analysis of uranium. Quarterly composites of the monthly samples are analyzed for thorium and radium.

Based on 1974 effluent data, the projected concentration of uranium in the liquid effluent with the plant operating at the expanded rate of 10,000 STU per year 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 potential maximum doses to an individual from Illinois River water downstream of the plant outfall are conservatively estimated as .071 millirem per year to the whole body, 0.25 millirem per year to the kidney and 1.1 millirem per year to the bone. As a consequence, the radionuclide content of the liquid effluent is not considered by the staff as representing any appreciable risk to the environment at present or projected plant production rates.

5.8 Compliance Inspection Results

A total of seven formal inspections were conducted by USAEC and USNRC from the time of plant startup in 1970 through June 1977. Following the initial inspection in April 1970 and the follow-up inspection in October 1970 when a number of discrepancies were found, the plant compliance record has been quite good over the subsequent seven year period. No instances of noncompliance were found during the September 1971 and April 1973 inspections and a total of only six minor items of non-compliance were found during the July 1975, the July 1976 and the June 1977 inspections. Of these, two involved failure to provide required posting, two involved failure to conduct required audits and the two remaining violations involved failure to collect all required bioassay samples and using canisters on full facemask respirators that had not been approved by the Bureau of Mines.

By letter dated October 21, 1976 the Oklahoma State Department of Health, Air Quality Service reported that a review of their files indicated that the Sequoyah Facility was in compliance with all State Air Regulations. The licensee has been requested to notify this state agency of the proposed plant production expansion and to request authorization for the expected increase in facility airborne effluents.

USEPA has reported that over the period August 1, 1976 (initial effective date) through mid-August 1977, the Sequoyah Facility has been in essentially complete compliance with the provisions of their National Pollutant Discharge Elimination System (NPDES) permit.

5.9 Conclusion

As a result of the findings in the review of the licensee's application and license compliance history, the staff has concluded that Kerr-McGee Nuclear Corporation employs the necessary technical staff to administer an effective and safe radiation protection program. Conformance by Kerr-McGee to their proposed method of operation combined with the conditions developed by FCPF staff should ensure safe operation and also ensure that unfavorable trends or effects can be readily detected by the licensee or by I&E for corrective action.

6.0 ENVIRONMENTAL MONITORING

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.

6.1 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 1,000 foot and 6,000 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.

6.2 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 sytem, and the by-passed plant intake water is 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.

7.0 EMERGENCY PLANNING

In the Emergency Section of the facility Standard Operating Instructions, the licensee describes in detail the action to be taken, personnel responsibilities, and safety considerations for each significant abnormal incident including the following:

- Electrical Failure
- Steam Failure
- Instrument Air Failure
- Nitrogen Supply Failure
- Water Supply Failure
- HF Release
- UF_6 Release
- Fluorine Release
- Fire
- Severe weather conditions

In addition, the licensee has described in detail in his application the mechanical systems, services and safety equipment utilized at the Sequoyah Facility in order to minimize the exposure of employees, the general public and the environment to hazardous materials. The licensee states that all designs, equipment and procedures conform to applicable Federal, State and local codes and insurance requirements currently in effect.

Specialized system designs are provided throughout the plant process to minimize the probability of accidents and additional systems are provided to minimize the effects of accidents in the event that they do occur. Items in the latter category include FM radio communication system, an automatically actuated emergency signal system, emergency power systems, emergency breathing air supply and emergency safety shower and eye wash stations located throughout the facility.

The electrical installation in the Solvent extraction plant is approved for Class I, Division I, Group D hazardous service. The electrical installation in the process building within 10 feet horizontally of all piping carrying hydrogen and all equipment vertically above the piping is approved for Class I, Division 2 service.

7.1 Fire Protection System

Fire protection for the facility is divided into two areas; Yard, including all uncovered areas; and Buildings, covering all areas not included under Yard. All design is in accordance with National Fire Protection Association Codes and approved by Factory Insurance Association. Hazardous chemicals are stored in diked areas as required by applicable fire codes.

By letter dated March 5, 1975 the Office of the Okalahoma State Fire Marshall reported having examined the plans for expansion of the Sequoyah Facility and concluded that the new construction is "in substantial compliance with all State-adopted codes."

7.1.1 Solvent Extraction Plant Fire Protection

The original plant design considered the Sx process as a special hazard and located the building more than 100 feet from the main building.

The Sx plant building is equipped with a foam system purchased and installed in accordance with Standards 11 and 16 of NFPA Code for Foam and Solvent Extraction Processes. The final test of the system was witnessed and approved by the F.I.A. Nuclear Energy Liability Insurance Association and Nuclear Energy Property Insurance Association in November 1971.

7.1.2 Yard System

The yard fire water system provides a 10-inch main looped around the main process building, an 8-inch main looped around the Sx building and 6-inch laterals serving 9 hydrants spaced a maximum of 300 feet apart. Each hydrant station is equipped in accordance with the National Fire Code.

7.1.3 Buildings

Non-combustible construction is used throughout the facility in accordance with applicable State and municipal codes. Fire protection in the main process building is provided by 43 wall-mounted extinguishers and by automatic sprinklers provided over the electrical cable trays and over the diesel fire pump and the emergency generator diesel engine. Protection for the Sx building is provided by the temperature actuated foamwater system and by 7 wall-mounted chemical extinguishers located in the Sx area.

Further details of the facility fire protection system and the fire water supply are provided in the licensee's renewal application.

7.2 Spill Prevention Control and Countermeasure Plan

In compliance with the USEPA regulation 40 CFR 112 covering Oil Pollution Prevention, the Sequoyah Facility has implemented a SPCC plan with the Sequoyah Facility Manager designated as the individual accountable for oil spill prevention.

The plan covers the procedure to be used for reporting to the Oklahoma Water Resources Board all discharges of oil or hazardous chemical substances that degrade or threaten the waters of the State of Oklahoma. In addition, the plan described in detail the personnel having the responsibility for reporting the spill incident.

The staff has reviewed the licensee's plant designs and plans for dealing with emergencies. After considering the limited potential impact of the maximum credible accident in a chemical facility processing low specific activity material, the staff has concluded that reasonable assurance is provided that appropriate protective measures can be taken within and beyond the site boundary in the event of a serious accident.

8.0 FACILITY SECURITY

Access to the plant area is controlled by a barbed-wire topped 6-foot chain link fence completely surrounding the facility restricted area with security guards on duty 24 hours per day. All equipment and scrap that has been exposed to radioactive materials inside the facility controlled area is subjected to a radiation survey by a member of the Health Physics and Industrial Safety Department before removal to an unrestricted area is permitted.

On the basis of observations and discussion with plant personnel, the staff concludes that the licensee's arrangements compare favorably with those used by other facilities processing low specific activity materials and are satisfactory for the prevention of unauthorized entry to or the unauthorized removal of radioactive materials from the plant area.

9.0 SUMMARY AND CONCLUSIONS

Kerr-McGee Nuclear Corporation is currently licensed to produce uranium hexafluoride by processing source material received as dry uranium ore concentrates in accordance with procedures described in their application dated September 23, 1969, as supplemented January 14 and February 3, 1970. There is no limitation placed on the quantity of source material which the licensee may possess under the existing license SUB-1010.

By letter dated January 24, 1975, the licensee requested renewal of the present license and on June 27, 1975, a revised renewal application was submitted requesting in addition, authorization to increase the plant capacity to 10,000 short tons per year of uranium as UF_6. A revised version of the June 27, 1975, application was resubmitted with forwarding letter dated January 12, 1977, in response to staff questions and requests for additional information. Additional modifications to the application were submitted dated May 20, June 14 and August 19, 1977.

In order to evaluate the licensee's capability for conducting the facility operation in a manner designed to protect the health of the employees and the general public and to minimize danger to life and property, the renewal application and other pertinent documents were reviewed by the staff with regard to meeting the criteria set forth in Paragraph 40.32 and in Parts 19 and 20 of Title 10 Code of Federal Regulations. The specific factors appraised related to management organization, administrative controls, facilities and equipment, safety programs and procedures and a review of the operating history of the facility. Since an accident analysis of the facility was conducted and reported in the Final Environmental Statement for the facility in February 1975 (NUREG-75/007) and is addressed further in an environmental impact appraisal conducted in conjunction with the major plant modification and license renewal applications, the potential effects of accidents are not covered in the present document.

Based on a review of the application, other pertinent documents, and the licensee's compliance history, the staff concludes that:

1. The issuance of a revised license, subject to certain conditions, would not be inimical to the common defense and security or to the health and safety of the public.

2. The licensee meets the requirements of the Atomic Energy Act of 1954, as amended (Act), and the regulations of the Commission in that, in accordance with the provisions of 10 CFR Part 40.32:

a. The application is for a purpose authorized by the Act;

b. The licensee is qualified by reason of training and experience to use the source material for the purpose requested in such manner as to protect health and minimize danger to life or property; and

c. The licensee's equipment, facilities and procedures are adequate to protect health and minimize danger to life or property.

3. By virtue of having operated his facility from October 1970 through mid-June 1977 in such a manner as to result in only six minor items of non-compliance found during five formal inspections by the USNRC Office of Inspection and Enforcement, the licensee is considered to have demonstrated the ability to conduct the operation in substantial compliance with Commission regulations and license specifications and conditions.

The staff recommends that the Kerr-McGee Nuclear Corporation License No. SUB-1010 be revised to incorporate reference to the statements, representations, procedures, and conditions contained in the application dated January 12, 1977 and supplements dated May 20, June 14, and August 19, 1977 and be reissued for a full five-year period subject to the following new conditions:

a. The licensee will be permitted to use the existing surface ponds for storing neutralized raffinate only until December 31, 1980. At this time all discharges into the ponds shall cease and all liquids and radioactive sludges in the ponds shall be removed and disposed of in a manner approved of by the Commission. In the event that additional ponding capacity is needed prior to December 31, 1980, the new pond installation will require a license amendment and the construction must comply with Regulatory Guide 3.13 entitled "Guide for Acceptable Waste Storage Methods at UF_6 Production Plants" or equivalent.

b. In addition to the monitoring programs committed to by the licensee in his application and supporting documents, all plant airborne discharges having the potential for containing fluorides and radioactive materials shall be sampled at least quarterly during normal plant operation over a sufficient period of time to provide a reliable indication of the fluoride release levels at current and projected UF_6 production rates and to verify that the licensee's proposed method for determining

the quantity of each of the principal radionuclides released to unrestricted areas in gaseous effluents as required for compliance with 10 CFR 40.65 will provide acceptably accurate estimates. Isotopic analyses shall be performed for uranium Th-230 and Ra-226 for this program.

c. In order to evaluate the effect of the liquid plant effluent on aquatic biota, the licensee shall obtain samples of bottom sediments upstream and downstream of the point where the plant outfall discharges into the Robert S. Kerr reservoir. Initial samples shall be taken as soon as practicable after issuance of this document and at semi-annual intervals thereafter until conclusive results are available. Samples shall 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 shall be made on these samples. Reports of initial findings shall be submitted for evaluation as soon as available. Results of subsequent sample analyses shall be made available during routine facility inspections.

d. Within 6 months of the issuance of this license, the licensee shall submit a plan for the future decontamination of the place of use and site authorized by this license so that they can be released for unrestricted use. This submittal shall identify and discuss the factors that were considered in the design of the plan in sufficient detail to enable an independent review. The plan shall include an estimate of the costs involved and the financial arrangements that have been or will be made to insure that adequate funds will be available to cover these costs at the time of decommissioning. In considering alternatives for these financial arrangements, the licensee shall specifically include the posting of a performance bond as a means of assuring availability of adequate funds.

e. The licensee is authorized a special exception to the provisions of 10 CFR 20.304(a) and (c) in that individual burials of fluoride sludge containing a larger quantity of radionuclides than specified in Appendix C is permitted at less frequent intervals but not to exceed 12 times the allowable monthly quantity to be buried in a single year. This exception is granted on an individual burial basis provided that documented

surface radiation measurements above each burial site prove to be no more than 50% higher than the background level of the surrounding offsite area after implementation of the approved decommissioning plan.

J. E. Rothfleisch
Fuel Processing & Fabrication Branch
Division of Fuel Cycle and
Material Safety

Approved by: L. C. Rouse

L. C. Rouse, Chief
Fuel Processing & Fabrication Branch

APPENDIX A

Review Documents

The following documents were reviewed during the course of conducting the present safety evaluation. These documents constitute all significant requests for, and submittals of, pertinent information supporting the license renewal application and the inspection compliance reports for the facility.

- Letter, Kerr-McGee Nuclear Corporation, to USNRC dated January 24, 1975 forwarding a timely application for renewal of Source Material License No. SUB-1010 having an expiration date of February 28, 1975.
- Letter, Kerr-McGee Nuclear Corporation, to USNRC dated June 27, 1975 forwarding amended application for license renewal covering proposed doubling of plant capacity from 5,000 STPY-Uranium to 10,000 STPY-Uranium.
- Letter, USNRC to Kerr-McGee Nuclear Corporation, dated October 8, 1976 forwarding copy of September 27-28, 1976 trip report and comments, questions and request for additional information regarding renewal application.
- Letter, Oklahoma State Department of Health to USNRC, dated October 21, 1976 reporting Kerr-McGee facility in compliance with all State Air Regulations.
- Letter, Oklahoma Water Resources Board to USNRC, dated November 3, 1976 forwarding copy of "Reconnaisance Inspection" conducted January 20-21, 1976.
- Letter, United States Environmental Protection Agency to USNRC, dated November 22, 1976 forwarding copy of NPDES Permit No. OK0000191 covering the Sequoyah facility.
- Letter, Kerr-McGee Nuclear Corporation, to USNRC dated January 12, 1977 responding to October 8, 1976 request in the form of a complete replacement of the June 27, 1975 amended application.
- Letter, Kerr-McGee Nuclear Corporation, to USNRC dated May 20, 1977 forwarding modifications to renewal application covering revisions in organization and personnel responsibilities for plant operation.

- Letter, Kerr-McGee Nuclear Corporation, to USNRC dated June 14, 1977 forwarding revision to renewal application adding proposed new method for receiving plant feed as yellowcake slurry.

- Kerr-McGee Nuclear Corporation environmental information regarding estimated impacts at the proposed expanded production rates submitted over the period September 11, 1975 to September 1977.

- USAEC-USNRC Compliance File covering seven inspections conducted over the period April 29, 1970 through June 17, 1977.

- USAEC-USNRC Region IV Reports of Inspections held in April 1970, October 1970, and June 1977.