FORM AEC-2
(3-64)

FORM APPROVED
BUREAU OF BUDGET NO. 38-R0002

UNITED STATES ATOMIC ENERGY COMMISSION

APPLICATION FOR SOURCE MATERIAL LICENSE

Pursuant to the regulations in Title 10, Code of Federal Regulations, Chapter 1, Part 40, application is hereby made for a license to receive, possess, use, transfer, deliver or import into the United States, source material for the activity or activities described.

1. (Check one)
   - ☐ (a) New license
   - ☐ (b) Amendment to License No. ______
   - ☒ (c) Renewal of License No. SUB-1010
   - ☐ (d) Previous License No. ______

2. NAME OF APPLICANT
   Kerr-McGee Nuclear Corporation

3. PRINCIPAL BUSINESS ADDRESS
   McGee Tower Center
   Oklahoma City, Oklahoma 73125

4. STATE THE ADDRESS(ES) AT WHICH SOURCE MATERIAL WILL BE POSSESSED OR USED
   Kerr-McGee Nuclear Corporation Sequoyah Facility located 2.5 miles southeast of Gore, Oklahoma, off Highway 64, Sequoyah County

5. BUSINESS OR OCCUPATION
   Natural Resources from exploration to Marketing

6. (a) IF APPLICANT IS AN INDIVIDUAL, STATE CITIZENSHIP
   N/A
   (b) AGE
   N/A

7. DESCRIBE PURPOSE FOR WHICH SOURCE MATERIAL WILL BE USED
   Natural Uranium - Refining of uranium from ore concentrate (yellowcake) and conversion to pure uranium hexafluoride (UF_6)

   Depleted Uranium - Storage of toll enrichment tailings as UF_6.

8. STATE THE TYPE OR TYPES, CHEMICAL FORM OR FORMS, AND QUANTITIES OF SOURCE MATERIAL YOU PROPOSE TO RECEIVE, POSSESS, USE, OR TRANSFER UNDER THE LICENSE

(a) TYPE	(b) CHEMICAL FORM	(c) PHYSICAL FORM (Including % U or Th.)	(d) MAXIMUM AMOUNT AT ANY ONE TIME (in pounds)
NATURAL URANIUM	Principally oxides nitrates & fluorides of uranium.	Solid - ca 88% U Liq.&Gas - 67.6% U	Unlimited
URANIUM DEPLETED IN THE U-235 ISOTOPE	UF_6	Solid - 67.6% U	Unlimited
THORIUM (ISOTOPE)	-	-	-

(e) MAXIMUM TOTAL QUANTITY OF SOURCE MATERIAL YOU WILL HAVE ON HAND AT ANY TIME (in pounds)
Unlimited

9. DESCRIBE THE CHEMICAL, PHYSICAL, METALLURGICAL, OR NUCLEAR PROCESS OR PROCESSES IN WHICH THE SOURCE MATERIAL WILL BE USED, INDICATING THE MAXIMUM AMOUNT OF SOURCE MATERIAL INVOLVED IN EACH PROCESS AT ANY ONE TIME, AND PROVIDING A THOROUGH EVALUATION OF THE POTENTIAL RADIATION HAZARDS ASSOCIATED WITH EACH STEP OF THOSE PROCESSES.

   See attached supplement.

10. DESCRIBE THE MINIMUM TECHNICAL QUALIFICATIONS INCLUDING TRAINING AND EXPERIENCE THAT WILL BE REQUIRED OF APPLICANT'S SUPERVISORY PERSONNEL INCLUDING PERSON RESPONSIBLE FOR RADIATION SAFETY PROGRAM (OR OF APPLICANT IF APPLICANT IS AN INDIVIDUAL).

    See attached supplement.

11. DESCRIBE THE EQUIPMENT AND FACILITIES WHICH WILL BE USED TO PROTECT HEALTH AND MINIMIZE DANGER TO LIFE OR PROPERTY AND RELATE THE USE OF THE EQUIPMENT AND FACILITIES TO THE OPERATIONS LISTED IN ITEM 9. INCLUDE: (a) RADIATION DETECTION AND RELATED INSTRUMENTS (including film badges, dosimeters, counters, air sampling, and other survey equipment as appropriate. The description of radiation detection instruments should include the instrument characteristics such as type of radiation detected, window thickness, and the range(s) of each instrument).

    See attached supplement.

    (b) METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED IN (a) ABOVE, INCLUDING AIR SAMPLING EQUIPMENT (for film badges, specify method of calibrating and processing, or name supplier).

    See attached supplement.

11(c). VENTILATION EQUIPMENT WHICH WILL BE USED IN OPERATIONS WHICH PRODUCE DUST, FUMES, MISTS, OR GASES, INCLUDING PLAN VIEW SHOWING TYPE AND LOCATION OF HOOD AND FILTERS, MINIMUM VELOCITIES MAINTAINED AT HOOD OPENINGS AND PROCEDURES FOR TESTING SUCH EQUIPMENT.

See attached supplement

12. DESCRIBE PROPOSED PROCEDURES TO PROTECT HEALTH AND MINIMIZE DANGER TO LIFE AND PROPERTY AND RELATE THESE PROCEDURES TO THE OPERATIONS LISTED IN ITEM 9. INCLUDE: (a) SAFETY FEATURES AND PROCEDURES TO AVOID NONNUCLEAR ACCIDENTS, SUCH AS FIRE, EXPLOSION, ETC., IN SOURCE MATERIAL STORAGE AND PROCESSING AREAS.

See attached supplement

(b) EMERGENCY PROCEDURES IN THE EVENT OF ACCIDENTS WHICH MIGHT INVOLVE SOURCE MATERIAL.

See attached supplement

(c) DETAILED DESCRIPTION OF RADIATION SURVEY PROGRAM AND PROCEDURES.

See attached supplement

13. WASTE PRODUCTS: *If none will be generated, state "None" opposite (a), below. If waste products will be generated, check here* [X] *and explain on a supplemental sheet:*

(a) Quantity and type of radioactive waste that will be generated.

(b) Detailed procedures for waste disposal. See attached supplement

14. IF PRODUCTS FOR DISTRIBUTION TO THE GENERAL PUBLIC UNDER AN EXEMPTION CONTAINED IN 10 CFR 40 ARE TO BE MANUFACTURED, USE A SUPPLEMENTAL SHEET TO FURNISH A DETAILED DESCRIPTION OF THE PRODUCT, INCLUDING: N/A

(a) PERCENT SOURCE MATERIAL IN THE PRODUCT AND ITS LOCATION IN THE PRODUCT.

(b) PHYSICAL DESCRIPTION OF THE PRODUCT INCLUDING CHARACTERISTICS, IF ANY, THAT WILL PREVENT INHALATION OR INGESTION OF SOURCE MATERIAL THAT MIGHT BE SEPARATED FROM THE PRODUCT.

(c) BETA AND BETA PLUS GAMMA RADIATION LEVELS (*Specify instrument used, date of calibration and calibration technique used*) AT THE SURFACE OF THE PRODUCT AND AT 12 INCHES.

(d) METHOD OF ASSURING THAT SOURCE MATERIAL CANNOT BE DISASSOCIATED FROM THE MANUFACTURED PRODUCT.

CERTIFICATE

(*This item must be completed by applicant*)

15. *The applicant, and any official executing this certificate on behalf of the applicant named in Item 2, certify that this application is prepared in conformity with Title 10, Code of Federal Regulations, Part 40, and that all information contained herein, including any supplements attached hereto, is true and correct to the best of our knowledge and belief.*

Kerr-McGee Nuclear Corporation
(Applicant named in Item 2)

Dated January 24, 1975

BY: W J Shelley
(Print or type name under signature)
W. J. Shelley
Director, Regulation & Control
(Title of certifying official authorized to act on behalf of the applicant)

WARNING: 18 U.S.C. Section 1001; Act of June 25, 1948; 62 Stat. 749; makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

U.S. GOVERNMENT PRINTING OFFICE: 1968-O-295-054

GENERAL INFORMATION

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1.0 GENERAL INFORMATION

Applicant: Kerr-McGee Nuclear Corporation

Address: McGee Tower
Oklahoma City, Oklahoma

Authorized Place of Use: Kerr-McGee Sequoyah Facility, Gore, Oklahoma

Scope: This application requests renewal of the Source Material License to authorize the Kerr-McGee Nuclear Corporation to receive, possess, use, transfer and deliver an unlimited quantity of natural and depleted uranium. It is requested that the renewal license be effective for a period of at least five years.

The Sequoyah UF_6 conversion plant has a nominal minimum capacity to convert 5,000 short tons per year of uranium as yellowcake to uranium hexafluoride.

Objective: The application is revised in its entirety and divided into two parts. One part, which does not become a license condition, provides a description of the facility and details of the proposed activities and safety items. The other part of the renewal application sets forth the technical and administrative specifications within which licensed activities are conducted. These specifications are license conditions.

1.1 Introduction

Kerr-McGee 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.

Starting as an oil well contract drilling partnership in 1929, the company later added production, refining, pipeline and marketing facilities. Today, Kerr-McGee is diversified with activity centered in discovering and developing a wide variety of natural resources through four operating divisions and ten wholly owned subsidiaries.

The company entered the nuclear industry in 1952 with the acquisition of uranium ore claims and mines in northeast Arizona. Today, Kerr-McGee is a leader in the uranium supply industry and is currently participating in five segments of the nuclear fuel cycle.

Kerr-McGee Nuclear Corporation is a wholly owned subsidiary of Kerr-McGee Corporation and responsible for the operations of its milling facilities at Grants, New Mexico, the conversion facility at Gore, Oklahoma and nuclear manufacturing facilities near Crescent, Oklahoma, and for sales of nuclear materials and services producted by these subject facilities.

1.2 Corporate Data

Kerr-McGee Nuclear Corporation is incorporated in the state of Delaware. The names, addresses and citizenship of the principal officers are:

Name	Address	Position	Citizenship
R. T. Zitting	Oklahoma City	President	USA
P. S. Dunn	Oklahoma City	Vice President Nuclear Manufacturing	USA
J. W. Swales	Oklahoma City	Vice President Milling	USA
W. E. Heimann	Oklahoma City	Secretary	USA
D. A. Watkins	Oklahoma City	Treasurer	USA

Parent company officers serving as the Board of Directors of the Kerr-McGee Nuclear Corporation in addition to Mr. Zitting listed above, are:

D. A. McGee	Oklahoma City	Chairman of the Board	USA
J. J. Kelly	Oklahoma City	President	USA
George B. Parks	Oklahoma City	Exec. V. President	USA

None of the other officers of the parent corporation are directly involved in the nuclear operation, however, all officers are United States Citizens.

1.3 Financial Qualifications

The Corporation is a wholly owned subsidiary of Kerr-McGee Corporation and there is no control of Kerr-McGee Nuclear Corporation by any alien, foreign corporation of foreign government through stock ownership, membership on the Board of Directors or stock ownership in Kerr-McGee Corporation.

Kerr-McGee Corporation, the owner of Kerr-McGee Nuclear Corporation, is a fully integrated natural resources 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. Kerr-McGee Corporation is listed on the New York Stock Exchange and its annual report provides the financial information required by 10CFR70.22. Kerr-McGee Nuclear Corporation data will be fully consolidated as are existing subsidiaries.

1.4 Facility Location

The licensed activities will be conducted in the Sequoyah Uranium Conversion Plant at the Kerr-McGee Nuclear Corporation's Sequoyah Facility located in Sequoyah County, Oklahoma. The site is located 2-1/2 miles southeast of Gore, Oklahoma, off Highway 64, and Interstate Highway 40 about 40 miles west of Fort Smith, Arkansas and 150 miles east of Oklahoma City, Oklahoma.

The Kerr-McGee site is bounded on the west by the Arkansas and Illinois Rivers, on the north by U.S. 64 and on the east by the eastern section line of Section 22, which is approximately two miles east of the Arkansas River. The plant is located in Section 21, T21N-R21E, Sequoyah County, Oklahoma.

The present plant site was selected before passage of the National Environmental Policy Act (NEPA). However, a description of the regional demography, land use and other required information has been documented and submitted in accordance with NEPA review requirements, which resulted in the publishing of the Draft Enviromental Statement by Fuels and Materials, Directorate of Licensing, United States Atomic Energy Commission.

The plant site is located about 2-1/2 miles southeast of Gore, Oklahoma (population 478). Other neighboring communities of the Sequoyah Facility include Webber Falls (population 485; 6 miles west), Vian (population 1,131; 9 miles east), Sallisaw (population 4,888; 19 miles east), the county seat of Sequoyah County, and Stigler (population 2,196; 20 miles south). Lake Tenkiller is situated approximately 10 miles to the north.

The nearest access to the plant site for the general public is Oklahoma Highway S.H 10, adjacent to the east site fence. The site is on gently rolling terrain at approximate elevation 570 M.S.L. The area surrounding the plant site is predominantly rural with interspersed wooded sections.

The General Plot plan of the Sequoyah Facility, Figure 1, consists of a total of about 53,000 square feet of plant and office floor space within three separate buildings. The major buildings of the facility include the Main Process and Administration Building the Solvent Extraction Building and the Warehouse. The Process and Administration Building is subdivided into the following contiguous areas: Administration and Laboratory area, Main Process and Sampling area, Shop and Utility area, Fluorine Generation area, and Boiler area.

1.5 <u>Material Description</u>

The uranium is received in the form of uranium concentrates (yellowcake) and compounds. During the process the uranium material is formed into uranyl nitrate, oxides of uranium tetrafluoride and other intermediate compounds formed in the preparation of uranium hexafluoride.

1.6 <u>Summary Description of Proposed Activities</u>

The general plan for the Sequoyah Facility consists of the following activities:

a. Refining of uranium from ore concentrates (yellowcake) and conversion to uranium hexafluoride (UF_6), and related control laboratory activities.

b. Storage of depleted uranium as UF_6.

The Sequoyah Facility utilizes a modification of the classical AEC conversion process, wherein yellowcake is first weighed and sampled, then refined by solvent extraction. The refined uranium is denitrated to UO3, reduced to UO_2, hydrofluorinated with anhydrous hydrofluoric acid to UF_4 and then fluorinated with elemental fluorine to produce UF_6.

1.7 <u>Conformance to License</u>

Assurance is given that all activites are performed or conducted in accordance with the license conditions.

a. Strict adherence to detailed operating procedures.

b. The use of operating personnel indoctrinated and trained in the safe handling of uranium materials.

c. Restricting access to the processing areas to authorized individuals.

d. Enforcement of administrative controls in production to maintain such records as required to reflect operational conditions, material movements, measurement data, and material losses.

e. Assignment of responsibility for the direct supervision, control, movement and management of the uranium materials to the production shift supervisors.

f. Conduct of periodic and unscheduled independent inspections, surveys, and audits by health and safety personnel to assure that procedures and license conditions are being followed and that safe conditions exist regarding contamination levels, radiation exposure and industrial safety hazards.

1.8 Exemption and Specific Approval Requests

As part of this license application, it is requested that the license for the Sequoyah Facility include an exemption and specific approvals relative to requirements of 10CFR20 as follows:

a. Exemption is requested from the specific posting requirement of Section 20.203(e) (2) of 10CFR20 for areas and rooms within the plant. All entrances to restricted areas will be conspicuously posted in accordance with Section 20.203(e)(2) and with the words, "Any area or room within this plant may contain radioactive material."

b. Specific approval pursuant to 10CFR20.305 for incineration of contaminated combustible waste materials is requested. Incineration of radioactive contaminated waste will be conducted as described subsequently under the Waste Disposal section.

ORGANIZATION, ADMINISTRATION AND PERSONNEL

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2.0 ORGANIZATION, ADMINISTRATION AND PERSONNEL

2.1 Organization and Administration

This section describes positions having managerial, technical or operational responsibility relating to the Sequoyah Facility in the areas of health physics and industrial safety. Personnel experience resumes and an organization chart are included.

The management, technical and engineering staffs of the Kerr-McGee Nuclear Corporation and the Sequoyah Facility are well versed and technically competent in all aspects of the health physics requirements of handling uranium materials, and have experience in training others in radiological health and safety. All supervisory operating personnel have at least a high school education and several years supervisory experience in the processing of chemicals or uranium materials.

The organizations of the Kerr-McGee Nuclear Operations and Sequoyah Facility are included in this section.

The functional responsibilities and authorities for the various management positions dealing with industrial and radiation safety and materials control are described.

2.2 Administration - Facility Control

The radiation protection control programs for the safe handling and process of the source materials and the control of all activities, personnel and equipment are the responsibility of the Manager of Sequoyah Facility, who reports to the Vice President, Nuclear Manufacturing, who is responsible to the President of Kerr-McGee Nuclear Corporation.

The Manager, Health Physics and Industrial Safety, reporting to the Manager, Sequoyah Facility conducts programs in plant radiation protection, industrial safety, monitoring and surveillance of plant activities and environmental impact, and audits health and safety and industiral safety aspects of facility activities.

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 performing independent audits of operations in the health physics and industrial safety areas. He reports to the Vice President, Nuclear Manufacturing.

All activities involving uranium are conducted in accordance with written and approved health and safety standards. These standards specify the rules, principles and measures used at the Sequoyah Manufacturing facility in the health physics safety programs. The health and safety standards are prepared under the direction of the Director of Regulation and Control, by the Health and Safety Coordinator. They are reviewed for license compliance by the Nuclear Safety and Licensing Officer and by the Manager, Sequoyah Facility for operability and approved by the Vice President, Nuclear Manufacturing. Changes to the health and safety standards follow the same administrative review and approval system as original standards.

2.3 Process and Equipment Control

Process and equipment design criteria, which generally delineate the process and prescribe critical parameters are prepared under the direction of the Manager, Conversion Engineering. They are reviewed as appropriate by the Manager, Health Physics and Industrial Safety, the Nuclear Safety and Licensing Officer, the Health and Safety Coordinator, and by the Manager, Sequoyah Facility for operability, and approved by the Vice President, Nuclear Manufacturing.

The Manager, Sequoyah Facility or his designate will approve in writing minor modifications to facility procedures and instructions within the scope of the installed equipment. All other changes must be approved by the Vice President, Nuclear Manufacturing, after the review described above.

Experimental and development work performed in the Sequoyah Uranium Facility is described in writing by the Manager, Conversion Engineering, reviewed by the Manager, Health Physics and Industrial Safety, approved by the Sequoyah Facility Manager for operability, with final approval by the Vice President, Nuclear Manufacturing.

In addition to the above reviews the Vice President, Nuclear Manufacturing may request review performance from the Technical Director for process control information, from the Senior Project Engineer for specific engineering requirements and the Director of Regulation and Control for administering independent inspection activities and liaison with the regulatory agencies of the local, state and federal governments.

2.4 Operating Procedures

Written procedures, which specify operating steps within process and equipment criteria and the health and safety standards, are approved by the Sequoyah Facility Manager.

The fluorinator consists of a vertical 6- or 8-inch diameter, 12-foot long pipe, provided with external cooling coils which are continuously welded to the shell and are used to remove the large amount of heat released by the reaction. Steam is used as the coolant. Uranium tetrafluoride is charged by a screw conveyor and drops through a powder disperser into the top of the reactor. Dispersion is accomplished by a spined shaft rotating at 1,750 rpm. Fluorine is introduced through an annulus at the bottom of the disperser where it reacts essentially instantaneously with the uranium tetrafluoride. When viewed through a sight port, a white-hot flame is observed just below the point at which the reactants are charged. If gas flows are controlled in the desirable range, 95% or more of the uranium tetrafluoride is consumed. In fact, under closely controlled pilot-plant conditions, more than 99% of the uranium tetrafluoride reacts. Most of the remaining solids are collected in an ash receiver mounted directly below the tower. The gases and a small part of unreacted uranium tetrafluoride are dischared through a gas cooler and a sintered metal filter. Solids collected in the filter usually contain a high percentage of nonvolatile impurities and are reprocessed through a wet uranium recovery system. Ash in the tower receiver is primarily uranium tetrafluoride and is ground and recycled.

The gas leaving the primary fluorinator is passed through a heat exchanger (cold trap) which operates at 40°F and removes a large portion of the uranium hexafluoride by desublimation. The gas is compressed and flows to the clean-up reactor.

In the clean-up reactor, an excess of uranium tetrafluoride is contacted with the vent gas in a flame-type unit which has heat supplied to hold the wall temperatures above a minimum of 850°F. Cooling coils are also provided as in the primary towers. At this temperature level, the fluorine is consumed, and only uranium hexafluoride and uranium tetrafluoride are present. The hot gas and solids stream are cooled before filtering. As the stream is cooled, some reaction of the uranium hexafluoride with the uranium tetrafluoride of their formation, low melting compounds are formed. Caking is prevented by cooling in a horizontal section equipped with a wall scraping ribbon screw flight. The solid discharged from the cooler is a uranium fluoride material which is recycled to the primary towers.

3.5.3 UF_6 Condensation

Uranium hexafluoride in the gases leaving the cleanup reactor is removed in a refrigerated cold trap operating at minus 70°F. The uranium hexafluoride content of the gas leaving the cold trap is about 50 ppm. This gas is then vented to the waste gas disposal system.

The UF_6 product is collected in two different types of heat exchangers. The first or primary cold trap operates at plus 40°F. and removes most of the UF_6. This trap is of tube and shell construction.

U-tubes are used to minimize thermal stresses and to allow easy removal of the core from the containing vessel. The heat exchange surface consists of flat plate fins attached to the tubes. Baffles are provided to give side to side flow. A water-glycol solution is circulated through the tubes when the trap is heated to liquify and drain the UF_6.

The secondary traps heating and cooling system is similar to the primary traps. Freon is recirculated and used as the coolant.

After collection, the UF_6 is heated to above its triple point of 147°F. (22.0 psia.) filtered and drained into an evacuated shipping cylinder.

3.6 Fluorine Production

The production of fluorine gas is an integral part of the facility. The production system consists of 32 electrolyte cells. The fluorine is produced by electrolysis of anhydrous hydrofluoric acid in a fused salt electrolyte. Hydrogen is produced as a by-product and subsequently burned.

The cells are of conventional design. The electrolyte is potassium bi-fluoride containing approximately 40% hydrogen fluoride.

A metered continuous flow of gaseous hydrogen fluoride is fed to the electrolyte to maintain the optimum composition and also to hold sufficiently high liquid level to prevent mixing of the hydrogen and fluorine.

The fluorine is compressed with a centrifugal unit and is charged to the uranium hexafluoride production reactors. Hydrogen flows to a gas burner. Both the hydrogen and fluorine headers are controlled at about 1-inch of water positive pressure on the cell side. Close control of the pressure of both these streams is provided to prevent mixing fluorine and hydrogen.

Both the hydrogen and the fluorine leaving the cell contain 10% or more hydrogen fluoride. This concentration is reduced before use in the uranium hexafluoride manufacturing systems. The fluorine stream is passed through minus 120°F condensers which collect hydrogen fluoride as a liquid and reduce the concentration to about 4%. The condensed anhydrous hydrogen fluoride is reused. Reduction to the 4% level is adequate to prevent deposition of hydrogen fluoride in subsequent uranium hexafluoride collection cold traps.

3.7 Uranium Losses

Essentially all the discarded uranium is in the raffinate from the refinery. Losses through the portions of the system where uranium powders are handled will be insignificant.

3.8 Mechanical Systems, Services and Safety Equipment

3.8.1 Codes and Standards

All design, equipment and work conforms to Federal, State and Local codes and insurance requirements in effect.

3.8.2 Nitrogen Purge System

Since much of the equipment in the pyro area operates in a neutral atmosphere, a nitrogen distribution system is provided for seal gas systems. Dry air is used for the fluorination purging and seal system to avoid explosive air mixtures.

3.8.3 Seal Water System

Seal water in the solvent extraction area is steam condensate and is filtered and delivered at positive differential pressure to all pumps handling uranium-bearing solutions. In other areas, filtered water is used for seal water.

3.8.4 Digestion Cooling Water (DCW)

The DCW system is monitored continuously (conductivity meter/pH meter) by pH control to detect coil leakage.

3.8.5 Hydrogen Gas System

Two ammonia dissociators are installed outdoors to provide hydrogen gas, which is delivered to the reduction reactors at positive pressure.

3.8.6 Hydrogen Fluoride Gas System

Anhydrous liquid hydrogen fluoride is transferred from storage to a vaporizing tank by pressurizing storage tanks with nitrogen and delivered to the hydrofluorination reactors and the fluorine cell room at positive pressure.

3.8.7 Fluorine Gas System

Fluorine gas produced in the fluorine plant is delivered to the fluorination reactors at positive pressure and surge capacity is provided.

3.8.8 Process Steam System

Process steam at pressure of 125 psig is produced by two 35,000 lb/hr gas fired, oil standby, package steam generating systems. All condensation, except that consumed in the process or having a high probability of containing contaminants, is recovered and returned to the condensation receivers at the steam plant.

3.8.9 Water Supply

The water supply for process and potable use and for fire fighting is obtained at 1200-2000 gpm from the Tenkiller Ferry Reservoir (7 miles north). Steam condensate or water is used as a process water source throughout the facility.

3.8.10 Nitrogen Oxide Recovery

Oxides of nitrogen, which evolve from digestion and denitration, are recovered by a system connecting to the nitric acid recovery facilities.

3.8.11 Piping

Stainless steel piping is used for all nitric acid solutions. Piping for uranium hexafluoride is Monel or carbon steel.

3.8.12 Instrumentation and Control

All normal plant control functions are centralized except in the sampling and product cold trapping and shipping areas. In addition to essential local control and instrumentation, the centralized control panels provided in the Main Control Room monitor and control the electrical equipment related to the process and fluorine area.

3.9 Communications

A private automatic (PABX) telephone system services the facility.

The Operator-Control Room Communications System used Frequency Modulated Radio equipment. Operators carry portable two-way radios. The base station is located in the Control Room and is remotely controlled from the receptionist's desk by means of a handset. The system is such that the Control Room has priority of the receptionist's desk handset.

An air horn type emergency signal system is provided so it can be heard throughout the project boundaries. The system is manually actuated from the Control Room and receptionist's desk and automatically actuated by the Solvent Extraction building sprinkler foam system.

Both the Operator-Control Room Communications System and the air horn emergency signal system actuator are supplied from emergency power.

3.9.1 Laundry

Automatic washer and dryers are provided for laundering of coveralls, smocks, gloves, etc. to handle 300 lb/day. Space is provided for accumulation of dirty clothes and storage of clean clothes.

3.9.2 Emergency Lighting

Emergency lighting using rechargeable battery-type incandescent fixtures is used throughout the facility. In the receptionist area, Control Room, and office corridor and stairway areas, emergency lighting is also provided from the emergency generator.

3.9.3 Emergency Breathing Air Supply

Emergency breathing air is provided by compressed breathing air bottles. Cart mounted bottles are available for use throughout the facility. Five (5) Scott Air-Paks are centrally controlled for use in unrestricted areas.

3.9.4 Safety Showers and Eye Wash Stations

Seventeen (17) combination safety shower and eye wash stations are located throughout the facility in selective areas.

3.9.5 Emergency Power

An emergency generator is provided and rated at 300 KW for continuous duty.

All emergency loads are connected to a Motor Control Center which is fed through an automatic transfer switch. This switch senses a drop of the normal power and starts automatically an internal combustion engine-driven generator. After a time-delay to allow the generator to reach operating speed, the switch transfers the bus supplying the emergency loads to the generator. Upon restoration of normal power, the switch transfers back to normal and stops the generator in a programmed way.

All the motors in the plant will stop in the case of power failure and have to be restarted. The operator in the Control Room is provided with information when emergency power is available so that he can restart the vital motors.

One of the H_2F_2 and waste gas scrubber blowers is arranged for automatic restarting after a power failure.

3.9.6 Hazardous Locations

All the electrical installation in the Solvent Extraction Plant is approved for Class I, Division I, Group D hazardous service.

Inside the process building all the electrical installation within 10 feet horizontally of all hydrogen carrying pipes and equipment in the space vertically above this area is approved for Class I, Division 2 service.

3.10 Heating and Ventilation

Proper ventilation systems are provided for the various areas of the facility. Special attention was given to obtain proper air changes in areas having air contamination potentials.

Ducts in the solvent extraction, and fluorine areas are of aluminum. Galvanized steel ducts are used in the office and laboratory, shops and maintenance facility and utility areas.

Air for the heating and ventilation of the main process area is provided by two fan-coil units (total capacity 82,000 cfm), one at each end of the process area. Ventilating air is introduced to maintain a minimum of six air changes per hour.

The fluorine cell area is ventilated by four fans for a total of about 36,000 cfm of exhaust air resulting in approximately 31 air changes per hour.

The ventilation of the solvent extraction building provides for a minimum of 12 air changes per hour by a supply fan-coil unit with a 24,000 cfm capacity.

3.11 Fire Protection System

Fire protection for the facility is divided into two areas: Yard, including all uncovered areas; and Buildings, encompassing all areas not included in 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.

3.11.1 SX System, Fire Protection

The original design considered the solvent extraction process as a special hazard and located the building over 100 feet from the main building.

The solvent extraction plant building is equipped with a foam deluge system. The building area is curbed without drains (divided into two areas) and the pulse column and UNH evaporator adjacent to the building have separate curbs. The curbed volumes were sized to contain the entire liquid contents in the event of an accident such as misoperation or equipment failure.

The solvent extraction foam system was purchased and installed in accordance with Standards 11 and 16 of NFPA Code for Foam and Solvent Extraction Processes, respectively, and has been accepted by Factory Insurance Association. The original system test revealed below specification foam density and, after changing foam proportioners, the system was retested as acceptable November 30, 1971. Both tests were witnessed and approved by the Facility's insurers, Nuclear Energy Liability Insurance Association and Nuclear Energy Property Insurance Association.

In the event of a fire the foam deluge system would be automatically activated, spraying the building and pulse column areas with a water-foam mixture from one foam tank (two are maintained full) for approximately eight minutes. One foam tank was deemed sufficient to extinguish a fire.

The foam system is actuated by a decrease in gas pressure when a sensor head melts. Corrosion, accidental sensor breakage, tornado or earthquake will not operate the system. Additionally, the deluge system can be manually actuated from the solvent extraction or main process buildings.

3.11.2 General Construction Features of Buildings

Noncombustible construction is utilized throughout the facility. Building design and construction is in accordance with the applicable state and municipal codes. The buildings are steel-framed structures, supporting metal deck roofs with insulation and built-up roofs, interior face, and metal-siding wall enclosures, except the shop and utility building where 12" masonry walls are utilized. A central security area is available through the receptionist office, where the PBX and fire alarm systems are located.

3.11.3 Yard System

The yard fire water distribution system provides a ten inch diameter main looped around the main process building and attached auxiliary structures. An 8 inch diameter water main is looped around the solvent extraction building. Six inch diameter laterals serve nine hydrant stations which are spaced a maximum of 300 feet apart. The system will supply 1,000 gpm at approximately 100 psig residual to any hydrant. Each hydrant station includes a low-profile house equipped in accordance with the minimum requirements of the National Fire Code.

3.11.4 Buildings

Fire protection in the Main Process Building is provided by 43 wall-mounted extinguishers. Sprinklers are provided over the electrical cable trays in congested areas and over the diesel fire pump and the emergency generator diesel engine.

Protection for the Solvent Extraction Building is provided by a foam-water system based on a water rate of 16 gpm per 100 square feet of building area for a period of 10 minutes.

Heat actuating devices are rated at 325°F. inside the building and 212°F. at the pulse column. In addition to the foam-water system, 7 wall-mounted chemical extinguishers are located in the solvent extraction area.

Suitable smoke-detecting devices are provided in electrical room to detect the presence of the products of combustion and sound an alarm located in the control room and security station.

In all cable trays throughout the plant, fixed temperature heat detector sensors (heat detecting wire run above the cables) are arranged to sound an alarm in the control room and security station to indicate over-heating. Wherever three or more cable trays are stacked vertically (other than short length cross-overs), fixed type fire water sprays are provided, arranged to give adequate coverage of the cables in the trays with individual sprays thermally activated. Flow switches sense water flow through this spray system and give an alarm in the control room and security station.

The engine driven emergency fire pump and the engine only of the emergency generator are also provided with individual thermally activated fire water spray heads with a flow switch and alarm in the control room and security station.

Adequate portable carbon dioxide extinguishers are provided just outside each entrance to the electrical rooms.

Two (2) roof fire hose stations, one at the flourine plant elevation and the other at the main roof elevation have been added to the original system. A hose station has also been added in the warehouse.

3.11.5 Fire Water Supply

The fire water requirements are 1,000 gpm for the yard system plus about 1,000 gpm for the cable tray sprinklers and the foam system. This is provided by a pump complex consisting of one 2,000 gpm, 100 psig electric driven pump and a 2,000 gpm, 100 psig diesel engine driven auxiliary pump plus a 50 gpm, 120 psig electric driven jockey pump. The pumps take suction through redundant dual lines from the water storage tank which contains 250,000 gallons of which 150,000 gallons is reserved for fire protection only. The remaining 100,000 gallons is designated emergency cooling water but is normally available for fire water use. The plant water supply is also connected to the pump suction for possible emergency use.

3.12 Main Plant Dust Collection System

A central, all-purpose dust collection system is provided. The system services all "dry-processing" areas within the plant, sampling/digestion and UO_3 pulverizing through ash grinding. The dust collection hoods servicing the areas are installed around packing glands, routinely-opened equipment, solids transfer areas and the discharge from special-duty dust collectors or vacuum systems. Size and shape of hoods and exhaust air volume are designed to efficiently collect the dust normally generated by the source.

The 27,750 cfm, 5-zone, "plenum-pulse" (reverse jet), bag-type dust collector discharges through a monitored stack above the plant to the atmosphere. The collector is periodically cleaned (back-blown) stepwise, one zone at a time. It can also operate with one or two zones out of service for maintenance. The solids are drummed off the reprocessed.

3.12.1 Vacuum Systems for Recovering Spilled Solids

The sampling plant has a separate vacuum for recovery and direct recycle of spilled yellowcake. Two other vacuum recovery systems are provided. Both are used for general plant cleanup and for "vacuum gulping" of uranium compounds from equipment components prior to maintenance servicing. The Main Plant Vacuum System services all areas after yellowcake sampling to hydrofluorination. The UF_4-Ash Vacuum System services all areas from hydrofluorination through fluorination. The Main Plant System discharges to the miscellaneous digester. The UF_4-Ash System discharges to drums for transfer to the Ash Grinding System. Each vacuum system has one vacuum source with dual particle separation systems.

The general cleanup piping system is provided with hose connections at convenient points. Piping sizing provides a minimum gas velocity of 3,000 feet per minute.

The Main Plant System contains a large mesh basket screen for collection chunks of solids which could jam and/or damage the discharge screw from the hopper to the miscellaneous digester. The UF_4-Ash System depends on screens in the Ash Grinding System to protect conveyors and screws when it is refed to the primary process stream. A portable vacuum cleaner is also provided.

3.12.2 Ash Grinding System for Direct Recycle of Fluorination Ash

An ash grinding system is provided for all-purpose crushing, pulverizing and screening of fluorination tower ash, or any other material capable of direct recycle. The pulverized

product is normally refed directly to fluorination through the UF_4 storage bin. The product can be redrummed. The system consists of a jaw-crusher, a hammer mill pulverizer, and a vibrating screener. Material is fed to the system via a drum elevator. The entire system is housed in an enclosure which is vented to the Main Plant Dust Collection System.

The hammer mill is protected from pieces of upstream equipment or other foreign matter by a 1-inch screen in the feed-stream, after the crusher. Collected solids from the UF_4-Ash Vacuum System are also recycled through Ash Grinding.

3.13 F_2 Cell Maintenance Area Fume Exhaust

Fumes from the dip tank and electrolyte area are exhausted by a 15,900 cfm exhaust fan to the atmosphere.

3.13.1 Laboratory System

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

3.13.2 Off-Gas Handling

Digesters - The primary vent system for the digestion vessels provides for removal of entrained dust and solution from the vapor stream and return to the digesters. The primary vent system for the digestion vessels exhausts to the plant nitric acid recovery system where NO_2 and NO are scrubbed out. The digestion system is maintained to assure that all air flow is inward.

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 solution or solid. After scrubbing, the off-gas is routed to the HNO_3 recovery system. Spent caustic is disposed of with the raffinate.

Denitrator off-gases are wet scrubbed with nitric acid and then pass through a vertical fin-tube gas cooler before passing on to the nitric absorber column.

Gases from reduction to UO_2 are vented through a sintered metal filter then through a back-up filter (nominal 10-micron pore size for 98% removal of 0.7 micron particles). Excess hydrogen is burned before venting. Burned gases are vented via the boiler stack.

Hydrofluorination - Only small amounts of gases containing traces of HF are vented from the HF condensers except when purging the reactors. In the latter case, very little HF should be present. The vent gases are combined with other similar gases and scrubbed with water prior to being vented through a pipe associated with the main boiler stack.

Fluorination - The system uses a once through fluorine process. The UF_6-laden gas leaving the sintered metal filter from the primary reactor passes through a back-up filter and then through a primary cold trap before being recycled. Gas passes through a tower-type clean-up reactor. The UF_6 gas leaving this reactor is removed in the secondary cold trap and the gas is sent to off-gas disposal. Under normal conditions with the fluorine clean-up reactor performing properly, little F_2 is discharged from the system. Any waste F_2 is burned with H_2 from the fluorine plant to form HF which is quenched and scrubbed with water. The scrubbed waste gases are discharged to atmosphere through pipe associated with the boiler stack.

3.14 Nitric Acid Recovery

A conventional absorption system is utilized for recovering nitrogen oxides from ore concentrate and fluorination ash dissolution, and denitration of UNH to UO_3.

WASTE DISPOSAL OPERATIONS

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4.0 Waste Disposal Operations

The various waste products which evolve from normal operation of the Sequoyah Facility include waste heat, a variety of solid, liquid and gaseous wastes. The various waste products are treated to meet Federal and State pollution control standards, for subsequent release to the environment.

4.1 Liquid Waste Treatment and Disposal Systems

The Sequoyah plant process generates two major liquid waste streams of varying composition which are treated to remove contaminants from solution.

The waste stream from the extraction system, known as raffinate, is primarily a solution of ammonium nitrate, nitric acid, metallic salts and minute quantities of uranium and the radioactive daughter products of normal uranium decay. This stream is combined with spent sodium hydroxide from the solvent treatment and miscellaneous digester scrubber systems along with any recovered weak acids. This liquid is neutralized by ammonia and impounded in storage ponds. Neutralization of the raffinate removes residual uranium and thorium, while the addition of a soluable barium compound removes 226 radium.

A second liquid waste stream is generated by the hydrofluoric acid scrubber. This fluoride waste stream is combined with waste sodium carbonate solutions originating in fluorine cell rework area, any acid spilled in the HF vaporizer room sump and laboratory wastes. The combined stream is treated with lime which neutralizes acids and precipitates fluorides as calcuim fluoride.

The alkaline sludge is permitted to settle in a retention basin to permit flocculation and sedimentation. The overflow is treated with sulfuric acid to adjust the pH and precipitate excess calcium. It is then permitted to clarify. The clarified treated waste overflows and is combined with clean waste water and the sewage lagoon overflow. A concrete stilling basin at the point of combination allows for mixing of the flow and controlled release through a slotted weir so that the rate of discharge can be measured. Discharge flows to the Illinois River through a natural watercourse.

Other plant streams which are combined with the treated fluorine effluent before being discharged to the river include sanitary and domestic wastes.

Evaporation of the waste pond with the climate in this area cannot maintain pond levels. The accumulation of rainfall in this area led to the construction and use of a second raffinate pond.

The Production Manager has the responsibility for formulating, developing and maintaining the detailed operating procedures based on approved criteria and standards. The operating procedures are reviewed by the Manager, Health and Safety and Industrial Safety and approved by the Manager, Sequoyah Facility.

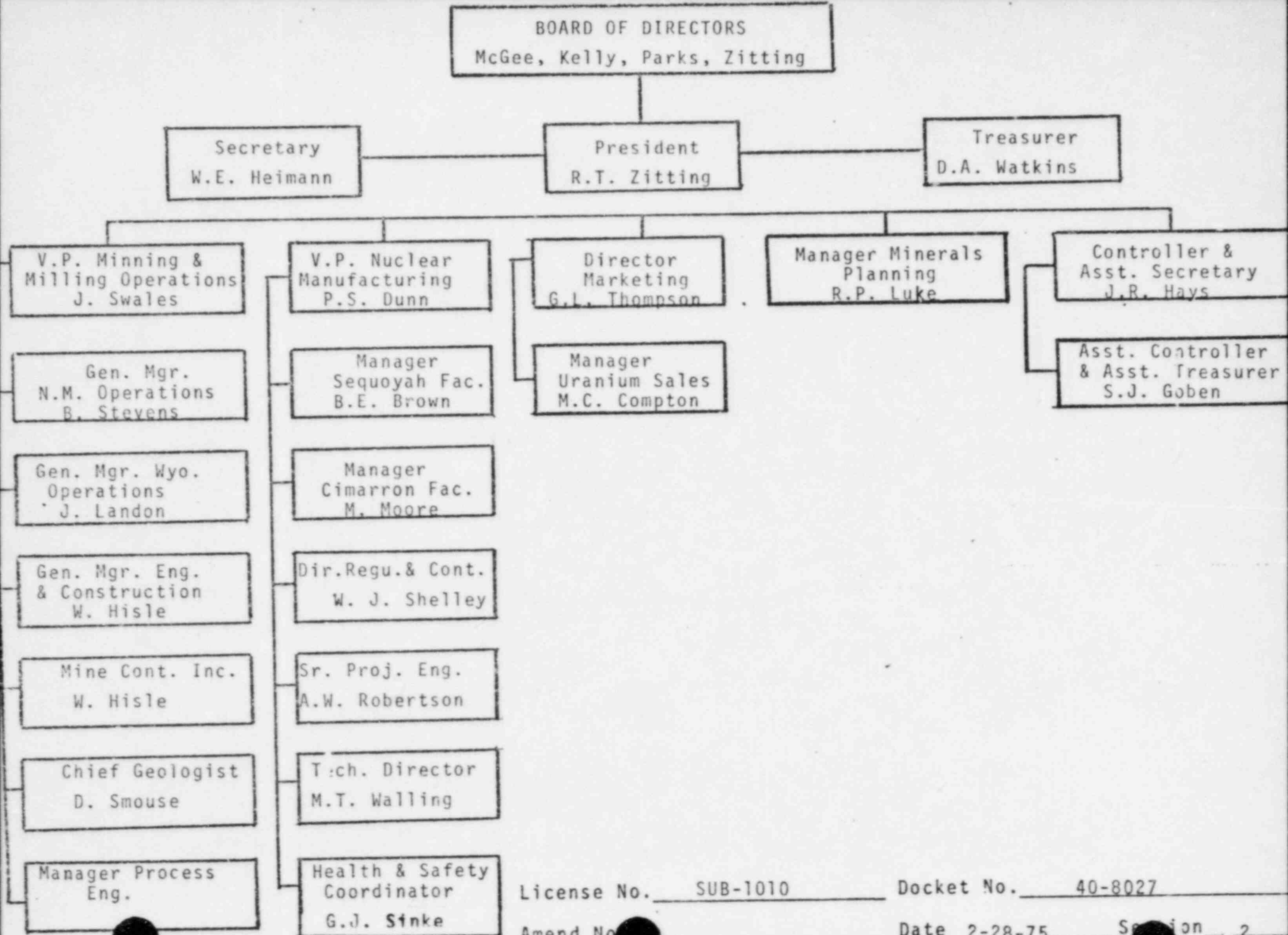
Changes to the operating procedures which are within the approved criteria and standards follow the same administrative review and approval system as original procedures.

Independent audits through the Director of Regulation and Control, by the Nuclear Safety and Licensing Officer and the Health and Safety Coordinator are conducted to assure compliance with license conditions and process and equipment criteria and standards.

The Nuclear Safety and Licensing Officer is responsible for determining when operational changes fall outside the scope of the license and such changes require appropriate license amendment.

2.5 Maintenance

No maintenance work is performed unless it is authorized in writing by a person having the proper authority. The Manager, Health Safety and Industrial Safety or his designate approves all hazardous work permits (and industrial safety hazards) involving any potential release of radioactive material. Maintenance work is considered complete only when work is physically completed, inspected and signed off by Maintenance, and inspected and accepted by the supervisor in charge.



License No. SUB-1010 Docket No. 40-8027

Amend No. Date 2-28-75 Section 2

Replaces Organizational Chart p. 4,5,&6 Dated 9-23-69

2.6 Personnel

Activities performed at the Kerr-McGee Nuclear Corporation, Sequoyah Facility, are under the direction of:

R. T. Zitting, President, Kerr-McGee Nuclear Corporation

P. S. Dunn, Vice President, Nuclear Manufacturing

Dr. M. T. Walling, Jr., Technical Director, Nuclear Operations

Education - B.S. in Chemical Engineering
Ph.D. in Inorganic Chemistry

Experience - Employed 1944-1949 by Metallurgical Laboratory, University of Chicago, (Manhattan Engineering District-Plutonium Project) and its successor, the Argonne National Laboratory, as Junior Chemist, Research Assistant, Research Associate and Associate Chemist. Collaborated with Walter J. Blaedel in development of first successful solvent extraction process for nuclear fuels.

Teaching Assistant, Research Fellow, Magnolia Petroleum Company, Research Fellow, University of Texas from 1949-1952. Discovered and proved existence of tetrammine platinum (o) as metastable solid entity. (First known example of actual compound of zero-valent platinum).

Employed from 1952-1967 by General Electric Company Hanford Laboratories, Hanford Atomic Company, Hanford Atomic Products Operation, as Scientist; Senior Scientist; Manager, Chemical Separations; Manager, Chemical Research; Manager Chemical Laboratories. With transfer of operating contract for Hanford Laboratories to Battelle Memorial Institute, became Manager, Chemistry Department, Battelle Northwest Laboratories for two years.

Dr. Walling joined Kerr-McGee in 1967 and is presently responsible for process and equipment development for nuclear corporation facilities.

William J. Shelley, Director, Regulation and Control

Education - B.S. in Chemical Engineering
M.S. in Chemical Engineering

Experience - Employed by Mallinckrodt Chemical Works from 1949-1967. Served as Project Engineer with assignments in construction, research and development, and plant start-up; Administration Assistant responsible for the operation of division purchasing, office services; Production Control Manager responsible for production scheduling, production reporting and material accountability functions; Director of Admisistration; and Assistant Division Manager.

Mr. Shelley was General Manager of the Mallinckrodt Uranium Division for six years, in which capacity he was responsible to the USAEC for the operation of its $50,000,000 chemical refining and metal fabrication facilities located at Weldon Spring, Missouri.

Burnell E. Brown - Manager, Sequoyah Facility

Education - B. S. in Chemistry

Experience - Employed for seven years by Union Carbide Nuclear Company, Paducah, Kentucky, in chemical operations. Worked in production of fluorine and hydrogen gases, attaining the position of Assistant Area Supervisor.

Employed in 1959 by American Latex Division, Dayco Corporation, as Production Chemist responsible for correcting production problems in rigid and flexible urethanes, cements and adhesives. Served in Dayco Rubber International Divison for three years as Technical Service Engineer, responsible for liaison, training and supervising of licensees producing polyurethane elastomers, flexible and rigid foams.

Employed by The Upjohn Company, CPR Division, as Production Manager responsible for all production including outside plant production, production control, shipping, receiving, and purchasing of bulk chemicals. Transferred to Franchise Operations after four years in production. Responsibilities included setting up franchise operations in "in-place" installations

of polyurethane foams, training of personnel and technical services to franchisees and their customers.

Joined Kerr-McGee in 1968 as Senior Staff Engineer and was later promoted to Manager, Sequoyah Facility.

G. J. Sinke, Health and Safety Coordinator

Education - B.S. in Chemistry - Postgraduate Health Physics training through the U.S. Department of Health, Education and Welfare.

Experience - Chemist, Chief Chemist and Manager of Testing Laboratories at Kingsbury Ordance Plant for eight years.

Thorium and rare earth chemist; Industrial Safety Engineer, Health Physicist and Radiation Safety Officer for the West Chicago Rare Earth and Thorium Operations of American Potash and Chemical Corporation (now a part of the Kerr-McGee Chemical Corporation). His duties included the licensing and regulation function for the operation. He has over 11 years experience in the field of industrial safety and health physics.

Mr. Sinke transferred to the Cimarron Facility in November 1969. He served as the Manager, Health Physics and Industrial Safety for the Cimarron Facility for nearly three years.

James W. Craig - Manager, Conversion Engineering

Education - B.S. in Chemical Engineering

Experience - Employed ten years by Union Carbide Nuclear Corp. at the Paducah, Kentucky site in various capacities of the operations in UF_6 production, decontamination work, uranium recovery facilities and shipping. Employed five years by Union Carbide Nuclear Corp. at the Y-12 Plant, Oak Ridge, working in nuclear components fabrication and assembly and nuclear rocket activities.

Joined Kerr-McGee in 1968. Mr. Craig reports to the Sequoyah Facility Manager.

G. M. France, III - Nuclear Safety and Licensing Officer

Education - B.S. in Chemistry

Experience - General Chemist, National Bureau of Standards, Washington, D.C., for four years. Provided radiochemical review of Bio-assay procedures used in the low level detection of radionuclides in the environs. Mr. France co-authored two papers for publication in the Health Physics Journal and International Journal of Radioisotopes, concerning the determination of uranium in urine and curium in vegetation.

For seven years; prepared uranium oxide and uranium hexafluoride standards for cascade isotopic control. while employed at the Goodyear Atomic Facility. Transferring to the Nuclear Corporation from Kerr-McGee Technical Center where he engaged in solvent extraction techniques for the recovery of uranium from wet process phosphoric acid; radiochemical bioassay analyses, Mr. France has acquired 18 years of experience in the nuclear field. He also participated in a four week training program in Nuclear Criticality Safety, at Battelle Pacific NW Laboratory, including attendance at the criticality safety course conducted by the University of New Mexico.

David R. Swaney - Laboratory Manager, Sequoyah Facility

Education - Bachelor Degree

Experience - Employed by Mallinckrodt Chemical Works for 18 years. Served as Chemist and Supervisor in the MCW Uranium Division Chemical Laboratories for 14 years.

C. A. Grosclaude - Manager, Health Physics and Industrial Safety

Education - Radiation Monitoring Course - General Electric Company Richland, Washington.
Basic Radiological Health Course (80 hours) - U.S. Public Health Service, Southwest Radiological Health Laboratory, Las Vegas, Nevada.
Radionuclide Analysis by Gamma Spectroscopy (80 hours) Taft Sanitary Engineering center, U.S. Public Health Cincinnati, Ohio

Experience - Health Physics Technician, Dairyland Power Cooperative, LaCrosse, Wisconsin. Provided contamination and radiation exposure control within the plant exclusion area, documentation of gaseous and liquid effluent release to non-controlled areas to assure conformance to AEC regulations.

Assigned to Site Monitoring Services Group, Nevada Test Site, Mercury, Nevada. Assisted in rewrite and/or design procedures for the decontamination laundry, high level "hot cell" and respiratory protection programs.

Currently supervises Health and Safety Technicians and maintains routine function of the Health and Safety and Industrial Safety Programs. Maintains records on items of non-compliance with health and safety program.

Patricia A. Rogers - Health and Safety Technician

Education - High School

Experience - Assigned as Health and Safety Technician effective August 16, 1974. Training included "on the job training" in air sample program, smear survey, some training in usage of radiation survey equipment. Training in usage of explosimeters, oxygen analyzers, etc.

Previous assignment included:
Kerr-McGee Sequoyah Facility, Secretary to Safety Processing records pertaining to Industrial Safety and Health Physics.

Ferrell Horn - Health Physics Technician

Education - High School

Experience - Employed by Kerr-McGee as a chemical operator for three years. In 1973 was assigned to the Health Physics Section as an HP Technician.

Prior to employment with Kerr-McGee Mr. Horn managed a gasoline service station.

Walter Harris - Manager of Maintenance & Construction Department

Education - B.S. 1943, Illinois Institute of Technology, Chemical Engineering
1944 - Continuing education in Advanced Organic Chemistry, Case Institute of Technology
1944-1945 - Electrical and Electronics, U.S. Navy

Experience - Assistant Manager and Manager, Maintenance and Construction, Sequoyah Facility, Kerr-McGee- 2 years.

Responsible for necessary preventative maintenance activities to keep production equipment in proper mechanical shape and locating causes of equipment breakdowns and making necessary repairs. Maintain utility equipment, buildings, grounds, and modify existing equipment and installation of new equipment.

Manager, Plant Engineering, West Chicago Rare Earth Facility, Kerr-McGee Chemical Corporation- 5 years.

Superintendent of Maintenance, American Potash- 9 years.

J. R. Davenport - Manager of Production Department

Education - B.S. 1957, Murray State University, Chemistry and Biology
1957-58 - 75% of studies for M.S. Educational Administration
1960 - Completed 11 units toward Chemical Engineering Diploma

Experience - Production Manager, Sequoyah Facility, Kerr-McGee - 4 years. Responsible for coordinating and supervising the production process, primarily designed to convert uranium ore concentrate to uranium hexafluoride, on schedule and within specifications.

Engineering (9 months) and Production Superintendent, (2-1/4 years). Kerr-McGee's Cimarron Facility -

Process Engineering, Allied Chemical - 2-3/4 years.

Shift Supervisor " 2 years.

Technical Problem Solving, Allied Chem. 3 years, UF_6 conversion

Analytical Chemist " 1/2 year.

L. A. Tharp - Area Supervisor

Education - B.S. 1963, University of Tulsa, Chemical Engineering, with minor in Petroleum Refining.

Experience - Area Supervisor, Sequoyah Facility, Kerr-McGee, 4 years. Performs long range planning involving the overall operation of a specific area of production. Analyze, define and establish priority of process problems and coordinate maintenance repair to effect a minimum of downtime.

Senior Engineer, Sequoyah Facility, Kerr-McGee, 1 year.

Project Engineer, International Paper Company, Pine Bluff, Arkansas, 6-1/2 years.

J. C. Brewer - Shift Supervisor

Education - High School Graduate (Bokoshe, Oklahoma) Radio Repair School, US Army

Experience - Sequoyah Facility, Kerr-McGee, 2 years. Responsible for planning and directing activities of one shift of production operations; for producing specification quality product at minimum costs; obtaining maximum production rates without injury to people or damage to equipment and for designing shift activities to meet production schedules.

Control Room Operator, Sequoyah Facility, Kerr-McGee, 3-3/4 years. Observe control room instruments and regulate when necessary by adjustment of remote control regulators. Direct chemical operators as control room instruments indicate.

Lab Technician and Chemical Operator, Rexall Company, Odessa, Texas - 4-1/2 years.

L. E. McCoy - Shift Supervisor

Education - High School Graduate (Vian, Oklahoma)

Experience - Sequoyah Facility, Kerr-McGee - 4 years Responsible for planning and directing activities of one shift of production operations; for producing specification quality product at minimum costs; obtaining maximum production rates without injury to people or damage to equipment and for designing shift activities to meet production schedules.

Control Room Operator, Sequoyah Facility, Kerr-McGee - 1-3/4 year. Observe control room instruments and regulate when necessary by adjustment of remote control regulators. Direct chemical operators as control room instruments indicate.

Control Operator, Tenneco Chemical - 1 year

Supervisor, Arkla Chemical - 3 years

Control Operator, NIPAK Chemical - 8 years.

S. N. Moore - Shift Supervisor

Education - High School Graduate (Ft. Gibson, Oklahoma) 1958-1959 Instrumentation schooling, Callery Chemical, Muskogee, Oklahoma.

Experience - Sequoyah Facility, Kerr-McGee - 4 years. Responsible for planning and directing activities of one shift of production operations; for producing specification quality product at minimum costs; obtaining maximum production rates without injury to people or damage to equipment and for designing shift activities to meet production schedules.

Control Room Operator, Sequoyah Facility, Kerr-McGee - 1-3/4 years. Observe control room instruments and regulate when necessary by adjustment of remote control regulators. Direct chemical operators as control room instruments indicate.

Relief Operator, Cabot Titania, Inc. - 5-1/2 years.

Truck Driver - Muskogee Supply - 9 months

Laborer - Brockway Glass - 4 months

Chemical Operator, Callery Chemical Company
1-1/2 years

PROCESS TECHNOLOGY AND EQUIPMENT

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3.0 PROCESS TECHNOLOGY AND EQUIPMENT

The process for producing UF_6 at the Sequoyah Facility for the past five (5) years, utilizes technology which has been proven by successful performance at various AEC plants, notably at the Weldon Spring, Missouri; Fernald, Ohio; Paducah, Kentucky; Oak Ridge, Tennessee; and Hanford, Washington sites. The Sequoyah process follows the AEC approach involving the preparation of pure uranium trioxide from ore concentrate and dry chemistry conversion to uranium hexafluoride. The uranium ore concentrate is purified by solvent extraction and converted to UF_6 by successive treatments with H_2, HF and F_2.

3.1 PRODUCTION METHOD

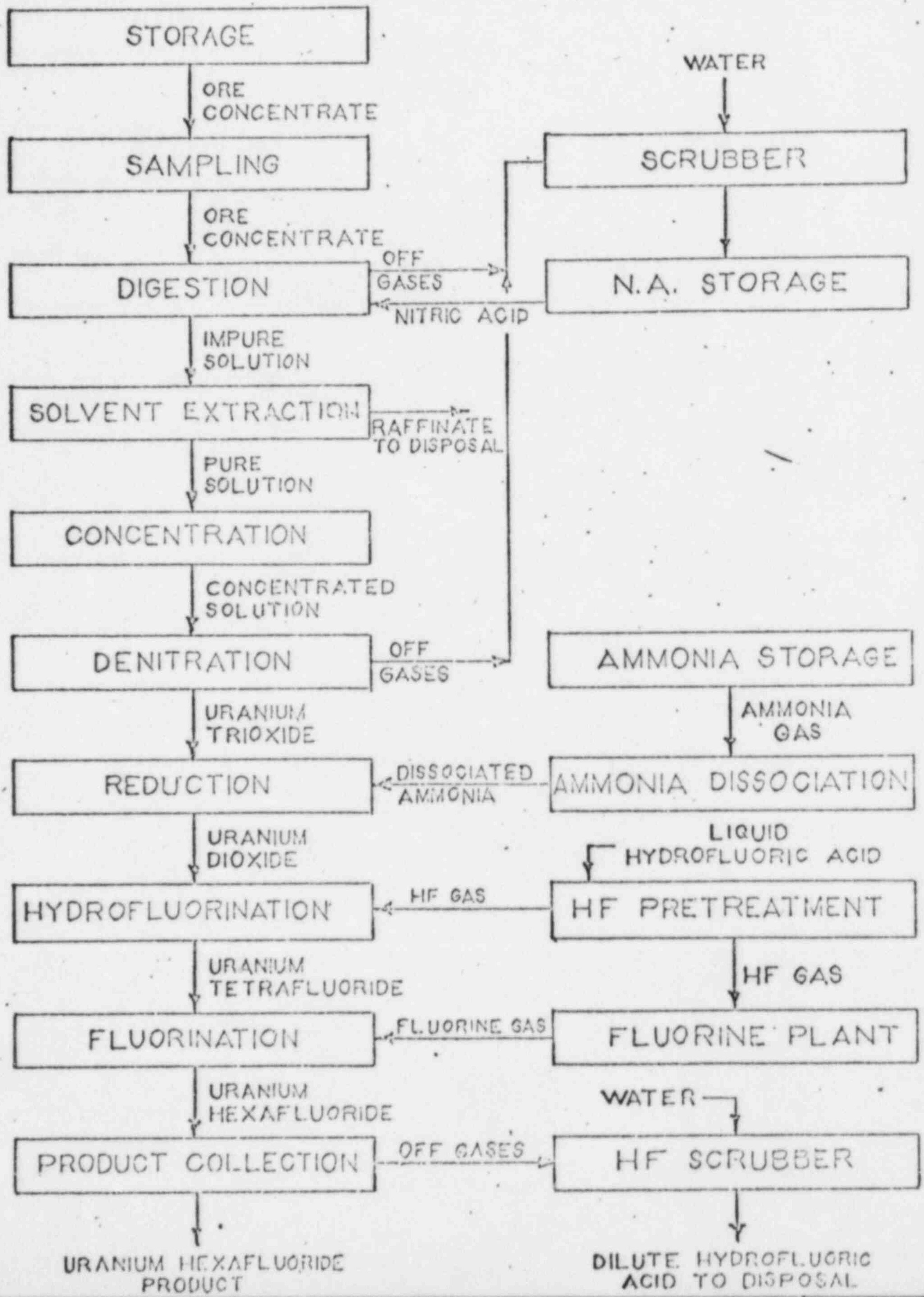
The production method used at the Sequoyah Facility involves (a) dissolution of the ore concentrate in nitric acid, (b) purification of the uranium solution by solvent extraction, (c) denitration of the uranyl nitrate to prepare uranium trioxide, (d) hydrogen reduction of the uranium trioxide to uranium dioxide, (e) conversion of the uranium dioxide to uranium tetrafluoride by reaction with anhydrous hydrogen fluoride, and (f) formation of uranium hexafluoride by contacting the uranium tetrafluoride with elemental fluorine. Pulse columns and pumper decanters are used for solvent extraction, fluid beds or mechanically agitated beds for denitration, reduction and hydrofluorination, and flame reactors for fluorination.

Figures 1 and 2 respectively show a block diagram and schematic flowsheet of the production process.

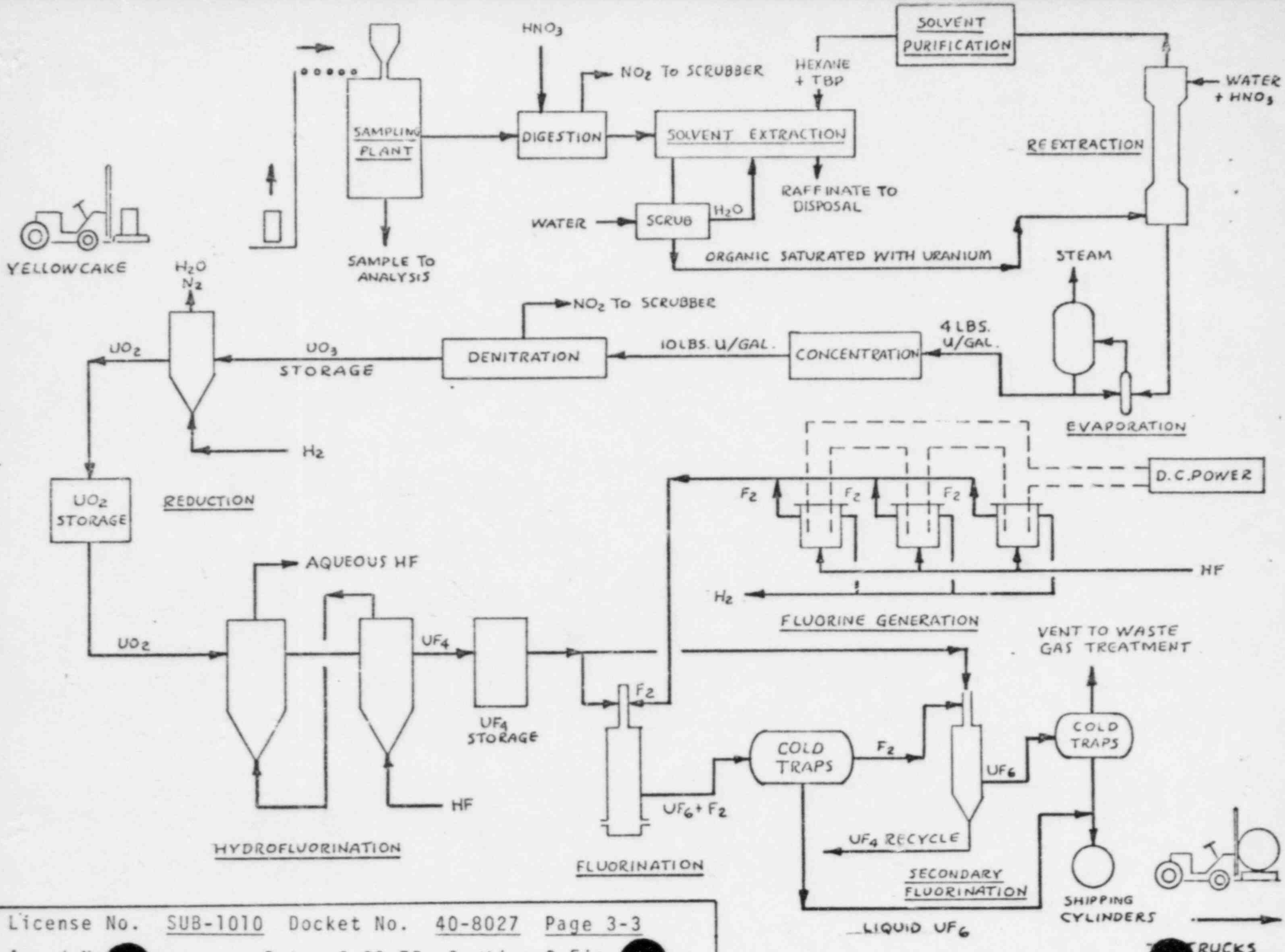
After sampling, ore concentrate is dissolved in nitric acid and the uranium extracted with TBP-hexane in a series of pumper decanters. The extract is passed through pulse columns to re-extract the uranium into water. This solution is evaporated and then heated in a continuous trough denitrator to form UO_3. The raffinate from the extraction step is pumped to holdup tanks for sampling and then to holding ponds. Before recycling, the solvent is treated with ammonium sulfate-caustic to remove any traces of uranium and TBP degradation products.

After grinding, the UO_3 is converted to UF_6 in three successive dry processing steps. The powder is fed first to a two-stage fluid-bed where it is contacted with H_2 to form UO_2. This product is then charged to series-connected stirred fluid-bed reactors in which UF_4 is formed by reaction with anhydrous HF. Any excess HF along with the water formed by the reaction is condensed to produce an aqueous acid which is transferred to storage tanks. The UF_4 is then converted to UF_6 by reaction with F_2 in a flame-type reactor. The gaseous UF_6 formed is

SEQUOYAH PROCESS FLOWSHEET



License No. SUB-1010 Docket No. 40-8027 Page 3-2
Amend No. ___ Date 2-28-75 Section 3 Fig. 3-1
Replaces Reproduced Process Flowsheet Dated 9-23-69



License No. SUB-1010 Docket No. 40-8027 Page 3-3

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Replaces evised Schematic Flowsheet Dated 9-23-6

collected by desublimation in refrigerated heat-exchangers (cold traps). These units are operated on a batch-cycle and are periodically taken off-line and heated to liquify and drain the UF_6 into product cylinders. For economy, fluorine vent gases are passed through a secondary or clean-up reactor to assure complete usage of gas.

Elemental fluorine required for the final processing step is generated by the electrolysis of a molten KF-HF electrolyte. Appropriate gas feed systems, dust collection devices and disposal systems are provided.

3.2 DETAILED PROCESS AND EQUIPMENT

Descriptions of the production systems involved are presented below.

3.2.1 Sampling the Ore Concentrate

The ore concentrate (yellowcake) is received from uranium mills in 55-gallon steel drums which are tared at the mill at the sampling plant. The drums of ore concentrate are weighed and sampled by a dry splitter system. Powder discharged from the falling-stream sampler is conveyed to the digestor feed hopper.

The drums are emptied one at a time through a falling-stream sampling unit. This unit consists of 2 samplers in series, each taking a small cut. This produces an initial sample weight of about one percent or less of the toal lot. The sample is split down again by a factor of about fifty and is collected in trays. The material collected in the trays is processed to a final sample pulp by the operations of drying, pulverizing, riffling, sieving and blending as needed.

The sampled ore concentrate is usually fed directly into the digestor feed hopper. The sampled concentrate can also be redrummed if desired.

3.2.2 Ore Concentrate to Purified $UO_2(NO_3)_2$

The process of purifying ore concentrate sufficiently for production of pure $UO_2(NO_3)_2$ involves nitric acid digestion and solvent extraction.

3.2.3 Digestion

Yellowcake and 40% nitric acid are fed to two 4,000 gallon digestors which operate on a batch basis. After digestion, the digestor tank contents are transferred to two 4,000 gallon adjustment tanks where adjustment of acid concentrations

and miscellaneous adjustment chemicals are added. Overall residence time varies from 12 to 24 hours.

3.2.4 Purification

Recovery of the U value from the digestor product is accomplished by extraction with 30 percent tributyl phosphate (TBP) in hexane, using a series of four-foot diameter by six-foot high pumper-decanters. The loaded solvent is then scrubbed in mixer settlers to remove residual impurities and entrained aqueous solution. The uranyl nitrate is re-extracted into water using a pulse column as a contactor. The purified solution is subsequently boiled down and denitrated to UO_3.

After the uranium has been removed from the solvent, it is treated with ammonium sulfate-caustic to remove the residual uranium and TBP degradation products.

The raffinate from the solvent extraction step(pumper-decanters) is stored in onsite ponds.

3.3 Preparation of Uranium Trioxide

The aqueous uranyl nitrate prepared in the solvent extraction step is converted to dry uranium trioxide by a two-step procedure. The solution is first concentrated by evaporation to form uranyl nitrate hexahydrate (UNH) which is then heated to yield uranium trioxide. Continuous processes utilize stirred trough and/or fluid-bed denitrators.

3.3.1 Evaporation and Denitration

The purified uranyl nitrate is concentrated by evaporation in a single effect evaporator followed by batch boildown tanks and converted to UO_3 by heating in agitated trough denitrators.

The boildown tanks are heated by steam. The boiling temperature is controlled at levels ranging from 250 to 290°F. Solution freezing points range from 140 to 240°F, thus requiring heating on all transfer lines and storage tanks. In general, nitric acid is recovered from the denitrator off-gas, and condensed streams containing uranium are recycled.

The concentrated uranyl nitrate hexahydrate (UNH) is denitrated to UO_3 by a horizontal heated and agitated trough.

Uranyl nitrate hexahydrate is introducted through four feed pipes extending vertically from the top of the trough to within about 3 inches of the bottom. The uranium trioxide product overflows through an adjustable weir into a collection bin below the reactor. The uranyl nitrate hexahydrate feed rate is regulated to control the bed temperature at a set value, usually about 525°F.

Trough outer wall temperatures are controlled at 950 to 1000°F. The uranium trioxide overflow is conveyed to a hammer mill. Off-gases go through a wet scrubber and then to a nitric acid absorber.

3.4 Reduction of Uranium Trioxide to Uranium Dioxide

The UO_3 from the denitrators is pulverized and then converted to UO_2 and UF_4 by successive reactions with H_2 and HF. Two stages of 18-inch diameter fluid-bed reduction and two stages of 30-inch diameter fluid-bed hydrofluorination are furnished.

The fluid-bed reduction is a two-stage system operated with series powder flow and parallel gas flows. With this arrangement, the desired use of staging to prevent short-circuiting of raw feed powder to the product discharge is accomplished. The parallel gas flows permit reduction of the reactor cross-secitonal area, since this parameter is determined by the design gas velocity. Both stages are heated electrically and are provided with external air cooling coils.

Uranium trioxide is screw fed from a weighed storage hopper into the reducer near the top of the bed. The outlet gases carry the uranium dioxide product into a collection hopper and are vented through a sintered metal filter. The filter tubes are pulsed periodically with nitrogen to dislodge powder which drops into the hopper. The uranium dioxide is then transferred to a seal bin.

The hydrogen gas is supplied by cracking ammonia. A mixture of 75 mole percent hydrogen and 25 mole percent nitrogen is formed by dissociation of ammonia and is passed through the fluid beds. The off gases after filtering are vented through a burner.

3.5 Hydrofluorination of Uranium Dioxide to Uranium Tetrafluoride

The fluid-bed hydrofluorinator consists of 30-inch diameter fluid beds arranged in series. The 6-foot deep powder bed in each reactor is agitated slowly with a wall scraping type stirrer. Uranium dioxide powder is screw fed into the upper reactor near the top of the bed. The partially reacted product powder and the outlet gases are discharged into an intermediate hopper which feeds the second reactor. The outlet gases vent through a carbon filter. The second fluid bed functions like the first with the exception that the outlet gases carry the powder to the uranium tetrafluoride product hopper and are then introduced without filtering to the bottom of the first reactor. Both reactors are provided with electrical heating and external forced air cooling.

Hydrogen fluoride economy in the fluid-bed system can be accomplished in several ways. A procedure is to sell dilute, about 20%, acid. The hydrogen fluoride flow to the reactor is adjusted to give the desired outlet concentration, and the aqueous acid is collected in tanks after condensation in a heat exchanger. If there is no market for the acid, the hydrogen fluoride flows will probably be lowered sufficiently to decrease the outlet hydrogen fluoride concentration to 10%. This acid could then be neutralized.

3.5.1 Fluorination and Condensation

The UF_4 is converted to UF_6 by reaction with F_2 in a system consisting of primary and clean-up flame reactors. Primary reactors operate with an excess of F_2 gas to consume as much UF_4 as possible, while the clean-up units use an excess of UF_4 powder to remove all the F_2 from the vent gas stream. The primary reactors are eight inches in diameter by twelve feet long. Primary and secondary cold traps are provided for UF_6 collection.

3.5.2 Fluorination of Uranium Tetrafluoride to Uranium Hexafluoride

The production process use flame reactors (fluorinating towers) for the conversion of uranium tetrafluoride to uranium hexafluoride.

In principle, a primary reactor is used in which uranium tetrafluoride is essentially converted completely to uranium hexafluoride using an excess of fluorine. The unused fluorine is then passed through a secondary or cleanup reactor which operates with an excess of uranium tetrafluoride and consumes all the fluorine. A single cleanup reactor services a bank of primary reactors.

4.2 Environmental Surveillance

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 bypassed plant intake water is sampled continuously at the point where it leaves the immediate plant area south of the road. Daily composite samples are analyzed for purposes of control and monthly composites are analyzed for uranium, gross alpha, gross beta, nitrate and fluoride. The samples are also analyzed quarterly for radium-226. In addition, the four individual streams are sampled and analyzed every two weeks to pin-point the major source of contamination.

The Illinois and Arkansas Rivers are sampled weekly upstream and downstream of the plant outfall and monthly composites are analyzed for the constituents listed above. Two onsite "farm ponds" are sampled weekly and monthly composites are analyzed for the same components as above. Samples are taken from water wells as well as from monitoring wells located near the raffinate and fluoride treatment storage ponds and analyzed as above. Additional wells have been added to support this effort.

Air samples are taken along the restricted area fence line (east, west, north, south) and counted daily for radioactive particulate matter. One week continuous air samples are taken each month for fluoride analysis.

Soil and vegetation samples are collected monthly. Vegetation samples are analyzed monthly and soil samples are analyzed quarterly for uranium, fluoride, and nitrate.

4.3 Accident Analysis

Efforts have been to minimize the occurrence of accidents in the plant through the incorporation of all practicable safety features in the design, construction and operating procedures for the facility. Properly engineered handling equipment, installation of automatic safety devices, and training of operating personnel add further to the safety of the operations and provide means to promptly mitigate the consequences of accidents. The effectiveness of these measures is demonstrated by the fact that there have been no accidents to date having any offsite environmental effects.

Incidents having a potential for causing offsite effects are:

- 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.

Although the uranium being processed is radioactive, the primary consideration with regard to health and safety is its toxicity as a heavy metal. Thus environmental considerations of accidents that could occur are related almost exclusively to the toxic effects of chemicals, including uranium, which might be released to the environs in the event of an accident.

1. Rupture of Waste Retention Pond Embankment

The most significant incident that might involve a radioactive release to the environment would be the highly unlikely simultaneous discharge of the entire contents of both raffinate storage ponds as well as the raffinate sludge pond to the Illinois River as the result of a natural phenomenon such as an earthquake or tornado. This incident could result in the discharge of more than 14 million gallons containing more than 8625 kgs of uranium to the river in both soluble and insoluble forms. The minimum dilution of about 36 needed to reduce concentrations of radionuclides to below the maximum permissible concentrations would require complete mixing with over 500 million gallons of river water. With the minimum daily flow of the Illinois River at times as low as 20 cfs, the required dilution might not occur until the release reached the Arkansas River about 1000 feet downstream. Under these conditions, the ammonium nitrate and nitrogen concentrations would probably be controlling and override the radioactive effects of the release and be sufficiently toxic to cause localized fish kills in the discharge plume until sufficient dilution occurred. This condition would be expected to be of relatively short duration and temporary in its effect on the local fish population.

2. Acid Storage Tank Rupture

Storage of large quantities of acids always involves the possibility of spillage or leakage with resulting releases to the environment. Of the acids stored at the Sequoyah plant, the anhydrous hydrogen fluoride represents the greatest potential for having an environmental impact due to its high volatility, its extremely corrosive character and a possible inventory up to 24,000 gallons in two tanks. The 15,000 gallon capacity storage tanks are only filled to 80% capacity and are located within curbed concrete pads containing sufficient limestone to neutralize the entire tank contents in the event of a slow leak. Each tank is operated at 30 psig to discharge acid through a dip-leg and is equipped with two rupture discs. The first, set at 55 psi dis-

charges into the scrubber system while the second set at 75 psi discharges into the atmosphere. In view of the engineering precautions, a highly unlikely although serious accident would be the rupture of a discharge line or valve releasing liquid HF to the atmosphere for the period of time it would take to reduce the tank pressure by manually venting to the scrubber. This conceivable incident could result in the ground level release of sufficient magnitude to result in the vaporization of 10 gallons per minute of HF. Assuming meteorological data at the 50 percent probability level and neglecting any building wake effect, the estimated concentration at the closest residence 2100 feet northeast of the plant would be about 40 mg/m^3. Thus, the release would produce transient offsite concentrations approximately 20 times above the long term threshold limit value of 2.0 mg/m^3 for hydrogen floride as recommended by the American Conference of Government and Industrial Hygienists but below lethal concentrations. In addition, the release would probably produce detectable damage to many of the plant species near the site.

3. Fire in the Solvent Extraction Circuit

A fire in the solvent rework section of the solvent extraction building might involve the combustion of several thousand gallons of hexane and would be considered as a typical industrial accident. A fire on the solvent extraction side of the building could involve the pumper-decanters containing uranium loaded solvent which might be dumped onto the curbed concrete pad and continue to burn. The fire would normally be suppressed by an automatic water-foam deluge system but, assuming failure of this system, the natural uranium carried in the smoke would be largely confined to the building, plating out with the soot particulates on all surfaces contacted. Traces of uranium carried out with the smoke would be expected to be deposited in the vicinity of the building. It is unlikely that there would be measureable uranium deposition beyond the site boundary. The expected consequences of the fire would be the creation of a localized cleanup problem with operational losses rather than a potential environmental effect.

4. Rupture or Valve Failure of a Hot UF_6 Product Cylinder

Another credible accident might be a wall rupture or valve failure in a hot ten-ton capacity UF_6 product cylinder or cold trap resulting in a combined release of soluble uranyl fluoride and hydrogen fluoride. The postulated accident involves the release of about 4550 pounds of UF_6 in 40 minutes through a 1.5 inch diameter hole in the cylinder wall above the UF_6 liquid level. After the 40 minute interval, the estimated loss is fairly small since the UF_6 should have

solidified. In the event of such an accident, plant employees would take emergency action as described by written procedures to mitigate the consequences of the accident. This action would include spraying the cylinder with water to cool it more quickly and minimize the UF_6 release. Calculations were made to evaluate the effect of the postulated accident using the extremely conservative assumption that the entire release will leave the building through roof vents with no deposition of UF_6 or UO_2F_2 either in the building or on the ground. The results of these calculations based on χ/Q value determined from meteorological data at the 50 percent probability level indicates that a fluoride concentration of about 16.3 mg/m^3 would be attained at the closest residence 2100 feet northeast of the plant. These levels are somewhat above the long term Threshold Limit Values recommended by the American Conference of Government and Industrial Hygienists (2.5 mg/m^3 for fluoride and 2.0 mg/m^3 for hydrogen fluoride). However, the short exposure times involved would not be expected to cause more than some transient discomfort to the residents although producing noticeable damage to some of the vegetation in the path of the release.

Similar calculations considering the uranium release indicated that the airborne concentration at the closest residence could reach a level of 1.14×10^{-2} $\mu Ci/m^3$ or 34.2 mg/m^3. The calculated radiological consequences to an individual exposed to the release for the full forty minutes estimated for the cloud to pass would be a dose to the kidney of about 0.8 rem and a bone dose of about 0.2 rem both of which are below the maximum annual doses of 1.5 rem and 3 rem for kidney and bone, respectively, recommended by ICRP for non-occupational exposures. Soluble uranium compounds such as UO_2F_2, like most heavy metal compounds, are toxic to the kidney when inhaled or ingested in large quantities. The total intake of uranium during the exposure period is calculated to be about 28 milligrams. While a single ingestion of 150 milligrams of soluble uranium normally has no observable effects, the inhalation of HF from very large releases of UF_6 for more than a few breaths may result in temporary lung impairment quite soon after the exposure and in some instances mild but repairable kidney damage within a few days from the UO_2F_2.

5. <u>Spill Prevention Control and Counter measure Plan</u>

In compliance with the Environmental Protection Agency regulation 40 CFR 112, on Oil Pollution Prevention the Sequoyah Uranium Conversion Facility has implemented a SPCC plan.

The Manager, Sequoyah Uranium Conversion Facility is designated as the person accountable for oil spill prevention.

Figure III shows the layout of the oil spill retention area and the appropriate drainage streams. The SPCC plan describes the quantity of oil stored, the primary and secondary containment areas and defines the reporting procedure to the Oklahoma Water Resources Board in the event of a spill of hazardous material at the Sequoyah Facility.

<u>Prediction and Control</u>

<u>Source</u> - Above ground oil storage tanks (Diesel & Fuel Oil)

<u>Major Type of Failure</u> - Tank rupture

<u>Total Quantity</u> of oil stored at the facility - 32,000 gallons.

<u>Primary Containment</u> - The diesel oil and fuel oil storage tank are located within an earthen dike. The capacity of this dike is 37,000 gallons. (The oil storage drain line is normally closed).

<u>Secondary Containment</u> - A surface rainwater holding area with a capacity of approximately 150,000 gallons.

Discussion: The secondary containment consists of an earthen dike rainwater holding basin. In the event of a simultaneous failure of an oil tank and the primary containment, the surface drainage from the oil storage tank area is into the rainwater holding basin. (See Figure III).

The rainwater holding basin is normally drained into the combination stream through two one-inch lines that enter the combined stream at the collection manhole. Both of these lines have inline valves which may be closed when the holding basin contains material that cannot be released. (Valves No. 2 and 3 on the attached drawing).

All plant personnel have been instructed to report any abnormal conditions to their immediate supervisor. It is reasonable to expect that an oil storage vessel rupture and/or a primary contain-

ment rupture would be noticed and reported by operating personnel who are in the area on an around the clock basis, seven days a week. In addition to the personnel in the area, combination stream grab samples are taken each eight hour shift. A spill which could have been missed by area personnel would be detected during this routine sampling.

When the supervisor receives notification that a spill has occurred his first action will be to close the two valves from the rainwater holding basin (Valves No. 2 and 3) that empty into the combination stream collection point. He will also notify personnel specified in the Sequoyah Facility Emergency Operating Instruction E-014.

The personnel notified, will initiate appropriate action, to collect and dispose of the oil contaminate.

Reporting Discharges of Hazardous Material

The purpose of this instruction is to define the reporting procedure to the Oklahoma Water Resources Board in the event of a spill of hazardous material at the Sequoyah Facility.

Procedure

I. General Reporting Requirements:

By definition, the types of spills which must be reported to the OWRB are discharges of oil or hazardous chemical substances that degrade or threaten the waters of the State of Oklahoma.

II. Classification of Discharge:

1. Minor Discharge -- Less than 1,000 gallons.
2. Medium Discharge -- 1,000 to 10,000 gallons.
3. Major Discharge -- More than 10,000 gallons.

III. Information Required for Report:

1. Location (Sequoyah Facility).
2. Material discharged and amount.

3. Waters of the state affected or endangered.

4. Cause or probable cause of discharge.

5. Steps taken for removal or containment where possible.

6. Measures taken to insure the discharge cannot reasonably reoccur.

IV. Notification Responsibilities

1. The shift supervisor shall notify at least one of the following personnel in the order listed and provide them with the information outlined in section II and III of this procedure.

   a. During the day evening or night and on weekends.

      1. Manager, Sequoyah Facility

      2. Manager, Conversion Engineering

      3. Manager, Production Department

      4. Manager, Health and Safety and Industrial Safety

2. When notification is received by the above personnel, and the information listed in section II and III is provided, the report of release will be transmitted to the "Discharge Report Center" by one of the above listed personnel.

   A memo, stating the information given to the "Discharge Report Center" shall be given to the Facility Manager and Director, Regulation and Control.

3. If one of the above mentioned individuals cannot be reached, within two hours after the spill occurs, the shift supervisor must notify and provide the necessary information to one of the following personnel.

   1. Director Regulation and Control

   2. Kerr-McGee Corporate Director of Safety and Environmental Services.

   The shift supervisor must then prepare a memo, for the Facility Manager, to inform him of the information which was forwarded.

6. Seepage Well Monitoring

The ponds were constructed as described in the Supplementary Environmental Report already submitted. All construction was supervised by a civil engineer specializing in such construction. Inspection of the placement of the liner and dikes was conducted on daily basis by an on-site inspector. The exact layout of the ponds and the location of monitoring wells were shown in the above mentioned Environmental Report. Figure IV is an up-date map showing the addition of ten monitor wells constructed in 1974. These additional wells are being tested as an additional part of the pattern analysis to determine the migration of raffinate solutions into ground water and resolve the anomalies in the levels of chemicals appearing in well waters as compared to chemical concentrations in the raffinate pond.

4.4 Location of Combustible Burner

A submerged combustible burner is used to process the supernatant liquid in Raffinate ponds 1 and 2 so as to avoid the immediate need to build a third pond. The evaporator is designed to evaporate incoming raffinate at a temperature of 150°F, and return the heated raffiante to the pond where further evaporation will take place on the surface of the pond.

The burner is located between the two raffinate ponds as shown on Figure 1.

A process equipment and instrument diagram required for the installation of the submerged combustion burner is shown on Figure 2.

4.5 Waste Heat

Heat generated in the plant process or supplied as building heat is dissipated to the atmosphere by direct convection or by evaporation from holding ponds or the plant cooling tower.

No significant reduction in visibility has resulted in heat and water from the cooling water setting up fog conditions. Assuming total discharge to the Illinois river of <200,000 gallons (plant start-up to date) the maximum temperature rise of the river water due to plant water temperature has not had any significant impact on the environment. Temperature of the water streams exiting to the river are measured daily.

4.6 General Environmental Requirements

To date no permanent method of disposal has been determined with respect to raffinate waste control resulting from operations of uranium conversion facilities. The design, construction and operations of the chemical waste treatment and disposal system presently in operation at the KMNC Sequoyah Facility is applicable to state and Federal laws, rules and regulations. The waste control system is designed to meet the water Quality Standards for the State of Oklahoma and limits the releases of radioactivity and hazardous materials to the levels consistant with the appropriate AEC requirements of Title 10 CFR 20; 50; 51; and 40CFR112.

In addition KMNC will make every effort to meet the timely and adequate reports concerning the environment, as required by the following permits and licenses:

Permits and Licenses

1. Oklahoma Water Resources Board-Permit to Appropriate Surface Water No. P67-765

2. U. S. Army Corps of Engineering-Contract No. DACW 56-70-C-0083

3. Oklahoma Water Resources Board-Waste Disposal Permit No. IW-70-011

4. Oklahoma Water Resources Board-Certification for Waste Discharges

5. AEC Radioactive Source Material License No. SUB-1010, Docket No. 40-8027 and Amendment No. 1

6. Oklahoma State Department of Health-Sanitary Waste Treatment Permit

7. Engineer's Report on Waste Treatment Plant

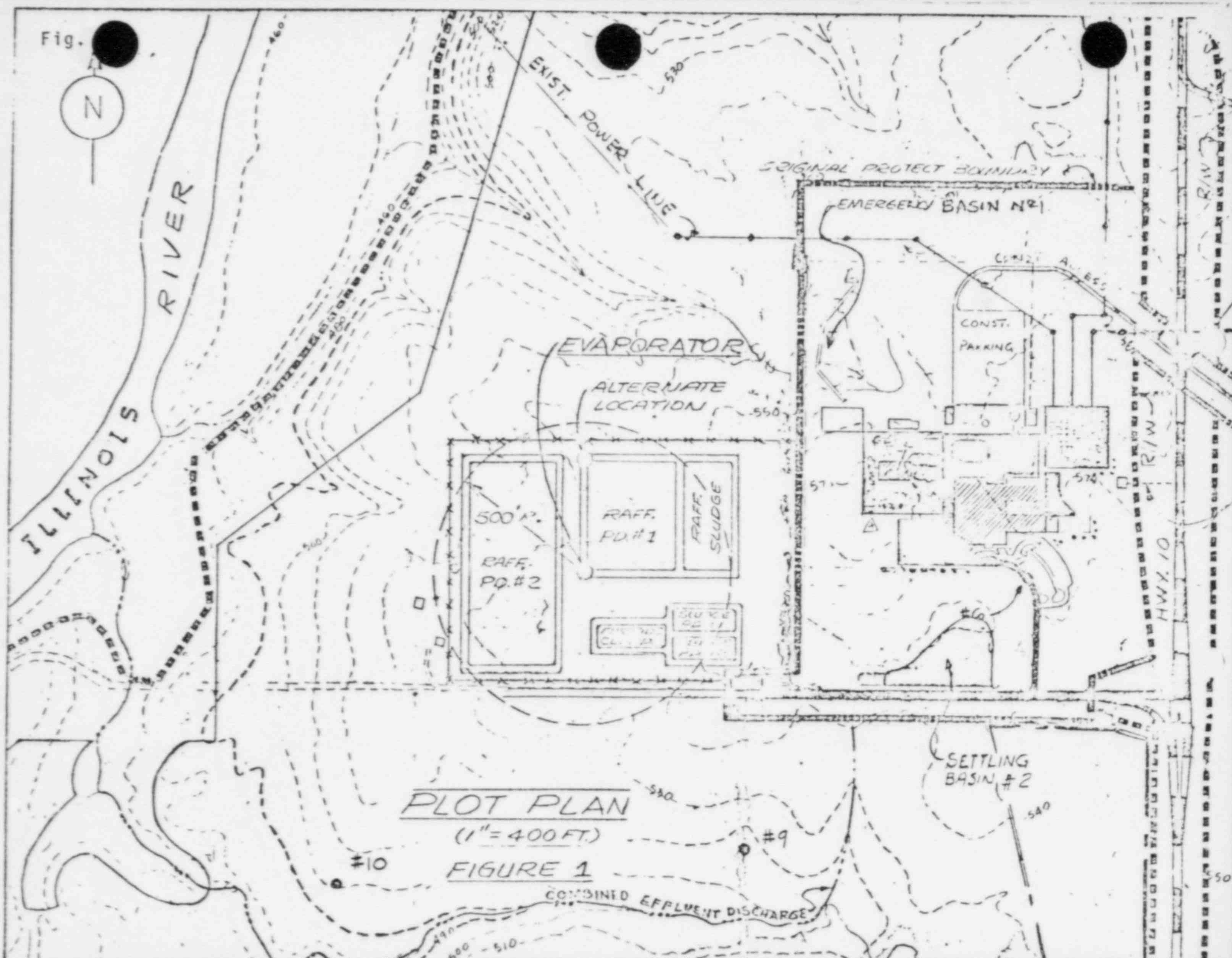
8. Technical Assessment by Dr. R. H. Ramsey, "Domestic Waste Disposal Procedures"

9. Oklahoma Air Pollution Control Division-Open Pit Incinerator Application

10. Oklahoma State Department of Health-Open Pit Incinerator Evaluation Test

11. Waste Disposal Technical Provisions and Specifications

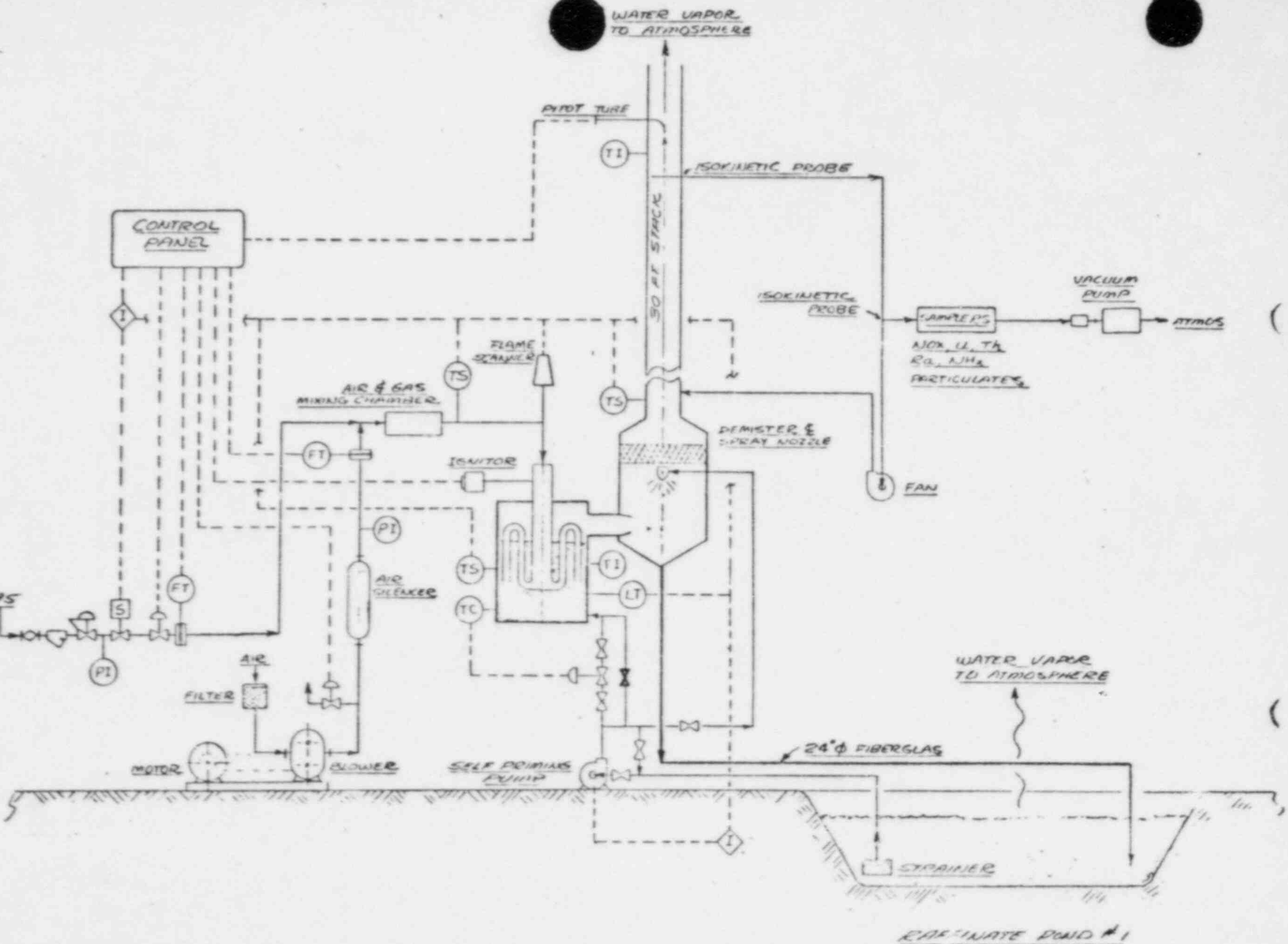
* 12. Oklahoma Water Resources Board - Spill Control Countermeasure Plan - Reporting of Hazardous Materials - Provisions of 40CFR112.



PLOT PLAN

(1" = 400 FT.)

FIGURE 1



KERR-McGEE CORPORATION
NUCLEAR DIVISION
OKLAHOMA CITY, OKLA.

FIG. 2

License No. SUB-1010 Docket No. 40-8027 Page

Amend No. Fig. II Date 2-28-75 Section 4.4 4-13

Applicants EPA Report; supplement Dated June 72-74

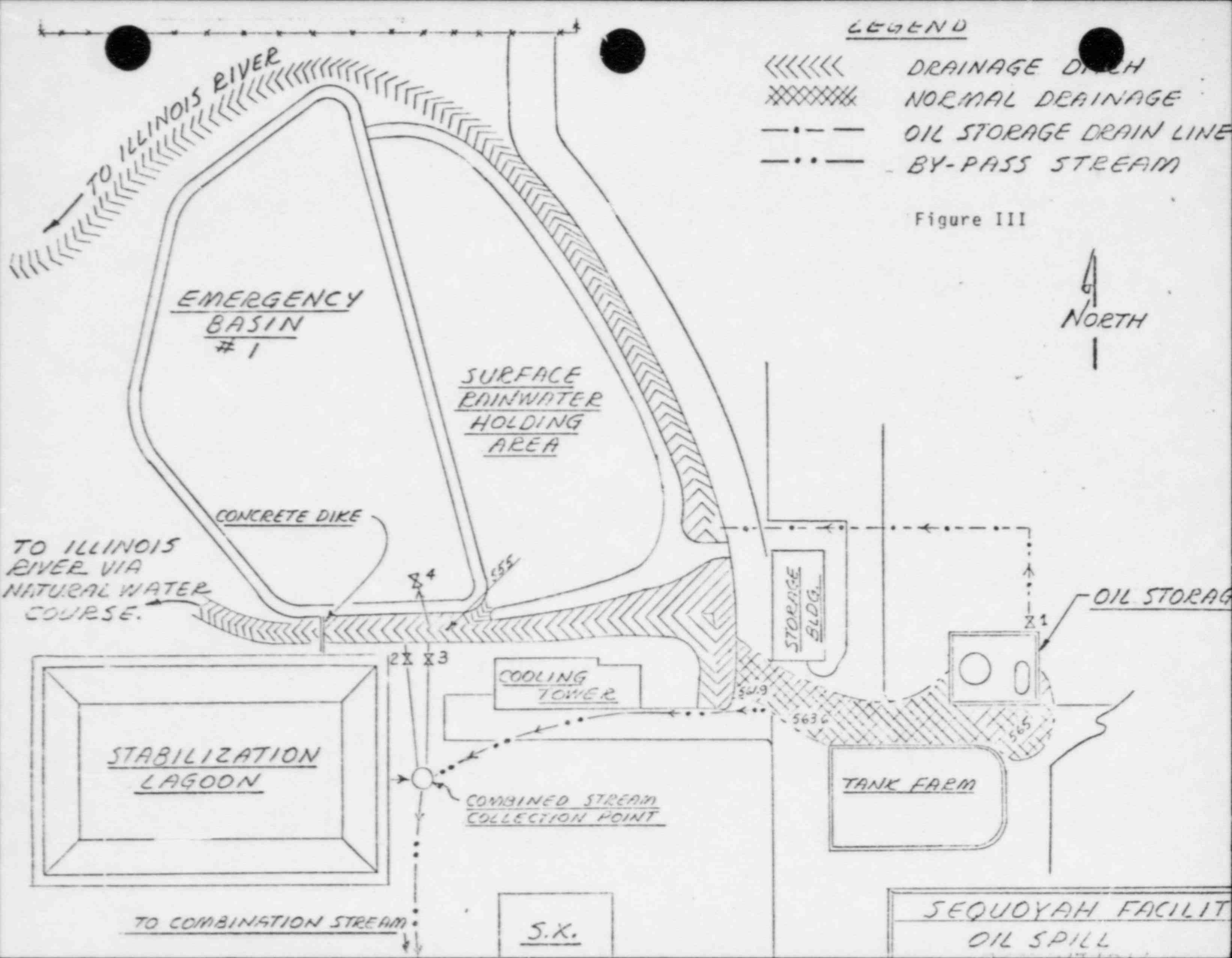
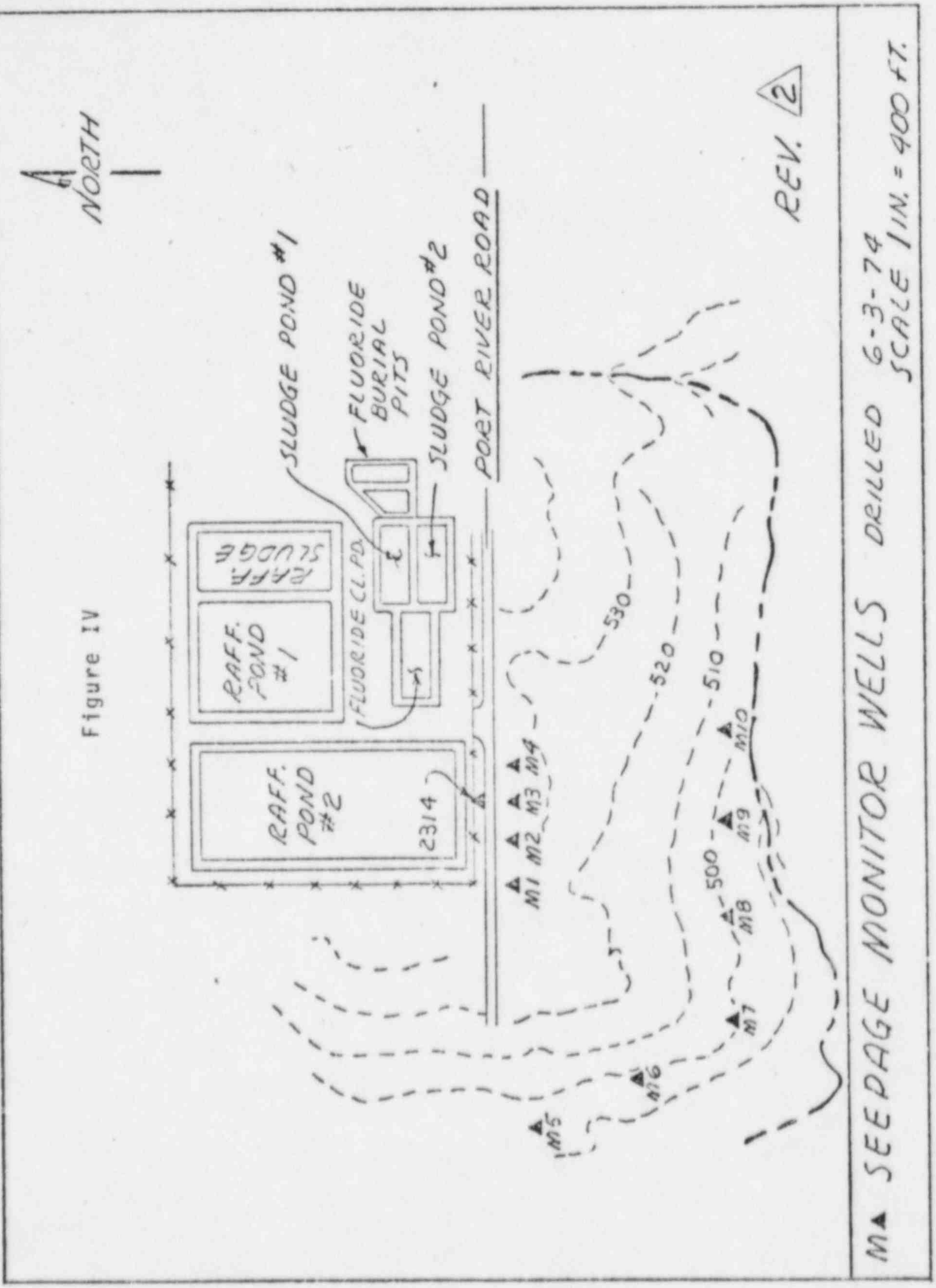

LEGEND
DRAINAGE DITCH
NORMAL DRAINAGE
OIL STORAGE DRAIN LINE
BY-PASS STREAM
Figure III
NORTH
TO ILLINOIS RIVER
EMERGENCY BASIN #1
SURFACE RAINWATER HOLDING AREA
CONCRETE DIKE
TO ILLINOIS RIVER VIA NATURAL WATER COURSE.
555
4
2
3
STORAGE BLDG.
OIL STORAG
1
COOLING TOWER
549
5636
565
STABILIZATION LAGOON
COMBINED STREAM COLLECTION POINT
TANK FARM
TO COMBINATION STREAM
S.X.
SEQUOYAH FACILIT
OIL SPILL

Figure IV



License No. SUB-1010	Docket No. 40-8027	Page
Amend No. Fig IV	Date 2-28-75 Section Fig. IV	4-15
Addendum p. VI-6.1.1	Dated 2-3-70	

HEALTH AND SAFETY

TABLE OF CONTENTS

5.0 HEALTH AND SAFETY

5.1 Health and Safety - General

This section outlines the various health and safety programs including descriptions of the facilities, equipment and procedures, which are provided and used at the Sequoyah Facility to protect health and minimize danger to life or property.

The protection of employees and the public from radiation and other operational hazards has been a prime consideration in the design and construction of the facility. For safe operation, much emphasis is placed on individual employee understanding and respect of radiation and use of the necessary precautions.

The basic philosophy that each individual is responsible for his and his fellow worker's safety is supplemented by health physics programs to assure and demonstrate that conditions in the Facility and in the surrounding environs are safe.

The health and safety standards adopted for the Sequoyah Facility are consistent with those stipulated in the latest amended version of Title 10, CFR Part 20, Standards for Protection Against Radiation. Future amendments to Part 20 will be incorporated into the health physics program as may be required for federal regulation.

Stringent operating precautions are taken and the process equipment is designed to prevent personnel exposure to uranium. Radiation detection and measurement instruments are utilized to reveal the presence of uranium contamination so that the necessary steps may be taken to control or eliminate contamination.

5.2 General Responsibilities

Primary responsibility for safety rests with each individual. Facility management and supervision is responsible for assuring that safe conditions exist and safe practices are followed. Management is also responsible for providing facilities and equipment required for safe conduct of work.

The Manager, Health Physics and Industrial Safety, working within approved standards and criteria, is responsible for developing and conducting detailed programs to determine the adequacy of plant safety conditions and practices and for determining the extent of effluent releases. He also provides training in radiation safety areas and offers competent assistance as required for finding and correcting unsafe conditions and practices.

5.3 Radiation Safety Program

Basically, the radiation safety program consists of the activities dealing with the control of the spread of radioactive contamination and the resultant personnel internal and external radiation hazards.

Details of the program elements are as follows:

5.3.1 Health and Safety Standards

The Health and Safety standard, Kerr-McGee standard No. 3, Radiation Protection in Natural Uranium Conversion Plants, governs all activities in the Sequoyah Facility. The standard specifics the definite rules, principles and measures established by nuclear corporate management for the conduct of the facility operations. The standard and any proposed operational changes which deviate outside of the standard is approved by the Vice-President, Nuclear Manufacturing.

5.3.2 Contents of Standard

1. Definitions
2. Responsibilities
3. Radiation Limits
4. Evaluation of Exposures and Contamination Levels
5. Control of Exposures and Contamination Levels
   - 5.1.1 Waste Disposal
6. Medical Program
7. Emergency Procedures
8. Radiation Safety Training
9. Records and Reports
10. Other Hazards

5.4 Procedures and Instructions

Operating processes and the equipment in which they are carried out are thoroughly reviewed for any unusual health safety aspects prior to approval. If results from any of the sampling, survey or monitoring programs or other audit and inspeciton activities indicate unfavorable trends, or potentially unsafe conditions, a report is made immediately to operating management and the cause is immediately investigated. Corrective action is initiated by the Production Manager or his designate. If necessary, specific operations are discontinued or curtailed by authority of the Sequoyah Facility Manager or his designate, or the Nuclear Manufacturing Vice President, until adequate protcctive measures are incorporated and demonstrated as providing for continued safe operation.

Standard operating instructions are prepared by production personnel and reviewed by the Manager, Plant Production, the Manager Health Physics and Inductrial Safety and by the Manager, Conversion Engineering and approved for operability by the Manager, Sequoyah Facility.

The Director of Regulatory and Control, through the Health and Safety Coordinator and the Nuclear Safety Coordinator and the Nuclear Safety and Licensing Officer, audit all operating instructions independently for conformance with license conditions, process criteria, standards and radiation safety.

The Manager Health Physics and Industrial Safety or his designate approves all hazardous work permits for equipment maintenance or repair involving any potential release of radioactive material. Prior to approval, he specifies safety requirements on a Hazardous Work Permit if special safety precautions are required.

KMNC Radiation Health and Safety Standard No. 3, prepared by the Health and Safety Coordinator serves as a guide for the Facility Health and Safety Manual of operating procedures or instructions specifying contamination, radiation, and safety requirements peculiar to the plant prepared by the Manager, Health Physics and Industrial Safety, concurred in by the Production Manager, and approved by the Manager, Sequoyah Facility. Included in the manual are such topics as: Protective clothing requirements, eating and smoking areas, emergency detection systems, emergency responses, and personnel dosimetry requirements.

A section of the Health and Safety Manual includes detailed Health Physics Instructions, including instructions for the following health physics topics:

1. Personnel Dosimetry

2. Facility Monitoring

3. Effluent Monitoring
4. Instrument Calibration
5. Air Monitoring and Concentration Evaluation
6. Count Room Practices
7. Respiratory Protection Program
8. Waste Handling
9. Equipment and Materials Monitoring
10. Personnel Decontamination
11. Training
12. Evaluation of Internal Exposures
13. Emergency Actions

5.5 TRAINING PROGRAM

Introduction

The training program is designed specifically to train the operating and maintenance personnel in the safe handling of uranium and the effective operation of equipment in the Sequoyah Facility. The training consists of both classroom instruction and in-plant training with demonstrations in the four basic program elements: 1) Radiation Safety, 2) Plant Operations, 3) Equipment Operation, and 4) Emergency Procedures.

5.6 Employee Safety Training

The initial training for new employees includes a minimum of six hours of topical material specifically relating to health and safety in formal lectures and demonstrations provided by health and safety personnel.

After this initial training phase and prior to the new employees work assignment the Facility Manager or his designate discusses with the employee the importance of rules pertaining to radiation and industrial safety.

Health Physics Technician(s) review the KM employee safety handbook with new personnel and conduct training in radiation safety, protective equipment and emergency procedures. Shift supervisors provide on-the-job-training for newly assigned personnel to include awareness of safety hazards related to the employees job assignment.

During the first month of in plant training or after ten days in a work assignment the Manager, Health Physics and Industrial Safety further instructs new employees in contamination control priorities, respiratory protection program, the plant emergency warning system and industrial safety matters.

Monthly safety meetings are conducted by the first line supervisor and/or Health Physics personnel for continual awareness of facility safety.

The Manager of Health Physics and Industrial Safety maintains a orientation checklist for new employees to assure their attendance participation and subject matter covered.

5.7 Personnel Dosimetry

Personnel dosimetry programs are implemented to measure: (1) External exposure to photon and beta radiation associated with handling uranium; and (2) exposure to internally deposited uranium. Details of the dosimetry programs are:

5.7.1 External

Personnel whole body exposure to photon radiation and beta radiation is measured with film badges using established film evaluation techniques. Badges are supplied and evaluated by an outside contractor who is competent in evaluating exposures associated with uranium handling. Film badges are exchanged on a monthly basis.

Monthly field measurements of photon exposure rates are made with calibrated ionization chamber instruments capable of measuring exposure rates between 0 and 2500 mR/hr. The Manager, Health Physics and Industrial Safety specifies a survey frequency consistent with the requirements for controlling and evaulating personnel exposure.

5.7.2 External Exposure Control

Operational control guides are established for external exposure to provide a basis for exposure control planning for work groups and facilities, and to minimize the possibility of any individual inadvertently exceeding the quarterly or annual radiation exposure limits. Using the

results of personnel exposure monitoring programs, exposures from controllable sources should be controlled in a manner that prevents individuals from exceeding the following quarterly exposure guides:

Organ	Quarterly Exposure Control Guides (rems)
A. Whole body and trunk, active blood forming organs, gonads, or lens of the eyes	1.25
B. Skin of whole body and thyroid	6
C. Hands and forearms, feet and ankles	15
D. All other organs	5

Ionization chamber pocket dosimeters 0-200 MR are used wh n necessary for estimating exposure on-the-spot.

5.7.3 Internal

Internal exposures from uranium are determined from urine sample results. Routine samples are collected from persons working in the process area on a bi-monthly frequency after periods of at least twenty four hours away from the facility. Standard fluorimetric assay techniques are used for sample analysis. Pre-employment and termination samples are collected and analyzed.

Additional special samples are collected and analyzed after suspect or known accidental exposures to excessive airborne uranium concentrations.

5.7.4 Urine Action Levels

Action levels are established for single bi-weekly samples for ne purpose of controlling kidney and bone exposure in ases of soluble uranium and lung exposure in cases involving inhalation of insoluble uranium.

Routine samples are collected after a worker has been out of the plant for at least 24 hours.

If an employee submits a urine sample >20 ug U/l, he is promptly given a take home sample kit. He collects a voiding before retiring, any voiding during the night, and any voiding the morning after. He returns the kit on his next shift. Should this second sample be >20 ug U/l, he is assigned to non-uranium work. He is resampled daily until a sample shows <20 ug U/l, after which he may return to his regular work assignment.

Shift samples or special samples (urine samples) showing uranium that result in frequent employee work restrictions will be investigated as deemed by the Manager, Health Physics and Industrial Safety, to determine the cause and need for corrective action. The Manager, Health Physics and Industrial Safety will also request in-vivo counting on personnel through specifications of Guide 8.11.

5.8 Contamination Control Practices

The Sequoyah Facility is divided into three control zones used to prevent the spread of contamination. Radioactive material handling and control practices vary for the three zones and are generally within the criteria described in the following paragraphs.

Restricted area includes the process buildings; the service and storage yards, the sanitary lagoon, and emergency basin #1, comprised of a controlled zone and an uncontrolled zone. This area is bounded by a security fence and access is limited to employees and authorized visitors. Entrances are posted with appropriate signs. Contamination and penetrating radiation levels are maintained low enough in restricted areas to allow personnel and vehicle entry. Work with radioactive material is limited to the restricted area in all cases.

All entrances to the restricted area are conspicuously posted in accordance with Section 20.203(e)(2) and with the words, "any area or room within this plant may contain radioactive material."

Access in controlled administratively and work in these areas by employees and authorized visitors is closely supervised by supervision and health physics personnel. Protective clothing and film badges are required. Equipment, items and vehicles from restricted areas are surveyed and decontaminated or packaged in a safe manner prior to release from the area. Personnel working in restricted areas follow procedures specifically designed to confine contamination to restricted areas. Included in these procedures are requirements for clothing changes and washing exposed skin surfaces or a hand and shoe survey and decontamination to less than 500 d/min. Contamination levels are maintained sufficiently low to permit control by normal standard clothing change and washing procedures in all restricted areas.

Controlled zones are areas within restricted areas that normally include powder handling areas and areas where maintenance work on contaminated equipment and clean-up work is performed. Temporary controlled zones maybe established in the event of an accidental spill or contamination spread or work performed on contaminated equipment in the maintenance shop. Upon completing a task or work period in a controlled zone, workers vacuum clean their protective clothing prior to leaving the zone if visible quantities of radioactive material was transferred to protective clothing articles. In addition to the above, personnel locker rooms are equipped with clothes hampers for discarding protected clothing and sinks and shower stalls for personnel decontamination. Persons entering controlled zones for inspection or supervision and who do not become contaminated with visible quantities generally follow procedures described for

restricted areas; however, if contamination levels are sufficiently high to result in excessive tracking, survey and/or additional protective clothing requirements may be imposed at the zone boundary. All work in controlled zones is performed according to requirements specified in "Hazardous Work Permit" or an operating procedure."

Contamination control practices for measuring and controlling facility radiological conditions and releases of radioactive materials to the environs include:

5.8.1 <u>In-Plant Air Monitoring</u>

In plant air monitoring facilities are sufficient to provide for collection work area samples and breathing zone samples.

a. Work area samples are collected continuously at approximately 36 locations for the purpose of detecting excessive airborne contamination levels that result in abnormal operating conditions and assessing chronic exposure conditions in the plant. These are strategically located in high airborne potential process areas.

An independent vacuum system is used to pull air through filter paper media. Each sampling head is equipped with a control valve and the sampling flow rate is adjusted weekly. Samples are normally collected for 24 hour periods and counted for alpha activity in a gas proportional counter.

Criteria for locating these samplers include:

1. Coverage must be sufficient to detect abnormal airborne contamination levels (>50% MPC_a) at work locations in the process area.

2. Sampling heads must be at a height 4-7 feet above the floor and within 6 feet of work locations normally occupied for 2 or more hours per shift.

3. Nominal flow rate is at least 1cfm.

Procedures for relating the results to employee exposures apply to accidental exposure cases expected to exceed airborne exposure limits and to workers working at specific locations such as in the sampling plant area where breathing zone samples are collected with the work area sampling system. The procedures include provisions for:

1. Determining employee's exposure time.

2. Accumulation of sample collection data.

3. Evaluation of air concentrations based on sample collection data and counting results.

4. Identification of personnel - Daily Work Location Card

   a. Work Location

   b. Time Loss - Date Worked

   c. Respiratory Protection Used

Results are used to calculate 40 MPC hours exposure, using 10CFR20, airborne limits for natural uranium.

b. Breathing zone samples are collected if it is suspected or known that personnel will likely receive a 7 day integrated exposure in excess of 25% applicable 10CFR20 limits. Four portable sampling units are available at the plant for collection of breathing zone samples.

There are procedures for determining air concentrations and exposure during operations requiring respiratory protective devices and for differentiating these exposures from those received when such devices are not used.

5.8.2 Shipments

Process material and sample shipments from the plant are surveyed and tagged within regulations established by Title 49, Code of Federal Regulations, Part 173 of the U.S. Department of Transportation prior to leaving the plant.

5.8.3 Protective Equipment

a. Protective Clothing is supplied for routine use to maintenance and operating personnel. Coveralls, 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.

b. Respirators used at the facility include half-mask MSA Comfo Aerosol Filter Respirators equipped with type "H" ultra filter elements, MSA-GMR Canister or equivalent, full-face MSA Clearvue Respirators and ACME Respirators with radioactive particulate filter, and or equipped with an element or organic-acid canister and fresh air respirators.

5.9 Surface Contamination

Surface contamination surveys are conducted routinely. Direct survey techniques using portable alpha survey instruments and smear survey techniques are used. Good housekeeping and dust control practices are maintained and locker room procedures prevent the spread of uranium to office areas that are outside the process area. In cases where airborne contamination has occurred, cleanup of contaminated areas is undertaken immediately.

5.9.1 Liquid Effluent

The Sequoyah plant process generates two major liquid waste streams of varying composition. The solvent extraction circuit raffinate and the waste hydrogen fluoride scrubber product are the two primary process waste streams. Sanitary and domestic waste water are combined with the fluoride effluent and treated before discharged to the river, while raffinate streams are contained in holding ponds.

The Liquid Waste Sampling Schedule For Radioactive Contamination.

Sample Location	Frequency	Uranium	Radium
Surface Water Illinois/Arkansas River	Monthly	X	X
Raffinate Ponds	Monthly	X	X
Residence Wells	Monthly	X	X
Monitoring Wells	Monthly	X	X

Grab samples are collected from the outflow stream, basins and lagoon on a weekly basis or as needed.

5.10 Hazardous and Electrical Work Permits are used in accordance with established procedures to assure safe operation during maintenance or unusual situations. It is the responsibility of the Shift Supervisor to determine when such work permits are necessary and to issue them as required. A listing of authorized signatures for work permits is issued by the Facility Manager.

5.11 First Aid

The plant has a well-equipped first aid facility located near the locker room. Safety showers and eyebath stations are strategically located throughout the plant. A visual inspection of each station is made weekly and an operational inspection and test of each shower station is conducted monthly to assure the

safety equipment is operable. Eyewash stations are tested weekly. Any discrepancies found during the inspections are reported to supervision and immediately corrected.

5.12 Visitors

Visitors are required to obey all local regulations within the various areas while in the plant. Shoe covers, eye protection and other safety equipment are supplied to visitors as required for the plant areas being visited.

5.13 Health Physics Equipment

Instrumentation is provided to perform the surveys associated with the health physics control programs. All survey and sampling equipment is inspected and calibrated under the direction of the Manager, Health Physics and Industrial Safety at intervals sufficient to assure reliable operation. The following instruments or equivalents are available at the facility for surveying and monitoring.

5.13.1 Radiation Detection and Related Instruments

Type	Available	Radiation Detected	Sensitivity Range	Use
Cutie Pie	2	Beta-Gamma	0-2,500	Survey
Eberline PAC-4G	2	Alpha	0-500,000 cpm	Survey
Geiger-Muller	2	Beta-Gamma	0-2,000 mR/hr	Survey
Geiger-Muller	2	Beta-Gamma	0-500,000 cpm	Personnel Monitor

Samples of airbo ne and liquid effluent are counted on a Nuclear Measurements Corporation gas proportional Model PC-3A alpha and beta counter. A certified alpha calibration source is used to calibrate the counter.

Liquid effluent samples are analyzed using the fluorimetric method both at the Sequoyah Facility and the Kerr-McGee Technical Center, Oklahoma City, Oklahoma. Isotopic analysis is performed on liquid samples at the Kerr-McGee Technical Center. Air samples are counted at the Sequoyah Facility using an internal proportional counter.

The beta-gamma survey instruments are calibrated using a 15 millicurie sealed Cobalt-60 in a Technical Operations Model 571 Meter Calibration Kit, or equivalent. Alpha detectors and counting instruments are calibrated against a standard Pu-239 reference source and or 230 Th source.

5.14 Environmental Surveillance

Environmental surveillance of the facility site is provided by Health Physics personnel or other qualified individuals for the purpose of sample collection and measurement of fluoride, nitrate and alpha and beta radioactivity. The capability to evaluate quantities accidentally released, potential personnel exposure and environmental contamination levels is maintained.

Environmental composited samples are analyzed by an independent laboratory and or by the Kerr-McGee Technical Center in Oklahoma City, Oklahoma.

Presently, soil samples are analyzed quarterly for uranium and fluoride, while vegetation samples are analyzed monthly for uranium and fluoride.

The enviromental samples are counted for gross alpha and beta activity and analyzed fluorometrically for uranium. Chemical analyses are also made for potential chemical pollutants.

5.14.1 Airborne Radioactivity

Trace quantities of uranium are routinely released from the facility through the main stack, the laboratory hood exhausts, the process building exhaust air vents, hydrogen fluoride off-gas scrubber exhaust, dust collector exhaust and roof hatches.

Various process equipment, exhaust streams and stacks are periodically sampled for uranium concentration as a service to operations to help them estimate the loss of accountable material. Loss of material for accountability purposes is controlled to the degree that there is little likelihood of an airborne concentration problem in the atmosphere resulting from stack releases.

The facility stack is a metal stack 150 feet in height located north of the main process building. The stack exhausts the off-gases from the facility boilers, the H_2 reduction burner, the HF scrubber. Emergency vents for F_2 and the UF_6 dump tank are also exhausted to the stack and sampled daily for radioactive particulates.

At least one twenty-four hour sample of the air effluent is collected daily from the vacuum and dust collection system exhaust. Air from the main process building is exhausted to the atmosphere through roof top vents, roof hatches and dust collector system at a nominal rate of 1.1×10^5 cfm.

The chemical laboratory hoods are vented to the atmosphere through stacks which terminate above the main process building roof. The quantities of uranium handling in the laboratory are small and the work does not result in dusting or conditions that might produce excessive losses. Routine sampling of these stacks is not practiced.

Sequoyah Stack Diffusion Calculations independently determined by the engineering firm of Dames and Moore were documented and submitted as a part of the environmental report in June of 1972. Estimates of airborne uranium releases fall well below the limits listed in 10CFR20.

APPENDIX A

LICENSE CONDITIONS

for the

KERR-McGEE SEQUOYAH FACILITY

Kerr-McGee Nuclear Corporation

February 28, 1975

License No. SUB-1010

APPENDIX A
LICENSE CONDITIONS
for the
KERR-McGEE SEQUOYAH FACILTIY

License Conditions
for the
Kerr-McGee Sequoyah Facility

Set forth herein are the technical and administrative specifications within which the authorized activities are conducted at the Sequoyah Facility (UF_6 Conversion Plant) of Kerr-McGee Corporation.

General

1.0 Authorized Place of Use

Kerr-McGee Sequoyah Facility located about 2-1/2 miles southeast of Gore, Oklahoma in Sequoyah County, Oklahoma.

1.1 Possession Limits

Unlimited amount of radioactive source material as natural and depleted uranium may be processed at the Sequoyah Facility.

1.2 Authorized Activities

The following activities are authorized:

1. Refining of uranium from ore concentrates (yellowcake) and conversion to uranium hexafluoride (UF_6), and related laboratory service activities.

2. Storage of depleted uranium compounds.

1.3 Contamination-free Ariticles

Articles which may have been contaminated with source uranium materials through use, handling or storage in the facility, may be disposed of or transferred to persons not licensed to possess radioactive materials when each of the following conditions are satisfied:

a. All surfaces are accessible for survey or, it is reasonable to assume from the design and usage that no uranium could have contaminated the inaccessible surfaces.

b. Survey of accessible surfaces by health physics personnel verify no fixed alpha contamination per 100 cm^2 in excess of 25,000 disintegrations per minute with an average not in excess of 5,000 d/m; nor removeable alpha contamination in excess of 1,000 d/m per 100 cm^2, and no beta-gamma radiation in excess of one millirad per hour with an average not in excess of 0.2 mr/hr as measured by an open-window beta-

gamma survey meter with a window thickness of not more than seven milligrams per square centimeter.

2.0 Organization Administration and Personnel

The Sequoyah Facility is part of the Nuclear Operations manufacturing complex. 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 Vice President, Nuclear Manufacturing, Kerr-McGee Nuclear Corporation.

The line authority for the operation of the Sequoyah Facility flows from the President of Kerr-McGee Nuclear Corporation through the Vice President, Nuclear Manufacturing, to the Manager of the Sequoyah Facility and to the Production Manager for Operations and finally to the Sequoyah Shift Supervisors.

2.1 Functional Organizations for Health and Safety

In view of the company's basic concern for the well-being and protection of its employees and for the health and safety of the public, and in the discharge of its responsibilities under public laws and regulations, a stringent effective program for the control of radiation and contamination hazards is maintained. To conduct these programs, organizational components are established to provide not only for strong facility management in radiation safety but also for independent development of process and equipment criteria and health and safety standards, and audit thereof under conditions which minimize the length of reporting lines and maximize the effectiveness of management control.

A basic premise of Kerr-McGee operation is that every individual has a personal responsibility for carrying out his assigned task in the manner which will not only achieve its operational objectives, but will do so without endangering the health and safety of the individual, his co-worker, or the public. It follows that every person in the chain of operational command has responsibility for health and safety matters for all operations under his control.

It is also a basic premise of Kerr-McGee that there be a strong independent overview of the activities of the line operations to assure, through a check and balance system, that health and safety problems have been adequately considered in the process selection and equipment design; that adequate procedures have been established to assure that the process and equipment are operating in a safe manner; and that personnel are adequately protected against radioactivity and radiation hazards.

Organizational responsibilities specific to the Sequoyah Facility are established to give full weight to these two premises.

The Vice President, Nuclear Manufacturing of Kerr-McGee Nuclear Corporation is responsible for all nuclear manufacturing activities, including technical service activities. He specifically approves of the modifications, process and equipment criteria and standards of the health and safety program.

2.2 Health and Safety Standards

All activities involving uranium are conducted in accordance with written and approved health and safety standards. Standard #3, Radiation Protection in Natural Uranium Conversion Plants, specifies the rules, principles and measures used at the Sequoyah Facility in the health physics programs. The health and safety standards are appropriately prepared under the direction of the Health and Safety Coordinator; reviewed for license compliance under the direction of the Director of Regulation and Control, or by the Nuclear Safety and Licensing Officer. The standards are reviewed for operability by the Manager, Sequoyah Facility and approved by the Vice President, Nuclear Manufacturing. Changes to the health and safety standards follow the same administrative review and approval system as original standards.

2.3 Process and Equipment Control

Process and equipment design, which generally delineate the process and prescibe critical parameters, are prepared by the Manager, Conversion Engineering, directed by the Technical Director, and reviewed as appropriate by the Director of Regulation and Control, the Health and Safety Coordinator and or the Nuclear Corporation's Senior Project Engineer. Major changes to process operations and to equipment design is reviewed by the Manager, Sequoyah Facility for operability and approved by the Vice President, Nuclear Manufacturing.

Modifications or changes to process operations or equipment that normally occur during operations are prepared under the direction of the Manager, Conversion Engineering. This requires a review by the Manager of Health and Safety and Industrial Safety and an approval for operability by the Manager, Sequoyah Facility.

2.4 Operating Procedures

Written procedures, which specify operating steps within process and equipment criteria and the health and safety standards, are approved by the Sequoyah Facility Manager.

The Manager for Production has the responsibility for formulating, developing and maintaining the detailed operating procedures based on approved criteria and standards. The operating procedures are reviewed by the Manager, Health Physics and Industrial Safety, and approved by the Manager, Sequoyah Facility.

Changes to the operating procedures which are within the approved criteria and standards follow the same administrative review and approval system as original procedures.

Audits are conducted through the Director of Regulation and control by the Health and Safety Coordinator, the Nuclear Safety and Licensing Officer and or other designated staff personnel to assure compliance with license conditions and process and equipment criteria and standards.

The Nuclear Safety and Licensing Officer is responsible for determining when operational changes fall outside the scope of the license and that such changes are appropriately amended.

2.5 Experimental and Developmental Work

All experimental and developmental work performed at the Sequoyah Facility must be approved by the Vice President, Nuclear Manufacturing, prior to its initiation.

2.6 Maintenance

No maintenance work is performed unless it is authorized in writing by a person having the proper authority. The Manager, Health Safety and Industrial Safety or his designate approves all maintenance work requests involving any potential release of radioactive material. Maintenance work is considered complete only when work is physically completed, inspected and signed off by Maintenance, and inspected and accepted by the supervisor in charge.

2.7 Operational Responsibilities

The operational functions in regard to health and safety matters are carried out under the Sequoyah Facility organization and are generally as follows:

1. To establish definite operating procedures consistent with the health and safety standards and guides approved by Kerr-McGee Nuclear Corporation Management; to assure that radiation and contamination levels are maintained at an acceptable level, and that radioactivity in effluents is controlled and monitored.

2. Carry out the manufacturing operations in a manner that insures safety of plant personnel and the public.

3. To carry out positive programs of audit, monitoring, inspection and surveillance; to assure that health and safety and industrial safety procedures are followed.

2.7.1 Production Organization

To discharge the responsibilities of the above-mentioned functions, Sequoyah Facility has established the following organizational pattern:

1. The Manager, Sequoyah Facility, reporting to the Vice-President Nuclear Manufacturing, has responsibility for all safety and all manufacturing and associated activities. He shall have a science or engineering degree and shall have had at least five years in management of manufacturing activities.

2. 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.

3. The Manager for 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 with five years' experience in a supervisory position. He shall have demonstrated a proficiency to manage the operations of the Sequoyah Facility and to identify process changes which require health physics analysis.

4. 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.

5. Shift Supervisors report to the Manager for 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 familiar with the uranium production activities and have thorough knowledge of the approved operating procedures.

2.7.2 Health Physics Program

The Sequoyah Manager of Health and Safety and Industrial Safety is responsible for:

The conduct of the health and safety and industial safety program at the Sequoyah Facility, including the effluent monitoring program, the bioassay program, the health physics training program and the program for surveillance of all plant activities in the area of health and safety and industrial safety.

Maintaining all radiation exposure and other health and safety and industrial safety records required by Kerr-McGee policy and by regulatory agencies.

The Manager, Health and Safety and Industrial Safety 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.

2.7.3 Independent Review Responsibility

The independent overview functions are carried out under the Director of Regulation and Control, through the Health and Safety Coordinator and the Nuclear Safety and Licensing Officer and are generally as follows:

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 processess 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 government.

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.

2.7.4 <u>Organization for Regulation and Control and Health and Safety</u>

The Office of the Director of Regulation and Control has the following organization.

1. The Director of Regulation and Control, reporting to the Vice President, Nuclear Manufacturing, is responsible for establishing general guidelines for the criteria, standards and procedures of the nuclear health and safety subjects for approving and recommending to the Vice President, Nuclear Manufacturing, 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 in 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 whould have been developed.

2. 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 Vice President, Nuclear Manufacturing. He shall be professionally qualified with a Bachelors Degree in Science or Engineering and shall have had five years experience in assignments involving radiation protection. He shall be capable of providing authoritative advice and counsel in matters of health physics, industrial hygiene and industrial safety.

3. The Nuclear Safety and Licensing Officer reports to the Director of Regulation and Control and is responsible for the preparation of detailed construction criteria and standards for equipment, review of operations for adherence to approved operating procedures. He shall review all planned equipment and procedure changes for nuclear safety and prepare detailed calculations as appropriate to demonstrate that nationally acceptable nuclear criticality safety standards are met. He shall be responsible for the preparation and coordination of regulatory communications in regard to license and nuclear criticality subjects.

He shall be professionally qualified by education and experience in the disciplines of nuclear physics, engineering or science and hold a Bachelors Degree in one of these fields. He shall have at least seven years experience in a nuclear field and at least two years experience in nuclear criticality safety calculations. Appropriate education by well qualified personnel or organizations may replace the requirements for one of the years of experience.

4. Nuclear Criticality Safety Specialist

This individual shall be responsible for the nuclear criticality safety portion of the nuclear safety and licensing officers responsibility and report to the Director of Regulation and Control. He may be assigned to other work in the organization contributing directly to the accomplishment of the work and serve in this position only on the basis of need. He shall make and/or verify analysis made by others as to the criticality safety of proposed installations and changes or modifications to equipment or procedures. His qualifications shall match those of the nuclear safety and licensing officer.

3.0 Health Physics Program Specifications

3.1 General Program Elements

The health physics program for the Sequoyah Facility is established to ensure the protection of employees and residents of the community against radioactive material and radiation. The health physics program includes, as a minimum:

a. The evaluation of release of radioactive effluents and materials;

b. The establishment of procedures to monitor and control spread of radioactive contamination, exposure to individuals, disposal of wastes and integrity and reliability of radiation detection instruments; and

c. The maintenance of appropriate reports and records associated therewith.

3.2 General Features of Plant Design and Construction

The necessity for protecting employees and the public from radiation and other operational hazards is a key consideration in the design and construction of the Sequoyah Facility.

The plant is designed, built, equipped and maintained to satisfactorily insure radiological, fire and structural safety for natural uranium processes. The plant design and contamination control programs provide for the occupational safety of employees and simultaneously prevent undue contamination of the surrounding area. Modifications to the plant shall consider the industrial safety and health physics aspects of the proposed activity. The plant provides for:

a. Controlled access to the plant process area

b. Adequate emergency exits

c. First aid, decontamination and dust control capabilities.

d. An emergency generator adequate to power critical control systems.

3.3 Ventilation and Exhaust Systems

Airborne uranium concentrations are minimized and effectively controlled by:

a. Controlled ventilation in work areas where airborne uranium exists or where there is a high potential for excessive concentrations. All process areas have at least six air changes per hour.

b. Dust collection systems are equipped with bag type collection systems.

3.4 Health Physics Equipment

Instrumentation is provided to perform the surveys associated with the health physics control programs. All survey and sampling equipment is inspected and calibrated under the direction of the Manager, Health and Safety and Industrial Safety at intervals sufficient to assure reliable operation.

3.4.1 Operating Instructions

1. Hazardous work permits are issued and approved by the Shift Supervisor for work on process systems. Safety equipment and precautions approved by the Manager, Health and Safety and Industrial Safety or designate are specified in the permits.

2. A set of instructions for radiation health and safety practices is maintained by the Manager, Health and Safety and Industrial Safety. Such instructions are approved by the Health and Safety Coordinator and reviewed at least on an annual basis.

3.4.2 Personnel Dosimetry

Personnel dosimetry programs are maintained to measure internal and external exposures to radiation.

1. Whole body photon and beta radiation exposures are measured with film badges using established film evaluation techniques. Employees are required to wear a radiation film badge while in the plant. Film badges are exchanged and evaluated on at least a monthly basis by an independent laboratory. (U.S. Testing, Richland, Washington)

2. Field measurements and surveys of photon and beta dose rates are made on a monthly basis or as required to properly control and evaluate personnel exposures.

3. Internal uranium exposure or the lack thereof are determined from urine samples results. Urine samples are collected and analyzed on an established routine program basis and following significant accidental exposures. If an employee submits a urine sample >20 ug U/l, he is promptly given a take home sample kit. He collects a voiding before retiring, any voiding during the night, and any voiding the morning after. He returns the kit on his next shift. Should this second sample be >20 ug U/l, he is assigned to non-uranium work. He is resampled daily until a sample shows <20 ug U/l, after which he may return to his regular work assignment.

4. Air samples collected in work areas are collected and analyzed to determine uranium concentrations in breathing air.

3.4.3 Facility Monitoring

1. Air Monitoring

   a. An air monitoring program is maintained that provides for:

      1) continuous collection at strategic work locations in the process area, and

2) breathing zone samples shall be taken when its suspected that personnel exposure could exceed 25% of applicable airborne exposure limits in 10CFR20.

b. Procedures are in effect for relating air sample results to personnel exposure during planned and accidental exposure to radioactive material.

2. Contamination Control

Routine measurements of surface contamination are made peridical to reliably demonstrate contamination control. Surface contamination measurements are made by appropriate direct alpha survey techniques and smear tests.

Non-radiation areas include the clean locker rooms, lunchroom, offices, control room and reception area and surface contamination levels in these areas are maintained below 1,000 d/min. by direct alpha survey and <500 d/min. by smear test.

Contamination control barriers and/or procedures are in effect to control uranium contamination within designated radiation areas.

Contaminated solid waste is disposed of under controlled condition that assure protection of personnel and the environs and compliance with regulations.

All persons leaving potentially contaminated process areas, i.e. radiation areas, follow locker room procedures that require removal of all protective clothing articles and washing of exposed skin surfaces or a shower. A survey of exposed skin surfaces and decontamination, as necessary, to less than 500 disintegrations per minute may be made in lieu of washing or shower.

To guard aginst contamination, protective clothing is worn by all personnel throughout the plant area and laboratories. Use of the company-provided clothing protects the wearer from contaminating himself and his own clothing and helps confine radioactive contaminants to the work areas.

The use of the regulated change rooms with locker-shower facilities makes it possible to maintain clean areas and have an effective control of radioactive contamination.

A regular cleaning schedule shall be established for the removal of surface contamination in controlled areas and on equipment. Wet-cleaning or vacuum-cleaning methods are recommended for general cleaning to eliminate the redistribution of dust and to reduce the inhalation hazard.

Spot checks for hand, shoe, and clothing contamination shall be made to evaluate the efficiency of the contamination control program.

The pertinent points of the contamination control program to substantiate that it is higly unlikely for contaminated employees to leave the plant are:

a. Operating and laboratory personnel are required to remove their protective clothing and place in clothes hampers.

b. Locker rooms are equipped with shower stalls to accomodate all employees handling radioactive materials, chemicals or other toxic materials.

c. Locker room procedures are announced to each employee with instruction to abide by the regulations.

d. Good personal hygiene practices are continually emphasized.

Additionally, visitors are required to don a protective smock and overshoes before entering the plant processing area as a further contamination control measure. The protective clothing is removed and left in the contaminated locker room upon leaving the plant. Visitors are always escorted by plant personnel to assure that this practice is followed.

Health Physics Technicans and or Shift Supervisors will periodically inspect, as deemed necessary, at the end of the work shifts to provide assurance that employees are adhering to the locker room procedure.

3. Respiratory Protection

Respiratory protection equipment is used in circumstances in which adequate limitation of radioactive materials by use of process or other engineering controls is impracticable.

1) In circumstances in which adequate limitation of the inhalation of radioactive materials by use of process or other engineering controls is impracticable, an individual may be exposed to average

concentrations of airborne radioactive materials in excess of the limits specified in Table 2, Section 3.2, provided:

a. the individual uses respiratory or other appropriate protective equipment such that the total intake, in any period of seven consecutive days by inhalation, ingestion, or absorption, would not exceed that intake which would result from breathing the concentrations specified in Table 2, Section 3.2, for a period of 40 hours.

b. the individual is advised that he may leave the area for relief from respirator use in case of equipment malfunction, physical or psychological discomfort, or any other condition that might cause reduction in the protection afforded the wearer, and

c. a respiratory protective program exists which is adequate to assure that the objective of Item "a" above is met. Such program shall include:

   (1) Air sampling and other surveys sufficient to identify the hazard, to evaluate individual exposure, and to permit proper selection of the respiratory protective equipment:

   (2) Procedures to assure proper selection, supervision, and adequate training of personnel using such protective equipment;

   (3) Procedures to assure the adequate fitting of respirators and the testing of equipment for operability;

   (4) Procedures for maintenance to assure full effectiveness of respiratory protective equipment, including issuance, cleaning and decontamination, inspection, repair, and storage:

   (5) Bioassay of individuals and other surveys as may be appropriate to evaluate individual exposures and to assess protection actually provided; and

(6) Records sufficient to permit periodic evaluation of the adequacy of the respiratory protective program.

d. The protective equipment supplied and used is capable of providing a degree of protection at least equal to the protection factors listed in Table I, following.

Table I

PROTECTION FACTORS FOR RESPIRATORS(1)

Description	Modes(2)	Protection Factors
I. AIR-PURIFYING RESPIRATORS		
Facepiece, half-mask	NP	10
Facepiece, full	NP	100
II. ATMOSPHERE-SUPPLYING RESPIRATOR		
1. Air-line respirator		
Facepiece, half-mask	CF	100
Facepiece, half-mask	D	100
Facepiece, full	CF	1000
Facepiece, full	D	500
Facepiece, full	PD	1000
Hood	CF	1000
Suit	CF	1000(3)
2. Self-contained breathing apparatus (SCBA)		
Facepiece, full	D	500
Facepiece, full	PD	1000
Facepiece, full	R	1000
3. Combination respirator		
Any combination of air-purifying and atmosphere-supplying respirator.		Protection factor for type and mode of operation as listed above.

(1) CF: continuous flow
D : demand
NP: negative pressure (i.e., negative phase during inhalation)
PD: pressure demand (i.e., always positive pressure)
R : recirculating (i.e., negative phase during inhalation)

(2) These factors may apply to protection against all particulates, vapors, and gases except tritium oxide; however,

(a) For purposes of this standard, the protection factor is a measure of the degree of protection afforded by a respirator, defined as the ratio of the concentration of airborne radioactive material outside the respiratory protective equipment to that inside the equipment (usually inside the facepiece) under conditions of use. It is applied to the airborne concentration inhaled by the wearer, according to the following formula:

$$\text{Concentration Inhaled} = \frac{\text{Airborne Concentration}}{\text{Protection Factor}}$$

(b) The protection factors apply:

(i) only for individually fitted respirators worn by trained individuals and used and maintained under supervision in a well-planned respiratory protection program.

(ii) for air purifying respirators only when high efficiency particulate filters and/or sorbents appropriate to the hazard are used.

(iii) for atmosphere supplying respirators only when supplied with adequate respirable air.

Excluding radioactive contaminants that present an absorption or submersion hazard.

Appropriate protection factors must be determined taking account of the permeability of the suit to the contaminant under conditions of use. No protection factor greater than 1000 shall be used except as authorized by the Commission.

NOTE 1: Protection factors for respirators as may be approved in the future by the U.S. Bureau of Mines according to approval schedules for respirators to protect against airborne radionuclides may be used in lieu of the protection factors listed in this Table. Where additional respiratory hazards other than radioactive ones are present, especially those immediately dangerous to life, the selection and use of respirators shall also be governed by the approvals of the U.S. Bureau of Mines in accordance with their applicable schedules.

NOTE 2: Radioactive contaminants for which the concentration values in Appendix B, Table I of 10CFR Part 20 are based on internal dose due to inhalation may, in addition, present external exposure hazards at higher concentrations.

Table II

RADIOACTIVITY LIMITS FOR UNRESTRICTED RELEASE OF FACILITIES AND EQUIPMENT CONTAMINATED WITH SOURCE AND/OR SPECIAL NUCLEAR MATERIAL

1. The maximum amount of fixed alpha radioactivity in disintegrations per minute per 100 square centimeters on buildings or equipment should not exceed 25,000.

2. The average amount of fixed alpha radioactivity in disintegrations per minute per 100 square centimeters on buildings or equipment should not exceed 5,000.

3. The maximum amount of removeable (capable of being removed by wiping the surface with a filter paper or soft absorbent paper) alpha radioactivity in disintegrations per minute per 100 square centimeters on buildings or equipment should not exceed 1,000.

4. (a) The maximum level at one centimeter from the most highly contaminated surface of a building or piece of equipment measured with an open-window beta-gamma survey meter through a tissue equivalent absorber of not more than seven milligrams per square centimeter should not exceed one millirad per hour.

   (b) The average radiation level at one centimeter from the contaminated surface of the building or equipment measured in the same manner should not exceed 0.2 millirad per hour.

5. The contamination limits for abandonment of facilities involving U-233 or plutonium should not exceed 1/10 of the limits in items 1, 2 and 3 above.

NOTES: A. A reasonable effort should be made to minimize the contamination present.

B. Surfaces of premises, equipment or scrap likely to be contaminated, and of such size, construction, or location as to make the surface inaccessible for purposes of measurement, shall be presumed to be contaminated in excess of the levels specified above.

C. Premises, equipment or scrap having contaminated surfaces which have been covered by painting, metal plating or other covering material should be presumed to be contamined in excess of the levels specified above, unless it can be established that the contamination was below the above levels prior to applying the covering.

4.0 Training

Time and effort is devoted to assuring that individuals have an adequate understanding of radiation safety as it applies to their work. All plant personnel shall receive an indoctrination lecture appropriate to their assigned job prior to starting work. Formal training sessions are conducted by the operating and health and safety staff to assure that employees are adequately trained in the basic aspects of uranium handling. Training is of a continuing nature. Periodic safety training meetings attended by operating personnel shall include topics on radiation safety.

4.1 Records

All plant and personnel health physics data and reports are recorded and filed. Timely trend analyses and reports are made at monthly intervals to plant management. The records of surveys and personnel exposure records are retained and reports are made in accordance with applicable regulations.

4.2 Inspections and Audits

Quarterly inspections are made of various health physics programs and the performance in that area. Individuals responsible for participating in these inspections include, as a minimum the Health Physics Coordinator and the Manager, Health Physics and Industrial Safety. A written report of the inspections is made to the Facility Manager with appropriate copies to other levels of management.

Audits of the overall health and safety program are made periodically by the Faciltiy Manager, the Health Physics Coordinator and the Director of Regulation and Control or his designate. A written summary of findings is used as the basis for correcting deficiencies.

5.0 Environmental Monitoring Program

A continuing environmental survey program is conducted to monitor the radiological conditions of the surrounding environs and to reasonably measure air, vegetation, soil, and liquid effluents.

Vegetation and soil samples are obtained from sampling points that have the maximum ground level concentrations of airborne effluents, as determined by standard diffusion calculations.

Water wells and monitoring wells are sampled at a frequency necessary to obtain supporting information in demonstration of the retention capability of the raffinate ponds. Additional monitoring wells were constructed near Raffinate Pond No. 2 to check for seepage of material from the ponds; to monitor water sample results that reflect an increase in radioactivity over background; to take corrective action where a health hazard exist.

5.1 Raffinate Pond Control

Submerged combustion burning (approved by Amendment No. 2, License No. SUB-1010) will continue to be used for limiting the rate of accumulation of raffinate in the retention ponds. This will include removal of radionuclides by ammonia and barium treatment. This also includes, the seasonal disposal of the resultant liquid as an ammonium nitrate-liquid fertilizer to the portion of the Sequoyah property immediately in front of the plant.

Additional tests for raffinate control alternatives are documented in environmental reports previously submitted.

In accordance with paragraph 20.1(c) of 10CFR20, every reasonable effort is being made to maintain radiation exposure as far below the permissible limits as possible in following the basic ALAP philosophy covered in Regulatory Guide 8.10.

5.2 Solid Wastes

Radioactive waste materials such as contaminated drums, sludges and other solids are buried in accordance with the provisions of 10CFR20.304 which permits up to 12 burials per year with as much as 50 mCi of natural uranium per burial at a minimum depth of four feet and spaced at least six feet apart.

Clean combustible materials such as boxes, crates, paper and rags are burned in an approved open pit incinerator. Other combustible wastes are disposed of by burning in an enclosed incinerator which discharges to the boiler stack. No radioactive materials or chemicals capable of releasing noxious vapors are processed in this unit.

5.3 Spill Prevention Control - Reporting Discharges of Hazardous Material

All plant personnel have been instructed to report any abnormal conditions to their immediate supervisor. Combination stream grab samples are taken each eight hour shift. A spill which could have been missed by area personnel would be detected during this routine sampling.

Reports of Discharges of Hazardous Material are handled in the following sequence:

1. Person(s) discovering the spill will notify the shift supervisor, who will in turn notify one of the following:

   a. Facility Manager

   b. Manager, Conversion Engineering

   c. Manager, Production

   d. Manager, Health and Safety and Industrial Safety

2. Information from above personnel is transmitted to a predetermined telephone number or "Dicharge Report Center."

3. A memo, stating the information given to the "Discharge Report Center" shall be given to the Facility Manager and the Director of Regulation and Control.

4. If individuals listed in item 1 are not available within two hours, the shift supervisor must transmit information to the Director of Regulation and Control or the Kerr-McGee Corporate Director of Safety and Environmental Services.

   During the interim or within a reasonable time frame the shift supervisor prepares a memo, for the Facility Manager, for document control at the facility level.

5.4 Emergency Planning and Control

5.4.1 Emergency Procedures

Approved procedures for the proper response of operating and health physics personnel are available and followed in the event of an emergency.

5.4.2 Emergency Equipment

First aid equipment, emergency showers, and personnel protection equipment are maintained and available for the adequate handling of emergency situations.

5.4.3 Emergency Reporting

The Director, Region IV, Division of Compliance, USAEC, White Settlement, Texas, shall be notified immediately by telephone and telegraph concerning any failure in an earth dam retention system which results in a release of liquid wastes containing radioactive material. This requirement is in addition to the requirements of 10CFR20.

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

November 24, 1971

RECEIVED DEC 1 0 1971

Mr. L. M. Muntzing
Director of Regulations
United States Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Muntzing:

Please refer to our submissions dated November 8 and 9 transmitting the "Environmental Report" for our licenses SUB-1010, Docket No. 40-8027, and SNM-1174, Docket No. 70-1193, required by Revised Appendix D of 10CFR50.

Upon more complete review and examination of other documents submitted by others to fulfill this requirement, we have concluded that our submissions referred to above are incomplete. After review we have concluded that complete resubmissions would be the most appropriate correction of this deficiency. Consequently, we are shipping 200 copies each of "Environmental Report-Revised" for the subject licenses. This "revised" submission has been significantly changed in content to meet what we believe to be your requirements more adequately.

We would appreciate your replacing the previous submission with these "revised" copies and your willingness to use it in your considerations. We would be happy to discuss all or part of these reports at your convenience.

Sincerely,

W J Shelley

W. J. Shelley
Director, Regulation and
Control

WJS:srj

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

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W. J. Shelley

W. J. Shelley
Director, Regulation and
Control

WJS:srj

KERR-McGEE CORPORATION

APPLICANTS ENVIRONMENTAL REPORT

USAEC
Docket No. 40-8027

Uranium Hexafluoride Plant

NOVEMBER 1971

Revised

APPLICANTS ENVIRONMENTAL REPORT

USAEC

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KERR-McGEE CORPORATION

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NOVEMBER 1971

Revised

FROM:
Kerr-McGee Corporation
Oklahoma City, Okla.
(W. J. Shelley)

TO:
L. Muntzing

CLASSIF: U
POST OFFICE
REG NO:

DATE OF DOCUMENT:	DATE RECEIVED:	NO.:
11-24-71	12-12-71	5344

LTR.: X | MEMO: | REPORT: | OTHER:

ORIG: | CC: | OTHER:
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ACTION NECESSARY ☐ | CONCURRENCE ☐ | DATE ANSWERED:
NO ACTION NECESSARY ☐ | COMMENT ☐ | BY:

FILE CODE:
DOCKETS: 70-1193 & 40-8027

DESCRIPTION: (Must Be Unclassified)
Ltr. trans. the following which completely revises the reports submitted earlier for Licenses SUB-1010 and SNM-1174:

ENCLOSURES:
(200 copies ea rec'd)

"Applicant's Environmental Report," (revised) for the UF_6 Plant (40-8027)

"Applicant's Environmental Report," (revised) for the Pu Fuel Plant (70-1193)

REMARKS:
Kepple

REFERRED TO	DATE	RECEIVED BY	DATE
Nussbaumer:	12-13		
w/2 cys. -- (70-1193)	FOR ACTION		
Buchanan:	12-13		
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2-reg. file cys.		1-R. Faulkner, RM	
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U.S. ATOMIC ENERGY COMMISSION

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KERR-McGEE CORPORATION

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ENVIRONMENTAL REPORT

SEQUOYAH FACILITY

KERR-McGEE CORPORATION

R E V I S E D

I. General

On February 20, 1970, the AEC issued License No. SUB-1010 to Kerr-McGee Corporation for the operation of a Uranium Hexafluoride Production Plant located in Sequoyah County, Oklahoma. This environmental report is submitted in accordance with the requirements of Appendix D, 10CFR Part 50, effective September 9, 1971.

II. Description of Site and Area

A. Location

The plant is located in a 2100-acre tract on the western edge of Sequoyah County. This tract is bounded on the north by U.S. Highway 64, on the west by the Illinois River and the Arkansas River, on the south by Interstate Highway 40 and on the east by the eastern section line of Section 22.

Drawing 110-C-151 Rev. 4, attached, shows the site layout and its location in relation to nearby population centers. The site is approximately 2.5 miles southeast of Gore, Oklahoma, 19 miles west of Sallisaw, Oklahoma, and 20 miles north of Stigler, Oklahoma. The immediate plant area is a fenced-in restricted area of about 75 acres in Section 21, T12N-R21E, with access to Oklahoma Highway 10 adjacent to the eastern boundary.

B. Physical Description

The Sequoyah Facility was designed and built by Bechtel Corporation based upon design criteria furnished by Kerr-McGee. The plant consists of about 69,000 square feet of manufacturing, warehousing and office floor space in three

separate buildings. The main process and administration building contains offices and laboratory (10,600 square feet), fluorine generation (17,250 square feet), maintenance (5,500 square feet), utility (5,500 square feet) and main process areas (26,900 square feet). A separate solvent extraction building (4,000 square feet) contains only the solvent extraction system. A separate warehouse building was provided for storage of mechanical parts. In addition, retention ponds for sanitary sewage, fluoride treatment and clarification, and raffinate are located to the west of the plant. The plant employs approximately 100 people of whom 75 are production and maintenance workers.

C. Process Description

The Sequoyah Facility receives impure uranium concentrates from concentration mills located in the western United States and Canada in 55 gallon drums by truck. The drums are weighed and the material emptied into a sampling system, after which the drums are vacuum cleaned and reused. The concentrate is passed through a sampling system which removes a small portion as a representative sample for analysis. The concentrate is stored in hoppers briefly, then digested in a hot nitric acid solution. Recycle materials are added, the solution adjusted for acid and uranium content, and the uranium values extracted in a countercurrent solvent extraction system using tribuytl phosphate as a specific extractant in a solution of diluent hexane. The uranium-rich organic solution is scrubbed by a small stream of water and the uranium is reextracted into a large portion of water and then concentrated in a two-stage heating process. The impurities extracted by the solvent extraction system constitute the primary liquid waste from the process.

Upon the completion of concentration, the uranium-rich water solution is dehydrated and denitrated in a stirred reactor to uranium trioxide, UO_3, which is conveyed to a milling system and stored temporarily. It is then fed into a two-stage fluid bed operating at approximately 1100°F where it is reduced

to uranium dioxide, UO_2, by a countercurrent flow of dissociated ammonia. Upon completion of the reaction, the UO_2 is stored in a hopper temporarily and fed to a two-stage reactor system in which it is converted to UF_4 by a countercurrent stream of anhydrous hydrofluoric acid gas. The UF_4 is then conveyed to a series of fluorination towers which burn the UF_4 in the presence of elemental fluorine to the gaseous compound UF_6. The gaseous product of this reaction is cooled and filtered twice by sintered metal particulate filters and then condensed to a solid at 50°F in a refrigerated heat exchanger known as a "cold trap." Gases not condensed in the first cold trap then pass through a cleanup reactor to scavenge any excess fluorine by passing it through a falling stream of UF_4. This gas, containing UF_6, noncondensable gases, HF and a trace of fluorine, is then passed into a secondary "cold trap" at a temperature of -50°F for the removal of UF_6. Noncondensables must be further treated for the removal of fluorine, HF and traces of UF_6. These noncondensable gases are exhausted to a three-fluid burner which combines them with air and hydrogen gas exhausted from the fluorine manufacturing process and burns the fluorine and hydrogen to HF and water. This hot gas stream is cooled and passed through a sieve-plate scrubber where the HF gas is absorbed in water.

The solidified UF_6 collected in the cold trap is melted by heating with steam and drained to a shipping cylinder. The cylinder is vented to the cold trap, disconnected from the drain manifold and moved to a storage yard for sampling, solidification and storage. After analytical tests are completed the cylinder can then be shipped to a diffusion site as feed material for the enrichment process. Such cylinders contain 10 tons of UF_6 and are approved by the Department of Transportation for natural UF_6 shipments.

This process is performed in a closed system consisting of a series of vessels, tanks, towers, evaporators and reactors employing auxiliary equipment to provide: conveying, removal of impurities, effluent control, heating and

cooling. The process is performed in the main process area and the solvent extraction building described above.

The process uses in sequence: 60% nitric acid, aluminum hydroxide, ammonia, hydrofluoric acid, potassium hydrogen fluoride, sodium carbonate, tribuytl phosphate and liquid hexane with natural gas as fuel for steam producing boilers. An oil inventory serves as standby fuel for the boilers.

Each of the raw materials listed above is stored and handled by methods recommended by the Manufacturing Chemists Association. The utility area containing boilers, nitric acid absorber, offgas burners and scrubber is located immediately behind the main process building. The storage area for chemicals is located across a driveway from this utility area. The area immediately surrounding the plant is covered with either concrete or asphalt paving. The area around the solvent extraction building for 100 feet distant is covered with non-combustible gravel in order to meet insurance requirements for flammable material.

A storage yard capable of containing 100 shipping cylinders for UF_6 is located adjacent to the northeast corner of the main process building. A switch yard for the necessary breakers and transformers to control incoming electrical power is located immediately east of the UF_6 storage yard and surrounded by a six-foot chain link fence.

D. Waste Treatment

The process produces waste streams which are treated to prevent uncontrolled release to the environment and are collected into three primary and several secondary streams.

1. Raffinate

The waste stream from the extraction system, known as raffinate, is primarily composed of ammonium nitrate, nitric acid, metallic salts and minute quantities of uranium and the radioactive daughter products of normal uranium decay. This stream is combined with spent sodium hydroxide from the solvent treatment system and the miscellaneous digest scrubber and any excess recovered weak acids from the absorber as a convenience

for treatment. Treatment provides for neutralization by lime slurry and impoundment in earthen-walled retention basins for permanent storage. After neutralization, contained uranium and daughter products in the raffinate, thorium 230 and 234 and radium 226 for the most part, coprecipitate with most of the other heavy metal impurities as hydroxides. This precipitate is allowed to settle first in a settling basin and then in a clarification lagoon. No sludge or supernatant liquid is released from the storage impoundments.

Two storage ponds have been constructed with a combined capacity of about 25 million gallons providing for three feet of freeboard height above the maximum liquid level to protect against accidental release by overflow. Basin No. 2, with approximately 15 million gallon capacity, has just been put into use. This basin provides storage capacity for approximately two years at planned production rates.

It would be desirable to develop an appropriate method of safe disposition of a solid. Currently, however, no practicable process for solidification has been developed. Several alternatives have been considered by the Kerr-McGee technical staff and engineering studies are proceeding with the objective of selecting the most desirable alternative for further development and installation.

2. <u>Fluoride Discard</u>

The second liquid waste stream is generated by the hydrofluoric acid scrubber. The scrubber is connected to all emergency vent headers located on process vessel and storage tanks so that gases evolved through the overpressurization of vessels and tanks are absorbed, thus avoiding uncontrolled release to the atmosphere. This fluoride waste stream is combined with waste sodium carbonate solutions originating in the fluorine cell rework area, spilled acid from the HF vaporizer room sump and laboratory wastes. Treatment of this fluoride-containing stream provides for neutralization by lime slurry with resultant precipitation of the fluoride as calcium fluoride.

This alkaline sludge is first settled in a retention basin to permit flocculation and sedimentation. The overflow is treated with sulphuric acid to adjust the pH and precipitate excess calcium hydroxide and permitted to clarify by retention in a second basin. The clarified treated waste overflows and is combined with clean waste water and the sewage lagoon overflow and is discharged to the Illinois River through a natural water course. A concrete stilling basin at the point of combination allows for mixing of the flow and controlled release through slotted weirs so that the rate of discharge may be measured. Samples of the discharge are taken periodically at this point.

3. Sanitary Waste

Sanitary and domestic wastes are treated in a stabilization lagoon which is approved by the State Department of Health. Overflow from this lagoon is combined in the stilling basin with clean waste water and the liquid effluent described in paragraph II.D.2.

4. Gaseous

During the dehydration and denitration of concentrated aqueous uranium solution to the intermediate product uranium trioxide, UO_3, gases are released containing nitric acid, water vapor, oxides of nitrogen and entrained solids. These gases are first scrubbed with water for the removal of entrained solids and condensation of nitric acid vapor and water and piped to an absorption tower for the absorption and concentration of nitrous oxides. The absorption tower is designed to remove approximately 99% of the incoming nitrous oxide. The gas stream is discharged from the absorber into the boiler stack and released at the top of the stack approximately 150 feet above ground level. Nitric acid produced from the absorption tower is recycled to the process for reuse.

Reduction of uranium trioxide to uranium dioxide, UO_2, produces a waste gas of nitrogen, hydrogen and water vapor. This gas stream is filtered on sintered metal particulate filters for the removal of any solid entrainment and piped to a waste gas burner where the excess hydrogen is converted to water

vapor. The gas from the burner is piped to the boiler stack and released approximately 150 feet above the ground.

A waste gas stream is discharged from the hydrofluorination reactors containing hydrofluoric acid vapor and water vapor. This gas is cooled in a condenser producing a weak hydrofluoric acid solution which is returned to the vendor and noncondensables are then piped to the hydrofluoric scrubber described for control of hydrofluoric acid gas evolution.

Noncondensable gases from the hydrofluoric acid scrubber are conducted to the top of the boiler stack and released to the atmosphere at this point. Initial diffusion and dispersion calculations concluded that the HF concentration discharged at this point would be reduced to one part per billion at the maximum fallout point at ground level based upon probable climatological conditions.

5. Miscellaneous

Considerable ambient air is moved through solid uranium streams as displaced gas when hoppers are emptied and filled and to pneumatically convey uranium dusts to a collection point to avoid their uncontrolled release. Uranium dusts are removed from such air streams by cyclone separators and filters of closely woven fabric felt. Such filters are provided on all exhaust gas streams in order to eliminate release of uranium dust to the environment.

The design, construction and operation of the waste treatment systems comply fully with applicable State and Federal regulations, specifically "Water Quality Standards of the State of Oklahoma 1968 and Title 10 Code of Federal Regulation Part 20."

Retention basins constructed for raffinate storage and fluoride stream settling and clarification are built to AEC standards, "Licensing Guide - Information and Criteria Pertinent to the Evaluation of Embankment Retention Systems." These storage pits are monitored by seepage wells located at the periphery. Results of this monitoring program are reported

under environmental surveillance programs later in this document.

The plant auxiliary systems were started in January, 1970, and uranium charged in late February, 1970. Production operations have continued since then without interruption.

E. Area Description

The plant site was located after a preliminary study of ten potential sites of the Arkansas River Valley. The specific site was selected after consideration of transportation, water supply, land availability, absence of other industrial installations, the quality and skill of available labor and recognition of the current and chronic depressed state of the eastern Oklahoma economic activity.

The topography in this area of Oklahoma along the Arkansas River generally varies from flat in the bottom lands of the river to gently rolling adjacent to the bottom lands to a high level ridge rising as much as 400 feet above the valley floor. Many large and small water courses drain the upland ridges. Farming, ranching, forestry and mining have been the primary economic uses of the land in this century. Mines are located near Stigler, Warner and Sallisaw.

Heavy timber growth covers this area of Oklahoma. Original stands of cedar, walnut, hickory and oak served as a source of a heavy forestry industry. This valuable timber has been replaced with heavy growth of blackjack and post oak on the hillsides. In the valleys oak, Osage orange, hackberry, willow, elm, pawpaw, sassafras, locust and many plum and sumac thickets grow profusely. Redbud and dogwood specimens survive interspersed with the taller timber. A few rare specimens of hardwood and cedar exist in more remote locations.

Farming and ranching in the Arkansas River Valley have been the only recent economic activities. Some cotton is raised in the river bottom and corn, wheat, soybeans, oats and sorghum are occasionally grown in small patches.

At the time of site acquisition a small soybean field was located at the west edge of the site along the Illinois

River and a small wheat field was located in the area now occupied by the plant. Approximately one-third of the site is open and the balance is heavily wooded. The timber consists primarily of post and blackjack oak with a few specimens of hickory, pecan and cedar remaining at more inaccessible locations. Most of the fringes of the open area are covered with sumac and plum brush with occasional Osage orange, hackberry, sassafras, pawpaw and elm trees.

None of the timber is mature enough for any extensive forestry operation. Some local cutting is done for fuel and farther east in Arkansas similar timber is used as a source of raw material for the manufacture of charcoal.

Grasses in the open area are primarily native wild pasture of infinite variety. After many seasons of heavy grazing, it is based primarily on native Bermuda grass with some sage grass, switch grass, gramma and Indian grass, along with sedge and imported lespedeza. No significant cultivation has occurred on the site except for the two small fields mentioned.

Typically, this section of Oklahoma receives ample rainfall in the spring and fall and is prone to have high temperatures and dry weather during the summer months. The vegetation will grow quickly in the spring, tend to be dormant in the hot summer, may brown off in the late summer and not completely regain its color until the following spring, though some growth is taking place during the cooler, wet fall months.

Wildlife in the area was once plentiful with large numbers of prairie and forest grazing animals and attendant populations of predators. Market hunting and heavy land usage essentially eliminated all of the large animals except a small deer herd. This deer herd has increased, however, since the early 1920's in response to protection and is now of sufficient size to support some regulated hunting in the area. Recently a small bank of elk were released in southeastern Oklahoma to determine if elk could be reestablished without interfering with

pasturage of domestic stock. Many species of small animals are present. Fox, coyotes, badgers, coons and opposum are plentiful. Muskrats and beaver can be located along many waterways in eastern Oklahoma. Rodents such as rabbits, packrats and field mice are plentiful and supply a food source for predatory animals and birds.

Innumerable species of birds are native to this area or use it annually as a flyway during migration. The Bobwhite quail, however, is the only indigenous bird which receives any hunting pressure. Falcons, hawks and crows are plentiful as are many varieties of songbirds and sparrows.

This area experiences heavy flights of migrating wild fowl. The Arkansas River Valley is well populated with several species of geese and ducks in the fall and early winter enroute to wintering grounds along the Gulf Coast and in Mexico. While not drawing large groups of hunters from urban areas, wild fowl hunting is a sport enjoyed by many local residents. The proximity of the water of the Arkansas River and grain fields along its course serve as an ideal stopping point in the yearly migration.

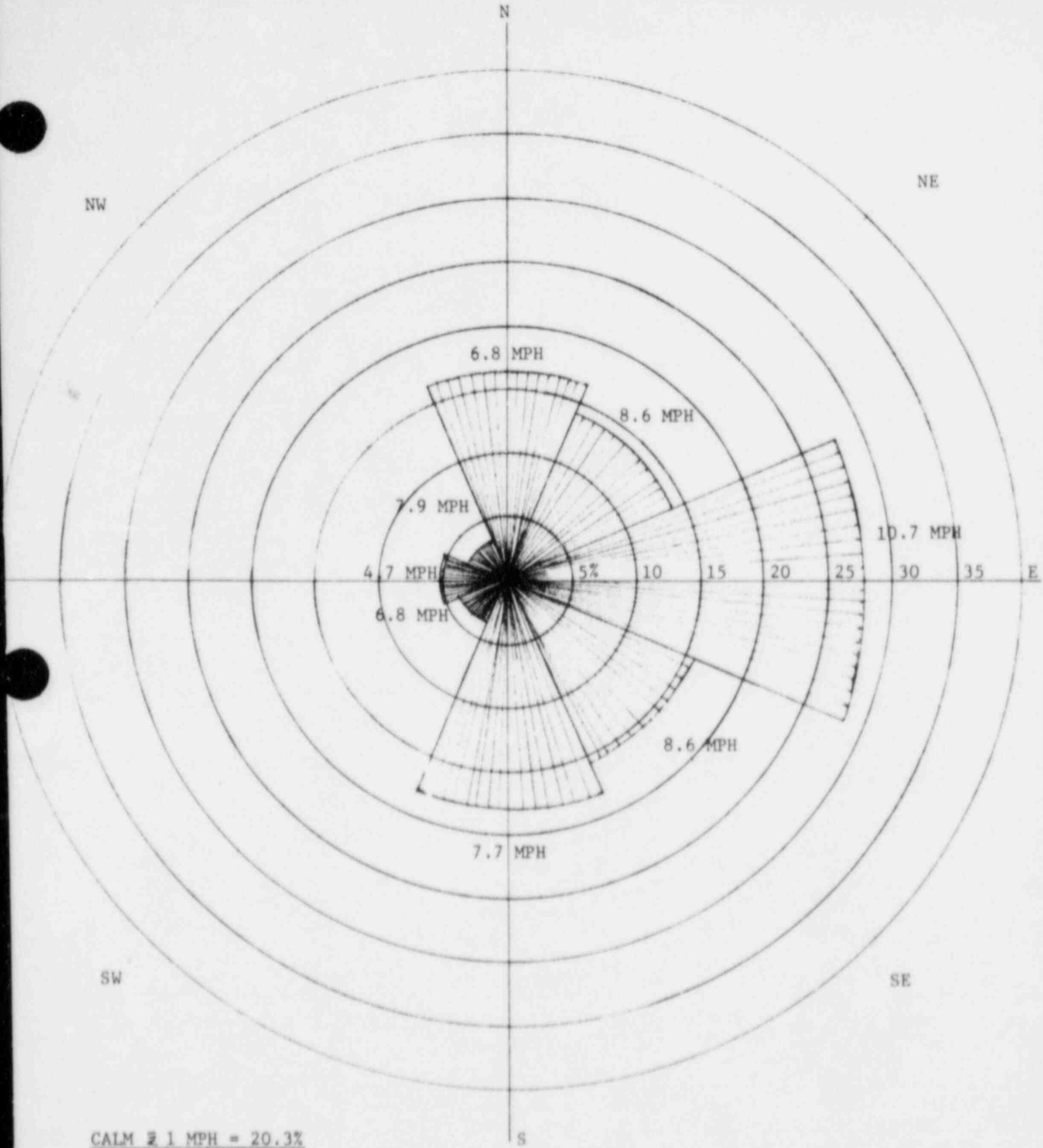
F. Population

This area of eastern Oklahoma is relatively sparsely populated and almost completely devoid of industrial activity. Population growth has been approximately 3% in the period 1960 to 1970. The plant site is located approximately 150 miles east of Oklahoma City on Interstate Highway 40, approximately 40 miles west of Fort Smith, Arkansas, and 25 miles to the southeast of Muskogee, Oklahoma. Nearby cities and towns in the area are listed on the next page.

County or City	Direction	Distance Miles	Population
Sequoyah County			23,370
Vian	E	4	1,131
Sallisaw	E	19	4,888
Muskogee County			59,542
Muskogee	NW	25	37,331
Warner	W	15	1,217
Webbers Falls	W	3	485
Gore	NW	2	478
Other			
Fort Smith, Arkansas	E	40	62,802

Since the selection of the site in 1967, completion of interstate routes and the Arkansas Riverway has considerably increased the amount of east-west traffic and will probably increase the recreational use of the entire area. The Robert S. Kerr Reservoir of the Arkansas Riverway is located in Sequoyah County, and the Webbers Falls Reservoir is immediately west of the plant site in Muskogee County. It is expected that these two impoundments, after further commercial development, will form an important recreational resource.

The climate in the area is characterized by hot summers and moderate winters. The normal annual rainfall is approximately 40 inches and the mean temperature is 62°. The extreme high temperature during a 62-year period of records was 115° and the extreme low was -15°. Winds in the area are somewhat variable and tend to be lighter than those of farther western Oklahoma. A wind rose showing the direction and velocity of the wind during the last six months is shown on the following page. This wind rose is constructed from data collected at the Sequoyah Plant since installation of measuring equipment early in 1971. No regular weather reporting station, either Fort Smith, Arkansas, or Muskogee, Oklahoma, was found to be representative of the actual conditions on the site.



CALM ≦ 1 MPH = 20.3%

WIND ROSE - SEQUOYAH FACILITY

FROM DATA TAKEN 3/28 - 11/8, 1971

Sequoyah County lies in a zone of approximately 1.66 x 10^{-3} probability of experiencing a tornado in any given year. Until the purchase of the site for the plant, one family had lived on this ground for a period of 100 years and has no record or recall of a tornado ever damaging the plant area.

This area was a part of the land given to the Cherokee Nation after their move from the southeastern United States. The Carlile house on the property at one time served as a station for a stage running from Fort Smith to Fort Gibson. The ford of the Illinois River was known as Carlile Ford but has been flooded by the completion of the Robert S. Kerr Reservoir.

G. Geography and Geology

The Arkansas River in this area flows through a mountainous section on the southwest flank of the Ozark Uplift and is characterized by level-topped parallel east-west ridges rising as much as 400 feet above the adjacent valley floor. These uplands are drained by several rivers and numerous creeks which flow into the Arkansas along the area. The maximum change of elevation across the site is from 450 feet above sea level at the Illinois River to 700 feet in the southeast corner of Section 22.

Exposed surface geology consists of sandstone and shale sequence of the lower Atoka structure. The outcropping Atoka rocks are approximately 100 feet thick and are capped by approximately 15 feet of thick terrace gravel in the immediate area of the plant. Much of the structure was determined from core hole data gathered to explore the size and extent of the normal fault which surfaces on Highway 64 at the Carlile School. Twenty-one cores were drilled in the area to examine the characteristics of this fault zone. The core holes exhibited alternating beds of sandstone and black shale. Three separate sandstone beds can be recognized in the deeper holes of Section 21 and correlated with outcrops above the Illinois River. The Atoka sandstone and shales were deposited on a stable shelf. In post Atoka time the region was affected by a major deformation which formed a number of northeast to

southwest trending folds and normal faults. The faulting ended in middle-Des Moinesian time and the region has been structurally stable since the middle-Pennsylvanian period, approximately 250 million years ago.

Exploration of the area has demonstrated no commercial deposits of oil and gas. Dry holes are located approximately two miles east and three miles south of the plant site. These two wells were plugged and capped with concrete after completion of drilling to 2000 feet and 4600 feet, respectively. All of the dry holes abandoned in the 16 township area surrounding the site were abandoned by leaving the surface casing in the hole and placing one or more cement plugs on top.

Other minerals in the area consist of coal, sandstone, sand and gravel from the Arkansas River floodplain. The nearest coal production is 14 miles west at the town of Warner. Coal is being mined from a depth of 1400 feet at Stigler in Haskell County 18 miles south of the site. The nearest coal deposits are located approximately 12 miles southeast of the plant site but these low-quality mines are currently inactive.

Local subsurface aquifers vary from poor quality and yield in the Atoka formation to good quality and higher yields from the Arkansas River alluvium. A water well on the plant site in Section 27-12N-21E is a typical Atoka well with a static water level of 30 feet, a total depth of 84 feet and a yield of one gallon per minute. An alluvium water well typical of this formation is located in Section 19-12N-21E. This well was drilled to a depth of 44 feet and has a static water level of four feet and a yield of 400 gallons per minute.

Monitor wells located on the site around the retention ponds have been drilled to a depth of 30 to 60 feet and are typical Atoka formation wells.

H. Seismicity

Authorities on the subject consider the Arkansas Valley area to have been stable since middle-Des Moinesian time.

Minor to moderate seismic activity has occurred in the El Reno area west of Oklahoma City, the Tulsa area and in the Quachita Mountains of southeastern Oklahoma. The nearest earthquake epicenter is near Poteau, Oklahoma, 40 miles to the south. An earthquake of April 27, 1961, at Poteau is listed[1] at intensity V on the Modified Mercalli Scale (very minor damage to dishes and windows). All of the earthquakes listed appear to be associated with structural features outside of the southwest Ozark tectonic province.[1,2] Consultants have concluded that earthquakes do not constitute a hazard at the Sequoyah site.

I. Waterways

As described above, the plant site is bounded on the west by the Illinois and Arkansas Rivers and, as can be seen on Drawing 151, the Arkansas River lays a short distance to the south of the site. All natural drainage of the plant area flows to the west into the Illinois River.

The Arkansas River has undergone significant development in recent years, primarily as a commercial waterway for the movement of freight. With completion in 1970 of the Robert S. Kerr and Webbers Falls Reservoirs and the installations in the north on the Verdigris River near Tulsa, Oklahoma, this waterway now has become a working commercial trafficway. Barge traffic has not thus far developed significantly but is expected to grow at a steady rate for the next decade.

The Illinois River is primarily noted as the only spring-fed cold water river in Oklahoma. Tenkiller Ferry Reservoir was completed and opened for recreation in 1953 approximately seven miles up river from the site. It has proven very popular with Oklahoma residents and has several commercial installations serving the recreational market. With the completion of the dam for Tenkiller Reservoir and the decrease in water temperature below the reservoir, the Illinois River from the dam to its junction with the Arkansas became one of two

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[1]U.S. Coast and Geodetic Survey Report 41-1 (Revised), "Earthquake History of the United States."

[2]Tectonic Map of the United States; USGS & AAPG, 1961.

artificially stocked trout streams in Oklahoma. Most of the stocking and trout fishing is done between the Highway 64 bridge north to the dam.

With completion of the Robert S. Kerr Reservoir in 1970, the headwater of the reservoir normal pool level now extends upstream in the Illinois to the Highway 64 bridge. As a result, the Illinois, from the Highway 64 bridge to the Arkansas proper, is classified as a part of the reservoir. Since the reservoir filled in December, 1970, it appears that water from the Arkansas has flowed up the Illinois past the plant outfall discharge point. This area around the highway bridge has not become commercialized for recreational purposes but, since the Corps of Engineers has designated the west bank of the Illinois immediately north of U.S. 64 as a public access area for the reservoir, it is expected that eventually it will develop as a recreational area.

The area on the shoreline of the Robert S. Kerr Reservoir from the I-40 bridge to Vian Creek is being studied as a possible wildlife refuge. This area will be partially reserved for wildlife with limited waterfowl hunting permitted.

As mentioned previously, the Corps of Engineers has control of the Illinois River at Tenkiller Reservoir, the downstream water to the Arkansas and the area reserved for the flood level (470') of the Robert S. Kerr Reservoir. The dams and their lock mechanism are the only government installations in the vicinity of the plant.

III. Environmental Approval

When this site was selected for the location of the plant, extensive consultation was held with the Oklahoma Water Resources Board and the Corps of Engineers as to the most acceptable method of diverting Illinois River water for use in plant cooling and potable water. Agreement was reached with the Oklahoma Water Resources Board on January 9, 1968, with the issuance of a "Permit to Appropriate Surface Water No. P-67-765"

covering 30,000 acre-feet of water per year to be diverted from the outlet works of the Tenkiller Reservoir.

Subsequently, Contract No. DACW 56-70-C-0083 for water storage space in Tenkiller Ferry Reservoir was completed with the Department of the Army Corps of Engineers. These agreements permitted the diversion system to be designed and installed to remove water from the reservoir dam and pipe it to the site.

No State, local or regional planning organizations have been authorized to consider regional economic development in this area.

The State of Oklahoma is proceeding in an orderly fashion to evolve a set of environmental control regulations that are consistent with the U.S. Government authorized regulatory activities. The Oklahoma Water Resources Board requires a permit for the disposal of waste to riverways. This permit has been granted by the State for the Sequoyah Facility, No. IW-70-011, for waste disposal. In addition, a Sanitary Waste Treatment Permit dated August 21, 1969, was issued.

Because this plant processes nuclear source materials, it was necessary to obtain an operating license from the USAEC. License SUB-1010 was granted February 20, 1970, based upon application submitted on September 25, 1969.

In accordance with applicable regulations under the Refuse Act of 1899, an application for a waste discharge permit was filed with the Corps of Engineers on June 21, 1971, and supplemented on October 4, 1971. The Discharge Permit Application OK-076-OYI-2-000111 is currently being processed.

Copies of these permits are attached in the appendix to this report.

IV. Environmental Impact

As described in paragraph I.B. above, plant construction was completed in early 1970. Production operations started immediately and have continued without interruption. As a result of the surveillance program described in paragraph V

below, we have measured no adverse effect on the environment.

A. Land Use

Prior to plant construction the immediate plant area was used partly for the cultivation of wheat and the balance was in pasture and woodland. Grading for the building site, settling basins and treatment and storage ponds (as shown on the attached Drawing 151) changed the original surface contours. All graded land not covered by hard surface materials was subsequently seeded with fescue and rye to prevent wind and rain erosion.

Because of the extensive availability of recreational land and water facilities in the area and the nature of the plant processes, we have no plans to provide public access or use of the site area.

With the completion of the Arkansas Riverway and the extensive interstate highway system, it is expected that land along the Arkansas River will be developed in many places for industrial and commercial use. Since the land chosen for the Sequoyah Plant is not uniquely suitable for other beneficial use, it is believed that erecting this plant in this location provided an overall benefit to the human environment in the area.

The plant site does not intrude into any site of historical significance and is not listed in the National Register of Historic Places.

B. Water Use

In accordance with the contracts described under paragraph III above, water for the Sequoyah Facility is withdrawn from the Tenkiller Reservoir Dam and conducted through a 16-inch water main to the site. Appropriate valving and metering are provided just above the raw water stilling basin. This water main was designed to provide sufficient cooling and potable water for the expanded capacity of the plant.

Very little water is used in the process except for makeup of neutralizing solutions, the absorption of noxious gases and for potable or sanitary purposes. Water used for these

purposes is discharged through treatment systems to a common outfall on the plant site prior to discharge to the Illinois River.

A portion of the water reaching the plant site bypasses the treatment system and joins the overflow from the cooling tower. This stream combines with the overflow from the sanitary lagoon and fluoride clarification pond and flows through a natural watercourse to enter the Illinois River approximately 1000 yards above its junction with the Arkansas River. As a part of our environmental surveillance system, the quality of the outfall water is routinely measured as described under paragraph V. The drawing on the following page, "Waste and Rainwater Drainage System," shows the flow of water through the plant.

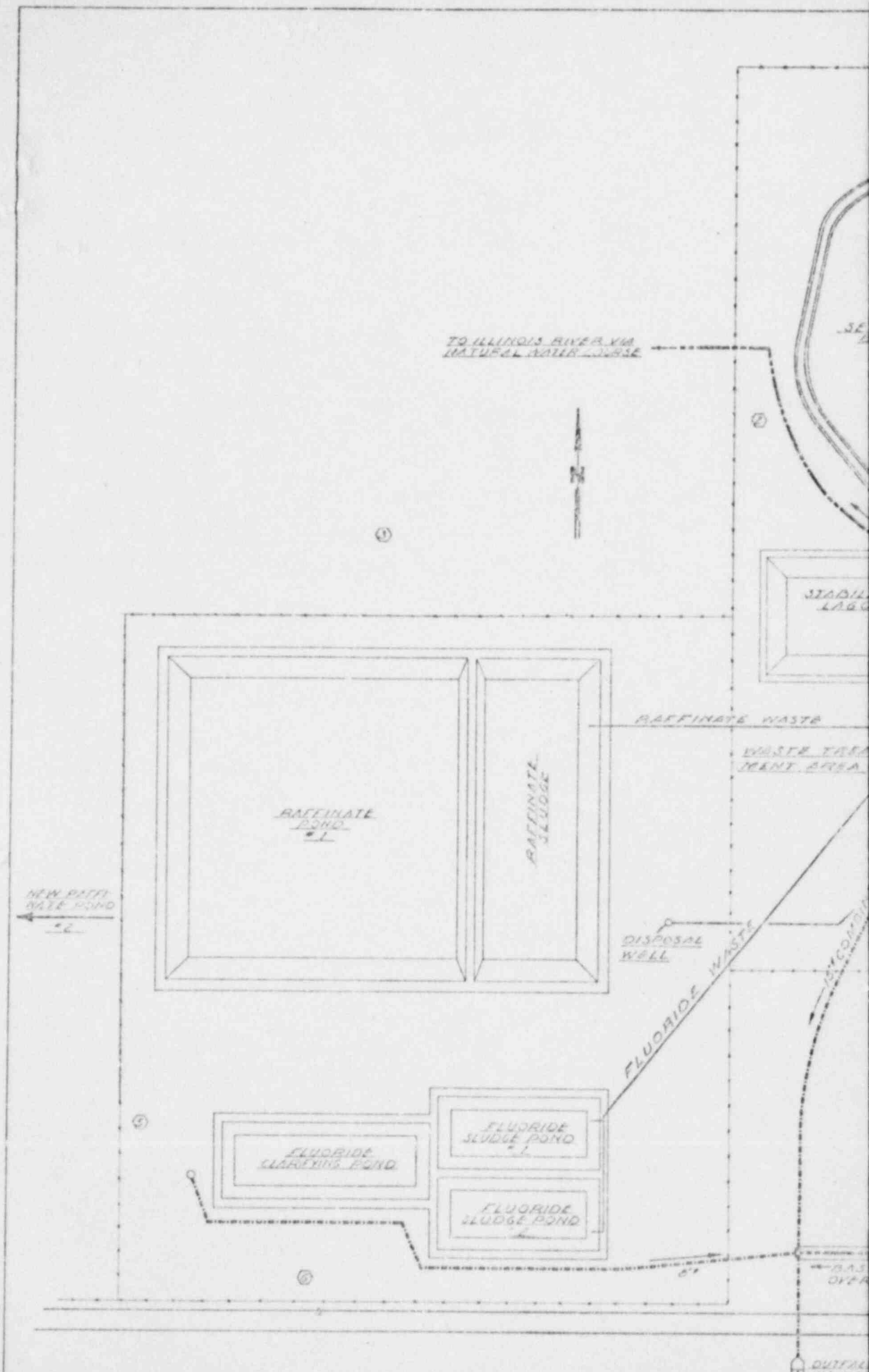
C. Heat Dissipation

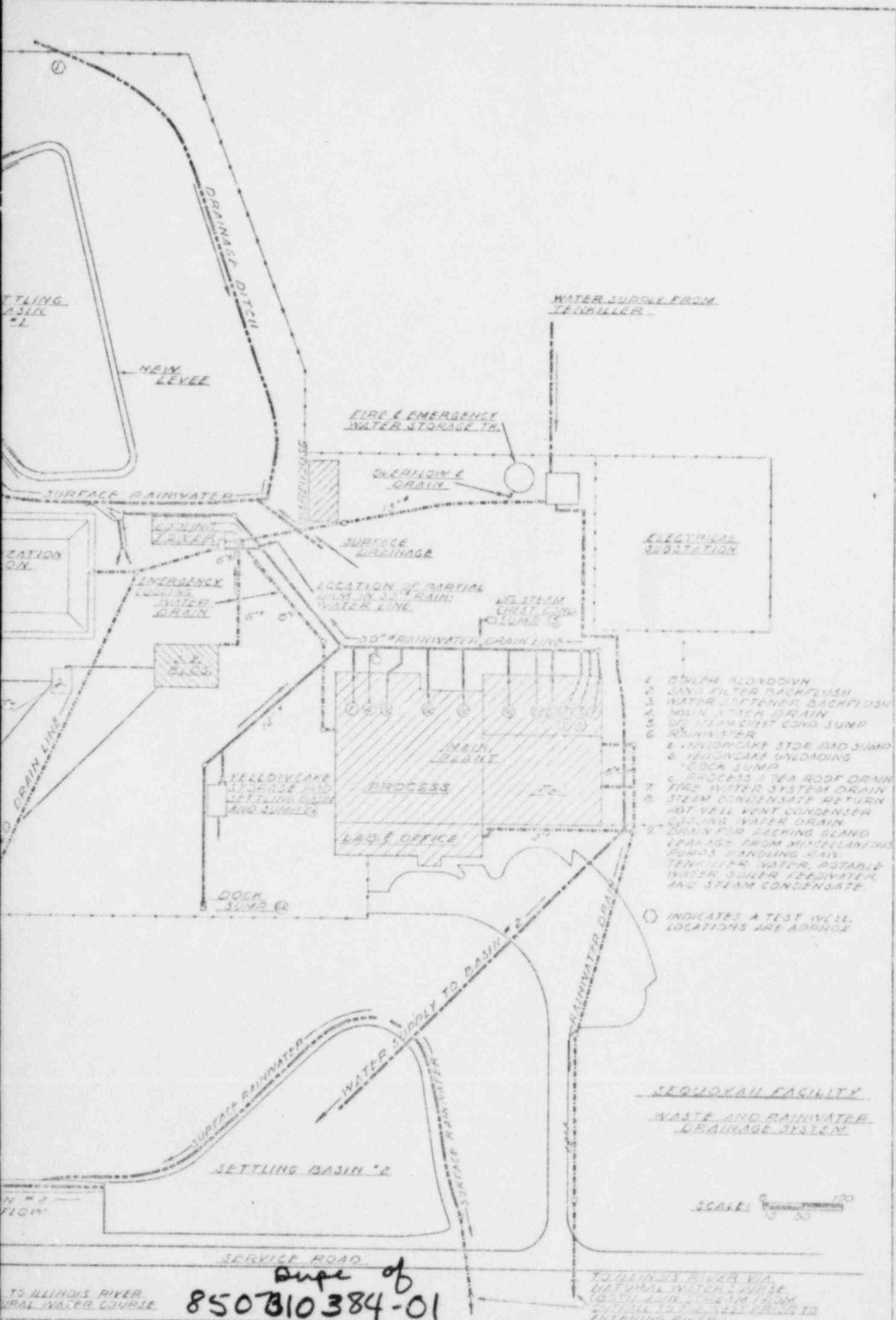
Process heat removal from the facility is provided for by the use of either cooling water or ambient air. Water received from Lake Tenkiller is sufficiently cold to use directly for cooling purposes. There are some very important and critical points in the process where temperature must be carefully controlled. Water is piped directly to these critical points and is then discharged to the cooling water system. Other, less critical heat release points are cooled by using the water in a cooling water system which circulates through cooling towers. In this manner critical points are provided with low temperature cooling water under sufficient gravity-induced pressure to protect the environs, personnel and equipment while less critical points are cooled with recycle water.

The heat dissipated from the plant results in a 5°F increase of the temperature of the water discharged. This discharge stream is calculated to raise the average temperature of the Illinois River by less than .1°F.

D. Chemical Discharge

Original plant design criteria provided that chemical waste originating from the solvent extraction building as an ammonium nitrate solution known as "raffinate" and the


TO ILLINOIS RIVER VIA NATURAL WATER COURSE
N
RAFFINATE POND #1
RAFFINATE SLUDGE
RAFFINATE WASTE
WASTE TREAT-
MENT AREA
NEW RAFFINATE POND #2
DISPOSAL WELL
FLUORIDE WASTE
FLUORIDE SLUDGE POND #1
FLUORIDE CLARIFYING POND
FLUORIDE SLUDGE POND #2



Dupe of 8508310384-01

scrubber solution containing small quantities of fluoride and uranium would be discharged as generated into a deep well disposal system. This deep well had been drilled to the depth of approximately 3700 feet into a porous Arbuckle limestone formation saturated with low-quality water unfit for agricultural, industrial or potable use due to the high quantities of soluble salts. However, the AEC Source Material License SUB-1010 did not approve the use of this well as planned because of the need for additional data as to the extent and capacity of the underground reservoir, the permeability of the formation and the uniform distribution of waste within the formation. Subsequently, Kerr-McGee has employed a consultant firm experienced in the delineation of such underground reservoirs, H. J. Gruy & Associates, Inc., to conduct a development program to determine the extent and capacity of this underground reservoir. This development program involves the measurement of injection rates and dissipation of injection pressures over time periods at various depths in the reservoir permitting the consultant to correlate the actual reservoir data with mathematical models of similar reservoirs. It is expected that these lengthy and expensive tests and the subsequent correlation will permit definition of the reservoir capacity and confirm the absence of risk of communication of waste fluids to potable and surface water. Currently, Kerr-McGee's geological and engineering review of these tests is proceeding and an AEC license amendment application will propose the authorization of the use of this deep disposal well upon completion of AEC and geological review.

As a consequence of the inability to license the deep disposal well, provisions were made to divide the chemical waste into two types with permanent surface storage of one and treatment of the other as fully described in paragraph II.D.

1. Nitrate Waste

The primary chemical waste of the uranium hexafluoride production process is a nitrate solution of ammonia containing the impurities removed from the feed material and

approximately one molar nitric acid concentration. These impurities contain minute quantities of radium 226 and thorium 230 and 234 as daughter products in equilibrium with the original uranium content. No practical method is known for the beneficial recovery, concentration or reduction to solid of these heterogeneous wastes. Consequently, holding ponds with carefully sealed bottoms were constructed in accordance with AEC criteria. A lime system to neutralize the excess nitric acid was installed and all such waste is treated with lime and pumped to the pond for storage. No nitrate chemical wastes have been discharged to the environment and all those generated are currently being held in disposal ponds in the plant area.

2. Fluoride Waste

The second portion of the chemical waste generated by the process is a very dilute solution of hydrofluoric acid (.3%) from the offgas scrubber in the hydrofluorination and fluorination processes. It was known that the treatment of this material with calcium hydroxide would precipitate calcium fluoride and further treatment with sulphuric acid would precipitate excess calcium and neutralize effluent solutions to acceptable disposal levels. A pond system with a carefully sealed bottom meeting AEC standards was constructed. The solution is neutralized with lime and then pumped to an initial pond for settling. The overflow from the first pond is then treated with sulphuric acid to adjust the pH and to precipitate excess calcium and allowed to settle. The final clear overflow liquid is combined with other aqueous effluents at the plant outfall. The combined stream meets accepted levels (USPHS drinking water standards) of fluoride ion.

Chemical wastes are retained or processed to remove chemical impurities prior to discharging to the Illinois River. As a result of this treatment no significant flow of chemical discharge occurs in the water returned to the Illinois River.

This effluent system is measured three times each day by removing a sample from the effluent stilling basin which

is analyzed for fluoride and nitrate ion and composited into weekly samples and subsequently into monthly samples. Daily samples are analyzed by the Sequoyah Laboratory staff to provide assurance to plant supervision that control measures are operating adequately. Daily samples are composited by months and analyzed by an independent laboratory.

The results of these independent analyses are shown on Table I for radioactivity and Table II for fluoride and nitrate, including data determined in a preoperational program conducted in 1969 by R. Y. Nelson of Oklahoma University. As can be seen from Table I, radioactive discharge is well within the alpha, beta and radium limits of 10CFR20. It can be seen from Table II that fluoride control resulting from the fluoride precipitation and clarification system shows only two months above U.S. Public Health Service drinking water standards. Nitrate concentrations are erratic, however. Source of the abnormal nitrate contamination in the effluent has been traced to originating as leaching by rainwater of nitrate solutions accidently spilled during early startup operations and not completely removed in decontamination efforts. As described above, all nitrate wastes have been stored in a neutralized condition in retention ponds since the startup of the plant.

DISCHARGE DATA

Effluent:	2,300,000 gal/day
	3.9 cfs
	19,159,000 lbs
Nitrate:	Current Daily Analysis
	N as NO_3 - 2 ppm
	NO_3 - 8.4 ppm
	160.9 lbs/day
Fluoride:	Current Daily Analysis
	F^- - .7 ppm 13.4 lbs/day
Illinois River:	1,462 cfs (Gore, Oklahoma)
	NO_3 - 2.4 ppm[1] 2,290 lbs/day
	F^- - .1 ppm[2] 95 lbs/day

Arkansas River: 19,500 cfs (Muskogee, Oklahoma)
NO_3 - 4.8 ppm[1] 64,000 lbs/day
F^- - .3 ppm[2] 4,680 lbs/day

[1]Oklahoma Water Quality Standards-1968

[2]Table II

Based upon these data and the continuing surveillance program, it establishes that the nitrate nitrogen content is being maintained at less that four ppm and fluorides at less than 1.5 ppm.

Recent literature[3], examined in a search for data as to the result of acute and chronic exposure at the levels of nitrate and fluoride contamination measured thus far, does not demonstrate any concern for below 10 ppm nitrate as nitrogen but reports chat infant methemoglobinemia has been caused by the use of drinking water containing 50 ppm nitrate. Precise concentration limits are not defined but it is widely recommended that water containing more than 10 ppm of nitrate nitrogen should not be used for infants. Other thresholds of deleterious effects appear to be approximately 20 ppm for the brewery industry with no effect from irrigation, stock or wildlife water below approximately 600 ppm. Fish and other aquatic life accommodate nitrate as a normal process of aerobic stabilization of organic nitrate. Aquatic plant life thrive in water containing elevated nitrate concentrations. Good fish life is supported in waters having up to 4.2 ppm. Consequently, levels of nitrate discharged from the Sequoyah Facility are well below those which cause harmful effects.

Fluoride levels at approximately 1 to 2 ppm are known to be beneficial in preventing the presence of caries in teeth. Levels of 3 to 4 ppm can cause mottled enamel but are not likely to cause other effects. No damage has been reliably reported from waters containing up to 5 ppm. For waters used for industrial purposes, a limit of 1 ppm is suggested for the

[3]Water Quality Criteria, 2nd Ed., McKee and Wolf; State Water Quality Control Board, Sacramento, California.

food processing industry although no serious effects have been noted until a concentration of 10 ppm is reached. Cattle, stock and wildlife apparently show no deleterious effects below approximately 10 ppm. In view of a control point of 1.5 ppm, the emission of fluorides in discharges from Sequoyah are well below those which cause any temporary or permanent harm.

E. Sanitary Wastes

Sanitary and domestic wastes are collected and piped to a stabilization lagoon approved by the State Department of Health of Oklahoma. Discharge of liquid effluent from this system has been tested and conforms to the State requirements. This stream is combined with the waste clear water and fluoride streams and flows to the Illinois River.

F. Biological Impact

Installation of the plant and its operation has caused minimum biological impact on the area. The construction work resulted in the removal of a small wheat field from production and of a few native trees, none of them of special or marked value. All slopes affected by the preparation of the area for construction were reseeded upon completion with a mixture of fescue and rye that rapidly became established, thus preventing erosion.

Small numbers of indigenous birds and animals were forced to relocate. A large amount of natural cover and feed sources remain to maintain native bird and game populations. There has been no noticeable reduction of the nearby population of deer and small animals or quail and other species of birds. It has been observed that many of the native animals are feeding upon the fresher grasses in the reseeded areas as a result of the water used in periods of dry weather.

The slightly elevated temperature (65°) of aqueous discharge has no effect on fish life and meets Oklahoma standards.[4] Schools of fish in the watercourse and at the point of discharge have been observed.

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[4]Oklahoma Water Quality Standards-1968.

G. Radioactivity Discharge

Processing results in minor radioactive contamination of the following plant discard streams which have been described more fully earlier in this report: (1) a small amount of uranium and daughter products contained in raffinate from the solvent extraction plant, (2) a small amount of normal uranium contained in the hydrofluoric acid solution, (3) ambient air passed through vacuum transfer and cleaning systems which is discharged to the atmosphere after filtering containing minute amounts of finely divided uranium salts, and (4) gaseous effluent resulting from noncondensable gas release from the UF_6 condensing system containing trace amounts of UF_6 which is piped to the top of the flue gas stacks from the boiler house.

All sources of discharge of radioactive substance are controlled either by permanent storage or treatment of filtration to keep effluents well within limits set by 10CFR20.

H. Transportation

Materials are normally moved to the plant in truckload quantities by common carriers or in vendor trucks. Such trucks travel over the interstate highway system to the turnoff on Interstate Highway 40 approximately one-half mile east of the Arkansas River Bridge. Here the route moves onto State Highway 10 for approximately one-half mile and then to the plant area over an asphalted concrete road installed as access to the plant. All radioactive materials are transported in accordance with D.O.T. regulations.

Plant personnel normally live in residential areas some distance from the site. A small percentage live in the area of Vian, Oklahoma, approximately six miles to the east. Others live at distances primarily in rural areas ranging up to Muskogee and Stillwell. All employees travel to the plant location from their homes in privately-owned automobiles or trucks.

This amount of movement of materials and personnel tc and from the plant since the commencement of operations in

February of 1970 has not resulted in unusual wear or caused hazardous conditions on these public-supported highways. Continued operation of the plant during the NEPA review period will not measurably increase the deterioration of the highway system.

I. Schools

No adverse impact of this installation on public schools has been experienced since the majority of employees were local residents. Additional tax income of approximately $90,000 is received by Sequoyah County annually.

J. Accidents

In an industrial processing plant such as the Sequoyah Facility, the possibility of internal accident or climatic conditions disrupting the closed processing system is present.

Sequoyah County is subject to steady winds and has a small probability of 1.66×10^{-3} of being hit by a tornado in any given year. The small probability decreases geometrically as the area of interest decreases. As a consequence, an advanced weather warning service has been arranged through local meteorological consultants. This weather warning service provides that at 50% probability of damaging winds at the site a warning is given four hours prior to its arrival and at 90% probability, one hour prior. Such warnings are made by the consultants after examining available weather information collecte through public and private networks and are based upon mathematical models and historical data of the system. In the event of a four-hour warning being received by the plant management, production operations are ceased and all personnel moved indoors. At the one-hour warning, all but essential services are terminated, storage tanks closed off and a close watch is posted. During 1971 five severe weather warnings have been received but no damaging storm has approached the plant.

Internal accidents caused by equipment malfunctions, design inadequacies or human error are a possibility in a newly-installed chemical plant. On three occasions during early

startup operations such accidents resulted in the release of some hydrofluoric acid, UF_6, and nitric acid solution of uranium to the restricted area in the plant. Since this time, considerable effort in correcting the design problems, securing equipment reliability, and training personnel in correct operating procedures has resulted in no accidental releases of contamination during the nine months of 1971.

The credibility and threat of an accident releasing uranium materials to the environment was carefully examined. The uncontrolled release of uranium materials must occur in one of three forms. Each has been separately scrutinized.

1. Gases

The production of UF_6 results in a reaction forming a volatile gaseous compound of uranium, uranium hexafluoride. This gaseous compound is formed in a gas-type reactor wherein solid UF_4 and gaseous elemental fluorine are combined with an excess of fluorine, essentially "burning" the uranium tetrafluoride to uranium hexafluoride. In the process of this reaction, an incomplete yield is obtained which results in the production of several intermediate uranium fluoride compounds, nonvolatile metallic impurities as fluorine compounds and large quantities of UF_6. The impurities and intermediate uranium fluoride solids are separated from the UF_6 gas stream by filtrations in series employing sintered metal filters. This filtration is repeated and the UF_6 is then condensed in a chilled heat exchanger.

While the gas formed is at high temperature and rates, the probability of escape is small since it is occurring in a sealed vessel on an essentially instantaneous basis. Any rupture in the sealed system would cause the production of an undesirable uranium oxyfluoride of extremely small particle-sized powder, comparable in nature to the particles existing in common smoke. The accidental breaching of the closed system would result in large clouds of white smoke emitted in the reactor area and the easily-controlled reaction would be

immediately detected and terminated by prompt closing of the fluorine feed valve.

Upon completion of the reaction and collection of the UF_6, the collection vessel is closed off from the process stream and the cooling terminated while steam is activated to several melting coils located on the bottom of the exchanger. The solidified UF_6 melts at 147° and 22 psi and can be handled with normal care as to operating and maintenance procedures. However, after all or part of the loaded heat exchanger is delivered to the cylinder for storage and shipment, the temperature of 200°F has generated a vapor pressure of approximately 60 psig. If ruptured during the transfer, cooling or storage, the maximum creditable accident would be the rupture of the valve connected to the shipping cylinder and subsequent vaporization of a portion of the contents.

The second possibility is a rupture of the valve of the same nature, however, occurring during the time that the cylinder is being reheated for homogenization in preparation for the removal of a sample. The solidified cylinder must be heated in live steam for approximately four hours before it becomes homogenous enough to blend.

The results of such an accident in terms of downwind concentrations and probable effect on humans at the nearest uncontrolled resident location (1/2 mile) are negligible as calculated by established diffusion methods[5] assuming moderately stable winds (four meters/sec). It is calculated that maximum exposure to airborne concentrations in the event the wind direction was correct would not exceed .053 microcuries assuming no washout, two hour presence in cloud and 100% deposition. Such exposure would amount to approximately 14% of established occupational body burden.

2. Liquid

All liquid handling equipment in the plant is located inside the building. If ruptured, liquid containers

[5]Meteorology and Atomic Energy, 1968.

are located in the sump areas with the volume of the depressed areas sufficient to hold any container in that area. As a consequence, an uncontrolled release of uranium-containing liquid from its immediate area could not occur without the compounding features of more than one accident simultaneously.

3. Solid

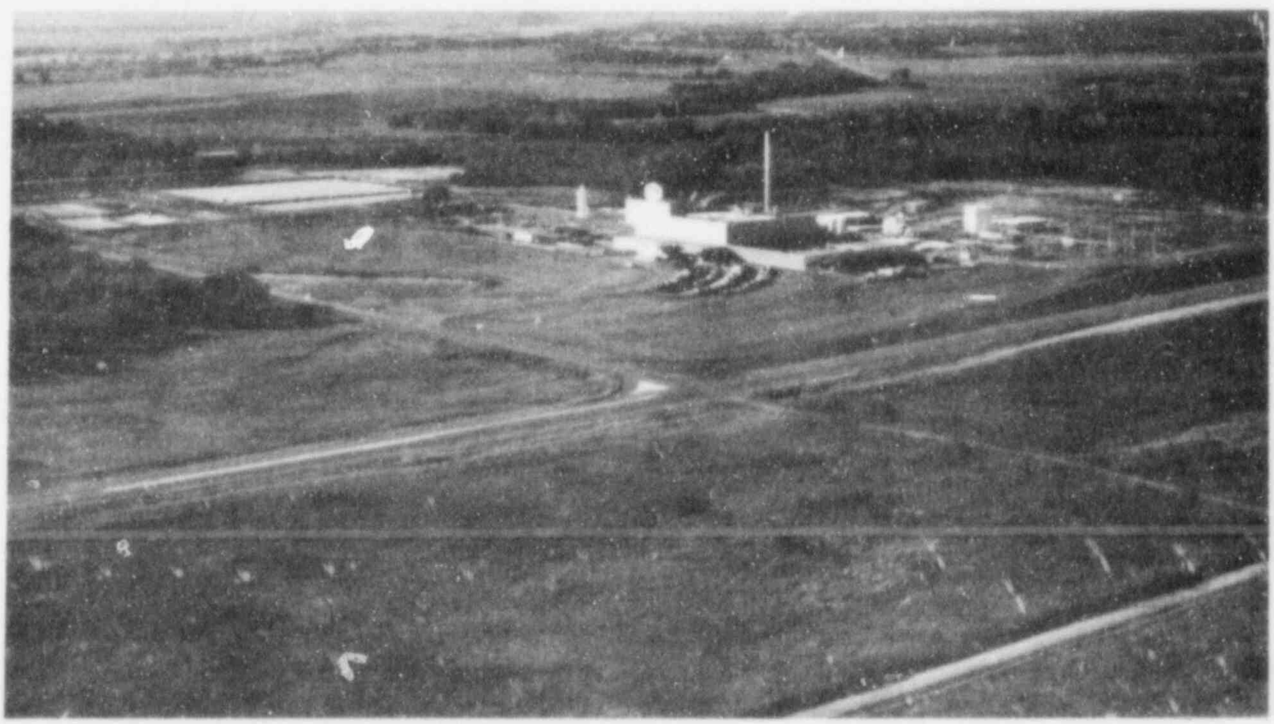
The breakdown of solids handling equipment and the release of the contained material to the plant is possible through the failure of packing or other equipment components. Such releases are normally restricted to the immediate local area where the material generates a pile of solid uranium powder. Some entrainment of such released powder on ambient air streams during the course of cleanup could occur, and the purpose of the fence line and remote air sampling stations is to detect any such release. In addition, regular surveying, both visually and with instruments, and routine monitoring of in-plant restricted area detects the accumulation of solids of a size range acceptable to air entrainment.

K. Aesthetics

The land chosen for the Sequoyah site, as described earlier, had been previously occupied by a small wheat field, woodland and the balance in uncultivated pasture. Efforts were made to design the facility in a manner so that land would be conserved and the resulting view would be enhanced rather than harmed. The view was unremarkable and similar to many others in the area. Architecturally, the lean, uncluttered appearance and orderly arrangement of the Sequoyah Facility enhances the aesthetic value of the site. Pictures of the plant from the air are on the following page.

V. Environmental Surveillance Program

The design criteria of the Sequoyah Facility included criteria for control of the quality of releases from the plant as a guide to the architectural engineering firm in establishing equipment design and specifications. Concurrently, it was



SEQUOYAH FACILITY
KERR-McGEE CORPORATION

realized that the meeting of these criteria could not be entirely verified by on-site measurements and an Environmental Surveillance Program was initiated. The purpose of the program is to demonstrate that effluent control equipment and procedures are limiting gaseous and liquid discharges of radioactive and chemical pollutants to the environment to acceptable levels. This program was initiated prior to the operation of the plant so that a base line could be established. The program covers all possible effluents from the plant and provides for monitoring of the holding ponds through the installation of several wells at their periphery to insure that no unforeseen leakage from the retention system occurs.

The following samples are taken at locations shown on Drawing 110-C-151 and analyzed for radioactivity, fluoride and nitrate contents as monitors for all other chemical releases:

1. The liquid effluent stream consisting of the combination of the fluoride treatment effluent, the sanitary effluent, water bypassed around the water treatment facility and overflow from the cooling tower plant is sampled at the point where it leaves the immediate plant control area south of the road. The stream is sampled once each shift and samples are composited on a weekly and monthly basis for analysis.

2. Air samplers are located at the fence perimeter and at a radius of 1000 feet in four directions. Continuous samples are taken for a week and analyzed.

3. The Illinois and Arkansas Rivers are sampled upstream and downstream of the outfall discharge once each week and analyzed in a monthly composite.

4. Soil and vegetation samples are taken near the location of the four air samplers quarterly. Vegetation is protected by cages and entirely collected at the time scheduled. Soil is taken from a four-square-foot area one-inch deep near the cages. All samples are analyzed for radioactivity, uranium, radium, fluoride and nitrate.

5. Samples are removed from the monitoring wells near the storage ponds and from water wells on the site once each

week and analyzed on a monthly composite.

6. Surface ponds on the site are sampled weekly and analyzed on a monthly composite.

All composited environmental samples are analyzed by an independent laboratory. Results of these analyses are given on Table I to X immediately following.

The environmental surveillance program was developed to (1) measure the effectiveness of in-plant control systems on regulating the discharge of potentially harmful chemicals and radioactivity, (2) demonstrate to State regulatory bodies that applicable regulations were being met on a continuing basis, and (3) measure the effects of discharge at lower-than harmful concentrations of such materials on the environment.

Justification of this program was the desire to secure the results described and the continuing concern of Kerr-McGee Corporation for the preservation and enhancement of the human environment Oklahoma.

VI. Results of Plant Use

The conversion of impure uranium concentrates to purified uranium hexafluoride is a central and necessary step in the complete nuclear fuel cycle. Nuclear power production promises a number of environmental advantages including the absence of release of significant amounts of combustion products to the atmosphere, the possibility of attractive architectural design, the significantly reduced flow of fuel materials and waste products and a reduction of associated noise and land commitment. Nuclear power is regarded as essential to meet the growing energy needs of the United States in the coming decades. The availability of abundant and reliable supplies of electrical power contributes in many ways to an enhanced human environment.

As stated above, Kerr-McGee does not believe that any adverse effect on the environment results from the past or continuing operation of the Sequoyah Facility.

TABLE I

GROSS ALPHA AND BETA AND RADIUM 226 ANALYSIS OF SEQUOYAH FACILITY
COMBINATION STREAM AND THE ILLINOIS AND ARKANSAS RIVERS
$\mu Ci/ml \times 10^{-7}$

	Combination Stream			Illinois River						Arkansas River					
	At Plant			Upstream			Downstream			Upstream			Downstream		
	α	β	^{226}Ra	α	β	^{226}Ra	α	β	^{226}Ra	α	β	^{226}Ra	α	β	^{226}Ra
Operational															
1971[a]															
January	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
February	1.6	.8	.01	<.01	.01	<.01	.04	.09	<.01	.02	.06	<.01	.03	.05	<.01
March	6.8	4.0	<.01	.01	.09	<.01	.20	.14	<.01	.02	.14	<.01	.29	.37	<.01
April	31.8	13.0	.26	.02	<.01	.04	1.10	.50	.01	.03	.10	<.01	.04	.06	<.01
May	26.4	47.4	.02	.01	.09	.01	.90	2.00	.05	.01	.03	.07	.01	.07	.04
June	NS	NS	NS	<.01	.09	<.01	.04	.12	<.01	.03	.12	<.01	<.01	.16	<.01
July	4.2	3.3	.03	.03	.03	.01	<.01	.14	<.01	<.01	.04	.02	<.01	<.01	.02
August	11.7	6.0	.06	.06	.03	.02	.06	.03	<.01	.01	.06	<.01	.02	.05	.02
September	3.6	3.0	.02	.08	.05	<.01	1.80	1.70	.02	<.01	.10	.02	<.01	.17	.01
Preoperational															
1969[b]															
July	No Effluent			.03	.08			NS		.03	.06		.04	.03	
August	"			.03	.07			NS		.04	.05		.02	.04	
September	"			.02	.03			NS		.02	.05		.02	.01	
October	"			.02	.03			NS		.02	.01		.02	.02	
November	"			<.01	<.01			NS		<.01	.04		<.01	.01	
December*	"			<.01	<.01			NS		NS	NS		NS	NS	

(a) Controls for Environmental Pollution Results
(b) R. Y. Nelson's Preoperational Survey Results
NS - Not Sampled
* - Sequoyah Lab Results

TABLE II

FLUORIDE AND NITRATE ANALYSIS OF SEQUOYAH FACILITY
COMBINATION STREAM AND THE ILLINOIS AND ARKANSAS RIVERS
CONCENTRATION IN PPM F^- & NO_3 AS N

	Combination Stream At Plant		Illinois River				Arkansas River			
			Upstream		Downstream		Upstream		Downstream	
	F	N	F	N	F	N	F	N	F	N
Operational										
1971[a]										
January	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
February	1.0	1.8	.5	1.8	.4	1.8	2.0	1.3	1.3	.5
March	2.6	<.1	<.1	<.1	.2	<.1	.4	.1	.2	<.1
April	2.6	22.0	.1	.2	.1	.2	.4	.4	.3	.4
May	.8	8.1	<.1	2.6	.3	1.2	.6	.6	.3	1.8
June	NS	NS	<.1	1.1	.2	.8	.4	1.1	.4	.8
July	.4	.9	<.1	.5	.2	.5	.2	.3	.2	.2
August	.7	13.7	.1	.3	.2	.2	.4	.3	.3	.2
September	.6	3.1	.1	.5	.2	.7	.2	.9	.2	.7
Preoperational										
1969[b]										
July	Not Operating		.2	.5	NS	NS	.4	.2	.1	.3
August	"		.2	.4	NS	NS	.5	.1	.2	.3
September	"		.2	.3	NS	NS	.5	.1	.4	.3
October	"		.3	.3	NS	NS	.4	.4	.3	.3
November	"		.1	.3	NS	NS	.4	.5	.1	.3
December*	.3		<.1		<.1		.3		.1	

[a] Controls for Environmental Pollution Results
[b] R. Y. Nelson's Preoperational Results
NS - Not Sampled
* - Sequoyah Lab Results

TABLE III

GROSS ALPHA, GROSS BETA AND RADIUM-226 ANALYSIS
SEQUOYAH FACILITY MONITOR WELLS
$\mu Ci/ml \times 10^{-6}$

	Well 1			Well 2			Well 3			Well 4*			Well 5			Well 6		
	α	β	Ra	α	β	Ra	α	β	Ra	α	β	Ra	α	β	Ra	α	β	Ra
Operational																		
1971[(a)]																		
January	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
February	.10	.07	.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	.01	<.01	.02	.06	<.01	.03	.02	<.01
March	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
April	.01	.02	<.01	<.01	.02	<.01	.19	.19	<.01	<.01	.04	<.01	<.01	.02	<.01	.03	.03	<.01
May	.04	.12	.03	.03	.08	<.01	.02	.06	<.01	.03	.06	<.01	.08	.18	<.01	.04	.07	<.01
June	.08	.11	<.01	.25	.11	<.01	.06	.08	<.01	NS	NS	NS	.03	.07	<.01	.02	.04	<.01
July	.07	.10	.04	.05	.07	<.01	.04	.12	<.01	NS	NS	NS	.02	.10	.06	<.01	.02	<.01
August	.09	.05	.03	.10	.03	<.01	NS	NS	NS	NS	NS	NS	.03	.08	<.01	.01	.02	<.01
September	.14	.08	.01	.05	.04	<.01	.03	.15	<.01	NS	NS	NS	.02	.05	.02	<.01	<.01	<.01

Preoperational
Wells were not drilled prior to facility operation.

(a) Controls for Environmental Pollution Results
* - Well #4 Abandoned in June
NS - Not Sampled

TABLE IV

FLUORIDE AND NITRATE ANALYSIS
SEQUOYAH FACILITY MONITOR WELLS
CONCENTRATION IN PPM F^- & NO_3 AS N

	Well 1		Well 2		Well 3		Well 4*		Well 5		Well 6	
	F	N	F	N	F	N	F	N	F	N	F	N
Operational												
1971[(a)]												
January	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
February	1.8	11.0	.4	4.3	2.0	3.3	6.0	5.5	6.3	5.5	.7	5.5
March	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
April	.5	32.0	.2	1.6	1.5	6.5	.6	3.1	1.0	4.4	.7	3.5
May	1.3	30.0	1.0	44.0	.9	5.5	.8	6.3	.9	3.9	.7	3.5
June	1.0	43.1	.6	14.7	1.1	2.3	NS	NS	1.1	1.8	.5	1.5
July	1.4	3.9	.9	23.3	1.2	.5	NS	NS	.8	19.5	.3	.3
August	1.0	2.2	.8	3.2	NS	NS	NS	NS	.9	44.3	.4	.2
September	1.2	4.1	.9	2.5	.6	4.3	NS	NS	1.0	3.1	.4	1.6

Preoperational
Wells were not drilled prior to facility operation.

(a) Controls for Environmental Pollution Results
* - Well #4 Abandoned in June
NS - Not Sampled

TABLE V

GROSS ALPHA, GROSS BETA AND RADIUM-226 ANALYSIS
SEQUOYAH FACILITY FAULT AND DOMESTIC WELLS
$\mu Ci/ml \times 10^{-6}$

	Fault Well			Carlisle School Well			Residence Well 1			Residence Well 2		
	α	β	Ra	α	β	Ra	α	β	Ra	α	β	Ra
Operational												
1971[a]												
January	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
February	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01			
March	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
April	.01	.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01			
May	.01	.02	<.01	<.01	<.01	<.01	<.01	<.01	<.01	NS	NS	NS
June	<.01	.03	<.01	<.01	<.01	<.01	<.01	<.01	<.01			
July	.02	.03	<.01	<.01	<.01	<.01	<.01	<.01	<.01	NS	NS	NS
August	.02	.02	<.01	<.01	<.01	<.01	<.01	<.01	<.01			
September	.01	.02	<.01	<.01	<.01	<.01	<.01	<.01	<.01	NS	NS	NS
Preoperational												
1969[b]												
July				<.01	<.01		<.01	.01		<.01	.01	
August				<.01	<.01		<.01	.01		<.01	.01	
September				<.01	<.01		<.01	.01		<.01	.01	
October				<.01	.01		NS	NS		<.01	.01	
November				<.01	<.01		NS	NS		<.01	.01	
December*	<.01	.04	<.01	<.01	.04		<.01	.03		<.01	.06	

(a) Controls for Environmental Pollution Results-Residence Well 2 abandoned prior to facility operatio
(b) R. Y. Nelson Preoperational Survey Results
NS - Not Sampled
* - Sequoyah Lab Results

TABLE VI

FLUORIDE AND NITRATE ANALYSIS
SEQUOYAH FACILITY FAULT AND DOMESTIC WELLS
CONCENTRATION IN PPM F^- & NO_3 AS N

	Fault Well		Carlisle School Well		Residence Well 1		Residence Well 2	
	F	N	F	N	F	N	F	N
Operational								
1971[(a)]								
January	NS	NS	NS	NS	NS	NS	NS	NS
February	1.8	6.6	1.0	4.4	1.8	5.5		
March	NS	NS	NS	NS	NS	NS	NS	NS
April	2.6	2.6	.1	6.2	.2	3.5		
May	2.9	2.7	<.1	3.2	.3	25.5	NS	NS
June	3.0	1.5	.2	1.6	.4	.8		
July	2.4	.1	.2	.5	.2	<.1	NS	NS
August	2.7	.6	.2	.4	.3	.4		
September	2.7	.1	.2	.4	.3	.3	NS	NS
Preoperational								
1969[(b)]								
July			.3	.3	.2	.3	.1	.6
August			.4	.4	.2	.1	.2	NS
September			.3	.5	.2	NS	.3	.4
October			.3	.4	NS	NS	.3	.6
November			.2	.3	NS	NS	.2	.4
December*	.7	2.3	.1	NS	<.1	NS	<.1	NS

(a) Controls for Environmental Pollution Results
(b) R. Y. Nelson Preoperational Survey Results
NS - Not Sampled
* - Sequoyah Lab Results

TABLE VII

GROSS ALPHA ACTIVITY AND FLUORIDE RESULTS
SEQUOYAH FACILITY ENVIRONMENTAL AIR
ALPHA RESULTS - $\mu Ci/ml \times 10^{-14}$
FLUORIDE RESULTS - CONCENTRATION IN PPM F^-

	East[1]		North[2]		South[2]		West[3]	
	α	F	α	F	α	F	α	F
Operational								
1971[(a)]								
April	5.4	<.001						
May	1.9	.001	<.3		3.0	.003		
June	5.8	<.001	10.6	<.001	3.4	<.001		
July	2.4	.002	7.0	<.001	3.6	<.001		
August	3.0	.001	7.2	.002	1.4	.002		
September	<.3	<.001	4.6	.001	2.6	.005		
Preoperational								
1969[(b)]								
June thru November Average	<100.0	NS	<100.0	NS	<100.0	NS	<100	NS

[1]East station installed in April, 1970
[2]North and South stations installed in May, 1970
[3]West station is under construction

(a) Controls for Environmental Pollution Results
(b) R. Y. Nelson's Preoperational Survey Results
NS - Not Sampled

TABLE VIII

RADIOACTIVITY AND CHEMICAL ANALYSIS
SEQUOYAH FACILITY PONDS[1]
ALPHA, BETA AND Ra-226 RESULTS - $\mu Ci/ml \times 10^{-6}$
FLUORIDE AND NITRATE RESULTS - CONCENTRATION IN PPM F^- & NO_3 AS N

	Pond 1 (1/4 Mile South of Facility)					Pond 2 (1/4 Mile East of Facility)				
	α	β	Ra	N	F	α	β	Ra	N	F
Operational										
1971[(a)]										
January	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
February	.02	.02	<.01	5.5	5.4	<.01	.02	<.01	11.0	1.5
March	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
April	.01	.04	<.01	1.7	.3	.01	.02	<.01	.5	.2
May	<.01	.02	<.01	1.4	<.1	<.01	.01	<.01	1.4	.1
June	.01	.01	<.01	1.3	.4	<.01	.01	<.01	.2	.3
July	.01	.01	<.01	<.1	1.2	.01	.01	<.01	.5	.1
August	.07	.04	<.01	.2	2.7	.01	.01	<.01	.3	.2
September	.02	.02	<.01	.3	1.7	<.01	.01	<.01	.6	.1
Preoperational										
1969[(b)]										
July	<.01	.01	NS	.4	.1	<.01	<.01	NS	.2	<.1
August	<.01	<.01	NS	.5	<.1	<.01	<.01	NS	.3	<.1
September	<.01	.01	NS	.4	<.1	<.01	<.01	NS	.3	<.1
October	<.01	.01	NS	.3	.1	<.01	.01	NS	.3	<.1
November	<.01	<.01	NS	.2	<.1	<.01	<.01	NS	.2	<.1
December*	<.01	<.01	NS	NS	.1	<.01	.04	NS	NS	<.1

[1]Ponds were constructed for water supplies when land was farmed and are fed by runoff and/or small springs.

(a)Controls for Environmental Pollution Results
(b)R. Y. Nelson's Preoperational Survey Results

NS - Not Sampled
* - Sequoyah Lab Results

TABLE IX

GROSS ALPHA RESULTS
SEQUOYAH FACILITY RESTRICTED AREA FENCE LINE AIR SAMPLES
$\mu Ci/ml \times 10^{-12}$ ASSUMING ALL ALPHA ACTIVITY DUE TO NATURAL URANIUM

	South Fence Gross Alpha	North Fence Gross Alpha
Operational		
1971[(a)]		
January	.78	.76
February	1.02	.84
March	1.30	1.06
April	2.00	1.20
May	.68	.76
June	.74	1.04
July	.78	.86
August	.80	.64
September	.22	.42
Preoperational		
1969[(b)]		
June thru October Average		<1.00

(a) Sequoyah Facility Health Physics Monthly Average Results
(b) R. Y. Nelson's Preoperational Survey Results

TABLE X

FLUORIDE AND URANIUM RESULTS
SEQUOYAH FACILITY ENVIRONMENTAL SOIL AND VEGETATION SAMPLES
FLUORIDE RESULTS - mg/g
URANIUM RESULTS - μg/g

	South		West		North		East	
	F	U	F	U	F	U	F	U
SOIL								
Operational								
1971[a]								
June	1.0	.3	4.1	.7	5.8	.8	2.7	3.7
September	3.4	3.0	<.1	8.0	3.9	15.0	2.0	3.0
Preoperational								
1969[b]								
June	NS	13.2	NS	29.7	NS	25.2	NS	22.5
October	NS	29.1	NS	22.2	NS	18.6	NS	17.1
VEGETATION								
Operational								
1971[a]								
September	3.0	32.0	2.0	75.0	4.0	13.0	1.0	11.0
Preoperational								
1969[b]								
June	NS	38.1	NS	34.5	NS	25.2	NS	13.2
October	NS	31.5	NS	18.9	NS	20.4	NS	22.8

(a) Controls for Environmental Pollution Results
(b) R. Y. Nelson's Preoperational Survey Results
NS - Not Sampled

VII. Alternatives

The site for the plant was chosen for its relative isolation, access to transportation and other favorable characteristics enumerated above. Alternate locations were evaluated and rejected on the basis of these criteria. These alternate locations, in view of the absence of any adverse environmental impact, would not currently be evaluated differently than they were at the initial consideration in 1967.

Alternate conversion processes were not available in the public domain at the time of initial planning without significant additional development work so we have duplicated the AEC process. The one other commercial process available is understood to produce no liquid effluent similar to the raffinate effluent generated at Sequoyah. Some technologists would view this as an advantage. However, since the process was proprietary and very little was known of its characteristics, the current process was chosen. The alternate process should offer no advantage in terms of gaseous effluents.

Kerr-McGee does not believe that a more favorable alternate site or process exists as confirmed by the environmental surveillance program now in effect at the Sequoyah Facility.

VIII. Commitments of Resources

The Sequoyah Facility requires commitment of a certain amount of land, water and various chemicals to the production activity. The use of water is temporary and is returned to the river. Its use, permitted by the authorizations cited in paragraph II, does not interfere with alternate constructive use such as potable water or irrigation.

The land commitment is not irretrievable since it could be restored to its initial condition at the end of the plant's useful life.

Chemicals used in the processes are all common items of commerce produced for such purposes and are not in limited supply. The uranium materials processed are not consumed but

leave the plant in an enhanced physical form for further use by an economically important segment of industry.

IX. Cost Benefit Analysis

A. Benefits

The benefits of the Sequoyah Facility will primarily accrue to the commerce and the residents of Sequoyah and Muskogee Counties, Oklahoma, as well as the overall nuclear industry.

1. Nuclear industry will gain the benefit of having a second domestic supplier of conversion service, employing a different process and accommodating a different set of specifications for the mining and milling segment of the uranium industry. The second supplier provides a degree of competition to insure an equitable price structure and assure the continuing availability of this important phase of the nuclear fuel cycle.

2. Of the approximately 100 employees at the Sequoyah site, 90 were hired from the immediate area resulting in a payroll of approximately $1 million per year. It has been estimated that for every direct factory employee, three times as many service personnel are required, thus resulting in a total infusion of payroll of approximately $3 million.

3. Sequoyah County activities will benefit due to the additional taxes paid on the industrial installation as compared to those paid on the unimproved land.

B. Penalties of Environmental Impact

This has been discussed above and it is concluded that no measurable adverse effect results from this installation.

1. Water Use

Since the water discharged is approximately the quality of the Illinois and somewhat above the quality of the Arkansas, into which it immediately flows, no measurable penalty is assessed upon downstream uses of water for industry, agriculture or potable service.

2. Land Use

Temporary removal of about 75 acres of land at an average cost of $400 an acre must be balanced by the value of a multimillion dollar industrial installation. Land not needed for the immediate plant area is continuing to be leased for agriculture. It is our belief that no penalty should be assessed for the change in land use or appearance of the area.

3. Biological Impact

No irreplaceable loss of wildlife or air quality has occurred and, as a consequence, it is concluded that no cost penalty can be assessed for this effect.

C. Conclusion

Based upon the above, it is our conclusion that the enhancement of values to the population of Sequoyah and Muskogee Counties by the addition of a viable industrial site far outweighs, in benefits, the nonmeasurable impact upon the environment.

APPENDIX

APPLICANTS ENVIRONMENTAL REPORT

SEQUOYAH FACILITY

AEC Radioactive Source Material License No. SUB-1010, Docket No. 40-8027, issued February 20, 1970, and Amendment No. 1, issued January 15, 1971.

Oklahoma Water Resources Board-Waste Disposal Permit No. IW-70-011, issued March 9, 1971.

Oklahoma State Department of Health-Sanitary Waste Treatment Permit, issued August 21, 1969.

Oklahoma Air Pollution Control Division-Open-Pit Incinerator Evaluation Test, July 26, 1971.

Oklahoma Water Resources Board-Permit to Appropriate Surface Water No. P67-765, issued January 9, 1968.

U.S. Army Corps of Engineers-Contract No. DACW 56-70-C-0083 for water storage space in Tenkiller Ferry Reservoir.

Form AEC—410
(1-61)

UNITED STATES
ATOMIC ENERGY COMMISSION

SOURCE MATERIAL LICENSE

Pursuant to the Atomic Energy Act of 1954, and Title 10, Code of Federal Regulations, Chapter 1, Part 40, "Licensing of Source Material," and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, possess and import the source material designated below; to use such material for the purpose(s) and at the place(s) designated below; and to deliver or transfer such material to persons authorized to receive it in accordance with the regulations in said Part. This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954 and is subject to all applicable rules, regulations, and orders of the Atomic Energy Commission, now or hereafter in effect, including Title 10, Code of Federal Regulations, Chapter 1, Part 20, "Standards for Protection Against Radiation," and to any conditions specified below.

Licensee		3. License No. SUB-1010
1. Name	Kerr-McGee Corporation	4. Expiration Date February 28, 1975
2. Address	Kerr-McGee Building Oklahoma City, Oklahoma 73102	5. Docket No. 40-8027

6. Source Material	7. Maximum quantity of source material which licensee may possess at any one time under this license
Uranium	No quantity limitation

CONDITIONS

8. Authorized use (Unless otherwise specified, the authorized place of use is the licensee's address stated in Item 2 above.)

   Subject to the conditions specified herein, this license authorizes the activities described in the licensee's application dated September 23, 1969, as supplemented January 14 and February 3, 1970, in accordance with the representations, specifications, and procedures in Appendix A of the said application, including supplements.

9. This license does not authorize the disposal of liquid waste containing radioactive constituents by injection into any disposal well.

10. Authorized place of use: The licensee's Sequoyah facility located about 2 1/2 miles southeast of Gore, Oklahoma.

11. This license authorizes the use of respirators in determining employee exposures to airborne radioactive materials subject to the conditions and specifications in the attached Annex A.

MATERIAL LICENSE
Supplementary Sheet

License Number SUB-1010

12. The licensee is exempt under the requirements of this license from compliance with Section 20.203(e)(2) of 10 CFR 20 provided all entrances to the plant are conspicuously posted in accordance with Section 20.203(e)(2) and with the words, "Any area within this plant may contain radioactive material."

13. The licensee shall immediately notify the Director, Region IV, Division of Compliance, USAEC, Denver, Colorado, by telephone and telegraph of any failure in an earth dam retention system which results in a release of liquid wastes containing radioactive material. This requirement is in addition to the requirements of 10 CFR 20.

14. Pursuant to Sections 20.106(b) and 20.302 of 10 CFR 20, this license authorizes the incineration of licensed material in accordance with the procedures specified in the application, including supplements, listed in Item 8 of this license.

15. As a minimum, the licensee shall conduct the environmental monitoring program described on pages V1-6.1.1 and V1-6.1.2 (Rev. 2/3/70) of the licensee's application listed in Item 8 above, including supplements.

16. This license authorizes the disposal or transfer of articles contaminated with source material to persons not possessing appropriate licenses provided the conditions in Annex B are met.

For the U. S. Atomic Energy Commission

Don F. Harmon

Date [illegible] 1970

by Don F. Harmon
Division of Materials Licensing
Washington, D. C. 20545

cc: P.S. Dunn/W. T. Shelley
D. J. Foley/A.W. Robertson
B. E. Brown
D. K. Sly
A. M. Valentine
Orig → G. E. Wuller ✓
~~Orig~~ J. Pyle

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

JAN 15 1971

DML:MB:RLL
40-8027
SUB-1010, Amendment No. 1

Kerr-McGee Corporation
ATTN: Dr. Frank K. Pittman, Director
Technical Services
Kerr-McGee Building
Oklahoma City, Oklahoma 73102

Gentlemen:

Your application dated November 5, 1970 has been incorporated into the "demonstration" portion of your application for License No. SUB-1010. In order to provide continued continuity in the license for subsequent construction of waste disposal facilities Condition 17 has been added to License No. SUB-1010 to read as follows:

"17. In the location, design, construction, maintenance and inspection of waste disposal systems into which effluents containing radioactive material in excess of the limits specified in Column 2, Table II of Appendix B, 10 CFR Part 20 are disposed, the licensee shall follow the criteria established in Section 4, page 5 of the enclosure entitled "Information and Criteria Pertinent to Evaluation of Embankment Retention Systems." In addition, the licensee shall establish appropriately located test holes near retention ponds to check for seepage, if any, of radioactive materials."

All other conditions of this license shall remain the same.

FOR THE ATOMIC ENERGY COMMISSION

Robert L. Layfield
Materials Branch
Division of Materials Licensing

Enclosure:
"Information and Criteria Pertinent to Evaluation of Embankment Retention Systems"

KERR-McGEE NUCLEAR DIVISION
JAN 19 1971
CONTRACT ADMINISTRATION

RECEIVED
JAN 19 1971
NUCLEAR DIV. MARKETING

RECEIVED
JAN 18 1970
TECH. SERVICES NUCLEAR DIV.

FORREST NELSON, Executive Director

OKLAHOMA WATER RESOURCES BOARD

DIALEX BUILDING • 2241 N.W. [illegible] STREET • OKLAHOMA CITY • OKLAHOMA • 73 .2

RECEIVED
MAR 23 1971

March 22, 1971

GJS
XC L97V BCB 3-23-71
XC L BB 3-26-71

P. S. DUNN

Mr. P. S. Dunn, Group Vice-President
Nuclear Operations
Kerr-McGee Corporation, Sequoyah Facility
Kerr-McGee Building
Oklahoma City, Oklahoma 73102

PERMIT NO: IW-70-011

DATE APPROVED: March 9, 1971

Dear Mr. Dunn:

This is to advise you that your application for Waste Disposal Permit has been approved by the Oklahoma Water Resources Board. This letter, accompanied by the enclosed copy of the application, constitutes the issuance of a Waste Disposal Permit.

Your permit will remain in effect so long as you are not in violation of the Oklahoma Water Quality Standards. In accordance with the Pollution Control Act of 1955:

SECTION 905 (a)

It shall be unlawful for any person to cause pollution of any waters of the State or to place or cause to be placed any wastes in a location where they are likely to cause pollution of any waters of the State.

SECTION 905 (b)

It shall be unlawful for any person to carry on any of the following activities without first securing such Permit from the Board, as is required by it, for the disposal of all industrial wastes which are or may be discharged thereby into the waters of the State.

1. The construction, installation, modification or operation of any industrial disposal system or part thereof or any extension or addition thereto.

SECTION 905 (b) (cont.)

2. The increase in volume or strength of any industrial wastes.

3. The construction, installation or operation of any industrial or commercial establishment or any extension or modification thereof or addition thereto, the operation of which would cause an increase in the discharge of wastes into the waters of the State or would otherwise alter the physical, chemical or biological properties of any waters of the State in any manner not already lawfully authorized.

4. The construction or use of any new outlet for the discharge of any wastes into the waters of the State.

The above activities can be carried out only after securing a Permit from the Oklahoma Water Resources Board or revising an existing Permit.

On occasions personnel from the Oklahoma Water Resources Board will be visiting your facilities; if a special visit is desired at any time, please notify our office.

Very truly yours,

Forrest Nelson

Forrest Nelson, Executive Director
OKLAHOMA WATER RESOURCES BOARD

FN/ph

Encl:

XC 0[illegible]

OKLAHOMA WATER RESOURCES BOARD
2241 N. W. 40th, Dialex Bldg. (East)
Oklahoma City, Oklahoma 73112

APPLICATION FOR WASTE DISPOSAL PERMIT
(Must be Typewritten and Filed in Triplicate)

Application No. IW-70-011

Stream System ____ (Office Use Only)

1. Name of Industry: Kerr-McGee Corporation, Sequoyah Facility
2. Address: Kerr-McGee Building, Oklahoma City, Oklahoma 73102 (Street No. or Box No. / City / State / Zip Code)
3. County: Sequoyah
4. Legal Description of Plant Location ____ ¼ NE ¼ Sec. 21
   Twp. 12N Rge. 21E
5. Legal Description of Point of Discharge ____ ¼ NE ¼ Sec. 21
   Twp. 12N Rge. 21E
6. Treated waste is discharged into the waters of: Illinois River
   tributary to the: Arkansas River
7. Source of Water Supply: Lake Tenkiller Reservoir Amount: 30,000 acre-ft/yr
8. Products Manufactured and Quantity: 5,000 tons per year of uranium hexafluoride
9. Type of Effluent (waste): Surface: Clarified effluent of lime-treated HF scrubber waste and cooling tower blowdown, boiler blowdown, domestic waste and water treatment brine. Surface retention: Solvent extraction raffinate waste after lime treatment.
10. Amount Discharged: ~1500 G.P.M. to Illinois River

WASTE TREATMENT FACILITIES

11. Primary Treatment: Lime treatment (Type and Capacity)
    A. Sludge Produced: None
    B. Final Sludge Disposal: Four (4) earthen pits (2 sludge pits, clarifier lagoon and raffinate evaporative lagoon 10,000,000 gal - one year waste capacity)
12. Secondary Treatment: pH adjustment of waste effluent (Type and Capacity)
13. Waste Stabilization Pond: Sanitary waste oxidation lagoon - 1,400,000 gal. (Type and Capacity)
14. Solid Waste Disposal: ____ (Type, Capacity and Life)
15. INJECTION WELL: (Pending AEC License Approval)
    A. Date Constructed: October 26, 1969
    B. Total Depth of Well: 3,100 feet
    C. Receiving Strata: Arbuckle limestone
    D. Total Thickness of Receiving Strata: ____
16. Laboratory Schedule for Quality Control: Radioactivity, F⁻, soluble sulfate and calcium, Cl⁻, pH, turbidity, dissolved solids. Grab sampling at frequency to demonstrate quality standards compliance.

SIGNATURE OF APPLICANT

F. S. Dunn, Group Vice-President
Nuclear Operations

(Office Use Only)

Application received and filed in this office, this ____ day of ____, 19 ____

OKLAHOMA WATER RESOURCES BOARD

[signature]
Executive Director

OWRB 2 5/70

PERMIT

OKLAHOMA STATE DEPARTMENT OF HEALTH
OKLAHOMA CITY 5, OKLAHOMA

Date August 21, 1969

The Kerr-McGee Corporation having complied with the requirements of the law is hereby granted permission to construct sanitary waste collection and treatment facilities to serve the Kerr-McGee Corporation's Sequoyah facility east of Gore in Sequoyah county, Oklahoma, to be constructed in accordance with the plans approved by this department on August 12, 1969.

subject to the following provisions :

1) That all details relative to the project not covered in the plans and specifications as approved will be constructed and accomplished in accordance with good public health practice.

2) That the recipient of the permit is responsible that the project receive supervision and inspection by competent and qualified personnel.

3) That wherever water and sewer lines are constructed with spacing of 10 feet or less, sanitary protection will be provided in accordance with Section 21 of the Standards for Water Pollution Control Facilities, ODH Engineering Bulletin No. 0587.

4) That this office will be notified approximately 10 days prior to completion of the project, so that a final inspection can be made by an engineer from this department before final payment is made to the contractor.

A. B. Colyar, M. D. Commissioner of Health

Loyd F. Pummill State Sanitary Engineer

ODH Form No. 535

Oklahoma
State Department of Health
3400 N. Eastern, Oklahoma City, Oklahoma 73105

July 26, 1971

Copies W. J. SHELLEY / P. S. DUNN
D. J. FOLEY
B. E. BROWN
S. J. GOKEN

Mr. George Wuller
Ker McGee Building
133 Robert S. Kerr Avenue
Oklahoma City, Oklahoma 73102

Dear Mr. Wuller:

A visible emission evaluation test was made on your open-pit incinerator located at Kerr-McGee's Seqouyah Facility in Gore, Oklahoma, July 14, 1971. The test consisted of making periodic visible readings of the stack emissions during the time period from 10:00 a.m. to 10:15 a.m., while the incinerator consumed approximately 2000 lbs. of type 0 waste.

The stack emissions ranged from a 0 to 3/4 Ringelmann during the test. It is our estimation that your incinerator will operate in compliance with the Air Pollution Control Division Regulation No. 5, if it is maintained and charged properly.

This letter is not intended to be a formal permit and does not waiver any requirements for stack sampling for determining exact emission rates in the future.

As we discussed, it is now necessary for the cost accounting and certification of cost to be submitted to our office so that your tax credit application can be completed.

We want to take this opportunity to thank you and your company for helping to protect Oklahoma's environment.

Please contact our office if we may be of any further assistance to you.

Very truly yours,

Doyle McWhirter

Doyle McWhirter, R.P.S.
Air Pollution Control Division

DMW:MJS

cc Mr. Loyd F. Pummill
Deputy Commissioner
for Environmental Services

cc Mr. Sam Trzcinski, R.P.S.
District Sanitarian

cc Mr. Homer Pace, R.P.S.
Sequoyah County Health Department

cc Mr. Robert V. Blanche, Director
Air Pollution Control Division

PERMIT TO APPROPRIATE SURFACE WATER

SW¼ & SE¼ Sec. 14; NW¼ & NE¼

Sec. 23, Twp 13N, Rge. 21EIM
(Legal Description, Office Use Only)

Stream System Illinois Number 2-17 County Sequoyah

Application No. 67-765 Date of Filing October 18, 1967

Permit No. P67-765 .

This is to certify that the Oklahoma Water Resources Board has held a public hearing on the application of Kerr-McGee Corporation By: R. . Fryar, Vice President; Att.: Carter Dudley, Attorney whose address is Kerr-McGee Bldg., Oklahoma City, Okla., for a Permit to appropriate 30,000 acre-feet of water, for the purpose of Commercial nuclear processing and allied facilities.

Water to be diverted from directly out of Tenkiller Reservoir in SW¼ & SE¼ Sec. 14 and NW¼ and NE¼ Sec. 23, Twp 13N, Rge. 21EIM

at a rate not to exceed 18,650 gpm.

The application is hereby approved and the applicant is authorized to proceed with the construction of the project in compliance with the above described application, which is made a part hereof and subject to the following terms, conditions and limitations:

1. Providing prior rights and domestic uses downstream are not affected by this diversion of water.

2. Work on the project must be started by the 18th day of October 1969, and the applicant has until the 18th day of October 1974 to complete the project.

3. Upon completion of the project applicant must file with the Executive Director of the Oklahoma Water Resources Board a NOTICE OF COMPLETION OF PROJECT in the manner prescribed.

4. In order to keep this Permit in full force and effect and retain the PRIORITY DATE, a WATER USE REPORT must be filed each year on forms furnished by the Board.

5. Acceptance of this Permit by applicant shall be an acknowledgement and agreement that application will comply with all the terms, conditions and limitations embodied in this Permit.

DATED this 9th day of January, 19 68.

OKLAHOMA WATER RESOURCES BOARD

enclosures Copy App. 67-765
Completion of Works
S.B. 324 & Receipt [illegible]

[illegible] Nelson, Acting Director

DACW56-70-C-0083

CONTRACT BETWEEN THE UNITED STATES OF AMERICA
AND
THE KERR-MCGEE CORPORATION, DELAWARE,
FOR
WATER STORAGE SPACE IN TENKILLER FERRY RESERVOIR

THIS CONTRACT, entered into this 27th day of February, 1970, by the UNITED STATES OF AMERICA (hereinafter called the ("Government"), represented by the Contracting Officer executing this contract, and the KERR-McGEE CORPORATION, a corporation organized and existing under the laws of the State of Delaware, with its principal office at Oklahoma City, Oklahoma, (hereinafter called the "User"), WITNESSETH THAT:

WHEREAS, the Act of Congress approved June 28, 1938 (Public Law 761, 75th Congress, 3rd session), as modified by the River and Harbor Act approved July 24, 1946, authorized the construction, operation and maintenance of the Tenkiller Ferry Dam and Reservoir on the Illinois River, Oklahoma, (hereinafter called the "Project"); and,

WHEREAS, under provisions of the Water Supply Act of 1958, as amended (43 USC 390 b-f), the Government is authorized to make contracts with States and local interests for water supply storage for municipal and industrial purposes; and,

WHEREAS, the User is empowered so to contract with the Government and is vested with all necessary powers for the accomplishment of the purposes of this contract;

NOW, THEREFORE, in consideration of the faithful performance of each party of the mutual covenants and agreements hereinafter set forth, the parties hereto do mutually agree as follows:

ARTICLE 1. WATER STORAGE SPACE.

a. The User shall have the right to utilize an undivided 3.780 percent of the storage space in the Project between elevations 632.0 and 594.5 feet above mean sea level as deemed necessary by the User to impound water for its present municipal and industrial use, and to make such diversions as granted to the User by the State of Oklahoma,

CONTRACTOR'S COPY

to the extent such storage space will provide, subject to the retention by the Government and others of the remaining undivided 96.220 percent of the storage space between said elevations for such purposes as the Government may deem desirable. Although the User's storage space is estimated to provide a dependable yield of about 10,000 acre-feet of water per year for municipal and industrial use, it is understood and agreed that the Government in no way guarantees such a yield.

b. The User shall have the right to withdraw water from the aforesaid 3.780 percent of the storage space between elevations 632.0 and 594.5, so long as the elevation of the water within the Project is above elevation 594.5 feet above mean sea level, and provided that such releases when combined with local runoff below the dam will not cause flooding.

c. The design and location of any future installations or facilities which the User may construct at the Project for the purpose of diversions or withdrawals shall be subject to the approval of the Contracting Officer, and the cost of such installation or facilities, or any modification thereof, shall be borne by the User. The User shall be responsible for operation and maintenance of all installations or facilities which may be provided and owned by the User.

d. The User recognizes that this contract provides storage space only, as stated above, and that any water that may be impounded therein will be raw water. The Government makes no representation with respect to the quality or availability of water and assumes no responsibility therefore, or for treatment of the water.

e. The User shall utilize such storage space in a manner consistent with Federal and State laws.

ARTICLE 2. MEASUREMENT OF WITHDRAWALS AND RELEASES.

a. For the purpose of maintaining an accurate record of water supply withdrawals, the User agrees to install, or cause to be installed, meters or measuring devices satisfactory to the Contracting Officer, without cost to the Government, at such times and places as the User, may construct facilities for the withdrawal of water from the Project by any means other than through the Project outlet works. The User shall furnish to the Contracting Officer regular monthly records of all such withdrawals, and shall furnish interim records at more frequent intervals upon specific request.

b. In the event the User desires releases through the Project works either as a sole source or as a supplement to facilities referred to in subparagraph "a" above, water will be released through the Project outlet works from water supply storage space in accordance with schedules prescribed in writing from time to time by the User and transmitted to the Contracting Officer. The measure of all such releases shall be by means of a rating curve of the outlet works, or by other suitable means, agreed upon in advance of the commencement of operation of the Project for water supply purposes.

ARTICLE 3. REGULATION OF THE USE OF WATER. The regulation of the use of water stored under this contract shall be the responsibility of the User and shall not be considered a part of this contract.

ARTICLE 4. CONSIDERATION AND PAYMENT.

a. The User shall pay the following sums to the Government:

(1) Annual payments of $9,717, based on the yearly amount required to amortize the investment cost for providing the aforesaid water supply storage space in the project over a 50-year period as determined in the manner set out in Exhibit A attached hereto and made a part hereof. Except for the first payment, which shall be applied solely to the retirement of the principal, all payments shall include accrued interest at the rate of 2.5 percent per annum on the unpaid balance. A schedule of annual payments is shown in Exhibit B attached hereto and made a part hereof. The first annual payment will be due and payable within 30 days of the date the User is notified that this contract has been approved by the Secretary of the Army. Payments thereafter shall be due and payable within 30 days of the yearly anniversary date of the first payment under this contract. Payments for any fractional part of a year which may result from termination of this contract shall be prorated on the basis of the annual charge.

(2) 55.12 percent of the annual loss in power revenue resulting from the operation of the Project for providing 25,400 acre-feet of storage for water supply. The annual payment shall be in the amount of $1,100. The first annual payment shall be due and payable on the date set forth in subparagraph a(1) of this Article. Annual payments thereafter shall be due and payable on the anniversary date of the first payment under this contract.

(3) 1.504 percent of the joint-use costs of ordinary operation and maintenance of the Project. Items of operation and maintenance which form the basis of computation and which will be used in future computation of operations and maintenance charges are shown in Exhibit A. Payments due prior to availability of actual experienced specific costs and joint-use costs of operation and maintenance shall be in the amount of $1,600. Payments thereafter shall equal to 1.504 percent of the joint-use costs of operation and maintenance for the preceding Government fiscal year. The first annual payment shall be due and payable on the date set forth in subparagraph a(1) of this Article. Annual payments thereafter shall be due and payable on the anniversary date of the first payment under this contract. Payments following the first complete fiscal year of operation shall be adjusted to reflect the difference between the prior payment or payments for operation and maintenance and the actual experienced specific costs for water supply and joint-use costs of operation and maintenance for the period covered by such payments.

(4) 1.084 percent of the joint-use cost of major capital replacement items and sedimentation resurveys, when incurred. Payment shall be made with the first annual payment becoming due after the date said cost is incurred.

(5) 2.50 percent per annum on any overdue payment until paid, to be compounded annually from the date such payments are due. The amount charged on payments overdue for a period of less than one year shall be figured on a monthly basis. For example, if the payment is made within the first month after being overdue (31 to 60 days after the anniversary date), one month's interest shall be charged.

b. If the actual construction cost of the Project differs from the estimated cost as set forth in Exhibit A, whether increased or decreased, the aforesaid cost to be repaid by the User as set forth in subparagraph a(1) above shall be adjusted accordingly upon final determination of Project costs. If the cost is increased or decreased, an adjustment, as determined by the Contracting Officer, of payments made prior to determination of the final Project cost shall be made in the first payment after such cost is determined. Exhibits A and B shall be modified to reflect the final Project costs, and the adjusted payments and such modifications shall form a part of this contract.

c. The extent of operation and maintenance of the Project shall be determined by the Contracting Officer, and all records and

accounting shall be maintained by the Contracting Officer. Records of the cost of operation and maintenance of the Project shall be available for inspection and examination by the User.

d. Should the User request additional operation and maintenance for water supply storage over and above that determined by the Contracting Officer, and over and above that which formed the basis for determination as set out in Exhibit A, the User shall bear the entire cost of such additional expense.

ARTICLE 5. PERIOD OF CONTRACT. This contract shall become effective as of the date of approval of the Secretary of the Army, and shall continue in full force and effect for a period of one year. The User shall have the right to renew this contract each year thereafter as long as storage remains available under the interim plan for providing water supply storage space in the Project or for a total period of 50 years, whichever expires first. Payment of each annual payment will constitute renewal for the ensuing year.

ARTICLE 6. NEW CONTRACT. It is understood that in the event of a change in project purposes, physical modification of the Project and/or reallocation of storage in the Project to provide for water supply by an Act of Congress, and upon equitable allocation of Project cost among purposes served by the reservoir, prior to expiration of 50 years, a new contract shall be negotiated for use of storage space, with the new contract providing for appropriate modification in quantity, elevations and annual payment. The new contract shall include permanent rights to storage space under the provisions of Public Law 88-140. The terms of the new contract shall be subject to mutual agreement at that time; however, it is further understood by the parties hereto, that credit will be given for the amount of repayment, applied to amortization of investment, which has been paid to the Government under this contract in computing the amount due under the new contract for investment allocable to the water supply storage space.

ARTICLE 7. WATER SUPPLY STORAGE, AND OPERATION AND MAINTENANCE.

a. The Government shall operate and maintain only the Project owned by the Government.

b. The Government shall not be responsible for diversions by others, nor will it become a party to any controversies between users of the aforesaid storage space, except as such withdrawal may affect storage space reserved by the Government.

c. The Government reserves the right to take such measures as may be necessary in the operation of the Project to preserve life and/or property.

ARTICLE 8. RIGHT-OF-WAY. The grant of an easement for rights-of-way over, across, in, and upon Government-owned lands under the control of the Secretary of the Army, required for transmission of water from the point of withdrawal, shall be by separate instrument without additional cost to the User under the authority of and in accordance with the provisions of 10 U.S.C. 2669.

ARTICLE 9. RELEASE OF CLAIMS. The User shall hold and save the Government, including its officers, agents, and employees, harmless from liability of any nature or kind for or on account of any claim for damages which may be filed or asserted as a result of storage and withdrawal or release of water from the Project made or ordered by the User or as a result of the construction, operation, or maintenance of the features or appurtenances owned and operated by the User.

ARTICLE 10. TRANSFER OR ASSIGNMENT. The User shall not transfer or assign this contract nor any rights acquired thereunder, nor suballot said water storage space or any part thereof, nor grant any interest, privilege, or license whatsoever in connection with this contract, without approval of the Secretary of the Army or his authorized representative; provided that, this restriction shall not be construed to apply to any water which may be obtained from the water supply storage by the User and furnished to any third party or parties.

ARTICLE 11. OFFICIALS NOT TO BENEFIT. No member of Congress, or resident commissioner, shall be admitted to any share or part of this contract, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit.

ARTICLE 12. COVENANT AGAINST CONTINGENT FEES. The User warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the User for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this contract without liability, or in its discretion to add to the

contract price or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

ARTICLE 13. APPROVAL OF CONTRACT. This contract shall be subject to the written approval of the Secretary of the Army, and shall not be binding until so approved.

IN WITNESS WHEREOF, the parties hereto have executed this contract as of the day and year first above written.

APPROVED:

Stanley R. Resor
Secretary of the Army

Date: 15 JUL 1970

THE UNITED STATES OF AMERICA

By Vernon W. Pinkey
VERNON W. PINKEY
Colonel, CE
District Engineer
Contracting Officer

KERR-McGEE CORPORATION

By F C Love
President

APPROVED
LEGAL

Attest:

By
Asst.
(Seal) Secretary

OVERSIZE DOCUMENT PAGE PULLED

SEE APERTURE CARDS

NUMBER OF PAGES: 1

ACCESSION NUMBER(S):

8512180069

APERTURE CARD/HARD COPY AVAILABLE FROM RECORD SERVICES BRANCH, TIDC
FTS 492-8989

KERR-McGEE CORPORATION

APPLICANTS ENVIRONMENTAL REPORT

USAEC

Docket No. 40-8027

Uranium Hexafluoride Plant

NOVEMBER 1971

INDEX

ENVIRONMENTAL REPORT

SEQUOYAH FACILITY

KERR-McGEE CORPORATION

ENVIRONMENTAL REPORT

SEQUOYAH FACILITY

KERR-McGEE CORPORATION

I. General

On February 20, 1970, the AEC issued License No. SUB-1010 to Kerr-McGee Corporation for the operation of a Uranium Hexafluoride Production Plant located in Sequoyah County, Oklahoma. This environmental report is submitted in accordance with the requirements of Appendix D, 10CFR Part 50, effective September 9, 1971.

II. Description of Site and Area

A. Location

The plant is located in a 2100-acre tract on the western edge of Sequoyah County. The site is bounded on the north by U.S. Highway 64, on the west by the Illinois River and the Arkansas River, on the south by Interstate Highway 40, and on the east by the eastern section line of Section 22. The plant area is located in Section 21, T12N-R21E, Sequoyah County, Oklahoma. Drawing 110-C-151 Rev. 4, attached, shows the site layout and its location in relation to nearby population centers. The site is approximately 2.5 miles southeast of Gore, Oklahoma, 19 miles west of Sallisaw, Oklahoma, and 20 miles north of Stigler, Oklahoma. The immediate plant area is a fenced-in restricted area of about 75 acres with access to Oklahoma Highway 10 adjacent to the eastern boundary.

B. Physical Description

The Sequoyah Facility was designed and built by Bechtel Corporation based upon design criteria furnished by Kerr-McGee. The plant consists of about 53,000 square feet of manufacturing, warehousing and office floor space in three separate buildings. The main process and administration building contains offices, laboratory, fluorine generation, sampling, and main process areas. A separate solvent extraction building contains only the solvent extraction system. A separate warehouse building was provided for storage of mechanical parts. In addition, to the west of the plant are located retention ponds for sanitary sewage, fluoride treatment and clarification and raffinate retention. The plant employs approximately 100 people of whom 75 are production and maintenance workers.

The Sequoyah Facility manufactures purified UF_6 from feed material consisting primarily of uranium concentrates received from mills located in the western United States and Canada. These concentrates are received in 55 gallon drums, weighed, sampled and digested in nitric acid solution. The uranium values in the solution are removed by a solvent extraction system and re-extracted into water. The re-extracted solution is concentrated and denitrated by heating. The resultant UO_3 is reduced to UO_2 with dissociated ammonia and hydrofluorinated to UF_4 with hydrofluoric acid. The UF_4 is fluorinated by elemental fluorine to UF_6. The UF_6 is removed from the process as a liquid, packaged into shipping cylinders containing 10 tons of UF_6 for shipment to USAEC diffusion plants.

This process is performed in a closed system consisting of a series of vessels, tanks, towers, evaporators and reactors employing a series of auxiliary equipment to provide: conveying, removal of impurities, effluent control, heating and cooling. The process is performed in the main process area and the solvent extraction building described above.

The process uses in sequence: 60% nitric acid, aluminum hydroxide, ammonia, hydrofluoric acid, potassium hydrogen fluoride, sodium carbonate, tribuytl phosphate and liquid hexane with natural gas as fuel for steam producing boilers. An oil inventory serves as standby fuel for the boilers.

Each of the raw materials listed above is stored and handled by methods recommended by the Manufacturing Chemists Association. The utility area containing boilers, nitric acid absorber, offgas burners and scrubber is located immediately behind the main process building. The storage area for chemicals is located across the driveway from this utility area. The area immediately surrounding the plant is covered with either concrete or asphalt paving. The area around the solvent extraction building for 100 feet distant is covered with noncombustible gravel in order to meet insurance requirements for flammable material.

A storage yard capable of containing 100 shipping cylinders for UF_6 is located adjacent to the northeast corner of the main process building. A switch yard for the necessary breakers and transformers to control incoming electrical power is located immediately east of the UF_6 storage yard and surrounded by a six-foot chain-link fence.

The process effluents are treated appropriately to avoid release to the environment.

1. A solution of impurities originating with the concentrates in the form of ammonium nitrate solution containing nitric acid, radium 226, thorium 234 and 230 and normal uranium.

2. A weak hydrofluoric acid solution (.31%) containing less than MPC amounts of normal uranium.

3. Flue gases from the combustion of natural gas in the boiler and the burning of excess cracked ammonia in the reduction process.

4. A weak hydrofluoric acid solution (approximately 25%) which is recovered and returned to the hydrofluoric acid suppliers.

5. Noncondensable fumes consisting of nitrogen, water vapor, HF, nitrogen oxide, sulphur oxide and negligible amounts of UF_6 in the offgas from the boiler stacks and the scrubber vent stacks.

6. Ambient air used in pneumatic transfer systems and dust control systems is emitted to the air after particulate filtration in high efficiency filters.

Waste materials from the plant are either buried on site or burned. Burnable wastes contaminated with uranium are burned in an incinerator close to the boiler house and its stack discharge is combined with the flue gas of the boiler. The burnable noncontaminated wastes are burned in a state approved open pit incinerator.

The plant auxiliary systems were started in January, 1970, and uranium charged in late February, 1970. Production operations have continued since then without interruption.

C. Area Description

The plant site was located after a preliminary study of ten comparable sites of the Arkansas River Valley. The specific site was selected after consideration of transportation, water supply, land availability, absence of other industrial installations, the quality and skill of available labor and recognition of the current and chronic depressed state of the eastern Oklahoma economic activity.

The topography in the vicinity of the site is gently rolling from a rather high ridge to the north of Highway 64 to the bottom land along the Arkansas and Illinois Rivers. As a result of ample rainfall, all the surface is densely covered by grasses, tree or shrub growth. The area

along the Illinois River was being used as a soybean field at the time of the site acquisition. Generally, other parts were used as pasture or are covered with profusely growing native oak. No large-scale agricultural enterprise existed except use of the pasture for cattle and the soybean field mentioned above. Since the area of the soybean field is partially under high-water levels set for the Robert S. Kerr Reservoir, the land has been acquired for the reservoir by the Corps of Engineers to the 470' elevation.

Naturally occurring wildlife has not been displaced by these original activities. Many species of birds and small animals exist in the area. A deer herd of significant size is increasing as more and more land is returned to pasture. Primary recreational use of the wildlife in the area is the hunting of quail and deer with some small amount of trapping of fur-bearing animals along the waterways. No significant lumbering activities exist in the area.

D. Population

This area of eastern Oklahoma is relatively sparsely populated and almost completely devoid of industrial activity. Population growth has been approximately 3% in the period 1960 to 1970. The plant site is located approximately 150 miles east of Oklahoma City on Interstate Highway 40 and approximately 40 miles west of Ft. Smith, Arkansas, and 25 miles to the southeast of Muskogee, Oklahoma. Nearby cities in the area are listed below.

County or City	Direction	Distance Miles	Population
Sequoyah County			23,370
Vian	E	4	1,131
Sallisaw	E	19	4,888
Muskogee County			59,542
Muskogee	NW	25	37,331
Warner	W	15	1,217
Webbers Falls	W	3	485
Gore	NW	2	478
Other			
Fort Smith, Arkansas	E	40	62,802

Main economic activity in this area at the time of plant construction consisted of farming. Since the selection of the site in 1967, completion of interstate routes and the Arkansas Riverway has considerably increased the amount of east-west traffic and will probably considerably increase the recreational use of the entire area. In Sequoyah County is located the Robert S. Kerr Reservoir of the Arkansas Riverway and the Webbers Falls Reservoir is immediately west of the plant site in Muskogee County. It is expected that these two impoundments, after further commercial development, will form an important recreational resource.

The climate in the area is characterized by hot summers and moderate winters. The normal annual rain fall is approximately 40 inches and the mean temperature is 62°. The extreme high temperature during a 62-year period of records was 115° and the extreme low was -15° below zero. Some strong winds are experienced in the area. Sequoyah County lies in a zone of approximately 1.66×10^{-3} probability of experiencing a tornado in any given year. Until the purchase of the site for the plant, one family had lived on this ground for a period of 100 years and have no record or recall of a tornado ever damaging the plant area.

This area was a part of the land given to the Cherokee Nation after their move from the southeastern United States. The Carlile house, on the property, at one time served as a station for a stage running from Ft. Smith to Ft. Gibson. The ford of the Illinois River was known as Carlile Ford but has since been flooded by the completion of the Robert S. Kerr Reservoir.

E. Geography and Geology

The Arkansas River in this area flows through a mountainous section on the southwest flank of the Ozark Uplift and is characterized by level-topped parallel east-west ridges rising as much as 400 feet above the adjacent valley floor. These uplands are drained by several rivers and numerous creeks which flow into the Arkansas along the area. The maximum change of elevation across the site is from 450 feet at the Illinois River to 700 feet in the southeast corner of Section 22.

Exposed surface geology consists of sandstone and shale sequence of the lower Atoka structure. The outcropping Atoka rocks are approximately 100 feet thick and are capped by approximately 15 feet of thick terrace gravel in the immediate area of the plant. Much of the structure was determined as a result of core hole data gathered to explore the size and extent of the normal fault which surfaces on Highway 64 at the Carlile School. Twenty-one cores were drilled in

the area in order to examine the characteristics of this fault zone. The core holes exhibited alternating beds of sandstone and black shale. Three separate sandstone beds can be recognized in the deeper holes of Section 21 and correlated with outcrops above the Illinois River. The Atoka sandstone and shales were deposited on a stable shelf. In post Atoka time the region was affected by a major deformation which formed a number of northeast to southwest trending folds and normal faults. The faulting ended in middle-Des Moinesian time and the region has been structurally stable since the middle Pennsylvanian period, approximately 250 million years ago.

Exploration of the area has demonstrated no deposits of oil, gas or other valuable minerals. Dry holes are located approximately two miles east and three miles south of the plant site. These two wells were plugged and capped with concrete after completion of drilling to 2000 feet and 4600 feet, respectively. All of the dry holes abandoned in the 16 township area surrounding the site were abandoned by leaving the surface casing in the hole and placing one or more cement plugs on top.

F. Waterways

As described above, the plant site is bounded on the west by the Illinois and Arkansas Rivers and, as can be seen on Drawing 151, the Arkansas River lays a short distance to the south of the site. All natural drainage of the plant area flows to the west into the Illinois River.

The Arkansas River has undergone significant development in recent years, primarily as a commercial waterway for the movement of freight. With completion in 1970 of the Robert S. Kerr and Webbers Falls Reservoirs and installations in the north on the Verdigris River near Tulsa, Oklahoma, this waterway now has become a working commercial trafficway. Barge traffic has not thus far developed significantly but is expected to grow at a steady rate for the next decade.

The Illinois River is primarily noted as the only spring-fed cold water river in Oklahoma. Tenkiller Ferry Reservoir was completed and opened for recreation in 1953 approximately seven miles up river from the site. It has proven very popular with Oklahoma residents and has several commercial installations serving the recreational market. With the completion of the dam for Tenkiller Reservoir and the decrease in water temperature below the reservoir, the Illinois River from the dam to its junction with the Arkansas became one of two artificially stocked trout streams in Oklahoma. Most of the stocking and trout fishing is done between the Highway 64 bridge north to the dam. Very little fishing is done in the area below the Highway 64 bridge for artificially

stocked trout. With completion of the Robert S. Kerr Reservoir in 1970, the headwater of the reservoir normal pool level now extends upstream in the Illinois to the Highway 64 bridge. As a result, the Illinois, from the Highway 64 bridge to the Arkansas proper, is classified as a part of the reservoir. Since the reservoir filled in December, 1970, it appears that water from the Arkansas has flowed up the Illinois past the outfall discharge point. This area has not become commercialized for recreational purposes but, since the Corps of Engineers has designated the west bank of the Illinois immediately north of U.S. 64 as a public access area for the reservoir, it is expected that eventually it will develop as a recreational area.

With the establishment of the reservoir, the area on the shoreline of the reservoir from the I-40 bridge to Vian Creek is being studied as a possible wildlife refuge. This area will be partially reserved for wildlife with limited waterfowl hunting permitted.

As mentioned previously, the Corps of Engineers has control of the Illinois River at Tenkiller Reservoir, the downstream water to the Arkansas and the area reserved for the flood level (470') of the Robert S. Kerr Reservoir. The only government installations on the river occur at the dams and their lock mechanism. No other government installations occur in the area.

III. Environmental Approval

When this site was selected for the location of the plant, extensive consultation was held with the Oklahoma Water Resources Board and the Corps of Engineers as to the preferred method of diverting Illinois water for use in plant cooling and potable water. Agreement was reached with the Oklahoma Water Resources Board on January 9, 1968, with the issuance of a "Permit to Appropriate Surface Water No. P67-765" covering 30,000 acre feet of water per year to be diverted from the outlet works of the Tenkiller Reservoir.

Subsequently, Contract No. DACW 56-70-C-0083 for water storage space in Tenkiller Ferry Reservoir was completed with the Department of the Army Corps of Engineers. These agreements permitted the diversion system to be designed and installed to remove water from the reservoir dam and pipe it to the site.

No state, local or regional planning organizations have been authorized to consider regional economic development in this area.

The State of Oklahoma is proceeding in an orderly fashion to evolve a set of environmental control regulations

without unnecessary conflict with the U.S. Government authorized regulatory activities. Currently, Oklahoma requires a permit for the disposal of waste to riverways. This permit has been granted by the State for the Sequoyah Facility, No. IW-70-011, for waste disposal and a sanitary waste treatment permit dated 8-21-69.

As described above, as this plant processes nuclear source materials, it was necessary to obtain from the USAEC an operating license. License SUB-1010 was granted February 20, 1970, based upon application submitted on September 25, 1969.

In accordance with applicable regulations, an application for a permit to discharge waste into navigable waters was filed with the Corps of Engineers on June 21, 1971, and supplemented on October 4, 1971. The Discharge Permit Application OK-076-0Y1-2-000111 is currently being processed.

IV. Environmental Impact

As described in paragraph I. B. above, plant construction was completed in early 1970 and production operations started immediately. Production operations have since continued without interruption. From these operations we measure no adverse effect on the environment as a result of the surveillance program described in paragraph V below.

A. Land Use

The immediate plant area was used for the cultivation of wheat and the balance was pasture. Grading for the building site and its auxiliaries changed the original contours to provide for the settling basins and treatment and storage ponds as shown on the attached Drawing 151. All graded land not covered by noneroding materials was subsequently seeded with fescue and rye to provide soil stability.

Currently, no plans have been made to provide public access or use of any of the 2100 acre site.

With the completion of the Arkansas Riverway and the extensive interstate highway system, it is expected that land along the Arkansas River will be developed in many places for industrial and commercial use. Since the land chosen for the Sequoyah Plant is not uniquely suitable for other beneficial use, it is believed that erecting this plant in this location provided an overall benefit to the human environment in the area.

The plant site does not intrude into any site of historical significance nor is it listed in the National Register of Historic Places.

B. Water Use

In accordance with the contracts as described under paragraph III above, water for the Sequoyah site is withdrawn from the Tenkiller Reservoir Dam and conducted through a 16-inch water main to the site. Appropriate valving and metering is provided prior to the water entering a stilling basin. This water main was designed to provide sufficient cooling and potable water for the expanded capacity of the plant.

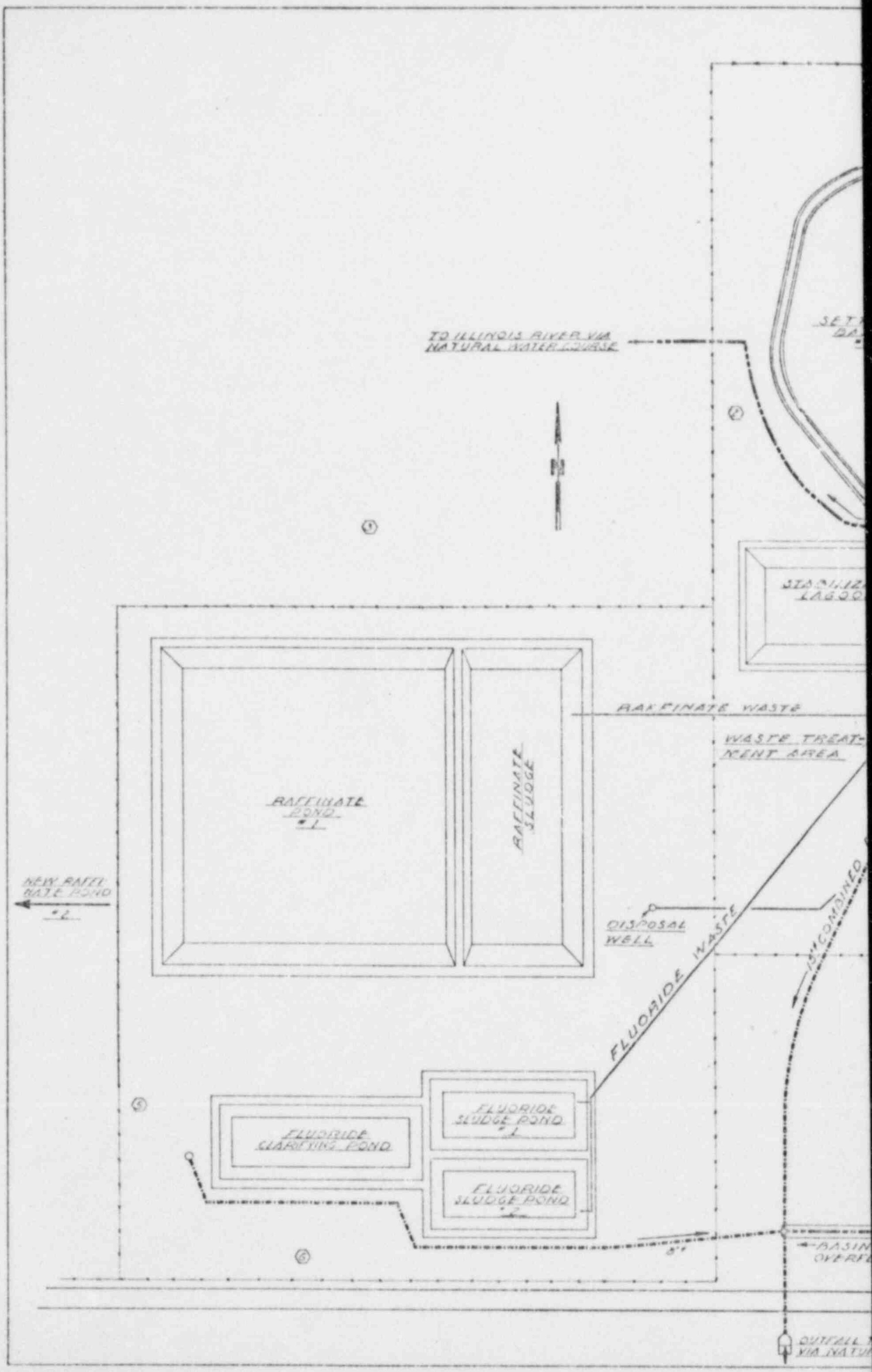
A portion of the water flowing to the plant site is permitted to bypass the treatment system and join the overflow from the cooling tower. This water combines with the overflow from the sanitary lagoon and fluoride clarification pond and flows through a natural watercourse to enter the Illinois River approximately 1000 yards above its junction with the Arkansas River. As a part of our environmental surveillance system, the quality of the outfall water is routinely measured as described under paragraph V. The drawing on the following page, "Waste and Rainwater Drainage System", shows the flow of water through the plant.

C. Heat Dissipation

Heat removal from the facility is provided for by the use of either cooling water or ambient air. Water received from Lake Tenkiller is sufficiently cold to use directly for cooling process heat sources. Certain points are extremely important and critical from the viewpoint of controlling the unplanned release of process material, protection of processing equipment, or the control of certain reactions. Water is piped directly to coolers and condensers for these critical points and thence discharged to the cooling water system. Other, less critical, heat release points are cooled by using the water in a cooling water system which circulates through cooling towers. In this manner critical points are provided with low temperature cooling water under sufficient gravity-induced pressure to protect the environs, personnel and equipment, while less critical points are cooled with recycle water.

Little water is used in the process except for makeup of neutralization solution, the absorption of noxious gases and for potable or sanitary purposes. Water used for these purposes is discharged through treatment systems to a common outfall on the plant site prior to discharge to the Illinois River.

The heat dissipated from the plant results in a negligible increase in the temperature of the water discharged to the outfall system and minor increases in ambient air temperature returned to the atmosphere.


TO ILLINOIS RIVER VIA
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NEW RAFFI-
NATE POND
#2
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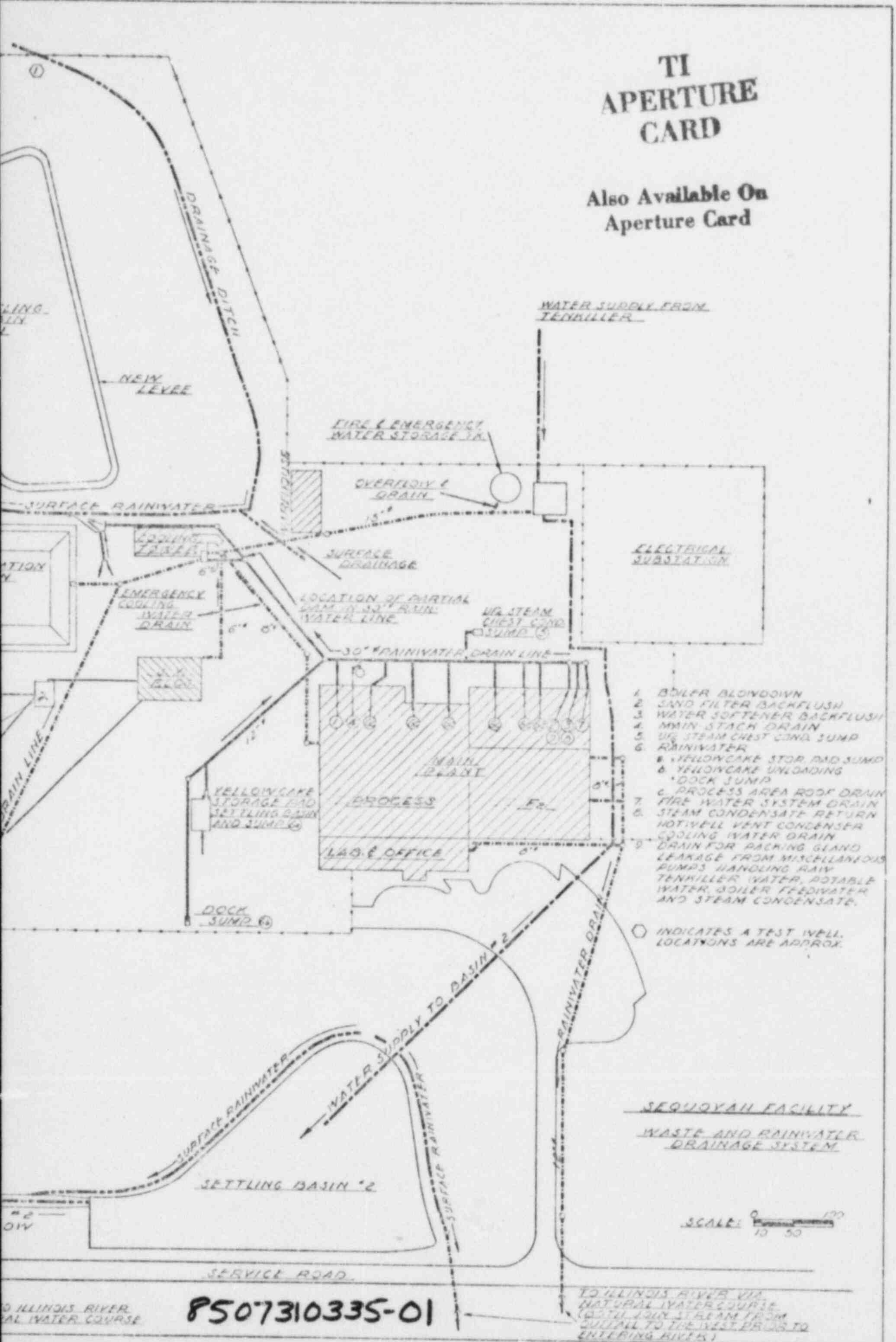
WELL
FLUORIDE WASTE
FLUORIDE
SLUDGE POND
#1
FLUORIDE
CLARIFYING POND
FLUORIDE
SLUDGE POND
#2



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D. Chemical Discharge

Original plant design criteria provided that chemical waste originating from the solvent extraction building as an ammonium nitrate solution known as "raffinate" and the scrubber solution containing small quantities of fluoride and uranium would be discharged as generated into a deep well disposal system. This deep well had been drilled to the depth of approximately 3700 feet into a porous Arbuckle limestone formation saturated with low-quality water unfit for agricultural, industrial or potable use due to the high quantities of soluble salts. However, the AEC source material License SUB-1010 did not approve the use of this well as planned because of the need for additional data as to the extent and capacity of the underground reservoir, the permeability of the formation and the uniform distribution of waste within the formation. Subsequently, Kerr-McGee has employed a consultant firm experienced in the delineation of such underground reservoirs, H. J. Gruy & Associates, Inc., to conduct a development program to determine the extent and capacity of this underground reservoir. This development program involves the measurement of injection rates and dissipation of injection pressures over time periods at various depths in the reservoir permitting the consultant to correlate the actual reservoir data with mathematical models of similar reservoirs. It is expected that these lengthy and expensive tests and the subsequent correlation will permit definition of the reservoir capacity and confirm the absence of risk of communication of waste fluids to potable and surface water. Currently, Kerr-McGee's geological and engineering review of these tests is proceeding and an AEC license amendment application will propose the authorization of the use of this deep disposal well upon completion of AEC and geological review.

As a consequence of the inability to license the deep disposal well, provision was made to subdivide the chemical waste into two types; with permanent storage of one, and treatment of the other to meet applicable Oklahoma discharge criteria.

1. Nitrate Waste. The primary chemical waste of the uranium hexafluoride production process is a nitrate solution of ammonia containing the impurities removed from the feed material and approximately one molar nitric acid concentration. These impurities contain quantities of radium 226, thorium 230 and thorium 234 as daughter products in equilibrium with the original uranium content. No practical method is known for the beneficial recovery, concentration or reduction to solid of these heterogeneous wastes. Consequently, holding ponds with carefully sealed bottoms were constructed in accordance with AEC criteria. A lime system to neutralize the excess nitric acid was installed and all

such waste was treated with lime and pumped to the pond for storage. No nitrate chemical wastes have been discharged to the environment and all those generated are currently being held in disposal ponds in the plant area.

2. Fluoride Waste. The second portion of the chemical waste generated by the process is a weak solution of hydrofluoric acid (.3%) resulting from the operation of the offgas scrubber in connection with the hydrofluorination and fluorination processes. It was known that the treatment of this material with calcium hydroxide would precipitate calcium fluoride and further treatment with sulphuric acid would precipitate excess calcium and neutralize effluent solutions to acceptable disposal levels. As a consequence, a pond system with a carefully sealed bottom meeting AEC standards was constructed and the solution neutralized with lime and then pumped to an initial pond for settling. The effluent from this first pond is then treated with sulphuric acid to adjust the pH and to precipitate excess calcium and allowed to settle further. The effluent supernatant liquid is combined with other effluents at the plant outfall. The combined stream meets accepted levels (USPHS drinking water standards) of fluoride ion.

3. Sanitary Wastes. Sanitary wastes are collected, piped to a stabilization lagoon approved by the State Department of Health of Oklahoma. Discharge of liquid effluent from this system has been tested and conforms to the State requirements. This stream is added to the combined stream and flows to the Illinois River.

F. Biological Impact

Installation of the plant and its operation has caused minimum biological impact on the area. The construction work resulted in the removal of a small wheat field from production and a few native trees, none of them of special or marked value. All slopes affected by the preparation of the area for construction were reseeded upon completion with a mixture of fescue and rye that rapidly became established, thus preventing erosion.

Small numbers of indigenous birds and animals were forced to relocate. A large amount of natural cover and feed sources remain to maintain native bird and game populations. There has been no noticeable reduction of the nearby population of deer and small animals or quail and other species of birds. It has been observed that many of the native animals are feeding upon the fresher grasses in the reseeded areas as a result of the water used in periods of dry weather.

G. Radioactivity Discharge

Processing results in radioactive contamination of the following plant discard streams: (1) small amount of uranium and daughter products contained in raffinate from the solvent extraction plant which is described above under chemical discharges, (2) a small amount of normal uranium contained in the hydrofluoric acid solution described above, (3) ambient air passed through vacuum transfer and cleaning systems which is discharged to the atmosphere after filtering containing finely divided uranium salts, and (4) gaseous effluent resulting from noncondensable gas release from the UF_6 condensing system which is piped to the top of the flue gas stacks from the boiler house.

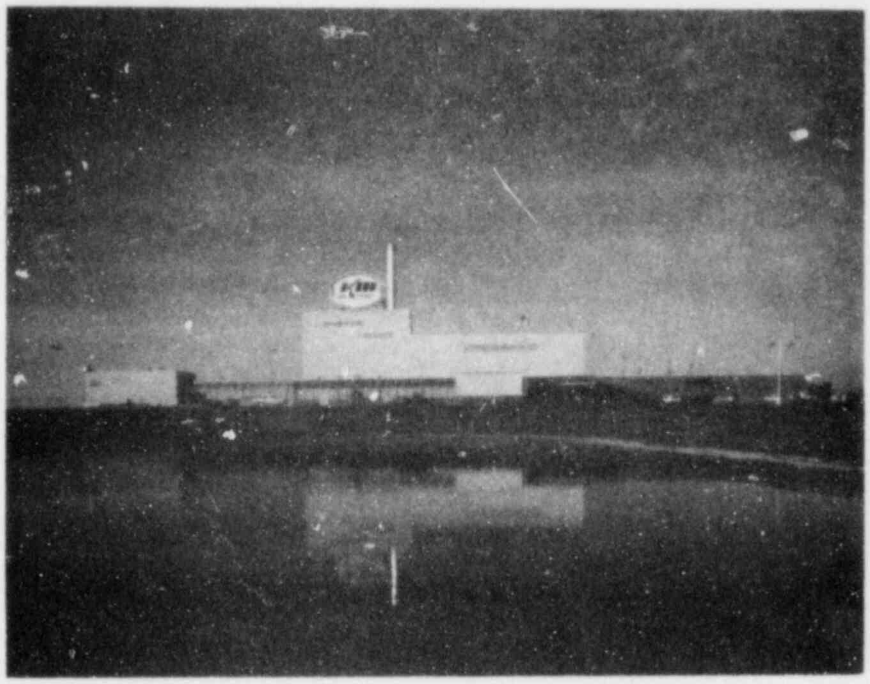
All sources of discharge of radioactive substance are controlled either by permanent storage, treatment or filtration to keep effluents well within limits set by 10CFR20.

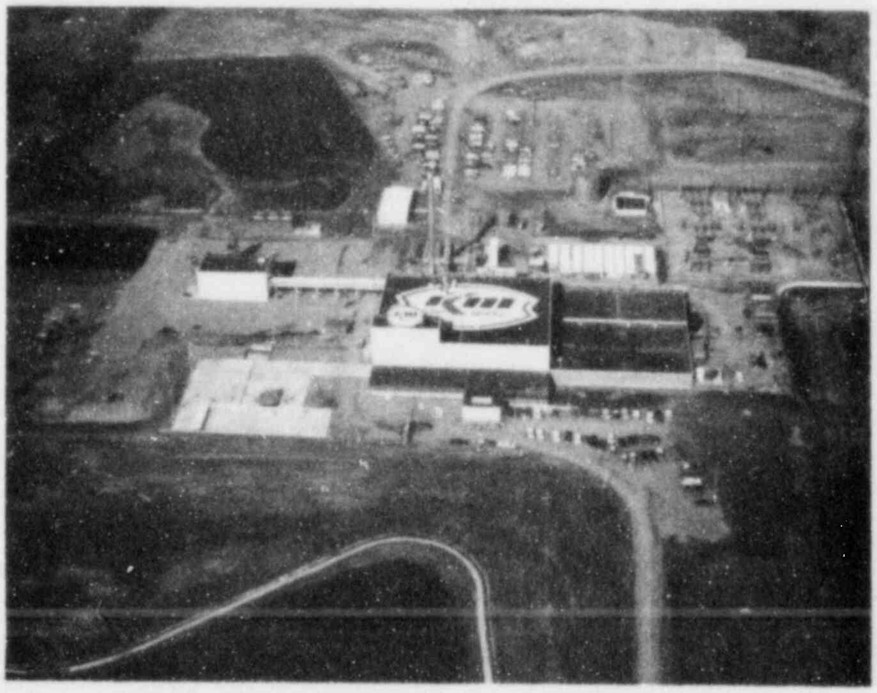
H. Aesthetics

The land chosen for the Sequoyah site, as described earlier, had been previously occupied by a small wheat field and the balance in uncultivated pasture. Efforts were made to design the facility in a manner so that land would be conserved and the resulting view would be enhanced rather than harmed. The view was unremarkable and similar to many others in the area and it is believed that design criteria have succeeded in enhancing the appearance of the area. Pictures of the plant from ground level and from the air are on the following page.

V. Environmental Surveillance Program

The design criteria of the Sequoyah Facility included criteria for the quality of release of noxious gases, fumes and radioactive materials as a guide to the architectural engineering firm in establishing equipment design and specifications. Concurrently, it was realized that meeting these criteria could not be entirely determined by on-site measurements and an Environmental Surveillance Program was initiated. The purpose of the program is to demonstrate that effluent control equipment and procedures are limiting gaseous and liquid discharges of radioactive and chemical pollutants to the environment to acceptable levels. This program was initiated prior to the operation of the plant so that a base line could be established. The program covers all possible effluents from the plant and provides for monitoring of the holding ponds through the installation of several wells at their periphery to insure that no unforeseen leakage from the retention system occurs.





SEQUOYAH FACILITY
KERR McGEE CORP.

The following samples are taken at locations shown on Drawing 110C-151 and analyzed for radioactivity, fluoride and nitrate contents as monitors for all other chemical releases.

1. The liquid effluent stream after the combination of the fluoride treatment effluent, the sanitary effluent, water bypassed around the water treatment facility, overflow from the cooling tower plant is sampled at the point where it leaves the immediate plant control area south of the road. The stream is sampled once each shift and samples are composited on a weekly and monthly basis for analysis.

2. Air samplers are located at the fence perimeter and at a radius of 1000 feet in four directions. Continuous samples are taken for a week and analyzed.

3. The Illinois and Arkansas Rivers are sampled upstream and downstream of the outfall discharge once each week and analyzed in a monthly composite.

4. Soil and vegetation samples are taken near the location of the four air samplers quarterly. Vegetation is protected by cages and entirely collected at the time scheduled. Soil is taken from a four-square-foot area one-inch deep near the cages. All samples are analyzed for radioactivity, uranium, radium, fluoride and nitrate.

5. Samples are removed from the monitoring wells near the storage ponds and from water wells on the site once each week and analyzed on a monthly composite.

6. Surface ponds on the site are sampled weekly and analyzed on a monthly composite.

All environmental samples are analyzed by an independent laboratory. Results of these analyses are given on Tables I to VI immediately following. We conclude from these data that no measurable impact on the environment has been detected.

VI. Results of Plant Use

The conversion of impure uranium concentrates to purified uranium hexafluoride is a central and necessary step in the complete nuclear fuel cycle. Nuclear power production promises a number of environmental advantages including the absence of release of significant amounts of combustion products to the atmosphere, the possibility of attractive architectural design, the significantly reduced flow of fuel materials and waste products and a reduction of associated noise and land commitment. Nuclear power is regarded as essential to meet the growing energy needs of the United

TABLE I

COMBINED LIQUID DISCHARGES AT PLANT OUTFALL

(1971 TO OCT. 1 - 8 SAMPLES)

	Combined Liquid Discharges			Limit	Ratio-Conc/Limit		
	High	Low	Ave.		High	Low	Ave.
1. Gross Alpha Activity ($\mu Ci/m\ell$)	1.6×10^{-6}	4.0×10^{-8}	$.7 \times 10^{-6}$	2×10^{-5} (a)	.08	.002	.035
2. Gross Beta Activity ($\mu Ci/m\ell$)	2.4×10^{-6}	$.7 \times 10^{-7}$	$.6 \times 10^{-6}$	1×10^{-5} (a)	.24	.007	.06
3. Total Uranium (ppm)	8.0	.2	2.82	60.0(a)	.13	.003	.05
4. Nitrate (as N) (ppm)	22.0	.2	6.8 (e)	3.9(d)	5.60	.05	1.75 (e)
5. Fluoride (as F) (ppm)	2.5	.2	1.34	1.5(c)	1.61	.14	.81
6. Radium - 226 ($\mu Ci/m\ell \times 10^{-8}$)	2.62	.054	.65	3(d)	.86	.018	.22

(a) 10 CFR 20.106 - Assuming Natural Uranium and Thorium Release Limits

10 CFR 20.5(c) - 1 μCi = 4.44×10^{-6} dpm - Specific activity - 33μCi/gram Uranium

(b) USPHS Drinking Water Standards - 1962 - Publication 956

(c) 10 CFR 20.106 - Assuming Soluable Radium - 226 Release Limits

(d) Oklahoma Water Quality Standards - 1968

All Samples Analyzed by Controls for Environmental Pollution, Inc., Santa Fe, New Mexico.

(e) This high average due to accidental release early in the year.

TABLE II

GASEOUS DISCHARGES

MONTHLY AVERAGE CONCENTRATIONS AT SAMPLING POINTS

(1971 TO OCT. 1 - 8 Samples)

	GROSS ALPHA				FLUORIDES (as F^-)			
	Limit µCi/mℓ	Ratio-Conc/Limit High	Low	Ave.	Limit ppm	Ratio-Conc/Limit High	Low	Ave.
Fence Line Sampling								
1. North	2×10^{-12} (a)	.81	.16	.42		NOT SAMPLED		
2. South	2×10^{-12}	1.00	<.1	.47		NOT SAMPLED		
Environmental Sampling (at 1000 ft)								
1. South	2×10^{-12} (a)	.029	<.002	.015	.01 (b)	.20	<.01	<.01
2. East	2×10^{-12}	.053	<.002	.029	.01	.20	<.01	<.01
3. West	2×10^{-12}	.026	.014	.018	.01	.50	<.01	.04

a. 10 CFR 20.106

b. K. M. Criteria - 10 ppb (as F_2) Maximum Ground Level Concentration Beyond Site Fence

TABLE III
1971 ARKANSAS AND ILLINOIS RIVER SAMPLING
MONTHLY AVERAGE CONCENTRATIONS
8 SAMPLES
(1971 TO OCT. 1)

Arkansas River	Upstream			Downstream			Okla Water Resources Board Standards
	High	Low	Ave.	High	Low	Ave.	
1. Gross Alpha Activity ($\mu Ci/m\ell x10^{-8}$)(a)	.17	<.005	.07	1.44	< .005	.24	2000
2. Gross Beta Activity ($\mu Ci/m\ell x10^{-8}$)(a)	.71	.16	.42	1.84	< .005	.59	1000
3. Total Uranium (ppm)	.014	.005	.003	.014	< .005	.004	60
4. Nitrate as N (ppm)	1.3	.1	.63	1.8	<.1	.57	4.9
5. Fluoride as F (ppm)	2.0	.2	.57	1.3	.2	.40	1.5 - 2.4
6. Radium 226 ($\mu Ci/m\ell x10^{-8}$)	.69	.002	.16	.42	.002	.115	3.0
Illinois River							
1. Gross Alpha Activity ($\mu Ci/m\ell x10^{-8}$)	.30	< .05	.09	8.8	< .05	2.55	2000
2. Gross Beta Activity ($\mu Ci/m\ell x10^{-8}$)(a)	.45	.05	.25	10.0	.17	2.99	1000
3. Total Uranium (ppm)	.013	<.005	.002	.50	< .005	.115	60
4. Nitrate as N (ppm)	2.6	< .1	.92	1.8	< .1	.8	3.9
5. Fluoride as F (ppm)	.5	< .1	.1	.4	.1	.2	1.5-2.4
6. Radium - 226 ($\mu Ci/m\ell x10^{-8}$)	.35	.001	.084	.45	< .001	.10	3

(a) Assuming all activity due to natural uranium or thorium

TABLE IV
1971 SEQUOYAH FACILITY SOIL AND VEGETATION SAMPLING
QUARTERLY CONCENTRATIONS
(1971 TO OCT. 1)

	No. Samples	Total Uranium ppm			Fluoride (F) ppm		
		High	Low	Ave.	High	Low	Ave.
Soil							
1. South 1000 ft.	2	3.0	.30	1.7	3.4	1.0	2.2
2. West 1000 ft.	2	8.0	.72	4.4	4.1	.1	2.1
3. North 1000 ft.	2	15.0	.84	7.9	5.8	3.9	4.8
4. East 1000 ft.	2	3.7	3.00	3.4	2.7	2.0	2.4
Pre-Operational Soil*							
Vegetation							
1. South 1000 ft.	1	32.0	32.0	32.0	3.0	3.0	3.0
2. West 1000 ft.	1	75.0	75.0	75.0	2.0	2.0	2.0
3. North 1000 ft.	1	13.0	13.0	13.0	4.0	4.0	4.0
4. East 1000 ft.	1	11.0	11.0	11.0	1.0	1.0	1.0
Pre-Operational Vegetation*	8	38.1	13.2	25.6	Not Analyzed		

*Based on Beta Analysis from 1965 Pre-Operational Survey

TABLE V
1971 SEQUOYAH FACILITY POND SAMPLING
MONTHLY AVERAGE CONCENTRATIONS
7 SAMPLES
(1971 TO. OCT. 1)

	Pond #1 (1/4 mi. south)				Pond #2 (1/4 mi. east)			
	High	Low	Ave.	Pre-operational[b] Ave.	High	Low	Ave.	Pre-operational[b] Ave.
1. Gross Alpha Activity ($\mu Ci/ml \times 10^{-8}$)[(a)]	3.31	.20	1.02	.23	.44	.005	.27	.18
2. Gross Beta Activity ($\mu Ci/ml \times 10^{-8}$)[(a)]	2.15	.63	1.16	.71	1.20	.36	.77	.39
3. Total Uranium (ppm)	.027	.005	.008		.007	.005	.003	
4. Nitrate as N (ppm)	1.7	.1	.81	.05	1.4	.2	.58	.02
5. Fluoride as F (ppm)	2.7	.1	1.05	.38	.30	.10	.16	.23
6. Radium - 226 ($\mu Ci/ml \times 10^{-8}$)	.18	.001	.08		.30	.001	.10	

(a) Assuming all Activity Due to Natural Uranium or Thorum

(b) From 1969 Pre-Operational Survey

TABLE VI
1971 SEQUOYAH FACILITY MONITOR WELL SAMPLING
MONTHLY AVERAGE CONCENTRATIONS
8 SAMPLES
(1971 TO OCT. 1)

	Seepage Wells (6)				Fault Well (1)				Residence Wells (2)			
	High	Low	Ave.	Preop. Ave.	High	Low	Ave.	Preop Ave.	High	Low	Ave.	Preop. Ave.
1. Gross Alpha Activity[a] ($\mu Ci/m\ell x10^{-8}$)	12.6	.07	2.3	Installed after Pre-operational Testing.	1.1	.07	.52	.4	.46	.01	.14	.14
2. Gross Beta Activity[a] ($\mu Ci/m\ell x10^{-8}$)	9.7	.11	3.2		1.7	.17	1.0	3.9	.98	.11	.32	.72
3. Total Uranium (ppm)	.95	.005	.081		.036	.005	.014	1.0	.032	.005	.008	NA
4. Nitrate as N (ppm)	44.3	.2	9.0		6.6	.10	1.8	9.2	25.5	.1	3.6	.27
5. Fluoride as F (ppm)	6.3	.1	1.3		3.0	1.8	2.6	.7	1.8	.1	.35	.42
6. Radium - 226 ($\mu Ci/m\ell x10^{-8}$)	6.2	.01	.37		.35	.01	.11	.3	.30	.01	.07	NA

(a) Assuming all Alpha and Beta Activity to be Natural Uranium and/or Thorium

States in the coming decades. The availability of abundant and reliable supplies of electrical power contributes in many ways to an enhanced human environment.

As stated above, Kerr-McGee does not believe that any adverse effect on the environment results from the past or continuing operation of the Sequoyah Facility.

VII. Alternatives

The site for the plant was chosen for its relative isolation, access to transportation and other favorable characteristics enumerated above. Alternate locations were evaluated and rejected on the basis of these criteria. These alternate locations, in view of the absence of any adverse environmental impact, would not currently be evaluated differently than they were at the initial consideration in 1967.

Alternate conversion processes were not available in the public domain at the time of initial planning without significant additional development work so we have duplicated the AEC process. The one other commercial process available is understood to produce no liquid effluent similar to the raffinate effluent generated at Sequoyah. Some technologists would view this as an advantage. However, since the process was proprietary and very little was known of its economics, the current process was chosen. The alternate process should offer no advantage in terms of gaseous effluents.

Kerr-McGee does not believe that a more favorable alternate site or process exists as confirmed by the environment surveillance program now in effect at the Sequoyah Facility.

VIII. Commitments of Resources

The Sequoyah Facility requires commitment of a certain amount of land, water and various chemicals to the production activity. The use of water is temporary and is returned to the river. Its use, permitted by the authorizations cited in paragraph II, does not interfere with alternate constructive use such as potable water or irrigation.

The land commitment is not irretrievable since it could be restored to its initial condition at the end of the plant's useful life.

Chemicals used in the processes are all common items of commerce produced for such purposes and are not in limited supply. The uranium materials processed are not consumed but

leave the plant in an enhanced physical form for further use by an economically important segment of industry.

IX. Cost Benefit Analysis

A. Benefits

The benefits of the Sequoyah Facility will primarily accrue to the commerce and the residents of Sequoyah and Muskogee Counties, Oklahoma, as well as the overall nuclear industry.

1. Nuclear industry will gain the benefit of having a second domestic supplier of conversion service through the use of a different process and accommodating a different set of specifications for the mining and milling segment of the uranium undustry. The second supplier provides a degree of competition to insure an equitable price structure and assure the continuing availability of this important phase of the nuclear fuel cycle.

2. Of the approximately 100 employees at the Sequoyah site, 90 were hired from the immediate area resulting in a payroll of approximately $1 million per year. It has been estimated that for every direct factory employee, three times as many service personnel are required, thus resulting in a total infusion of payroll of approximatey $3 million.

3. Sequoyah County activities will benefit due to the additional taxes paid on the industrial installation as compared to those paid on the unimproved land.

B. Penalties of Environmental Impact

This has been discussed above and it is concluded that no measurable adverse effect results from this installation.

1. Water Use. Since the water discharged is approximately the quality of the Illinois and somewhat above the quality of the Arkansas, into which it immediately flows, no measurable penalty is assessed upon downstream uses of water for industry, agriculture or potable service.

2. Land Use. Temporary removal of about 75 acres of land at an average cost of $400 an acre must be balanced by the value of a multimillion dollar industrial installation. Land not needed for the immediate plant area is continuing to be leased for agriculture. It is our belief that no penalty should be assessed for the change in land use or deterioration of appearance of the area.

3. Biological Impact. No irreplaceable loss of wildlife or air quality has occurred and, as a consequence,

it is concluded that no cost penalty can be assessed for this effect.

C. Conclusion

Based upon the above, it is our conclusion that the enhancement of environmental values to the population of Sequoyah and Muskogee Counties by the addition of a viable industrial site far outweighs in benefits the nonmeasurable impact upon the environment.

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