



1523410 ✓

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

MAY 24 1978

MEMORANDUM FOR: Docket File No. 40-8064

THRU: L. C. Rouse, Chief  
Fuel Processing and Fabrication Branch  
Division of Fuel Cycle and Material Safety

FROM: R. Cooperstein  
Fuel Processing and Fabrication Branch  
Division of Fuel Cycle and Material Safety

SUBJECT: EXXON MINERALS COMPANY, U.S.A., AMENDMENT APPLICATION  
TO PERMIT CONTINUED R&D STUDIES ON URANIUM RECOVERY  
BY IN-SITU SOLUTION MINING AT THE HIGHLAND URANIUM  
MILL AREA, CONVERSE COUNTY, WYOMING

By letter dated January 19, 1978, the licensee applied for an amendment to Source Material License No. SUA-1064 to authorize continuing uranium solution mining studies on small localized ore deposits within the restricted area around their Highland Uranium Mill in Converse County, Wyoming. Subsequently, the company submitted additional information to support their amendment request in correspondence dated February 22, 1978.

The applicant proposes to continue field testing in a well field area of one acre or less located approximately 1500 feet east of the original test site. The existing surface plant facilities, with minor modifications, will continue to be used for this program.

The proposed continuing test will permit the evaluation of the effects of process variables, the generation of additional pilot plant operating experience, cost data and the collection of environmental impact information. Thereby, the economic and engineering viability of Exxon's solution mining method under field conditions will be further tested while coincidentally assessing its environmental impact. Upon completion of the mining tests, the licensee will perform aquifer restoration studies to effectively return the groundwater in the aquifer to its natural quality and will reclaim the surface area to comply with the requirements of Wyoming's Department of Environmental Quality, Land Quality Division (DEQ).

In Exxon Minerals' solution mining process, a sodium carbonate-bicarbonate solution containing hydrogen peroxide is injected into the localized ore zone through cased wells and allowed to permeate through the zone under controlled conditions. The ore zone lies below the regional groundwater level and is sealed at the top and bottom by shale intervals.

The injected leach solution (lixiviant) will dissolve the uranium contacted as it passes through the ore zone. The resulting uranium-bearing solution is pumped to the surface through production wells. Pumping rates needed to create a cone of depression within the well field area, to draw the reacted leach solution from the ore zone, will be used. Thereby, the mining activities will be contained and the potential of leachant migration from the well field area which would degrade the quality of the groundwater in the aquifer will be minimized.

The surfaced uranium-bearing leach solution will be metered into the existing recovery mini-plant where the uranium will be removed from the solution by absorption on ion exchange resin columns. The uranium-depleted leach solution from the resin columns will then be reconstituted to the desired lixiviant concentrations of carbonate, bicarbonate, and oxidant, and will be recycled to the ore zone for additional uranium extraction.

Periodically, the sorbed uranium will be eluted from the ion exchange columns and precipitated as diuranate in a precipitation tank. The diuranate slurry will be transported to the Highland Uranium Mill facilities for conversion to yellowcake ( $U_3O_8$ ).

Generation of significant airborne radioactive dusts will not occur from the operations, since all unit operations are hydrometallurgical and the diuranate product will be transported to the on-site mill facilities as a slurry.

The solution mining R&D project is located on the Highland property where Exxon operates the Highland Uranium Mill under the authorization of Source Material License No. SUA-1139 (Docket No. 40-8102). The uranium ore feedstock for the mill is provided from surface and underground mining operations on Exxon's property.

Several small ore bodies, which cannot be economically mined by conventional methods but which contain significant quantities of uranium, have been identified in the vicinity of the deposits being mined. In 1972, under Source Material License No. SUA-1064 (Docket No. 40-8064), Exxon undertook an R&D test program utilizing a solution mining technique for recovering uranium from such deposits. This mining study, utilizing

a flow capacity of 15-30 gpm, was terminated on November 7, 1974; and an aquifer restoration program was initiated.

The mining study program demonstrated that substantial quantities of uranium could be recovered by the solution mining technique without safety hazards to employees or to the public and without significant adverse effects on the environment. Currently, Exxon's restoration program is ongoing. Results to date demonstrate that return of the groundwater quality to premining levels is in view utilizing a groundwater sweeping technique, i.e., producing groundwater from the ore zone without any lixiviant injection into the ore zone.

Exxon's request to continue research on solution mining in an area of one acre or less located approximately 1500 feet east of the original site at a flow capacity of 60 gpm is a logical step in the development of this mining technique.

The proposed site is located in the southwestern edge of the Section 21 solution mining area described in Exxon's Supplemental Environmental Report supporting the application for amendment to License No. SUA-1139 for a commercial-scale solution mining plant at Highland (Docket No. 40-8102) and shown in Figure 1.1. The fluid production rate in the amended test program will be about 2000 barrels per day (84,000 gpd) of pregnant leach solution versus 500-1,000 barrels (21,000-42,000 gpd) previously. The increased fluid volume will require minor modifications to the existing recovery plant. This should result in no significant impact on the environment nor create any safety hazards to the occupational workers and the public.

The injection well-production well pattern in the approximately one-acre well field will consist of injection wells, each offset by four production wells with observation (monitor) wells encircling the operating area. Monitor wells will also be completed in the aquifer above and below the ore zone. The former ore zone was located in the Middle Highland Sandstone (~320 feet); the proposed site ore zone is in the Lower Highland Sandstone (380-410 feet). The observation wells will be spaced 250 to 350 feet apart and will be located approximately 200 feet from the well field perimeter. The distance between injection and production wells will be about 70 feet. In the initial study, this distance was 90 feet.

Adequate monitoring, sampling, and reporting commitments have been made by the licensee to both the NRC and the Wyoming's Department of Environmental Quality (DEQ) to ensure the control of study, the public's safety, and the environment's protection.

Monitor wells will be sampled monthly for excursion indicators. Restoration of the groundwater quality in the aquifer following the test's completion, by a groundwater sweeping operation, will be effected until the fluids being produced are below the maximum permissible concentrations for unrestricted areas as listed in Column 2, Table II, Appendix B, 10 CFR 20, or until such concentrations are no higher than 1.2 times the natural background (baseline) concentrations where such background concentrations are in excess of MPC. Nonradioactive elements introduced by or mobilized by the solution mining process will be reduced to levels such that the water will be acceptable for purposes for which it was acceptable prior to the solution mining operations (DEQ's Land Quality Division's Guideline No. 4 for livestock impoundments or to within 20 percent of baseline, whichever is greater for the specified parameters.

All liquid effluents produced by this operation will be pumped to the existing Highland Mill tailings pond for disposal by evaporation. The quantity of liquid wastes to be routed to the tailings pond from this program are calculated to average about 20 acre-feet per year. The capacity of the tailings pond with a five-foot freeboard allowance is 9900 acre-feet. Thus, the incremental contribution to the tailings pond attributable to solution mining on an annual basis would amount to an insignificant 0.2 percent exclusive of evaporation.

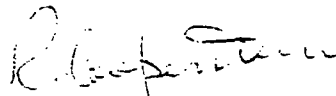
Access to the solution pilot plant and well field area is restricted, and all gates are posted with approved warning signs. The radiation protection and safety program currently in effect for the solution mine plant will continue. Thermoluminescent dosimeter (TLD) badges are worn by all employees normally working at the recovery plant. During the past year, the employee who has worked continuously in the solution mine pilot operation had a total TLD badge exposure of 0.25 rems or five percent of the permissible exposure.

The leaching operation for this amendment is expected to continue for approximately two years and will be followed by an aquifer cleanup operation utilizing a groundwater sweeping technique. From the information submitted by Exxon Minerals Company and discussions both with the company's personnel and the staff of Wyoming's DEQ, Land Quality Division, it is noted that:

1. The site is located in a sparsely populated area. Land in the site area is semi-arid and used primarily for grazing. The operational areas will be fenced and posted.

2. Liquid effluents will be contained in the mill tailings pond on the site. It appears unlikely that any liquid from the pond will reach potable water supplies. Adequate monitoring to ensure that this is the case is in effect by the applicant.
3. Air effluents in the processing plant will be sampled and monitored for radioactivity levels in the entire circuit and within the enclosing structure by responsible radiation safety personnel using adequate instrumentation and in conformance with required MESA and NRC procedures.
4. The proposed monitoring program is adequate for this type of operation. Periodic water samples will be taken from monitor wells surrounding the well field, at the pond, and from nearby potable water supplies to assure that solution mining activities do not adversely impact the existing water quality.
5. Exxon Minerals Company's management appears capable of enforcing a radiation safety program, and the individuals assigned the responsibility for conducting this program are technically qualified to do so. Mine site employees are provided adequate instruction and safeguards for radiation protection.
6. From the licensee's data and five years of experience with solution mining pilot operation, the staff concludes that a continuation of the subject solution mining operation can be conducted with no significant long-term adverse effect on the groundwater or the environment.

The issuance of this license is not deemed to be a major federal action significantly affecting the quality of the human environment. Thus, pursuant to 10 CFR Part 51, Section 51.5(d)(4), an environmental impact statement, negative declaration, or an environmental appraisal need not be prepared. Approval of the requested license is therefore recommended.



R. Cooperstein  
Fuel Processing & Fabrication Branch  
Division of Fuel Cycle and  
Material Safety