DISCUSSION AND FINDINGS BY THE DIVISION OF MATERIALS LICENSING U. S. ATOMIC ENERGY COMMISSION RELATING TO CONSIDERATION OF SUSPENSION PENDING NEPA ENVIRONMENTAL REVIEW OF THE OPERATING LICENSE FOR KERR-MCGEE SEQUOYAH URANIUM HEXAFLUORIDE PRODUCTION PLANT

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The criteria set forth in Section E of Appendix D, 10 CFR 50, have been evaluated with this approximate time period in mind. The environmental impact of continuing operation of the uranium hexafluoride plant, the foreclosure of alternatives of the type that might be required as a result of the full NEPA review, and the cost of delay have been considered with respect to approximately 8 months of continuing operation. Should the actual NEPA review for this case exceed 8 months, we feel the additional time required would not significantly add to the environmental impact which plant operations have caused to date and the cost to the licensee and his employees would be substantial if the operations were suspended. We have taken these considerations into account in balancing the factors specified in paragraph E(2) of Appendix D, 10 CFR 50, and have concluded that extension of the estimated time period for NEPA review would not affect our determination that the license for the Kerr-McGee Sequoyah plant should not be suspended at this time.

3.0 Environmental Impact During The Prospective Review Period

3.1 Plant Location and Land Use

The Kerr-McGee Sequoyah Uranium Hexafluoride Production Plant was designed to produce 5000 tons of UF_6 per year. It has been in operation since February 20, 1970, and employs approximately 100 people. The plant is located in Sequoyah County, Oklahoma on a 2100 acre site at the confluence of the Illinois and Arkansas Rivers. The area is rural, sparsely populated, and agricultural in nature, and located about 2-1/2 miles southeast of Gore, Oklahoma. Gore has a population of approximately 480. The land is used principally for raising wheat and beef cattle.

The immediate plant site consists of a fenced-in restricted area of 75 acres on which is constructed the main processing building, a solvent extraction building, warehouse and parking lot. In addition, there are waste retention ponds for sanitary sewage, fluoride treatment and clarification, and for raffinate retention. The 75 acre area received the usual grading and clearing necessary for the construction of buildings, parking lot, retention ponds, and an access road from an adjacent highway. After the plant was constructed, the area was landscaped, seeded in grass, and trees and shrubs were planted. Most of the 2100 acres remain in their natural state; however, some of the land is leased to farmers for intermittent pasturing of cattle. No expansion of the plant or modification of operations is anticipated during the review period. There will be no additional commitment of land above that already experienced by the construction of the existing plant. The incremental environmental impact during the next 8 months will be that associated with the continued manufacture of UF_6 and retention of liquid wastes.

3.2 Plant Process and Resultant Wastes

The Sequoyah Facility is a chemical plant which converts and purifies UF_6 from uranium concentrates (yellowcake) received from ore processing mills. The process is performed in a closed system consisting of a series of reaction vessels, tanks, towers, evaporators, and auxiliary equipment which provide conveying, removal of impurities, effluent control, ventilation, heating and cooling. The process is performed in the main process building and the solvent extraction building. The yellowcake is dissolved in hot nitric acid and when the proper uranium and acid content is reached, the uranium is extracted in a solvent extraction system using tributyl phosphate and hexane. This uranium rich solvent is re-extracted into water and then concentrated and denitrated by a heating process which produces uranium trioxide (UO_3). The impurities removed in the solvent extraction system and subsequent denitration by heating constitute the primary liquid waste from the process. The concentrated UO_3 is further heated in the presence of hydrogen from dissociated ammonia and converted into uranium dioxide (UO_2). This is then fed into a two-stage reactor which converts it to uranium tetrafluoride (UF_4) by contacting it with hydrofluoric acid gas. The UF_4 is then conveyed to a series of fluorination towers which burn the UF_4 in the presence of fluorine gas to make gaseous UF_6. The UF_6 gas is cooled and condensed in "cold traps" as a solid. The solidified product is periodically melted by heating with steam and drained to a 10 ton shipping cylinder for shipment to gaseous diffusion plants for the enrichment process.

The process produces a variety of chemical wastes which are treated to meet the State of Oklahoma requirements and the requirements of the AEC with respect to radioactivity prior to release to the environment. Wastes containing significant quantities of radioactive materials (raffinates) are impounded in settling basins and stored. Other liquid chemical wastes which contain traces of radioactivity are diluted and released to the Illinois River. The average concentration of radioactivity in these effluents is less than 20% of 10 CFR 20 limits based on radium as the most restrictive element.

3.2.1 Raffinate Waste

The primary chemical waste in the production process is a nitrate solution composed of ammonium nitrate, nitric acid, metallic salts, and small quantities of uranium with its daughter products, thorium 230 and 234, and radium 226. The acidity of these wastes is neutralized and the radioactive elements along with other heavy metal impurities are precipitated and allowed to settle out in a large settling basin. The liquid then flows to a clarification lagoon where it remains impounded.

The holding ponds are constructed in accordance with AEC criteria with sealed bottoms. The two raffinate storage ponds have a combined capacity of 25 million gallons and provide for three feet of freeboard height above the maximum liquid level to protect against overflow. No sludge or supernatant liquid is released from the storage ponds. The licensee indicates the storage capacity is sufficient for two years at planned production rates.

Kerr-McGee conducts an environmental survey program to assure that the storage of raffinates does not result in migration of radioactive materials into unrestricted areas. The storage ponds are monitored by sampling monitoring wells located at the periphery of the ponds. Also, included in the environmental sampling program are two onsite drainage ponds, two offsite wells, and the Arkansas and Illinois Rivers. Samples are taken weekly and a composite sample is analyzed monthly for radioactivity, fluoride, and nitrate content. The licensee supplied data that indicate the release of contaminants is controlled within State and AEC requirements.

3.2.2 Fluoride Waste

The second portion of the liquid waste generated by the process is a weak solution of hydrofluoric acid resulting from operation of an off-gas scrubber system serving the hydrofluorination and the fluorination processes. This fluoride waste stream is treated with a lime slurry to neutralize the waste and precipitate the fluorides. The alkaline sludge is allowed to settle out in settling basins of the type described for the raffinates. The overflow from the first basin is treated with sulfuric acid to adjust the pH and precipitate excess calcium hydroxide which is allowed to settle out in a second retention basin. The clarified waste water is combined with clean waste water from the rest of the plant and is discharged through a stilling basin into a natural water course which drains into the Illinois River.

The rate of release from this waste system is controlled through slotted weirs so that the rate of discharge can be measured. Samples of discharge water are taken three times a day and analyzed for fluoride and nitrate ions by the Sequoyah Laboratory staff. Analysis of monthly samples for fluoride indicated that the plant slightly exceeded the U. S. Public Health Service drinking water standards on two occasions during the past year. The licensee's environmental samples from the Illinois and Arkansas Rivers for the same months showed no detectable fluoride above that normally found in the rivers.

3.2.3 Nitrate Wastes

Some nitrate concentrations have been observed in waste water leaving the plant. The nitrates detected were well below the 45 milligrams/liter concentration limit recommended by the U. S. Public Health Service for water supplies. The licensee indicates the amounts of chemicals that have appeared in plant effluents have shown no measurable adverse environmental effect. The licensee supplied data which reflected that the small amounts of radioactivity appearing in these wastes were well within 10 CFR 20 concentration limits for alpha, beta, and radium for unrestricted areas.

3.2.4 Gaseous Waste

All gaseous effluents are treated to remove uranium contamination and noxious gases used in the manufacturing process. The hydrofluoric acid treatment system includes the gas scrubber previously mentioned under Section 3.2.2. This scrubber cleans off-gases prior to their release to the environment through a pipe mounted to the side of the 150-foot stack. The manufacturing system was designed so that concentrations of uranium in the gas stream before it enters the scrubber would be less than that permitted to be released into unrestricted areas under 10 CFR 20. The scrubber system was designed to allow no more than 330 parts per million of HF to leave the scrubber with a maximum stack emission of 15 parts per million. Under these design conditions, the licensee expected the maximum off-site concentration not to exceed 1 part per billion based on dispersion calculations. Kerr-McGee has advised that the off-gas line entering the plant stack had been sampled over a period of 53 days (December 3, 1971-January 26, 1972). The rate of fluoride discharge averaged 1.27 pounds per 24 hours with a calculated average concentration of 0.75 part per million. The fluoride air sampling data submitted by the licensee covered a six-month period. Measurements were made outside the plant restricted area, but within the site boundary at expected locations of maximum concentration within areas open to grazing. Of 60 samples collected, 28 samples were below the detectable concentration limit of 1 part per billion. The average of the remaining samples was 2 parts per billion. According to the American Conference of Governmental Hygienists, the recommended HF limit for occupational exposure is 3000 parts per billion (3 parts per million).

Fluoride analyses of grass samples taken from the above areas ranged from 4 to 20 parts per million (avg. 10 ppm). Although there is no means of correlating air concentrations with vegetation concentrations, the grass concentrations are less than the 40 parts per million for fluoride quoted in authoritative literature and in the State of Washington

fluoride standards for total forage ration for livestock.[1,2] Since livestock occasionally graze on part of the site, the control of fluorides in the forage of the area is important to the protection of cattle from long-term accumulation of fluorides. Based on the information presented, it appears that fluorides are controlled within currently acceptable guidelines. The Environmental Protection Agency and the State of Oklahoma have not yet established ambient air quality standards for fluorides. The licensee will be requested to submit results of fluoride analyses of forage on a regular basis.

Other gases generated in the process contain nitric acid, oxides of nitrogen, and entrained solids. These gases are scrubbed with water to remove the solids and condensation of nitric acid vapor and water and piped to an absorption tower for absorption and concentration of nitrous oxides. The absorption tower is designed to remove 99% of the incoming nitrous oxide. The nitric acid produced in this removal process is recycled for use. The cleaned gas stream is then discharged through the plant stack. Stack sampling data submitted by Kerr-McGee state the release rate of NO_2 is 24.1 pounds per hour which is calculated to give 3 parts per million at the stack discharge 150 feet above ground. Calculations based on varying distances from the plant and applicable atmospheric and wind speed conditions indicate that maximum downwind concentrations of NO_2 could range from a low of 0.009 part per million to 0.041 part per million at the highest (average 0.018 part per million). These concentrations are well within the Environmental Protection Agency's national ambient air quality standards of 100 micrograms per cubic meter (0.05 part per million) annual arithmetic mean for NO_2.[3] At these levels no discernible health or environmental effect is expected.[4]

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(1) Fluorides - Committee on Biologic Effects of Pollutants, Division of Medical Sciences, National Research Council, National Academy of Sciences, Washington, D.C. (1971)

(2) State of Washington Department of Ecology, Chapter 18-48 WAC, Fluoride Standards, Effective February 4, 1971.

(3) Title 40, Code of Federal Regulations, Part 50, National Primary and Secondary Ambient Air Quality Standards, Federal Register, Volume 36, No. 228, November 25, 1971.

(4) Air Quality Criteria For Nitrogen Oxides, Environmental Protection Agency, Washington, D.C., January 1971.

The reduction of uranium trioxide to uranium dioxide produces waste gases of nitrogen, hydrogen, and water vapor. This gas stream is filtered on sintered metal particulate filters to remove any solids and then goes to a waste gas burner where the hydrogen is converted to water vapor. The gas from the burner is discharged into the plant stack.

Uranium dust is generated in the system since air moves through process streams and is used to convey materials in various parts of the process. Uranium dusts are removed from air streams by cyclone separators and filters of finely woven felt fabric. Filters are provided on all exhaust gas streams to reduce release of uranium dust to the environment.

Effluents are measured as a part of the licensee's environmental monitoring system by stack samplers and air samplers located at the fence in the immediate plant area and at 1000 feet in four directions from the plant. Air samples taken at the boundary of the restricted area and at the remote air samplers within the exclusion area have shown no radioactive contamination in excess of the MPC levels under 10 CFR 20 for unrestricted areas during the period the plant has been in operation.

3.2.5 Sewage Wastes

Sanitary wastes from the plant are treated in a stabilization lagoon which has been approved by the Oklahoma Department of Health. The outflow from this lagoon is combined with other liquid wastes from the plant and discharged to the Illinois River. The sewage treatment system meets the State of Oklahoma requirements.

3.2.6 Soil and Vegetation Sampling

In addition to the air and water sampling program previously mentioned, the licensee collects soil and vegetation samples in the four areas where environmental air samplers are located. The samples are analyzed for fluoride and uranium content. The data presented by the licensee for the quarters ending in June and September 1971, indicate that the uranium content of soil samples has not increased over the content of preoperational soil samples collected in June and October 1969. No soil and vegetation samples were taken and analyzed for fluoride prior to plant operation. Due to insufficient data, no determination can be made as to the possible increase of fluoride in the soil and vegetation in the vicinity of the Sequoyah plant.

Vegetation sampling data were submitted for September 1971 and January 1972. One sample showed the uranium content to be approximately twice the uranium concentration of the highest background value obtained in the preoperational vegetation sampling program. All other samples indicated less uranium content than preoperational samples. The results of fluoride analyses in grass samples were given under Section 3.2.4.

3.2.7 Water Use and Heat Dissipation

Water for the plant is obtained from Tenkiller Reservoir located seven miles north on the Illinois River. The water is piped from the dam of the reservoir through a 16 inch main to the plant's treatment system at approximately 2.5 million gallons a day. The water used is covered by a permit from the Oklahoma Water Resources Board. After the water is used in the plant process and for sanitary and potable purposes, it is returned to the Illinois River through the natural water course previously mentioned. Except for the water impounded in the waste system and evaporated through a cooling tower, most of the water is returned to the surface water system. The licensee indicates that the average water discharged from the plant is 2.3 million gallons per day. The amount of water used by the plant would not appear to create a significant impact on the environment.

Heat is dissipated from the process by means of a cooling water system including a cooling tower. About 5% of the water withdrawn from the reservoir is returned to the atmosphere as water vapor from operation of the cooling tower. The temperature of the plant discharge stream is approximately 5 degrees higher than the intake temperature. The licensee calculates that the discharge water raises the temperature in the Illinois River by one-tenth of a degree Fahrenheit. According to AEC publication WASH-1169, Thermal Effects and U. S. Nuclear Power Stations, Appendix I, B, the State of Oklahoma temperature standards limit temperature changes to 5 degrees provided the maximum man-made temperature change does not exceed the State's specified temperatures for trout, bass, and warm water streams. From the data submitted by the licensee, the Sequoyah plant would meet the State's requirements.

3.3 Accidents

In-plant accidents caused by equipment malfunctions or human error are a possibility in any chemical plant. On three occasions during the start-up operations, the licensee indicates that accidents resulted in the release of some hydrofluoric acid, UF_6, and a nitric acid solution of uranium to the restricted area of the plant. Except for

the small amount of nitrate observed in plant drainage wastes previously mentioned in Section 3.2.3, none of the materials were released outside the restricted area. Following these accidents, design changes were made, faulty equipment replaced, and increased emphasis was placed on training personnel in correct operating procedures. No accidental releases to the environment have occurred since these corrective measures were taken.

The County of Sequoyah is subject to steady winds but is determined by the licensee to have a probability of 1.66×10^{-3} of being subjected to a tornado in any given year. The licensee utilizes an advanced weather warning service through local meteorological consultants. It 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, a one-hour warning is given. Should a four-hour warning be received, production operations cease and all personnel are moved indoors. If a one-hour warning is received, all but essential services are stopped, storage tanks are closed off, and a watch is posted. During 1971 five severe weather warnings were received but no damaging storm approached the plant. Based on the foregoing, the licensee indicates the probability of release of materials to the environment during the NEPA review period would be essentially nonexistent. From the information presented, it appears that the possibility is small for a significant accident to occur during the period required for completion of the NEPA review.

4.0 Foreclosure of Alternatives During NEPA Review Period

The Sequoyah plant has been constructed and in operation since February 1970. The licensee plans no change in design or operations during the period required to complete the NEPA review. Continued operation during the review period is not expected to result in a significant increase in the existing environmental impact nor will it foreclose subsequent adoption of alternatives in plant design, operation, or additional requirements related to protection of the environment that may be deemed necessary from the ongoing NEPA review.

5.0 Cost of Suspending Operations

We have examined Kerr-McGee's estimate of costs that would be incurred through suspension of the operating license during the eight month review period. Kerr-McGee estimates it would cost the Company approximately $1,700,000 in revenue if required to shutdown operations. In addition, it would cost the Company $350,000 in maintenance and deterioration expense for a shutdown as long as six months. The licensee points out that a shutdown would require the dismissal of

trained and experienced personnel who would be difficult to replace and require additional time and expense to recruit and train new operating personnel. During the initial plant start-up, the expenditure for recruiting and training personnel was approximately $3,000 per man.

The Sequoyah plant expects to employ approximately 100 people by early 1972. The licensee indicates that a majority of the employees would face immediate layoff in a currently depressed area. Such a layoff would reduce the income in the area by about $500,000 as well as decrease the demand for services supported by employee's income. To find employment, laid off personnel might have to move from the area.

Termination of operations at the Sequoyah plant would remove from the market a demand for materials, supplies, and equipment of approximately $600,000 for a six month period. The transportation industry would lose approximately $100,000 in business due to no demand for hauling materials to and from the plant. Sequoyah County may stand to lose $90,000 in taxes based on a year's rate.

6.0 Determination and Balancing Factors

Pursuant to Section E of Appendix D, 10 CFR 50, we have taken into consideration and balanced the following factors in making a determination whether to suspend the license for the Kerr-McGee Sequoyah Plant pending completion of the NEPA environmental review.

6.1 It is unlikely that the operation of the Sequoyah plant during the review period will give rise to an incremental impact on the environment that is unduly adverse. The incremental impact will be small in relation to the changes already made in the environment due to construction of the plant and its operation until the present. According to information presented, operations to date do not appear to have caused any significant adverse environmental impact.

6.2 Continued operation of the plant during the NEPA review period would not appear to foreclose any alternatives to current plant design and operations.

6.3 The effects of suspension of the operating license would entail a substantial cost to the Company and to the employees in loss of income, and to the locality from loss of a market for services, equipment, and transportation business.

6.4 The termination of operations could possibly cause a delay in meeting proposed installation schedules for nuclear power because the licensee could not meet its commitments to produce UF_6 in the fuel cycle.

6.5 Due to loss of personnel, the licensee would experience difficulty in obtaining new trained and experienced personnel if the plant is required to shutdown.

6.6 After balancing the factors described above as to the environmental impact of continued operation and the potential for foreclosure of alternatives against the effect of costs, we conclude that the license for operation of Kerr-McGee's Sequoyah Uranium Hexafluoride Production Plant should not be suspended pending completion of the NEPA review.

The discussion and findings herein do not preclude the AEC as a result of its ongoing NEPA environmental review from continuing, modifying, or terminating the operating license or its appropriate conditioning to protect environmental values.