

MEMORANDUM

DATE: November 7, 1978

TO: Memo for File

FROM: Jerry Stewart *JS*

SUBJECT: Mobil In Situ Leach Pilot Test - Staff Comments

1. An application for a Radioactive Material License was submitted by Mobil Oil Corp. on June 12, 1978, to perform an in-situ uranium leaching pilot test. The site location is the SW/4, Section 9, T17N, 13W N.M.P.M. in McKinley County, NM (approx. 5 miles NW of Crown Point, NM).
2. The pilot test will force the alkaline leach solution through 9 injection wells to the ore body in the Westwater Canyon Member. The leach solution is withdrawn from 4 production wells at a flow rate of approximately 75 gpm, slightly greater than the injection flow rate for control of the leach field. Monitor wells are located about 275 ft. from the injection wells. The leach solution containing the dissolved uranium ore is processed through an ion exchange tower which separates the ore from the leach solution. The barren leach solution with chemical additions is recirculated to the ore body in a continuous flow process. The resin with the ore is passed through an elution column where the U_3O_8 ore solution is removed and passed to the precipitation tanks. After treatment, the U_3O_8 ore is precipitated into a slurry form (30% U_3O_8 by weight). The estimated production is about 25 gallons of U_3O_8 slurry per day. The slurry is stored in drums while awaiting shipment to a drying process. The test operation is planned for 14 months with an additional 8 months for restoration of the leach field water consistent with the original conditions and usage of the water.
3. The pilot test operation is estimated to release about 5 curies per year of Radon 222 as the most significant radiation source term. Potential inhalation exposure is estimated to be 10.8 mrem/year at one half mile NW of the site - no persons reside in that area at the present time. The potential inhalation exposure to the nearest permanent resident is 4.9 mrem/year and at Crown Point 0.02 mrem/year. These potential inhalation exposures are significantly below the estimated lung exposure from natural sources of radon at the site of 1200 mrem/year (background 300 pCi/m³ times EPA conversion factor of 4 mrem/year per pCi/m³).
4. Based on the data submitted by the applicant, supplemental information requested by EID, independent calculations by EID staff, and the limited scope of the proposed in situ leach operation, the Radiation Protection Section proposes to issue the attached license.

JS:ns



MEMORANDUM

To: File Information

Date: December 7, 1978

From: Gerald W. Stewart, Env. Scientist III

Subject: Mobil In-Situ Pilot Plant for Uranium Leaching Staff Comments

A. The major issues for Mobil's In-Situ Leach pilot operation are:
Control of the leach field and restoration of the aquifer.

1. Control of Leach Field. To control the leach field Mobil proposed two major procedures: Operational control of the injection and withdrawal flow rates and a ring of monitor wells located about 375' from the central injection well.

a. Operational Controls. Monitoring of flow rates to each injection well and from each production well, the operator can quickly identify any change which would indicate a shift in the underground leach field. There is a planned over production of about 2-3 percent so that withdrawal flow exceeds injection flow. In addition the operator monitors pressure at each well head. A reduction or increase of pressure will also indicate a potential leach field shift: reduced pressure would indicate a possible outward shift and a increased pressure could indicate a possible reduced outward flow or well restriction. The operators control is vital for the leaching operation to proceed successfully and operating parameters are available to provide indications of the leach field characteristics.

b. Excursion Controls. Unplanned movement of the leach field and/or loss of control is called an excursion. Mobil's operating philosophy is "No Excursions", and their past experience in Texas has followed this philosophy. To insure control of the leach field a ring of monitor wells are placed around the leach site. Location of their wells is critical since if they are too close they may always be in the leach field and if too far away they may never see the leach field if an excursion did occur. Mobil estimates that the operating leach field will be about 70' to 100' outward from the injection wells about 12 months from the start of operations. This places the monitor wells at about 170' to 200' from the leach field. If an excursion is indicated at a monitor well by analysis of water samples and confirmed, there are six corrective actions which could be employed.

1) Overpumping: Increasing the production well flow rate compared to injection wells.

2) Reordering: Increasing the production well flow rate in one specific area toward the monitor well indicating an excursion.

3) Reducing Injection: Reducing the injection flow rates at all injection wells or selectively (variation of 1) & 2) above).

- 4) Cease Pumping: Stopping the flow and let natural migration reorder the leach field.
- 5) Beginning Restoration: Pumping water from recovery wells with no added leaching chemicals.
- 6) Pumping All Injection/Production Wells: Removal of water from leach field by pumping all wells.

If operational parameters are indicating a leach field movement, the operator can employ variations of 1), 2), and 3) above as part of his operational techniques. If monitor well water samples confirm an excursion, Mobil plans to put an additional monitor well approximately 100' radially outward from the well indicating the leach field excursion. The new well will be monitored and sampled in the same manner as the regular monitor wells. One monitor well is approximately 95' surface distance (approx. 114' bottom hole distance) from private property. Mobil plans to drill any additional monitoring wells on their own property in the area. Mobil also plans to monitor water level at the monitor wells as an indication of an excursion although the validity of this technique is not proven at this time.

2. Aquifer Restoration: Returning the aquifer to a condition consistent with it's original use and condition of the water is an expected outcome of the pilot test. Mobil will flush the leach zone and use an electrodialysis or reverse osmosis unit to purify the injected water until the aquifer water meets the restoration standards. Laboratory tests of core samples from the Crownpoint site have indicated that flushing will reduce the contamination in a manner consistent with results from their Texas operation and be able to meet the N.M. standards. Mobil has estimated that eight months will be required for the restoration phase of the pilot test.

- B. Meteorological Data: Because of the minimal radiation releases estimated for the pilot In-Situ Uranium Leaching Operation, the normal requirement for site specific met data has not been established. Mobil is collecting met data Approx. 3 miles away and this data will be correlated with the Gallup data to check the estimated radiation exposures.

NEW MEXICO ENVIRONMENTAL IMPROVEMENT AGENCY
RADIOACTIVE MATERIALS LICENSE

Pursuant to the New Mexico Radiation Protection Act of 1971, and the Radiation Protection Regulations Part 3, and in reliance on statements and representations heretofore made by the licensee designated below, a license is hereby issued authorizing such licensee to transfer, receive, possess and use the radioactive material(s) designated below; and to use such radioactive materials for the purposes(s) and at the place(s) designated below. This license is subject to all applicable rules, regulations, and orders now or hereafter in effect of the New Mexico Environmental Improvement Agency and to any conditions specified below.

Licensee		3. License number NM-MOB-UL-00
1. Name Mobil Oil Company Energy Minerals - U.S. P.O. Box 5444		4. Expiration date December 26, 1983
2. Address Denver, Colorado 80217		5. Reference number
6. Radioactive materials (element and mass number) A. All natural radioisotopes encountered in the production of natural uranium.	7. Chemical and/or physical form A. Any required in the production of U_3O_8 slurry.	8. Maximum quantity licensee may possess at any one time A. 30,000 lbs. maximum of yellowcake slurry (30% by weight U_3O_8).

CONDITIONS

9. Authorized use. (Unless otherwise specified, the authorized place of use is the licensee's address stated in Item 2 above.)
- A. For pilot plant in-situ leaching, processing leach solution into yellowcake slurry and distribution to authorized recipients. Pilot plant is located at Mobil Oil Corporation Crownpoint Project Site; SW/4, Section 9, T17N, 13W, N.M.P.M. in McKinley County, New Mexico (approximately 5 miles NW of Crownpoint, NM). Site address is Mobil Oil Corporation, Producing-Operations, P.O. Drawer F, Crownpoint, New Mexico 87313. Except as specifically provided otherwise by the license, the licensee shall comply with all procedures set forth in the Interior Mining and Reclamation Plan for Pilot Testing of In-Situ Uranium Leaching, dated May 1978, supplemented by response to division questions submitted August 18, October 26, and November 9, and letters signed by Mr. D.B. Cooper dated August 24 and 30, Dec. 4 and 7, 1978.
10. The licensee shall comply with Part 4, New Mexico Radiation Protection Regulations.
11. Radioactive material shall only be used by individuals designated in writing by the Radiation Protection Officer, Mr. W.R. Bowman.

NEW MEXICO ENVIRONMENTAL IMPROVEMENT AGENCY
RADIOACTIVE MATERIAL LICENSELicense Number NM-MOB-UL-00

12. The division shall be notified within 48 hours of any migration of the leach field to a monitor well as indicated by a change in leach field excursion monitor parameters as set forth on Page 162, Interim Mining and Reclamation Plan for Pilot Testing of In-Situ Uranium Leaching dated May 1978, and Page 16, Mobil Oil Corporation's August 18, 1978 responses to EID-WPC letters of July 10 and 20, 1978.
13. Aquifer shall be restored when leach operations are completed with the ground water quality consistent with the original conditions and usage. Concentration of radioactive materials in the aquifer shall be reduced to levels consistent with restoration standards accordance with Mobil letter dated August 30, 1978.
14. Mobil Oil Corporation shall furnish the Division a Transportation Accident/ Incident Response Plan for yellowcake slurry shipments from the Crownpoint Project in-situ leaching site. Division approval of the plan is required prior to any shipment from the site.
15. The Division Director or his authorized representatives shall be allowed to enter the premises and inspect the radiation-related activities of the licensee at all times. Failure of the licensee to admit the Director or his authorized representatives shall constitute grounds for issuance of an immediate cease and desist order.

FOR THE NEW MEXICO ENVIRONMENTAL IMPROVEMENT AGENCY

Date December 26, 1978By Gerald W. Stewart

Gerald W. Stewart

Environmental Scientist III



State of New Mexico

Environmental Improvement Agency

P. O. BOX 2348

SANTA FE, NEW MEXICO 87501

APPLICATION FOR
RADIOACTIVE MATERIAL LICENSE

INSTRUCTIONS—Complete Items 1 through 16 if this is an initial application. If application is for renewal of a license, complete only Items 1 through 7 and indicate new information or changes in the program as requested in Items 8 through 15. Use supplemental sheets where necessary. Item 16 must be completed on all applications. Mail two copies to: Radiation Protection Section, Box 2348, Santa Fe, New Mexico 87501. Upon approval of this application, the applicant will receive a Radioactive Material License. A Radioactive Material License is issued in accordance with the general requirements contained in the New Mexico Radiation Protection Regulations, Part 3, Licensing and the License is subject to Part 4, Standards for Protection Against Radiation.

<p>1. (a) NAME AND STREET ADDRESS OF APPLICANT (Institution, firm, hospital, person, etc.)</p> <p>Mobil Oil Corporation Energy Minerals - U.S. P. O. Box 5444 Denver, Colorado 80217</p>	<p>1. (b) STREET ADDRESS(ES) AT WHICH A RADIOACTIVE MATERIAL WILL BE USED (If different from 1 (a).)</p> <p>SW/4, Section 9, T17N, 13W, N.M.P.M., in McKinley County, New Mexico</p>
<p>Phone <u>(303) 572-2000</u></p>	<p>Phone <u>(505) 786-5620 and (505) 786-5619</u></p>
<p>2. DEPARTMENT TO USE RADIOACTIVE MATERIAL</p> <p>Mobil Oil Corporation Producing - Operations P. O. Drawer F Crownpoint New Mexico 87313</p>	<p>3. PREVIOUS LICENSE NUMBER(S). (If this is an application for renewal of a license, please indicate and give number.)</p> <p>Radioactive Material Licenses presently held for Texas in situ leach operations:</p> <p>10-2027 10-2436 10-2486</p>
<p>4. INDIVIDUAL USER(S). (Name and title of individual(s) who will use or directly supervise use of radioactive material. Give training and experience in Items 8 and 9.)</p> <p>W. R. Bowman Production Supervisor</p>	<p>5. RADIATION PROTECTION OFFICER (Name of person designated as radiation protection officer if other than individual user. Attach resume of his training and experiences as in Items 8 and 9.)</p> <p>W. R. Bowman Production Supervisor</p> <p>Phone <u>(505) 786-5620, (505) 786-5619</u></p>

6. (a) RADIOACTIVE MATERIAL.
(Elements and mass number of each.)

Uranium

6. (b) CHEMICAL AND/OR PHYSICAL FORM AND MAXIMUM NUMBER OF MILLICURIES OF EACH CHEMICAL AND/OR PHYSICAL FORM THAT YOU WILL POSSESS AT ANY ONE TIME. (If sealed source(s), also state name of manufacturer, model number, number of sources and maximum activity per source.)

U_{38}^{90} as yellowcake slurry

30,000 lbs. (maximum)

7. DESCRIBE PURPOSE FOR WHICH RADIOACTIVE MATERIAL WILL BE USED. (If radioactive material is for "human use," supplement RPS 16A must be completed in lieu of this item. If radioactive material is in the form of a sealed source, include the make and model number of the storage container and/or device in which the source will be stored and/or used.)

To test feasibility of in situ leaching process for Crownpoint project. The produced uranium slurry will be transported to authorized and licensed recipients.

B. INDIVIDUAL USER(S) TRAINING

Complete the following information on the individual user(s) and his training in:

- A) Nuclear physics, atomic structure, and interaction of radiation with matter
- B) Radiation detection instrumentation, calibration, and standardization
- C) Radiation protection, waste disposal, and survey and dosimetric procedures
- D) Radiobiology, including effects of radiation on the human body

Name, Title, Degree(s)	Where Trained	Length of Academic Training in A, B, C, and D	Length of On-the-job Training in A, B, C, and D
W. R. Bowman Production Supervisor BS, Metallurgical Engineering	Univ. of Texas Atlas Minerals Wyoming Minerals	A - 15 mo.	B and C - 6 years. D - 2 mo.

Project organizational chart and qualifications of additional personnel are summarized in Attachments A and B.

9. EXPERIENCE WITH RADIATION. (Actual use of radioisotopes or equivalent experience.)

Isotope	Maximum Amount	Where Experience Was Gained	Duration of Experience	Type of Use
Yellowcake	250,000 lbs.	Bruni and Three Rivers, Texas	1½ years	Pilot & production in situ leach
U ore and yellowcake	2000T/day ore	Moab, Utah	3/4 year	Mill
U ore and yellowcake	3000T/day ore	Grants, NM	3½ years	Mill

10. RADIATION DETECTION INSTRUMENTS. (Use supplemental sheets if necessary.) (Also see Attachment C)

Type	Number Available	Radiation Detected	Sensitivity Range (mr/hr)	Window Thickness (mg/cm²)	Use (Monitoring, surveying, measuring)
See Sections 3.2.4.2, 10 and 5.7 of the Interim Mining and Reclamation Plan for Pilot Testing of In Situ Uranium Leaching, Crownpoint Project, McKinley County, New Mexico.					

11. METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED ABOVE.

See Sections 3.2.4 and 5.7 of Interim Mining and Reclamation Plan.

12. FILM BADGES, DOзимETERS, AND BIO-ASSAY PROCEDURES USED. (For film badges, specify method of calibrating and processing, or name of supplier.)

See Section 5.7 of Interim Mining and Reclamation Plan.

INFORMATION TO BE SUBMITTED ON ADDITIONAL SHEETS

13. FACILITIES AND EQUIPMENT. Describe laboratory facilities and remote handling equipment, storage containers, shielding, fume hoods, etc. Explanatory sketch of facility is attached. (Circle answer) Yes No See figure
3.1.3-1 and Section 3.1 of Interim Mining and Reclamation Plan.

14. RADIATION PROTECTION PROGRAM. Describe the radiation protection program including control measures. If application covers sealed sources, submit leak testing procedures where applicable, name, training, and experience of person to perform leak test, and arrangements for performing initial radiation survey, servicing, maintenance and repair of the source.
See Sections 3.2.4 and 3.2 of Interim Mining and Reclamation Plan

15. WASTE DISPOSAL. If a commercial waste disposal service is employed, specify name of company. Otherwise, submit detailed description of methods which will be used for disposing of radioactive wastes and estimates of the type and amount of activity involved.
See Section 3.1.3, 3.1.4 and 5.1.7 of Interim Mining and Reclamation Plan.

CERTIFICATE (This item must be completed by applicant)

16. THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE APPLICANT NAMED IN ITEM 1, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH THE NEW MEXICO RADIATION PROTECTION REGULATIONS, PART 3, LICENSING, AND THAT ALL INFORMATION CONTAINED HEREIN, INCLUDING ANY SUPPLEMENTS ATTACHED HERETO, IS TRUE AND CORRECT TO THE BEST OF OUR KNOWLEDGE AND BELIEF.

MOBIL OIL CORPORATION, ENERGY MINERALS - U.S.

Applicant Named in Item 1

DATE

June 12, 1978

By:

J. H. Timmins

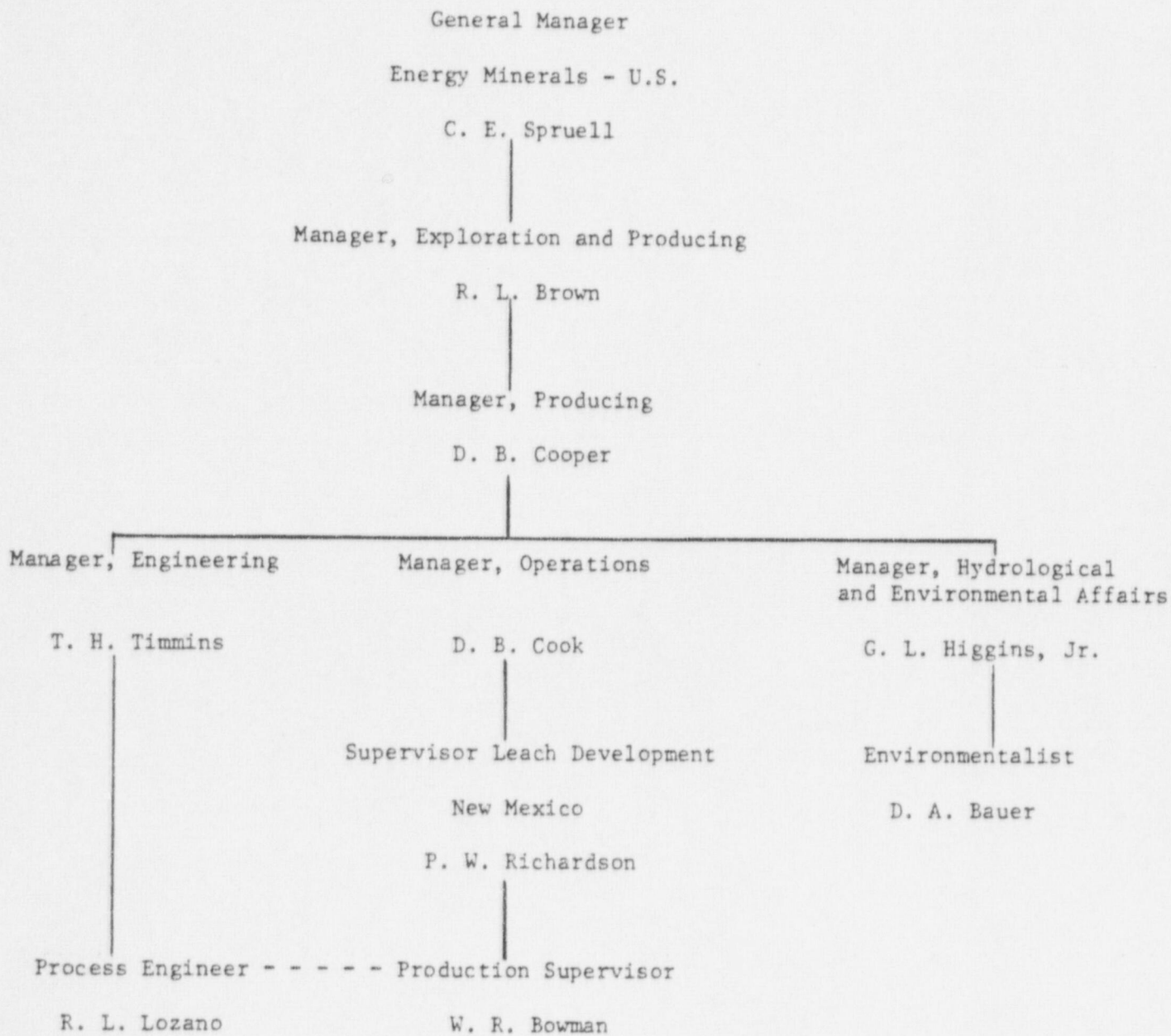
T. H. Timmins

Manager, Engineering

Title of Certifying Official

Boyle
6/12/78

ORGANIZATION CHART



Attachment B

QUALIFICATIONS

1. W. R. Bowman, Production Supervisor

Received BS Degree in Metallurgical Engineering from the University of Texas in 1972. Mr. Bowman has worked over six years in the uranium mining industry with four yellowcake (U_3O_8) producers. Over two years of Mr. Bowman's experience in the uranium industry has been in construction and operation of both pilot test and commercial in situ uranium leach plants. He was functional supervisor for the field safety and environmental technician at in situ leach plants. He was employed by Mobil in October 1977; he is the Production Supervisor and safety/radiation protection officer for the Crownpoint in situ uranium leach pilot test.

2. R. L. Lozano, Process Engineer

Received BS Degree in Metallurgical Engineering from New Mexico Institute of Mining and Technology in 1975. He has two years experience in in situ uranium production operations, involved in handling, sampling and analysis of radioactive material, particularly uranium. Mr. Lozano has had instruction in DOT shipping procedures for yellowcake and uranium bearing samples. Also, he has taken courses in training and safety for handling of radioactive sources and materials and assisted in development of procedures and instructions for personnel in exposure safety. He has been employed by Mobil since February 1978. Mr. Lozano is the Process Engineer for the Crownpoint in situ uranium leach pilot test.

3. Dr. T. H. Timmins - Manager, Engineering

Dr. Timmins received a BS Degree in Chemical Engineering from the University of Texas in 1960; an MS Degree in 1963; and an SCD in 1967 in Nuclear Engineering from the Massachusetts Institute of Technology. Dr. Timmins has been actively involved in research and development for all of Mobil's in situ uranium leaching projects since 1975. His primary function will be as engineering manager and advisor to the Crownpoint operations.

4. G. L. Higgins, Jr. - Manager, Hydrological and Environmental Affairs

Mr. Higgins received his BS Degree in Geology in 1951 and MS Degree in 1955 from Syracuse University. He has been employed by Mobil since 1974 as Manager of Hydrological and Environmental Affairs and has responsibility for all environmental affairs.

Attachment B

In addition, consultants are available from other divisions of Mobil Oil Corporation to assist the Crownpoint project in the Radiation Control Program. Dr. W. W. Givens is a research associate for Mobil Research and Development in Dallas, Texas. He received a BA and MA from North Texas State University in 1956 and 1957 respectively. He was associated with Mobil's Field Research Lab during 1957 and 1958, where he engaged in research on the application of nuclear techniques in oil exploration. He entered the Rice University graduate school (Department of Physics) in 1958 and received an MA in 1960 and a Ph. D. in 1963. Since returning to Mobil's Field Research Lab in 1962, he has engaged in research in nuclear technology. As part of his duty, Dr. Givens has had the responsibility to teach a safety course to Mobil personnel prior to their handling any radioactive sources.

Attachment C

Mobil holds radioactive material licenses for three in situ uranium leaching plants in Texas, issued by the Texas Department of Health Resources. Copies of these licenses have been included with the transmittal letter and pertinent data is summarized below:

<u>License No.</u>	<u>Date</u>	<u>Plant</u>	<u>Quantity (lbs)</u>
10-2027	April 3, 1975	O'Hern	300,000
10-2436	Dec. 16, 1977	El Mesquite	1,500,000
10-2486	March 6, 1978	Brelum-Piedre Lumbré	1,500,000