70-1257

PDR
Return
to 39655

EXXON NUCLEAR COMPANY, INC.

2101 HORN RAPIDS ROAD, PO BOX 130, RICHLAND, WA 99352
(509) 375-8100 TELEX: 15-2878

June 12, 1985

Mr. W. T. Crow, Section Leader
Uranium Process Licensing Branch
Division of Fuel Cycle and Material Safety
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

License No. SNM-1227
Docket No. 70-1257

Dear Mr. Crow:

Exxon Nuclear Company, Inc. hereby requests that the reference license be amended to provide for the dry conversion of low enriched (less than or equal to 5% U-235) UF_6 to UO_2. The dry conversion process and equipment described herein were developed by Exxon Nuclear and are considered confidential and proprietary. Certain patent applications have been filed but no patents have been issued. This Application is, therefore, submitted in two parts; Part I contains the non-proprietary portion of the application and Part II contains the proprietary portion of the Application, and is submitted in accordance with 10 CFR 2.790(a)(4). In addition, an affidavit is attached in accordance with 10 CFR 2.790(b)(1).

Background

The ammonium diurinate (ADU) process is used by Exxon Nuclear and other fuel fabricators to convert UF_6 to UO_2 for fuel fabrication purposes. The ADU process has the disadvantage of producing significant quantities of uranium and chemical bearing liquid wastes. The storage of these liquid wastes potentially present some hazard to the environment and the wastes require additional processing or treatment prior to ultimate disposal. As an option to the ADU process, Exxon Nuclear has developed a dry conversion process (see Figure 1 in Part I) which results in producing fuels grade UO_2 at greatly reduced liquid waste rates.

The dry conversion process was developed and demonstrated in small scale equipment using depleted uranium as feedstock. A larger scale unit was then constructed followed by further demonstration with depleted uranium. Demonstration of the technology is now considered complete. This Application is for operation of this second, larger scale unit using low enriched uranium feedstock to manufacture a few fuel elements conta n ng dry converted oxide and gain some in-reactor experience to show proof of product and gain

25393

customer acceptance. It is, therefore, planned to produce some low enriched uranium oxide for that purpose using the dry conversion process during the fourth quarter of 1985.

As mentioned above, the dry conversion process and equipment are considered proprietary by Exxon Nuclear; therefore, the non-proprietary Part I of this application addresses the feed supply and off-gas treatment system only. A separate proprietary supplement, Part II to this Application, addresses the dry conversion process and equipment.

The prime purpose of processing enriched uranium through the demonstration unit is to manufacture lead assemblies for in-reactor testing. We must meet extremely tight customer schedules which require operation of the dry conversion equipment beginning in the fourth quarter of 1985. We, therefore, request your timely review and approval of this Application. Toward this end, we suggest that you and your review staff forward any questions as they arise so that we may assist you on a timely basis.

Enclosed is a check for $150 as the initial fee payment.

Sincerely,

C. W. Malody

C. W. Malody
Corporate Licensing

CWM:jrs

Attachments
As Noted

DOCKET NO. 70-1257

CONTROL NO. 25393

DATE OF DOC. 06/12/85

DATE RCVD. 06/17/85

FCUF ✓ PDR Hr only

FCAF _____ LPDR _____

WM _____ I&E REF. ✓

WMUR _____ SAFEGUARDS ✓

FCTC _____ OTHER _____

DESCRIPTION:

Requests Amendment

06/20/85 INITIAL CEC

License No. SNM-1227
Docket No. 70-1257

PART I

LICENSE AMENDMENT APPLICATION
DRY CONVERSION PROCESS
NON-PROPRIETARY SUPPLEMENT

This part contains the non-proprietary portion of this Application. Also the radiological safety and environmental safety features are covered herein and are not repeated in Part II.

PROCESS DESCRIPTION

Uranium hexafluoride gas (UF_6) produced from a conventional vaporization system, is reacted with superheated steam to form HF and UO_2F_2 powder. The UO_2F_2 further reacts with steam and hydrogen (cracked ammonia) to produce UO_2 and additional HF. The reactor is electrically heated and insulated and operated at temperatures of 500-700°C. The product UO_2 is then further processed conventionally to reactor fuel elements.

The process off-gas contains hydrogen, steam, HF and nitrogen. The off-gas is filtered with porous metal filters and cooled in a heat exchanger. The condensate from the heat exchanger is monitored for uranium content and drained to a receiver tank. The condensate receiver is drained to a batch neutralizer and discharged to lagoon storage. The uncondensed gases are passed through a venturi scrubber where they are scrubbed with potassium hydroxide to remove residual HF. The scrubber solution is also discharged to lagoon storage. The process is depicted in simplified form as Figure 1.

The scrubbed off-gas from the dry conversion system is vented to the existing Line 2 process off-gas scrubber and filtration system. The hydrogen concentration in the Line 2 process off-gas system is currently 0.80 vol% which originates in the Line 2 calciner. The additional hydrogen from the dry conversion process will increase the hydrogen concentration in the process off-gas system to 1.25 vol%.

FACILITY DESCRIPTION

The dry conversion system is located within the existing UO_2 plant adjacent to the Line 2 vaporization room.

FEED SUPPLY

A UF_6 vaporization chest and flow control system are located in the Line 2 vaporization room. The chest is vented to the existing Line 2 process off-gas (POG) system and is monitored by a smoke detector to detect UF_6 leakage. A UF_6 leak outside the chest would be detected by means of the existing Line 2 vaporization room smoke detection system. As the vaporizer chest and its adjuncts are similar to those currently in use to supply UF_6 to the existing ADU process and are described in existing licensing documents they will not be discussed further in this application.

OFF-GAS TREATMENT

The off-gas from the dry conversion reactor is passed through sintered metal filters that are programmed to be blown back periodically with nitrogen gas. The off-gas consists of excess hydrogen and steam, hydrogen fluoride and nitrogen. The off-gas is routed to a single pass, fixed tube sheet type heat exchanger with Monel or 70/30 copper-nickel used for materials of construction where in contact with the off-gas stream. The condenser cools

the off-gas from approximately 450°C to approximately 25°C. The water vapor and approximately 85% of the hydrogen fluoride are condensed, routed through a continuous uranium analyzer and drained to a condensate receiver. The uranium concentration of this stream has been routinely less than 1 ppm as substantiated by both the monitor and laboratory analysis. The uranium monitor is interlocked with the UF_6 feed supply to the dry conversion unit such that a high (50 ppm) uranium concentration will turn off the UF_6 feed flow. The hydrofluoric acid concentration of the condensate ranges from 35 to 55 wt%. The condensate is drained periodically to a neutralizer tank where it is sampled, analyzed for uranium and HF, neutralized with ammonium hydroxide and transferred to lagoon storage.

The uncondensed gases from the condenser are routed to a venturi scrubber where they are scrubbed with potassium hydroxide to absorb the residual hydrogen fluoride. The potassium hydroxide solution is recirculated to the venturi scrubber from a recirculation tank and periodically sampled and discarded to lagoon storage. The recirculation line contains a pH monitor to assist in assuring that scrubber efficiency is adequate.

The uncondensed off-gas from the venturi scrubber is routed to the existing Line 2 process off-gas system. This system also vents the Line 2 calciner. The hydrogen concentration in the Line 2 process off-gas system has been measured at 0.80% during calciner operation. The off-gas from the dry conversion system increases this hydrogen concentration by 0.45% to 1.25%.

INDUSTRIAL SAFETY

The following chemicals are used or produced by the dry conversion process:

- Uranium hexafluoride
- Hydrogen fluoride (gas)
- Hydrofluoric acid
- Uranium dioxide
- Cracked ammonia gas (75 vol% H_2, 25 vol% N_2)
- Ammonium hydroxide
- Potassium hydroxide

All of these chemicals are used or produced by the existing ADU process and thus no new chemical hazards are introduced. Existing industrial safety standards are being applied to this new operation.

RADIOLOGICAL SAFETY

There are no new radiological safety hazards introduced by the dry conversion process.

Protection of employees will be by routine monitoring and Radiation Work Permit requirements similar to those employed for other Exxon Nuclear activities. Load out of uranium oxide into standard containers is accomplished within a vented enclosure. Air samples taken during demonstration runs were well within prescribed limits.

CRITICALITY SAFETY

The dry conversion process and equipment have been subjected to a criticality safety analysis and found to be safe for enrichment levels up to 5 wt% U-235. The process and equipment will be operated within appropriate criticality safety specifications and monitored by the existing criticality detection and alarm system. None of the vessels in the process off-gas system will normally contain significant concentration or quantities of uranium.

The condenser, condensate receiver and venturi scrubber are safe by geometry with the largest diameter of these equipment pieces being nine inches. The condensate neutralizer tank and the scrubber recirculation tank are not safe by geometry. Both tanks will be under batch control. Any uranium carried overhead from the reactor unit would drop out in the condenser, be dissolved in the hydrofluoric acid and flow to the condensate catch tank. The uranium monitor on the line to the catch tank will continuously analyze the condensate for uranium and automatically shut off the feed supply to the process if uranium concentrations exceeded preset values. To-date, the condensate has consistently contained less than 1 ppm uranium. The condensate neutralizer tank and the scrubber recirculation tank are both downstream of the monitoring system. These vessels will be inspected or acid flushed periodically to confirm absence of uranium. Initially inspection will be scheduled quarterly or immediately following the detection of significant quantities of uranium.

ENVIRONMENTAL SAFETY

The equipment is housed within the confines of the existing UO_2 plant; therefore gaseous effluents are treated by existing scrubber and filtration systems. No increase in radioactivity was measured in the gaseous effluents during the demonstration process. Liquid wastes are routed to existing lagoon storage. Liquid waste volumes are but 10% of those for comparable production using the ADU process. The chemical components that make up these wastes are hydrofluoric acid from conversion of the UF_6, ammonium hydroxide used for HF neutralization and potassium hydroxide used for off-gas scrubbing. The uranium concentration is less than 1.0 ppm.

ENC DRY UF_6 CONVERSION PROCESS FLOWSHEET

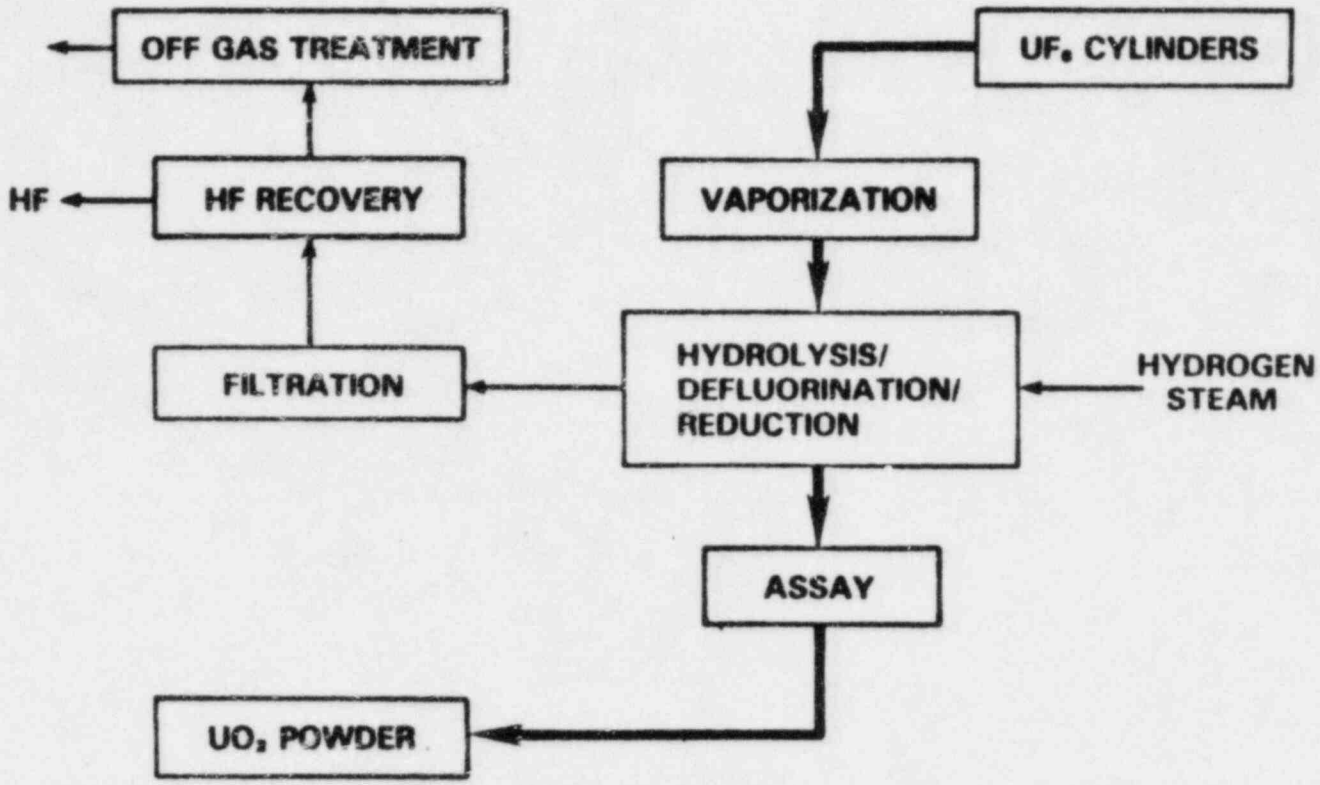

FIG. I

UNITED STATES OF AMERICA

Nuclear Regulatory Commission

Division of Fuel Cycle and Material Safety

In the Matter:

Exxon Nuclear Company, Inc.

License No. SNM-1227
Docket No. 70-1257

Affidavit Pursuant to 10 CFR
Section 2.790(b)(1)

State of Washington

County of Benton

R. W. McCullugh being first duly sworn on oath, deposes and states:

1. I am Vice-President, Engineering and Production of Exxon Nuclear Company, Inc., and I am authorized to make this affidavit.

2. The information that Exxon Nuclear Company intends to produce or disclose to the Nuclear Regulatory Commission, a copy of which is attached hereto and entitled, "Part II, License Amendment Application, Dry Conversion Process, Proprietary Supplement," constitutes trade secrets or privileged or confidential commercial or financial information within the meaning of Section 2.790(b)(1) of the Commission's regulations.

3. This information has been held in confidence by Exxon Nuclear and is of a type that is customarily held in confidence by Exxon Nuclear and is not available in public sources. This information is not known outside of Exxon Nuclear except to the extent that it has been made available to other entities (including government agencies) on a confidential basis. It is being transmitted to the Nuclear Regulatory Commission in confidence. Within

Exxon Nuclear such information is made available only to those employees having a need for such access in the conduct of their Company responsibilities. Exxon Nuclear has procedures for handling confidential and proprietary information. These procedures include the proper designation of documents containing confidential or proprietary information and document control systems appropriate for each classification.

4. Public disclosure of this information would provide Exxon Nuclear's competitors with significant competitive information which could be used to the substantial detriment of Exxon Nuclear and hamper Exxon Nuclear's efforts to compete in the marketplace. The "Dry Conversion" process and equipment were developed by Exxon Nuclear over a four year period at a cost of nearly 2 million dollars. It represents a significant improvement over similar processes being used by Exxon Nuclear competitors. The innovative features of the "Dry Conversion" process could be readily duplicated by others if they were able to acquire information concerning the process and/or equipment.

Dated this 13th day of June, 1985.

R W McCullugh

R. W. McCullugh, Affiant

SUBSCRIBED AND SWORN to before me this 13 day of June, 1985.

Susan L. Backus

Notary Public in and for the State of Washington, County of Benton.

My Commission Expires: 8-26-86