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MEMORANDUM FOR: Docket File No. 40-8697

FROM: Sandra L. Wastler, Project Manager  
 Licensing Branch 1  
 Uranium Recovery Field Office, Region IV

SUBJECT: RESTORATION AND STABILITY OF ROCKY MOUNTAIN  
 ENERGY COMPANY'S (RMEC) RENO CREEK ISL, PATTERN 1

Background

Rocky Mountain Energy Company (RMEC) conducted acid leach of Pattern 1 at the Reno Creek R&D ISL from February 1979, to November 1979. The use of sulfuric acid-based lixiviant proved to be incompatible with the formation geochemistry causing continual plugging, which resulted in very low uranium recovery. Pattern 1 ground-water restoration began in December 1979, with ground-water sweep. During restoration, RMEC attempted to neutralize the effects of the acid leach on the formation by injecting a solution of various soluble salts (1980) and calcium hydroxide (June 1980 - July 1981). In a meeting between RMEC, NRC and WDEQ, RMEC proposed two methods of additional restoration to further clean-up the Pattern 1 ore zone aquifer - an active restoration method and natural restoration. The active method of restoration was considered by both the NRC and WDEQ to have a potentially adverse effect on the ground-water quality and to be expensive. Therefore, the NRC and WDEQ agreed to allow RMEC to suspend active restoration and begin their proposed monthly stability monitoring, for a period of 1 year, in an attempt at natural restoration. The NRC and WDEQ based their decision, in part, on the conclusion that the buffering capacity of the formation combined with the negligible ground-water flow rate of the host aquifer substantially alleviated the concerns of detrimental ground-water contamination occurring due to solution movement away from the pattern. The WDEQ concluded that if there was no deterioration of ground-water

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MAY 15 1985

quality at the end of the year, RMEC would not be required to perform additional restoration and monitoring. The NRC required RMEC to submit a restoration history as well as the ground-water data at the conclusion of the year of natural restoration. The NRC agreed to review this data and make a decision regarding the adequacy of restoration and the need for additional restoration. By letter dated August 27, 1982, RMEC submitted this data and requested NRC's approval of the restoration of Pattern 1. As a result of an informal agreement between RMEC, NRC, and WDEQ, further review of the restoration and stability of Reno Creek Pattern 1 was postponed until problems at RMEC's Nine Mile Lake ISL project were resolved. Since August 1982, RMEC has continued to sample the Reno Creek Pattern 1 wells on a semi-annual basis. By letter dated March 12, 1985, RMEC submitted the result of all the ground-water sampling conducted since June 1981. The results of the NRC review are presented below.

#### Pattern 1

Since June 1981, RMEC has sampled and analyzed production wells P-1 and P-2, monitor wells M-1, M-2, M-3 and M-4, upper aquifer monitoring well USM-1 and lower aquifer monitor well LSM-1 for a modified list of water quality parameters. RMEC analyzed for the full suite of water quality parameters on three occasions; June 3, 1981, January 25, 1982, and June 10, 1982. The four injection wells in the interior of Pattern 1 were not sampled to determine baseline conditions and have not been sampled during the stabilization period. The NRC has reviewed all available Pattern 1 ground-water data and has noted the following regarding water quality in the Pattern 1 wells sampled:

- ° Most water quality parameters in the monitor and production wells have either returned to baseline conditions or are near baseline with decreasing trends toward baseline conditions.
- ° In production wells P-1 and P-2, manganese, iron, aluminum and ammonia remain above baseline or have increased slightly during stabilization. Manganese ranges from .76 to 1.2 mg/l, but is considered by the WDEQ to be within the normal range of probable occurrence in the Powder River Basin. Iron ranges from .01 to .21 mg/l baseline with current values ranging from 31 to 54 mg/l. The high iron content most likely has resulted from either pyrite in the ore zone or the well casings releasing iron into the ground water due to the acid leach. Aluminum concentrations increased and remained above baseline conditions during stabilization, but are at WDEQ water quality standards. Baseline concentrations of ammonia

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MAY 15 1985

range from .1 to .5 mg/l and have stabilized at approximately 1.2 to 1.4 mg/l during stabilization. No livestock or agricultural WDEQ standards exist for ammonia.

- ° In production wells P-1 and P-2, pH remains two or more log units below baseline. The low pH resulted from the acid leach, but has distinctly increased 1 log unit since the beginning of stabilization.
- ° In monitor well M-4, manganese also shows an increase from baseline conditions of .04 mg/l to present concentration of .08 mg/l.
- ° In lower aquifer monitoring well LSM-1, concentrations of ammonia have increased over baseline concentrations of .15 mg/l to a most recent value of 1.2 mg/l. This increase appears to be the result of the different methods used to obtain the water sample, rather than an actual change in water quality. No livestock or agricultural standards exist for ammonia.
- ° The overall water quality in the above sampled wells is within the original pre-mining WDEQ Class IV - Industrial water quality.

#### Recommendations and Conclusions

A review of the restoration and stability data for wells P-1, P-2 and the monitoring wells, received to date, indicates that restoration through natural processes to essentially baseline conditions can be achieved at Pattern 1. The NRC staff review of this data also indicates that:

- ° RMEC has not taken the final verification samples, which should be analyzed for the full suite of water quality parameters.
- ° In the actual injection/production area of Pattern 1, RMEC was required to sample only production wells P-1 and P-2.

Therefore, in order for the NRC to reach a final determination on the restoration and stabilization of Pattern 1, the following additional information will be required. First, since RMEC has been analyzing the water samples from these wells for an abbreviated list of parameters, the NRC will require RMEC to take final verification samples from all wells, to be analyzed for the full suite of water quality parameters. It is our understanding that WDEQ will be requiring two separate samplings of all wells. The first sampling to be conducted by RMEC, and after WDEQ review

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MAY 15 1985

of the results, a second confirmatory sampling (final verification) to be split between WDEQ and RMEC will be taken. The NRC will also split samples with WDEQ and RMEC on the final verification samples, if deemed necessary at that time.

Secondly, since June 1981, RMEC has sampled all wellfield wells with the exception of the four injection wells, apparently due to the small size of their casings. Technology exists today which will allow pumping of wells with 2-inch diameter casing. Since RMEC has sampled only the two production wells in the center of Pattern 1, sampling of the injection wells would provide additional data to support RMEC's conclusions regarding the restoration of Pattern 1 and provide additional data upon which to base the NRC's final decision. Therefore, prior to taking the final restoration samples, the NRC will require that RMEC investigate the condition of injection wells and the potential for pumping in order to gain additional water samples, representative of wellfield restoration.

RMEC should provide all water quality analysis and the results of the investigation of the injection wells for NRC review. If the NRC concludes that RMEC's first sampling and the second split sample analysis results are consistent with the past sampling results, the NRC will approve restoration and stabilization of Reno Creek Pattern 1.

151

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Original Signed By  
Edward P. Hawkins

Approved by:

Edward F. Hawkins, Chief  
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