40-8968

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 20, 1998

MEMORANDUM TO: Peter B. Bloch, Presiding Officer
Atomic Safety and Licensing Board

FROM: Joseph J. Holonich, Chief
Uranium Recovery Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

SUBJECT: SUPPLEMENT TO FEBRUARY 27, 1998, NOTIFICATION OF NEW INFORMATION POTENTIALLY RELEVANT AND MATERIAL TO THE PROCEEDING IN THE MATTER OF HYDRO RESOURCES, INC. (ASLBP NUMBER 95-706-01-ML): MARCH 19, 1998, TELECONFERENCE WITH PROFESSOR NEUMAN

Pursuant to Commission policy on notifying Licensing Boards of new information that is potentially relevant and material to an ongoing proceeding, the U.S. Nuclear Regulatory Commission (NRC) staff provides this supplemental notification and assessment of the subject information.

On March 19, 1998, the NRC staff held a teleconference with Professor Shlomo Neuman of the Department of Hydrology and Water Resources at the University of Arizona, who is also an NRC consultant. As previously indicated in the February 27, 1998, Board Notification, and in the letter to Susan Jordan dated March 18, 1998, this teleconference was made to gain a better understanding of Professor Neuman's views on NUREG-1508, and to ensure he had the full breadth of information that the staff used to arrive at the conclusions stated therein.

Consistent with the Final Policy Statement on Meetings Open to the Public, 59 FR 48340 (September 20, 1994), the teleconference was not open to the public. The teleconference was attended by the following NRC personnel:

Ralph Cady	Office of Nuclear Regulatory Research (RES)
Robert Carlson	Office of Nuclear Material Safety and Safeguards (NMSS)
William Ford	NMSS
Dan Gillen	NMSS
Joe Holonich	NMSS
John Hull	Office of the General Counsel
Mike Layton	NMSS
Tom Nicholson	RES

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In the teleconference, Professor Neuman stated that his opinions about NUREG-1508 for the Crownpoint *in situ* leach (ISL) mining project were shaped by his review of: (1) NUREG-1508; (2) the Draft Standard Review Plan for *In Situ* Leach Uranium Extraction License Applications

(Published October 1997, NUREG-1569); and (3) other generally relevant hydrologic literature. Regarding the bases for the staff's conclusion that the potential for vertical excursions to occur in the Dakota Sandstone aquifer is low at the Crownpoint site (*see* NUREG-1508, at 4-42 and 4-43), Professor Neuman stated that he did not dispute the staff's findings, with one exception: the significant difference in water levels between the Dakota Sandstone aquifer and the Westwater Canyon aquifer does not indicate a lack of connection between these two aquifers.

Professor Neuman's opinion is based on his conceptual model of groundwater, where in his view, it is appropriate to consider all geologic materials as having some permeability to ground water -- no matter how small. Therefore, given enough time, water will move through any geologic material, hence making it appropriate to view all aquifers as being in hydrologic communication. This conceptual view was Professor Neuman's basis for the conclusions presented in his slides. However, Professor Neuman did not indicate it was his opinion that the staff's conclusions were wrong regarding the potential for vertical excursions to occur at the site. Furthermore, he did not specifically identify anything in NUREG-1508 that he believed would disqualify the site from ISL mining. Instead, he was concerned the staff had assumed the aquifers beneath the proposed sites are not hydraulically connected, and that NUREG-1508 does not contain a compelling argument showing the geologic materials of the Brushy Basin Shale will adequately prevent vertical excursions.

Professor Neuman could not find where the rate of water movement through the Brushy Basin Shale was described in NUREG-1508. He is concerned that during solution mining, lixiviant could slowly move through the Brushy Basin Shale and cause a vertical excursion into the overlying Dakota Sandstone aquifer. Professor Neuman opines that if monitor wells were located in the Brushy Basin Shale, they would be well situated to identify the vertical movement of lixiviant before it could reach the Dakota Sandstone aquifer during an excursion. He also observed that sandstone layers interbedded within the shales and siltstones of the Brushy Basin Shale would be excellent locations for vertical monitor wells. In conclusion, Professor Neuman stated it was his "gut feeling" that the proposed ISL operation was safe; however, in his opinion, NUREG-1508 does not adequately demonstrate a complete technical understanding by the staff of vertical hydraulic communication.

The NRC staff agrees with Professor Neuman's observation that the geologic materials of the Brushy Basin Shale contain measurable permeabilities. At the Unit 1 and Crownpoint sites, the Brushy Basin Shale is predominantly composed of siltstone, mudstone, and shale layers with discontinuous, comparatively thin beds of sandstone. The siltstone, mudstone, and shale layers have low permeability levels, and water movement through this medium is considered extremely slow when compared to the much more permeable sandstone beds of the Dakota and Westwater Canyon aquifers. Moreover, the permeability of the siltstone, mudstone, and shale beds is so low that it does not require a great thickness of this material to prevent the movement of lixiviant between aquifers over the relatively short period of time (3-4 years) that ISL mining takes place in a well field. Some solution mines routinely mine in sandstone aquifers that are overlain by 25 to 30 feet of siltstone and shale without causing vertical excursions from lixiviant movement through the confining unit. At the Crownpoint property, the Brushy Basin Shale appears to range in thickness from 100 to 250 feet, while at the Unit 1 site, the thickness appears to be on the order of 250 to 300 feet. At the Church Rock site, there is

16 to 32 feet of mudstone between the Westwater Canyon Aquifer and the first overlying aquifer (Brushy Basin "B" Sand).

During the teleconference, it became apparent that confusion existed over what the NRC staff meant by the word "interconnected" when referring to the stratigraphy of the Brushy Basin Shale. As used in NUREG-1508, the term "interconnected" means that siltstone, mudstone, and shale layers are absent or extremely thin, such that for all practical purposes, the Dakota and Westwater Canyon aquifers are connected by sandstone beds. This term was used in recognition of the practical considerations concerning the very low permeabilities of the siltstones, mudstones, and shales, and the short period of mining relative to the extremely low rate of water movement through these geologic materials. Historically, almost all vertical excursions at ISL mining operations have been caused by faulty well completions or unsealed exploration boreholes. The staff is aware of only one ISL site (Irigaray, Wyoming) where vertical excursions may have been caused by stratigraphic interconnections. In this instance, the licensee tried to prevent lixiviant from moving across a confining unit of one to 3 feet in total thickness. However, even in this case, it could not be established that the failure of the confining unit was the cause of the excursion. This was because open exploration boreholes and badly constructed injection wells were also found to be contributing to the excursion.

To quickly detect excursions, vertical monitor wells are placed inside the well fields so they will be near the injection wells which could be the cause of vertical excursions. If monitor wells were placed within the siltstones, mudstones, and shales of the confining units, there is a high probability that vertical excursions caused by open exploration holes, faults, or f actures would go undetected because the permeability of these materials is so low. Similarly, if monitor wells are placed in the comparatively thin sandstone layers within the confining unit, the discontinuous nature and low rate of ground-water movement within these layers means that there is an increased probability vertical excursions would go undetected. In addition, the completion of monitor wells into the siltstones, mudstones, shales, and thin sandstone layers of the confining unit would make it very difficult, if not impossible, to obtain good water-quality samples. This is because wells completed in this medium would have very low production rates.

The identification of excursions through geochemical means may also be more difficult if monitor wells are placed in the confining units. This is because the water quality of the interbedded sands, siltstones, mudstones, and shales will probably contain much poorer water quality than either the Westwater Canyon or Dakota Sandstone aquifers. Therefore, this might make it difficult to derive effective upper control limits. Also, the large clay content of siltstones, mudstones, and shales, and the increased clay content of thin bedded sands could significantly retard, if not for all practical purposes stop, the movement of many of the dissolved chemical constituents in the lixiviant. Again, this would increase the difficulty of identifying excursions.

Injection and production wells are cased and cemented through the confining unit. However, in order to obtain water quality samples, the completion of monitor wells within the confining unit would require the creation of open, uncemented voids over several feet within the confining unit. Placement of such wells would have to be accomplished with special care so that the confining unit is not compromised. For the foregoing reasons, the NRC staff does not require or recommend that monitor wells be placed in confining units to monitor for vertical excursions.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of

HYDRO RESOURCES, INC.
2929 Coors Road, Suite 101
Albuquerque, New Mexico 87120

Docket No.(s) 40-8968-ML

CERTIFICATE OF SERVICE

I hereby certify that copies of MEMO FROM J. HOLONICH TO PETER B. BLOCH RE: SUPPLEMENT TO FEBRUARY 27, 1998, NOTIFICATION OF... have been served on the following by deposit with Federal Express as indicated by triple asterisk; by deposit in the United States Mail, express mail by double asterisk; or as indicated by a single asterisk through deposit in the Nuclear Regulatory Commission's internal mail system, in accordance with the requirements of10 CFR Sec. 2.712.

Office of Commission Appellate*
Adjudication
Mail Stop O-16G15
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Chief Administrative Judge
B. Paul Cotter, Jr., Esq.*
Presiding Officer
Atomic Safety and Licensing Board
Mail Stop T-3F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Administrative Judge
Thomas D. Murphy*
Special Assistant
Atomic Safety and Licensing Board
Mail Stop T-3F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Secretary* (2)
Attn: Rulemakings and Adjudication Staff
Mail Stop O-16C1
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Adjudicatory File*(2)
Atomic Safety and Licensing Board
Mail Stop T-3F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Atomic Safety and Licensing Board Panel*
Mail Stop T-3F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555

John T. Hull, Esq. *(2)
Mitzi A. Young, Esq. *
Office of the General Counsel
Mail Stop O-15B18
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Jep Hill, Esq.**
Jep Hill and Associates
PO Box 2254
Austin, Texas 78768-2254

Richard F. Clement, Jr.**
President
Hydro Resources, Inc.
2929 Coors Road
Suite 101
Albuquerque, New Mexico 87120

Lila Bird, Executive Director**
Water Information Network
PO Box 4524
Albuquerque, New Mexico 887106

Mitchell W. Capitan, President**
Eastern Navajo-Dine' Against
Uranium Mining
PO Box 471
Crownpoint, New Mexico 87313

Diane Curran, Esq.**
Harmon, Curran, Spielberg,
& Eisenberg, L.L.P.
2001 S Street, N.W., Suite 430
Washington, DC 20009

Lori Goodman**
Dine' CARE Navajo Nation
10 A Town Plaza, S-138
Durango, Colorado 81301

Mary Lou Jones, President**
Zuni Mountain Coalition
PO Box 39
San Rafael, New Mexico 87501

Grace and Marilyn Sam**
PO Box 714
Thoreau, New Mexico 87323

Susan G. Jordan, Esq.**
New Mexico Environmental Law Center
1405 Luisa Street, Suite 5
Santa Fe, New Mexico 87505

Bernadine Martin**
Po Box 370
Crownpoin', New Mexico 87313

W. Paul Robinson**
Chris Shuey
Southwest Research and
Information Center
PO Box 4524
Albuquerque, New Mexico 87106

Grace and Marilyn Sam**
PO Box 800
Gallup, New Mexico 87323

Mervyn Tilden**
PO Box 457
Church Rock, New Mexico 87311

Anthony J. Thompson, Esq.**
Paul Gormley, Esq.
Counsel for Hydro Resources, Inc.
Shaw, Pittman, Potts & Trowbridge
2300 N Street, N.W.
Washington, DC 20037-1128

Jon J. Indall**
Comeau, Maldegen, Templeman
and Indall, LLP
141 East Palace Avenue
Santa Fe, New Mexico 87504-0669

Dated at Rockville, MD, this
20th day of April 1998

Betty Barrett

Uranium Recovery Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

It is important to note that in NUREG-1508, the staff did not assume vertical excursions cannot occur at the Crownpoint site. Instead, at 4-17, the NUREG contains a description of the causes of vertical excursions. Additionally, at 4-40 to 4-58, for each of the three sites, a description of the relative potential for vertical excursions to occur as the result of each cause is provided. The NUREG concludes that given the tests to be conducted prior to lixiviant injection in each well field, the potential for vertical excursions to occur is considered low. However, the NUREG further states that should a vertical excursion occur, it would be detected by the overlying monitor wells and the licensee would be required to (1) stop the excursion, and (2) restore the water quality in the upper aquifer.

During the licensing of an ISL uranium mine, not all of the detailed information required to fully describe a project is available at the time of licensing. As well fields are developed, final well locations are adjusted as additional data from previously drilled wells is obtained. Therefore, prior to licensing, only enough well field information is required to adequately describe the environmental impacts and make a decision concerning the safety of the proposed activities. Given the license requirements and commitments made by Hydro Resources, Inc. (HRI) to mitigate environmental impacts as documented in its license and application, the staff determined that HRI had submitted enough well field information to satisfy the aforementioned objectives.

In summary, the staff agrees with Professor Neuman's observation that the geologic materials of the Brushy Basin Shale possess some measurable level of permeability. However, the staff believes that the Brushy Basin Shale contains more than adequate thickness of siltstones, mudstones, and shale beds to prevent the movement of lixiviant between aquifers over the relatively short period of time (3-4 years) that mining takes place in a well field.

Docket Number 40-8968-ML

cc: Service List
Prof. Shlomo Neuman, Univ. of Arizona

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Prof. Shlomo Neuman, Univ. of Arizona