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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE PRESIDING OFFICER

In the Matter of	)	
	)	Docket No. 40-8968-ML
HYDRO RESOURCES, INC.	)	
2929 Coors Road, Suite 101	)	(Leach Mining and Milling License)
Albuquerque, New Mexico 87120	)	

NRC STAFF'S MOTION TO STRIKE MATERIALS FROM THE RECORD, OR, IN THE ALTERNATIVE, FOR LEAVE TO FILE A REPLY

INTRODUCTION

Pursuant to the Presiding Officer's unpublished order dated April 21, 1999 ("Memorandum and Order (Questions)" (April 21 Order), the staff of the Nuclear Regulatory Commission (Staff) and licensee Hydro Resources, Inc. (HRI) filed answers to the questions on May 11, 1999. In accordance with the April 21 Order's discretionary terms, Intervenors Eastern Navajo Diné Against Uranium Mining (ENDAUM), Southwest Research and Information Center (SRIC), Marilyn Morris, and Grace Sam (Intervenors) chose not to file answers by the May 11, 1999, deadline. *See* April 21 Order, at 4, ¶¶ 1-2.[1] Instead, on May 25, 1999, they filed "Intervenors' Joint Response To HRI's And The NRC Staff's Responses To The Presiding Officer's April 21, 1999 Memorandum And Order (Questions)" (Joint Response), as had been authorized by the Presiding Officer. *See* April 21

[1] By agreement of the parties, a one-day extension of the May 10 answer date was granted. Similarly, the parties agreed to a one-day extension of the May 24 response date.

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Order, at 4, ¶ 3. The Joint Response includes as Exhibits 1-4 affidavits of Dr. Richard Abitz, Michael Wallace, Dr. Spencer Lucas, and Dr. Michael Sheehan.[2]

However, portions of the Joint Response, and the supporting affidavits, improperly introduce new arguments, models, and concepts, in belatedly answering the Presiding Officer's questions, and go far beyond responding to the Staff's and HRI's May 11 answers. This new material should not be accepted for consideration in this proceeding, unless the Presiding Officer gives the Staff adequate time to file replies. The material which the Presiding Officer is requested to strike is as indicated in the lined-out copies of the Joint Response brief, and the affidavits of Mr. Wallace, Dr. Abitz, and Dr. Lucas, which are attached hereto as Staff Exhibits A, B, C, and D, respectively.[3]

DISCUSSION

I. Motion To Strike

Pursuant to 10 C.F.R. § 2.1209(a), a presiding officer has the general authority to "[r]egulate the course of the hearing and the conduct of the participants." Implicit in this grant of authority is the duty to ensure that a presiding officer's orders are followed, in order to achieve a fair hearing and maintain order. *See* 10 C.F.R. § 1209(a). Included within this general authority is the specific power to strike cumulative material from the record. *See* 10 C.F.R. § 2.1233(e). As discussed below, in filing the Joint Response, the Intervenors have ignored the terms of the April 21 Order, and have

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[2] Copies of the attachments to the affidavits were not received until May 27, 1999.

[3] Staff Exhibits A-D were made from copies of the electronic versions of these documents received from the Intervenors. Electronic versions of the attachments to the affidavits were not received from the Intervenors. Page numbers between the electronic versions and the executed copies are not consistent. To avoid confusion, cites herein are to paragraph and section numbers, rather than to page numbers, of the Intervenors' May 25 filings.

filed cumulative material, both of which work to the detriment of the Staff's right to a fair hearing. Accordingly, pursuant to 10 C.F.R. §§ 2.1209(a) and 2.1233(e), the Staff moves the Presiding Officer to strike parts of the Joint Response, and the supporting affidavits.

The April 21 Order was structured to allow for a round of answers to the questions it propounded, followed by a round of responses to the answers. *See* April 21 Order, at 4, ¶¶ 1-3. The April 21 Order also specified that any requests for extensions of time to the deadlines it imposed were to be filed by April 28, 1999. *See id.*, at 4, ¶ 5.

Without any explanation, and in the absence of any request for an extension of time, the Joint Response legal brief includes a section titled "Responses To Questions 1-8." *See* Section III of the Joint Response. Section III, to the extent it goes beyond directly responding to the Staff's and HRI's May 11 answers, is clearly not authorized by the terms of the April 21 Order. To allow all of the Section III responses into the record at this time, when the Staff has no right of making a technical reply, would unfairly prejudice the Staff's case. By failing to file timely answers to the April 21 Order's questions, the Intervenors waived their right to answer those questions. The Intervenors' answers are, accordingly, properly subject to being stricken from the record.

At this stage of the proceeding, with respect to Section 8 issues, the Intervenors are properly limited to responding to the Staff's and HRI's May 11 answers. *See* April 21 Order, at 4, ¶ 3. The Intervenors are attempting instead to introduce new material in their Joint Response, at a time when, under the terms of the April 21 Order, the Staff would have no opportunity to comment on the new material. This Intervenor gambit obviously seeks to unfairly deny the Staff any rebuttal opportunity. Accordingly, the Joint Response's new arguments, models, and concepts specified below should be

stricken from the record. Alternatively, the Presiding Officer should grant the Staff leave to file replies to the new information.[4]

A. Strike Portions of Wallace Response Affidavit

Portions of the "Response Affidavit of Michael G. Wallace," dated May 20, 1999, and attached to the Joint Response as Exhibit 2 (Wallace Affidavit), are particularly objectionable and should be stricken from the record. Specifically, the Staff requests the Presiding Officer to strike ¶¶ 5-27, and ¶ 51, of the Wallace Affidavit, and all new exhibits referenced therein.[5]

These portions of the Wallace Affidavit rely on a new contaminant transport model Mr. Wallace has created. As is evident from his statements (*see, e.g.*, ¶ 26), Mr. Wallace could have created this transport model much earlier in this proceeding, at a time when the other parties would have had the opportunity to provide their comments. Even assuming that until Mr. Wallace read the April 21 Order, the need to create such a model had not occurred to him (*see* ¶ 21), the Intervenors made no motion to extend the May 10 date by which answers to the Presiding Officer's questions were due. *See* April 21 Order, at 4, ¶ 5. Instead, without any explanation or excuse, the Intervenors submitted Mr. Wallace's new model at the very end of the Section 8 phase of the proceeding.

Even if the Presiding Officer views the model as a legitimate effort to respond to the April 21 Order's question 3, the well to which the model pertains is on United Nuclear Corporation (UNC)

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[4] Due to the technical nature of the new information, particularly the attachments to the new affidavit of Michael Wallace, to adequately respond the Staff estimates it would need until July 1, 1999, or two weeks after the Presiding Officer rules on this motion, whichever time is later.

[5] By contrast, other portions of the Wallace Affidavit reflect the type of response allowed for by the April 21 Order, at 4, ¶ 3. *See, e.g.*, Wallace Affidavit ¶¶ 29-44, and 46-50.

land, and the Intervenors provide no evidence that this is a "private well"[6] within the scope of question 3. *See* April 21 Order, at 2, ¶ 3. Mr. Wallace's new model is thus not responsive to the relevant question.

Additionally, ¶ 51 of the Wallace Affidavit introduces new testimony regarding "environmental" costs of $3,000 to $4,000 per acre foot of water. No showing is made as to why Mr. Wallace waited until now to offer this opinion.

Accordingly, for the reasons stated above, the Presiding Officer should strike ¶¶ 5-27, and ¶ 51, and other lined-out portions, as indicated on Staff Exhibit B attached hereto, and strike all new exhibits referenced therein.

B. Strike Portions of Abitz Response Affidavit

Portions of the "Affidavit of Dr. Richard J. Abitz In Response To The Presiding Officer's Questions In The Memorandum And Order Of April 21, 1999," dated May 21, 1999, and attached to the Joint Response as Exhibit 1 (Abitz Affidavit), should be stricken from the record. Specifically, for the following reasons, the Staff requests the Presiding Officer to strike portions of ¶ 16, and ¶¶ 20-22, of the Abitz Affidavit, and all new exhibits referenced therein.

Dr. Abitz introduces the concept of "reaction kinetics" to the proceeding. Dr. Abitz links this concept to his charge that it is only "speculation" as to whether groundwater concentrations of uranium and other redox-sensitive ions in ore zones at HRI's Church Rock site will decrease (*i.e.*,

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[6] Mr. Wallace attempts to convert the UNC well into a private well by citing to page 16 of the May 6, 1999, affidavit of Craig Bartels, filed by HRI on May 11, 1999. *See* Wallace Affidavit, at ¶ 25. Mr. Bartels makes no reference to the UNC well as a private well.

precipitate from solution) as groundwater moves away from the ore zones. Abitz Affidavit, at ¶ 16.[7] However, instead of explaining what "reaction kinetics" means, he faults the Staff's William Ford for not providing any information on the topic in Mr. Ford's May 11, 1999, affidavit (attached as Exhibit 1 to the "NRC Staff Response To Questions Posed In April 21 Order"). *See* Abitz Affidavit, at ¶ 16. As a scientist testifying in an adjudicatory proceeding, Dr. Abitz has a duty to explain the meaning of any new technical concepts he introduces, and to discuss how the concept is relevant to the question of whether the Deutsch studies' findings apply to HRI's Church Rock site. Despite being on notice for more than two years (since the February, 1997, FEIS publication date) that the Staff was relying on the Deutsch studies, and other relevant studies cited in the 1997 FEIS, Dr. Abitz and the Intervenors unfairly seek to create doubt at the last minute, at a time when the Staff has no right of making a technical reply.

Unless the Presiding Officer strikes portions of Abitz Affidavit ¶ 16, or allows the Staff to file a technical reply, a cloud of doubt will be unfairly cast over the validity of the Deutsch studies.

In ¶¶ 20-22 of the Abitz Affidavit, Dr. Abitz addresses question 3 of the April 21 Order, which asked about effects on private water wells. *See* April 21 Order, at 2, ¶ 3. Dr. Abitz's answer is not responsive to the Presiding Officer's question, as it refers to the potential placement of future wells, rather than the present location of any private wells. Dr. Abitz also variously references the

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[7] Dr. Abitz's criticism is made in the context of his attack on Mr. Ford's reliance on studies conducted by W.J. Deutsch, and published in 1983 (Aquifer Restoration at In-Situ Leach Uranium Mines: Evidence for Natural Restoration Processes, NUREG/CR-3136) and 1985 (Method of Minimizing Ground-Water Contamination From In-Situ Leach Uranium Mining: NUREG/CR-3709). These studies, which are referenced in the 1997 Final Environmental Impact Statement (FEIS), at page 4-39, support the Staff's conclusion that uranium and other redox-sensitive ions will not migrate very far from HRI's well fields, thus preventing the spread of contamination outside the well field area. *See* Mr. Ford's May 11, 1999, affidavit, at ¶ 12.

new Wallace transport model, and the proffered testimony of Dr. Lucas, in support of his response to the Presiding Officer's question 3. As discussed in Section A, *supra*, and Section C, *infra*, the new Wallace model, and the proffered testimony of Dr. Lucas, should not be accepted in this proceeding, and references to those items should also be stricken.

Accordingly, for the reasons stated above, the Presiding Officer should strike the lined-out portions of ¶ 16, and ¶¶ 20-22, as indicated on Staff Exhibit C attached hereto, and strike all new exhibits referenced therein.

C. Strike The Entire Lucas Response Affidavit

The "Response Affidavit of Dr. Spencer G. Lucas," dated May 20, 1999, and attached (with enclosures) to the Joint Response as Exhibit 3 (Lucas Affidavit), should be stricken from the record. Dr. Lucas is a new witness, and acceptance of his proffered testimony at this time would unfairly prevent the Staff from filing any technical comments on its substance, or on the qualifications of Dr. Lucas. Unlike portions of the Wallace Affidavit and the Abitz Affidavit, which simply reiterate previously-filed testimony on which the Staff has had an opportunity to comment, and to which the Staff is not now objecting, admitting the Lucas Affidavit would impose substantial prejudice on the Staff.

As discussed above, the April 21 Order was structured to allow for a round of answers to the questions it propounded, followed by a round of responses to the answers. *See* April 21 Order, at 4, ¶¶ 1-3. Admitting the Lucas Affidavit now, absent any further order, would deny the Staff any opportunity to file comments on Dr. Lucas' opinions, contrary to what the April 21 Order intended. The Intervenors proffer the Lucas Affidavit, which provides Dr. Lucas' answers to the April 21

Order's questions 2 and 8, without any explanation for their failure to comply with the April 21 Order. By failing to file timely answers to the April 21 Order's questions, the Intervenors waived their right to answer those questions. Accordingly, the entire Lucas Affidavit is properly subject to being stricken from the record.

Moreover, the Intervenors make no showing as to why Dr. Lucas' testimony should not be viewed as cumulative. Dr. Lucas' ¶¶ 4-7, submitted in answer to the April 21 Order's question 2, duplicate ¶¶ 28-44 of the Wallace Affidavit, to which the Staff is not objecting. Dr. Lucas admits that his answer to question 2 is "intended to supplement his [Wallace's] response." Lucas Affidavit, ¶ 4. His concurrence with Mr. Wallace's January, 1999, testimony further emphasizes the cumulative nature of the Lucas Affidavit. *See* Lucas Affidavit, ¶ 5. Similarly, as Mr. Wallace states, the Lucas Affidavit duplicates Dr. Staub's January, 1999, testimony. *See* Wallace Affidavit, ¶ 31. Additionally, Dr. Lucas' ¶¶ 8-15, submitted in answer to the April 21 Order's question 8, duplicate ¶¶ 52-53 of the Wallace Affidavit, and ¶¶ 23-24 of the Abitz Affidavit. Except to the extent that these Wallace and Abitz affidavit sections reference the Lucas Affidavit, the Staff is not objecting to those portions of the Wallace and Abitz Affidavits. Thus, due to its cumulative nature, the Lucas Affidavit is properly subject to being struck from the record pursuant to 10 C.F.R. § 2.1233(e).

Accordingly, for the reasons stated above, the Presiding Officer should strike the entire Lucas Affidavit from the record (as indicated in Staff Exhibit D attached hereto), along with all of its attachments.

D. Strike Portions of Joint Response Brief Section III

Significant portions of Section III of the Joint Response legal brief, titled "Responses To Questions 1-8," are not authorized by the terms of the April 21 Order, and should, accordingly, be struck from the record. For ease of reference, each portion of Section III is addressed separately below.

1. Section (1) (A) (1)

The Staff does not object to this section, as it does not improperly introduce new material. Here, the Intervenors reference various filings previously made in this proceeding, on which the Staff has had an opportunity to respond.

2. Section (1) (A) (2)

The Staff moves to strike the third paragraph of this section, in which the concept of "reaction kinetics" is referenced. As discussed in Section B, *supra*, no showing is made as to why Dr. Abitz waited until now to reference "reaction kinetics" in support of his opinions.

3. Section (1) (B)

To the extent this section of the Joint Response brief references the opinions of Dr. Lucas, the Staff moves to strike those references, for the reasons discussed in Section C, *supra*. Dr. Lucas has not previously been proffered as an expert in this proceeding, and the Staff has had no opportunity to assess the weight his opinions should be given.

4. Section (1) (C)

The Staff moves to strike this section of the Joint Response brief, which references the new transport model Mr. Wallace has created. As discussed in Section A, *supra*, no showing is made as to why Mr. Wallace waited until now to introduce such a model in support of his opinions.

5. Section (2) (A)

To the extent this section of the Joint Response brief references the opinions of Dr. Lucas, the Staff moves to strike those references, for the reasons discussed in Section C, *supra*. Dr. Lucas has not previously been proffered as an expert in this proceeding, and the Staff has had no opportunity to assess the weight his opinions should be given.

6. Section (2) (B)

As indicated in Staff Exhibit A attached hereto, the Staff moves to strike most of the last paragraph of this section of the Joint Response. As discussed in Section A, *supra*, no showing is made as to why Mr. Wallace waited until now to introduce his new transport model, and to offer his opinion pertaining to the "environmental" costs of $3,000 to $4,000 per acre foot of water. The Staff thus objects to the legal brief's references to these new opinions.

7. Section (3) (A)

To the extent this section of the Joint Response brief references certain opinions of Dr. Abitz, which in turn reference the new Wallace transport model, and the proffered opinions of Dr. Lucas, the Staff moves to strike those references, for the reasons discussed in sections A and C, *supra*.

8. Section (3) (B)

The Staff moves to strike most of Section III (3) (B) of the Joint Response, for the reasons discussed in Section A, *supra*. This section references the new Wallace transport model, and unfairness would result if this argument is considered in the absence of any Staff technical response to the model.

9. Sections (4)-(7)

The Staff does not object to these sections of the Joint Response, which reply to the answers made by the Staff and HRI to questions 4-7 of the April 21 Order. These sections do not improperly introduce new material. While Section 4 relies largely on a May 21, 1999 affidavit of Dr. Michael Sheehan (attached to the Joint Response as Exhibit 4, with enclosures), this affidavit simply reiterates his earlier testimony. or relies on existing, publicly-available information. Section 5 relies largely on previously-filed environmental justice arguments made by the Intervenors.[8] Similarly, Sections 6 and 7 cite previously-filed arguments made by the Intervenors on National Environmental Policy Act (NEPA) issues, or otherwise rely on publicly-available information. Accordingly, since Sections 4-7 reference various filings previously made by the Intervenors in this proceeding, or otherwise rely on publicly-available information, the Staff has no objection to these sections of the Joint Response.

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[8] Section 5 also cites some of the previously-filed testimony of Dr. Robert Bullard. The Staff's motion to strike Dr. Bullard's proffered testimony is pending. *See* "NRC Staff's Response To Intervenors' Presentations On Environmental Justice Issues," dated April 1, 1999, at 5-6. If this April 1 motion is granted, Section 5's references to Dr. Bullard's proffered testimony would need to be stricken as well.

10. Section III (8)

To the extent this section of the Joint Response brief references the opinions of Dr. Lucas, the Staff moves to strike those references, for the reasons discussed in Section C, *supra*. Dr. Lucas has not previously been proffered as an expert in this proceeding, and the Staff has had no opportunity to assess the weight his opinions should be given.

Accordingly, for the reasons stated above, the Presiding Officer should strike portions of the Joint Response legal brief, as indicated on Staff Exhibit A attached hereto, and strike all new exhibits referenced therein.

II. Motion For Leave To File A Reply

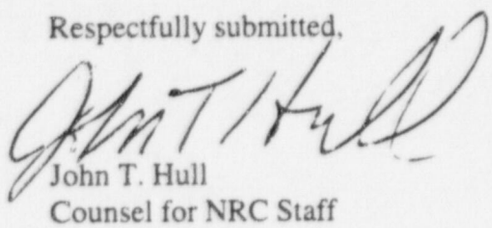
Under the terms of the April 21 Order, the Staff has no right to reply to the Joint Response. As indicated above, the Staff's first preference is that portions of the Joint Response and its supporting exhibits be stricken from the record. There is no excuse for the Intervenors to have waited until this stage of the proceeding before attempting to introduce into the record the new material outlined above.

For any such material which the Presiding Officer declines to strike from the record, the Staff hereby requests leave to file a reply. If the reply motion is granted, the Staff also requests the Presiding Officer to specify in the order granting the reply motion that the Intervenors do not thereby have any right of response, absent a showing that the Intervenors are unfairly prejudiced by new information. The Staff submits that such a restriction would be necessary in order to avoid further prolonging this phase of the hearing, now scheduled to be concluded by July 23, 1999.

CONCLUSION

The Presiding Officer needs to insert some discipline into this proceeding. Until now, the Intervenors have had free rein to make their case in the manner they thought best. Such freedom, however, should not include being able to ignore the Presiding Officer's orders. Parts of the Joint Response do just that. Those parts should accordingly be struck from the record.

Respectfully submitted,



John T. Hull
Counsel for NRC Staff

Dated at Rockville, Maryland
this 10th day of June, 1999

STAFF EXHIBIT A

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judge Peter B. Bloch, Presiding Officer
and Robin Brett, Special Assistant

In the Matter of	)	
	)	
HYDRO RESOURCES, INC.	)	Docket No. 40-8968-ML
(2929 Coors Road, Suite 101	)	ASLBP No. 95-706-01-ML
Albuquerque, NM 87120)	)	
	)	

INTERVENORS' JOINT RESPONSE TO HRI'S AND THE NRC STAFF'S RESPONSES TO THE PRESIDING OFFICER'S APRIL 21, 1999 MEMORANDUM AND ORDER (QUESTIONS)

INTRODUCTION

Intervenors Eastern Navajo Diné Against Uranium Mining ("ENDAUM"), Southwest Research and Information Center ("SRIC"), Marilyn Morris ("Morris") and Grace Sam ("Sam") ("Intervenors") hereby respond to the answers filed by Hydro Resources, Inc. ("HRI") and the Nuclear Regulatory Commission ("NRC") Staff to the Presiding Officer's April 21, 1999 Memorandum and Order (Questions) ("April 21 Order"). Hydro Resources, Inc.'s Reply to April 21, 1999 Memorandum and Order (Questions) (HRI's Response"); NRC Staff Response to Questions Posed in April 21 Order (Staff Response"). This Response is filed on May 25, 1999 in accordance with the Presiding Officer's order of May 21, 1999.

This Response is supported by the attached Exhibits 1-4, Response Affidavits of Dr. Richard J. Abitz ("Abitz Response Testimony") (Exhibit 1), Michael G. Wallace ("Wallace Response Testimony") (Exhibit 2), ~~Dr. Spencer G. Lucas ("Lucas Response Testimony") (Exhibit 3),~~ and Dr. Michael F. Sheehan ("Sheehan Response Testimony") (Exhibit 4). This Response also is supported by the study by E.J. Cowan submitted by ENDAUM and SRIC in response to Question 8 of the April 21 Order.[1] This Response addresses Questions 1 through 8.[2]

I. HRI AND THE STAFF HAVE PRESENTED ANSWERS BY INDIVIDUALS WHO ARE NOT QUALIFIED TO ADDRESS THE ISSUES.

A. Neither HRI's attorneys nor its witness are qualified to respond to Questions 1, 2, 3, or 8.

HRI's response to Question 1 is based in large part on the unsworn allegations of its counsel and the opinions of Craig Bartels, who is not qualified to provide expert analysis of the issues presented by that Question. That response therefore should be disregarded by the Presiding Officer; at the very least it should not be given credence as against the conflicting opinions of experts in the field.

Evidence can only be presented by a witness who is both qualified to provide the testimony and sworn to tell the truth. *See* Louisiana Power and Light Co. (Waterford Steam Electric Station Unit 3), ALAB-732, 17 NRC 1076, 1091 (1983); Duke Power

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[1] Cowan, E.J., 1991 *The Large-Scale Architecture of the Fluvial Westwater Canyon Member, Morrison Formation (Upper Jurassic), San Juan Basin, New Mexico: SEPM Concepts in Sedimentology and Paleontology* ("Cowan Study").

[2] By responding to Questions 1 through 7, ENDAUM and SRIC do not waive their objections to those Questions or their May 14, 1999 Petition for Interlocutory Review of the April 21 and May 4 Orders.

Co. (William B. McGuire Nuclear Station, Units 1 and 2), ALAB-669, 15 NRC 453, 477 (1982); Fed. R. Evid. 603. HRI's attorneys are not witnesses, and there is nothing in the record to indicate that one or more of them has any qualifications to make these statements.

For example, HRI's attorneys are the only authors of the statement that:

> Groundwater at Section 8 is not currently a source of drinking water and its future use is severely restricted due to the naturally occurring concentrations of radionuclides.

HRI's Response at 2.

There is nothing in HRI's Response to indicate which of HRI's three attorneys on the pleading is making these allegations, or which of those attorneys purports to have the knowledge, or the education, training, or experience in hydrology, mining, or other disciplines to make these allegations. As another example, HRI's counsel state:

> As has been discussed in HRI's previous presentations, the history of URI and the ISL industry throughout the United States reflects that groundwater restoration at ISL sites typically has achieved levels at or near baseline.

HRI's Response at 3. This assertion is supported only by the Randall J. Charbaneau article referred to in footnote 3 of HRI's Response, for which there is no evidentiary foundation in the record. The article also is not verified by any expert or other individual providing sworn testimony in this matter, and was written 15 years ago by an individual whose backgrounds and qualifications are not in the record.

These assertions by HRI's attorneys are not evidence, and they should be stricken from the record or at least disregarded. The Presiding Officer also should not

be persuaded by the opinions of Craig Bartels, who is presented by HRI as an expert even though he does not have the requisite qualifications.

HRI cites the opinion of Craig Bartels for its assertion that "no important difficulties, including unlikely but foreseeable difficulties, concerning groundwater restoration present themselves for consideration." HRI's Response at 6. In fact, however, Mr. Bartels states only that the required remediation and other conditions of the FEIS and HRI's license (SUA-1508) are designed to prevent such costs; he never states that environmental costs will not occur. Moreover, he is not qualified to address the costs that may arise.

By his own admission, Mr. Bartels is a Petroleum Engineer and a Professional Engineer in Illinois. Bartels Affidavit filed with HRI's Response, at 1-2. Mr. Bartels' only direct assertion concerning his knowledge of what is likely to happen in the event of ISL mining at Section 8 is his experience in the ISL industry. There is nothing presented, however, that indicates the quality of his work in that industry; he may have more than 20 years of experience doing poor quality work. Moreover, mere length of experience without anything more does not necessarily mean that an individual is well qualified. Virtually all sectors of the economy include many individuals who have long careers but who are not well qualified to be doing their jobs.

As with its Response to Question 1, HRI's Response to Question 2 relies upon the unsworn allegations of its counsel and the affidavit of Mr. Bartels. Here, HRI's counsel presents conclusory statements such as:

> The detailed mine unit level data reflect the extent of confinement and confirms that the mine zone baseline and monitor wells are functional.

and

> Data compiled by HRI to date are strong evidence that the production zone at the Churchrock Section 8 is confined and is laterally contiguous.

HRI's Response at 8, 9.

HRI's counsel have no qualifications to make these statements. In addition, HRI's witness, Mr. Bartels, is not qualified to address these issues. Mr. Bartels's lack of knowledge on the geology of the site is underscored by his reference to the Poison Canyon and Dakota formations as the overlying layers at Church Rock. ~~As Dr. Lucas has pointed out, this is a "remarkable error" because~~ the Poison Canyon is in fact the designation of an ore horizon in the Ambrosia Lake/Laguna region of New Mexico. The overlying layers at Church Rock are the Dakota and the Brushy Basin B sand. ~~Lucas Response Testimony at 3-4.~~

HRI's answer to Question 3 also is based on the unsworn and unqualified assertions of its counsel, the unqualified opinion of Mr. Bartels, and the assertion that because the License requires remediation there can be no impact from the proposed mining on ground water. None of these provides an adequate basis for an answer to the Question.

Finally, in response to Question 8, HRI's counsel purports to interpret the Cowan study. Counsel asserts that the study shows that the Westwater Canyon Member consists of coalesced sandstone sheets that preclude confined elongated channels; counsel also criticizes the Cowan study because of the amount of the Westwater geology that it examined. HRI's Response at 41. ~~Dr. Lucas, who is a very well qualified expert in geology, has testified that HRI's reading of the Cowan study is~~

~~incorrect. Lucas Response Testimony at 5. He also has stated that HRI's criticism of the study is without basis, and that the method used by the study is "standard sedimentological procedure." Lucas Response Testimony at 7. As Dr. Lucas pointed out: "Any competent geologist would readily extend Cowan's conclusions into the Church Rock area, given the vast scale of the Westwater Canyon Member river system." *Id.* The reason that did not occur to HRI is that its counsel are not geologists.~~

B. The Staff's witness, Robert Carlson, is not qualified to respond to Questions 4 through 7.

The Staff has presented an affidavit by Robert Carlson in which he addresses Questions 4 through 7, even though he has no qualifications to do so. Mr. Carlson is an Engineer with experience in project and systems engineering as well as operations, personnel, and project management. Carlson Resume (Attachment 1 to his Affidavit, Exhibit 3 to the Staff's February 20, 1998 Response to Motion for Stay, Request for Prior Hearing, and Request for Tempora.y Stay). There is nothing in Mr. Carlson's education, training, or background to qualify him to give opinions on issues of economics, environmental justice, financial and tax considerations, or treatment of alternatives in the Final Environmental Impact Statement.[3] Yet he does just that.

[3] NUREG-1508, Final Environmental Impact Statement to Construct and Operate the Crownpoint Uranium Solution Mining Project, Crownpoint, New Mexico (February, 1997) ("FEIS") (ACN 9703200270).

For example, Mr. Carlson asserts that there are several steps involved in an analysis of Question 4, which deals with issues of economics. Carlson Affidavit at 2-3. In response to that Question, he also makes assertions such as:

> The most important local benefit would be opportunities for employment and earnings.

and concludes that:

> The potential costs of the proposed project to the local communities would not change from those discussed in the FEIS (Section 5.2) regardless of the price of U3O8.

Carlson Affidavit at 4-5.

Similarly, in response to Question 5, Mr. Carlson makes assertions about environmental justice, local governmental needs and services, traffic, and socioeconomic impacts of the CUP. Carlson Affidavit at 6-9. He also quotes the FEIS concerning the implications of application of a tax on the proposed mining project by the Navajo Nation (Question 6), without having the qualifications to validate the opinions expressed there. Finally, in response to Question 7, Mr. Carlson purports to evaluate the advantages and disadvantages of different alternatives examined in the FEIS on the basis of issues such as environmental protection, costs, socioeconomics, environmental justice, and cultural resources. There is no indication anywhere in the record that Mr. Carlson has the qualifications to address any of these issues.

II. THE PRESIDING OFFICER'S REQUEST FOR INFORMATION IN THE APRIL 21 ORDER'S QUESTIONS DEMONSTRATES THAT THE FEIS DOES NOT COMPLY WITH NEPA.

The issues covered by Questions 1-8 should have been covered in the FEIS. As is indicated in the testimony of Drs. Abitz, ~~Lucas,~~ and Sheehan and Mr. Wallace, these issues are not covered. For example, there is no discussion of the restoration difficulties that are likely to occur at Section 8 or of the environmental costs that probably will arise if there is mining there. There also is no information in the FEIS about the effects of Section 8 mining on the nearest well; in fact the FEIS does not even identify the nearest well. The FEIS also omits any calculation of the environmental and other costs of excursions during operations and restoration. Similarly, the FEIS fails to present adequate analyses of the issues covered by the April 21 Order's Questions relating to economics, environmental justice, comparison of alternatives, and geology.

These are all critical issues that must be examined, and NEPA requires that the examination be set forth in the FEIS. National Wildlife Federation v. Marsh, 568 F.Supp. 985, 996-997 (D.C. Cir. 1983) (holding that "the cost-benefit analysis and the analysis of alternatives must be contained within the environmental impact statement standing alone, and not as complemented by the administrative record.") The Presiding Officer's Questions indicate that the FEIS is deficient, and the provision of the information sought in the April 21 Order confirms that the FEIS does not comply with NEPA.

III. RESPONSES TO QUESTIONS 1-8.

Question 1.

1. Based on the experience of Uranium Resources, Inc. (URI) and of the *in situ* leach mining (ISL) industry generally, as well as the laboratory work reported in the Final Environmental Impact Statement, NUREG-1508, February 1997, Tables 4.8 and 4.9 at pp. 4-32, 33, what *important* difficulties (including unlikely but foreseeable difficulties) may reasonably be considered for the Crownpoint Uranium Project (CUP) concerning restoration of groundwater quality at Churchrock Section 8? What environmental costs may reasonably be expected to result from foreseeable difficulties?[4]

Response 1.

A. The Responses presented by HRI and the Staff are not persuasive.

1. HRI does not have an aquifer designation under the Safe Drinking Water Act.

Once again, HRI asserts that it has a valid temporary aquifer designation under the Safe Drinking Water Act ("SDWA") for Section 8, and therefore the use of groundwater at Section 8 is restricted to uranium mining. HRI Response at 2 and note 1. This assertion is patently wrong because first, HRI does not have an aquifer exemption from EPA and second, it is unlikely that it would be able to obtain one for Section 8.

HRI argues that future use of Section 8 for drinking water is restricted by naturally occurring radionuclides and "[t]his restriction on use of groundwater from Section 8 is assured by the aquifer exemption for Section 8 previously granted by EPA." HRI Response at 2. HRI, as Intervenors have previously pointed out, does not have an "aquifer exemption previously granted by EPA." Intervenors' Groundwater

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[4] The Presiding Officer acknowledges the information contained in the Affidavit of Mark S. Pelizza Pertaining to Water Quality Issues, at 60-78. None of the issues addressed in that affidavit are a part of this question, which is concerned about estimating the *a priori* risk that baseline values will not be restored.

Presentation at 59-65; ENDAUM'S and SRIC'S Motion for Leave to Submit Reply Brief And Rebuttal Testimony In Response to HRI's Response Presentation on Groundwater Protection Issues at 6 (March 5, 1999). At one time the state of New Mexico issued a temporary aquifer designation, which was approved by EPA Region 6. EPA Region 9 has since determined that it has regulatory jurisdiction over Section 8 under the SDWA, on behalf of the Navajo Nation, and not the state of New Mexico. *See* Intervenors' Groundwater Presentation, Exhibit 8. HRI has therefore, misrepresented that it has a valid aquifer exemption for Section 8, when in fact the State of New Mexico did not have jurisdiction to issue the exemption in the first place, and HRI must instead comply with EPA's federal Navajo UIC program.

HRI refers to the EPA's aquifer exemption regulations as if application and approval with EPA is not required. It is, however, within EPA Region IX's discretion to grant an application for an aquifer exemption. 40 C.F.R. § 146.7. Since the uranium market is so low as to prevent HRI from initiating the CUP (See Response to Question 4), there is no guarantee that the Church Rock groundwater will not be further developed as a drinking water resource before HRI could attempt its project. More importantly, Church Rock qualifies as an "underground source of drinking water," which is a term of art under the SDWA and its implementing regulations. Intervenors' Groundwater Presentation at 59-65. Section 8 cannot qualify for an aquifer exemption because it currently serves a domestic water supply well, can potentially serve a public water supply system, the water is of good quality, and the TDS content is under 3,000 mg/l. *Id.* at 63-65.

2. HRI and the Staff's Responses as to restoration difficulties are not persuasive.

Both HRI and the Staff take the positions that there will be no difficulties in restoration at Section 8 and that even if there are there will be no environmental costs. This incorrect approach is based on a lack of understanding about the conditions in which mining would occur, and an unrealistic view that since the FEIS and the License prohibit excursions they necessarily will not occur.

As Dr. Richard J. Abitz[5] has pointed out, both HRI and the Staff's hydrologist, William Ford, assert incorrectly that the ground water at Section 8 cannot be used for drinking water because of naturally occurring concentrations of radionuclides. Abitz Response Testimony at 5; HRI's Response at 2, n.1; Ford Affidavit (Staff's Response Exhibit 1) at 2. In fact, as Dr. Abitz has explained, that assertion is based on HRI's improper calculations of baseline, in which HRI has included in their figures the elevated levels of uranium and radium in the oxidized water surrounding the Old Church Rock mine. Abitz Response Testimony at 6-8. Moreover, he has explained the ground water in well CR-4 does meet all EPA standards, and the water in well CR-5 meets almost all of those standards. *Id.*

~~HRI and Ford also argue incorrectly that the studies of Deutsh support their assertion that uranium and other elements will not migrate outside the well field area. HRI's Response at 18; Ford Affidavit at 6-7. As Dr. Abitz has pointed out, HRI and Ford have read the pertinent language in the Deutsh study without the operative word~~

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[5] Dr. Abitz's qualifications are set forth at page 13 below.

~~"should"; they also have produced no information on reaction kinetics to support their speculation that uranium and other redox sensitive elements such as arsenic and selenium will decrease in the ground water as it leaves the ore zone. Abitz Response Testimony at 8-9.~~

Mr. Ford also has contradicted himself concerning the likelihood of successful restoration at Section 8. In paragraph 4 on page 2 of his affidavit, he states that it is "extremely likely" that ground water quality will be restored to acceptable levels, but in the next paragraph he concedes that "it is unlikely" that restoration will be achieved for all ground water parameters. Ford Affidavit at 2.

HRI, for its part, simply ignores the unfavorable data in FEIS Tables 4-8 and 4-9. HRI cites a Staff conclusion in the FEIS for authority that at most 9 pore volumes will be required for restoration. HRI's Response at 6. HRI does not address the information in Tables 4-8 and 4-9 showing that uranium and radium levels were not returned to baseline values even after 16, 16.7, 20, and 28 pore volumes in both bench-scale tests and at the Mobil Section 9 pilot site. Abitz Response Testimony at 9-10.

Finally, neither HRI nor the Staff addresses the environmental costs that would result from restoration difficulties at Section 8. Dr. Ford asserts that there is only a low likelihood that any such costs will result. Ford Affidavit at 15. HRI argues that because restoration is required, no environmental costs will arise. HRI's Response at 4-6. Neither of these approaches is realistic.

A requirement that restoration take place does not guarantee that it will be successful, or that environmental costs will not arise during operations or during

restoration. Nor do monitoring and surety requirements insure that there will be no environmental costs; detection and confirmation of an excursion may take as long as 60-70 days during which time significant amounts of water may become contaminated. Finally, if any of the restoration involves consumptive use of water, that water will no longer be available. The argument that costs cannot arise because the License and the FEIS prohibit them from arising simply ignores what may happen on the ground.

B. There will be important difficulties concerning restoration of ground water at Church Rock Section 8.

The difficulties that will arise in efforts to restore the ground water at Section 8 are set forth in the testimony provided in attached Exhibits 1-3 by Dr. Abitz, Michael G. Wallace, ~~and Spencer G. Lucas.~~ Each of these witnesses is very well qualified to address the issues posed by Question 1. Dr. Abitz is a qualified expert in geology and geochemistry, who is currently serving as a technical expert to the United States Department of Energy Fernald Environmental Management Project.[6] Michael Wallace is an expert hydrologist.[7] ~~Dr. Lucas, who has a Ph.D. in geology from Yale University, is both the Curator of Paleontology and Geology at the New Mexico Museum of Natural History and an Adjunct Professor of Geology at the University of New Mexico. He has extensive knowledge of the geology of the Crownpoint and~~

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[6] Dr. Abitz's qualifications are set forth in detail in his testimony that was filed as Exhibit A to his testimony filed as Exhibit 1 to Intervenors' January 18, 1999 Amended Written Presentation in Opposition to Hydro Resources, Inc.'s Application for a Materials License with Respect to: Groundwater Protection Ground Water Brief Testimony ("ENDAUM's and SRIC's Amended Ground Water Brief").

[7] Mr. Wallace's qualifications are explained in his resume, Exhibit A to his testimony submitted as Exhibit 3 to Intervenors' Amended Ground Water Brief.

~~Church Rock area in which HRI proposes to conduct the CUP. He has conducted major studies and published several dozen articles on Jurassic strata in New Mexico; these studies and his qualifications are set forth in his testimony (Exhibit 3), his resume (Exhibit 3A), and his publications (Exhibit 3B).~~

1. The experience of the *in situ* leach mining industry generally indicates the problems that will occur at Section 8.

As Dr. Abitz has pointed out, problems with restoration of ground water have occurred in several other locations where *in situ* leach (ISL) mining has been conducted. The ISL industry has not been successful in restoring uranium and radium ground water quality in New Mexico, Texas, or Wyoming. Abitz Response Testimony at 5. The restoration efforts at an ISL test field at the Teton project did not achieve baseline values for selenium, radium, or uranium. Restoration of ore-zone ground water to either baseline or drinking water standards has not been demonstrated in either core leach tests or the Teton test pilot effort west of Church Rock. *Id.* Similarly, baseline values were not achieved for radium, selenium, or uranium concentrations at ISL operations in Wyoming even though more than 20 pore volumes were used to flush the mined ore zones at those operations. *Id.* In Texas, 25 pore volumes used in a reverse-osmosis circuit failed to achieve restoration limits for ammonium, sulfate, and uranium concentrations set by the Texas Department of Health. Abitz Response Testimony at 5-6.

Finally, these experiences in New Mexico, Texas, and Wyoming are not isolated instances. As Dr. Abitz has pointed out, in Wyoming ground water that has been affected by commercial ISL operations has *never* been restored either to baseline

levels or to U.S. Environmental Protection Agency ("EPA") drinking water standards. *Id.*

2. The conditions at Church Rock Section 8 will cause important restoration difficulties.

Dr. Abitz also has explained that the conditions that exist at Church Rock Section 8 will cause important restoration difficulties. His conclusions are confirmed by the testimonies of Michael Wallace ~~and Dr. Spencer Lucas~~.

As Dr. Abitz has testified, the ground water in the Westwater Canyon formation is largely within non-ore zones, where the quality of the water ranges from very good to excellent and meets all EPA drinking water standards. Abitz Response Testimony at 5. Moreover, the ground water in the ore zone at Section 8 meets primary EPA drinking water standards at well CR-4, and almost meets those standards at well CR-5. Abitz Response Testimony at 7. In addition, most of the water at Section 8 is not within the ore zones and currently meets EPA standards. A specific example of this is the water at well CR-7. *Id.*

Dr. Abitz has explained that the poor water quality that is referred to by HRI and the Staff is not accurate; it is the result of the statistical bias caused by the introduction into the water quality calculations (for wells such as CR-8) of the elevated levels of uranium and radium in the oxidized water around the old Church Rock mine. Abitz Response Testimony at 8. As Dr. Abitz has pointed out, HRI's baseline water quality calculations are not correct, and the Section 8 water quality generally cannot be considered to be poor simply because the water in isolated ore zones occasionally exceeds EPA primary drinking water standards for uranium and radium.

The ground water that will be affected at Section 8 therefore is not poor quality, as HRI has alleged. Moreover, the geologic conditions there will make restoration difficult. ~~Dr. Lucas and~~ Mr. Wallace have pointed out that the Recapture Shale at Section 8 is not a confining layer. ~~Lucas Response Testimony at 3-4;~~ Wallace Response Testimony at 18-19. ~~Dr. Lucas has explained specifically that the rock section immediately beneath the Westwater Canyon Member is not shale at all; it is a mixture of sandstone, siltstone, and gypsum beds that overlie the gypsum beds of the upper Toldito Formation. Lucas Response Testimony at 3.~~

~~Dr. Lucas has further testified that because these gypsum beds are very ductile and soluble, they are easily deformed or dissolved, and that this produces numerous fractures in the surface and the subsurface. *Id.* He has stated as well that these numerous fractures are conduits for ground water flow (*Id.*), and that the Cowan study provided in response to Question 8 confirms the lithologic heterogeneity of the Westwater Canyon Member at the scale of the small channels and the continuity of long, nearly linear channel belts. Lucas Response Testimony at 4-7. Dr. Lucas's conclusion is that there are at least three levels of permeability/porosity in the Westwater Canyon Member, and that in the presence of those levels the small channel effects that exist greatly complicate the ground water flow in the larger channels. Lucas Response Testimony at 6.~~

Mr. Wallace has also testified that the old mine workings at Section 17 will complicate restoration, and that any vertical excursions and excursions caused by leaky aquifers, such as those that have occurred at other ISL operations, will cause problems

for restoration. Wallace Response Testimony at 27. As Dr. Abitz has pointed out, excursions will be a particular problem because of the high concentrations of radium, arsenic, and uranium in the pregnant lixiviant. Abitz Response Testimony at 4; FEIS, Table 4-8 at 4-32.

The other restoration difficulty that will be presented in Section 8 is that excursions are likely not to be detected. As Dr. Abitz has testified, the ground water in the Westwater Canyon is largely within non-ore zones, where the water quality is very good and meets all EPA standards for drinking water. The combination of high concentrations of arsenic, radium, and uranium in the pregnant lixiviant, complex channels in the Westwater sheet sands, and low density of down gradient monitoring wells make it probable that there will be excursions that are not detected by the monitoring wells. Abitz Response Testimony at 4-5. Restoration efforts in the ore zones therefore will not even address excursions into non-ore zones. *Id.*

~~**C. The environmental costs of restoration difficulties will be significant.**~~

~~The only effort to quantify the cost of the problems that will occur at Section 8 is presented by Mr. Wallace in his affidavit. As he has explained, he prepared a model that quantified the volume of ground water that could be expected to be contaminated by the end of restoration. The results of the model are set forth in Exhibits 2F through 2I; he estimates a problem zone of degraded ground water 12,000 feet long, 700 feet wide, and 200 feet thick. That is equivalent to 336 million cubic feet, or 7,713 acre feet of water. Wallace Response Testimony at 28. The value of water rights in an area for similar use for water that is potable but not currently being used for drinking water~~

~~is between $3,000 and $4,000 per acre foot. Using an average of $3,500 per acre foot, the contaminated ground water would entail an environmental cost of almost 27 million dollars. *Id.*~~

Question 2.

2. Based on local geology, what assurance is there concerning the likelihood of the existence of shears, fractures, and joints that could transmit appreciable quantities of water above or below the Westwater aquifer?[8] How much greater assurance may reasonably be anticipated prior to commencing ISL operations at Churchrock Section 8? What environmental costs may reasonably be expected to result from foreseeable difficulties at Churchrock Section 8?

Response 2.

A. HRI's and the Staff's assertions concerning shears, fractures, and joints and resulting environmental costs are not accurate.

Both HRI and the Staff deny the existence of shears, fractures, and joints in the Church Rock geology, and both also assert that no environmental costs can result because the License and FEIS provide measures that must be taken in the event of excursions. These arguments are neither sound nor presented for HRI by anyone with appropriate qualifications to address the issues.

HRI relies on the FEIS and on its "geologic cross sections" to argue that there are not shears, fractures, or joints at the Church Rock site. HRI's Response at 6-9. Speaking for the Staff, Mr. Ford argues that there is little likelihood that vertical excursions will occur because of the "projected thickness and rock type of the overlying

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[8] *See* Affidavit of Frank Lee Lichnovsky, February 19, 1999 at 24-25, commenting on the absence of faults and mentioning a "pump test" but not assessing the extent of the risk that could occur through undetected sheers, fractures, or joints.

confining rock units at the site." The fallacy in these arguments is that there are not confining rock units at the site.

As ~~Dr. Lucas and~~ Mr. Wallace have both testified, the Recapture Shale is not a confining unit and in fact has numerous fractures that are conduits for ground water flow. ~~Lucas Response Testimony at 3, 4;~~ Wallace Response Testimony at 18-19. ~~More specifically, Dr. Lucas has explained specifically that the gypsum beds immediately beneath the Westwater Canyon Member are easily deformed or dissolved, and that this produces numerous fractures in the surface and the subsurface. *Id.* He has stated as well that these numerous fractures are conduits for ground water flow (*id.*), and that the Cowan study provided in response to Question 8 confirms the lithologic heterogeneity of the Westwater Canyon Member at the scale of the small channels and the continuity of long, nearly linear channel belts. Lucas Response Testimony at 4-7.~~

Mr. Wallace has reiterated his earlier testimony (Wallace Ground Water Brief Testimony) that it is quite likely that there are shears, fractures, and joints in the Church Rock site. Wallace Response Testimony at 17. He also has pointed out that vertical fault planes are common in the San Juan Basin, and that a fault of 70 feet or so could bring the Westwater directly into contact with the overlying Dakota. *Id.* Moreover, as he has testified earlier, the Recapture Shale which the Staff and HRI allege to be the confining unit, may not even exist at Section 8. *Id.*

Finally, Mr. Wallace also has pointed out that HRI's reliance on geologic cross sections is misplaced. Those cross sections are constructed by *artificially* shifting geologic units to create a horizontal top; they therefore cannot provide accurate

information on displacement of geologic features. Wallace Response Testimony at 23. Despite that, despite repeated assertions by Mr. Wallace that structural cross sections should be prepared because they will show faults, and despite HRI's possession of the requisite data to prepare structural cross sections, HRI has refused to prepare them. *Id.*

HRI's and the Staff's assertions concerning additional assurances that may reasonably be anticipated prior to mining at Section 8 are similarly unreliable. HRI claims that it will conduct pump tests, but Mr. Wallace has pointed out that HRI does not know how to conduct pump tests properly and that HRI's sister corporation, URI, ignored pump test data when that showed that a well field should not be developed. Wallace Response Testimony at 21-22.

HRI and the Staff also rely upon monitoring and surety updates. HRI's Response at 16; Bartels's Affidavit at 15; Ford Affidavit at 17-20. As Mr. Wallace has testified, however, neither monitoring nor updates of the surety will reduce the likelihood of excursions. Wallace Response Testimony at 24. Although the immediate detection of an excursion might mitigate resulting environmental damage, the monitoring well plan for Section 8 does not assure that excursions will be detected promptly. Wallace Response Testimony at 24-25. There is no requirement of monitoring in the Cow Springs aquifer, which is the aquifer most likely to be in communication with the Westwater. *Id.* In addition, the spacing of the monitoring wells that are required for the overlying units is over either 4 or 8 acres; by the time that excursions are finally detected and confirmed under this scheme, vast areas of overlying or underlying units could be affected. *Id.* This latter point was also spoken

to by Dr. Abitz, who pointed out that the low density of down gradient monitoring wells makes highly probably undetected excursions outside the ore zone. Abitz Response Testimony at 4-5.

B. Significant environmental costs may be expected from the difficulties that will be encountered at Section 8.

Neither HRI nor the Staff addresses the environmental costs that may arise from difficulties at Section 8; rather they assert that there will be no such costs because the conditions in the License are supposed to prevent them from occurring. *See, e.g.* HRI's Response at 15-16; Ford Affidavit at 20. This head in the sand approach is not appropriate. As Mr. Wallace has testified, it is foreseeable that HRI would need to create a cone of depression in order to contain an excursion. Wallace Response Testimony at 25. Depending upon the number and size of excursions that develop, it also is possible that HRI would need to increase its consumptive use of water, which would be an environmental cost, particularly because of the limited ground water resources in the San Juan Basin. *Id.* Finally, if an excursion is not remediated, there would be contamination of ground water, which is another cost. *Id.*

Use of additional water and contamination of ground water resources would both have high environmental costs. ~~As Mr. Wallace testified, ground water is scarce in the San Juan Basin, and he has pointed out that the value of water in the Section 8 area is about $3,000 to $4,000 per acre foot. Wallace Response Testimony at 28. The monetary costs therefore could be very high; the contamination of usable water in an arid region such as the San Juan Basin is a much more significant loss.~~

Question 3.

3. Qualitatively and, if possible, quantitatively, what are the effects on the quality of water that may reasonably be foreseen at the closest private water wells to Churchrock Section 8, resulting from the poorest foreseeable condition of groundwater after restoration is completed?

Response 3.

A. Neither HRI nor the Staff addresses accurately the reasonably foreseeable qualitative impacts on water quality in the nearest private well to Section 8 that would result from the poorest foreseeable condition of water after restoration.

The Staff's answer to this Question is not responsive. The Staff identifies the nearest well as being a private well to the south, and concludes that the proposed mining cannot possibly have any impacts on the well. Ford Affidavit at 20. The Staff never addresses impacts that might result from the proposed mining to the nearest well that could be affected.

Dr. Abitz has testified that HRI's response to this Question does not address the issue with respect to the "*poorest* foreseeable condition of ground water after restoration is complete." Abitz Response Testimony at 10-11. As Dr. Abitz stated, the poorest foreseeable condition of the water is likely to be the restored concentrations reported in Table 4.8 of the FEIS (*id.*), not the return to baseline asserted by Mr. Bartels. Bartels Affidavit at 16. ~~He has also pointed out that the combination of the poor water quality listed in that Table, the reasonable interpretation of the fabric of the Westwater sandstones, and future wells in Sections 8 and 9, that the travel time of ground water is likely to be much faster than the 8.7 feet per year asserted by HRI. Abitz Response Testimony at 11-12.~~

B. Neither the Staff nor HRI has addressed the qualitative impacts on the nearest well.

There is no mention in the Responses filed by HRI or the Staff of any quantitative analysis on impacts on the quality of water in the nearest well or even of any effort to make such an analysis. The only such analysis that has been performed is presented in Mr. Wallace's Response Testimony.

Using standard industry practices, Mr. Wallace conducted a modeling analysis of the quantitative impact that the Section 8 mine would have on the ground water at the well at the United Nuclear Corporation mill site about 2.5 miles northeast of Section 8. Wallace Response Testimony at 4-6. The model simulated the migration of a plume of contaminants from the mine to the well over a period of 274 years, and Mr. Wallace verified the values that he used in the model by comparing the model's predictions to actual water levels in three Section 8 monitor wells.[9] Wallace Response Testimony at 5-11.

In contrast to the vague assurance by Mr. Bartels that it would take 1,632 years for contaminants to reach the United Nuclear well, Mr. Wallace's model demonstrates that concentrations exceeding 0.17 mg/l would reach the well within 200 years. Wallace Response Testimony at 15. The model also demonstrates that uranium concentrations exceeding the NRC restoration standard of 0.44 mg/l would exist only a short distance from the proposed mining within a few years after restoration is

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[9] Mr. Wallace also pointed out that the results that follow from HRI's assumption that the Westwater is a homogeneous perfectly confined and infinitely wide aquifer do not match the actual water well levels. Wallace Response Testimony at 7-9.

complete. *Id.* Moreover, Mr. Wallace has testified that his model takes into account only one contaminant and does not account for the possible future drilling of a well closer to the Section 8 mining site. *Id.*

Mr. Wallace's model is the only quantitative analysis of the impacts of Section 8 mining on the nearest well. It is persuasive and uncontradicted, and is an analysis, unlike Mr. Bartels's vague estimate and HRI's and the Staff's assurance that there can be no impact on the nearest well because the FEIS and License are supposed to prevent such impacts. And Mr. Wallace's model shows that impacts will occur.

Question 4.

4. What are the adjusted benefits of the CUP, as stated in the FEIS, for one or two prices of yellowcake that are at or above the minimum price at which HRI would commence work on this project? (This is important because the price of uranium fluctuates and a reasonable cost/benefit picture requires an assessment of benefits at more than one arbitrary price.)

Response 4.

Question 4 must be addressed in two parts. First, what is the minimum price at which HRI would commence work on the Crownpoint Project? Second, assuming prices that are at or above the minimum price, what are the adjusted benefits of the project? The first question must be answered before going on to the second question, because there will be neither costs nor benefits if HRI never enters the market place. Neither HRI nor the Staff provides an answer to the first question. Moreover, the figures they provide for a "break even" or "minimum" uranium price have no basis in reality. Thus, they provide no foundation for the analysis of benefits provided in answer to the second question. As a result, HRI's and the Staff's discussions of the

second question, i.e., what are the benefits of the Crownpoint Project, amount to baseless illusions.

A. Failure to address minimum cost at which HRI would enter market.

Neither HRI's nor the Staff's responses identifies the minimum price at which HRI would commence work on the Crownpoint Project. HRI does not address the question at all, and the NRC admits that it simply does not know. Carlson Affidavit at 2. HRI identifies a "break even" price for the uranium of $15.70, which happens to coincide with the October 1966 spot market price identified in Table 5.1 of the FEIS. The Staff uses the FEIS to determine a range of production costs of $9 to 12 per pound, and adopts those costs as the "minimum" price that HRI would charge for its uranium. Carlson Affidavit at 2. As discussed in the attached Testimony of Michael F. Sheehan, Ph.D., neither of these responses addresses the question of what price would induce HRI to enter the market. It is extremely unlikely that HRI would enter the market if all it could do was recover its costs. Thus, HRI's and the Staff's failure to address the issue of what price would induce HRI to enter the market leaves unanswered the fundamental question of whether it is likely that HRI will ever undertaken the activities that it asserts will produce economic benefits for the local community.

B. Flawed analyses of minimum or break-even prices of uranium.

In order to provide a basis for a cost-benefit analysis, HRI and the Staff come up with a "break even" or "minimum" price of uranium, which they assert is conservative for purposes of evaluating costs and benefits. As discussed above, these

figures are insufficient to answer the Presiding Officer's question of what price would induce HRI to actually begin operation at Crownpoint. Moreover, the figures are not grounded in reality.

HRI identifies a "break even" uranium price by comparing the October 1996 spot market price of $15.70 per pound (reported in the FEIS at Table 5.2) to Section 8 production costs of $14.50 per pound, and declares that the "FEIS spot price of 15.70 $/lb would allow a reasonable overhead contingency of 8.2% and makes suitable break even production cost for the cost/benefit analysis." HRI's Response at 19. Having identified its "breakeven production cost," HRI then describes the $15.70 per pound figure from the FEIS as "the breakeven price."

The Staff identifies a "minimum" uranium price by essentially adopting the range of production costs set forth in the FEIS at Table 5.1:

> FEIS Table 5-1 indicates that HRI's production costs would vary from $9.38 to $11.83 per pound . . . . Thus, a conservative estimate of benefits would be to assume prices of $9 and $12 per pound.

Carlson Affidavit at 2. The Staff uses these "minimum prices" together with the roughly identical cost figures to arrive at local economic benefits.

As discussed by Dr. Sheehan, the problem with HRI's use of the $15.70 price is that it has no relationship with real-world market conditions. It is highly unlikely that uranium spot market prices will rise even close to this "break even" level in the foreseeable future. As Dr. Sheehan observes, the $15.70 per pound price is not only significantly above the current spot market price of $10.65 (CIS $8.50), but it is

significantly higher than the trend of future spot market prices predicted in Table 5.2 of the FEIS.

Moreover, these prices are unlikely to change significantly any time soon. As acknowledged in the UR 10-Q SEC filing for the Third Quarter of 1998:

> The market price of uranium has fallen to levels that are currently below the Company's cost of uranium production. The outlook for uranium prices through the end of 1999 indicates that a price rebound during this period is not likely."

URI, 10-Q SEC filing, Third Quarter 1998, p.9 attached as Exhibit BB to Testimony of David Osterberg (January 7, 1999).

Even more recently, URI reported that:

> The volatility of the uranium market saw spot prices that ranged from $12.00 per pound in January (1998) to lows at year-end of $8.75. The steady decline during the year, which was attributed primarily to low utility demand, has begun to firm somewhat to the current (March 1999), but remains below the level needed by the Company to obtain the necessary financing to allow development of new production areas at its Kingsville Dome and Vasquez sites.

URI's 1998 10-K at 5 (March 31, 1999). In sum, HRI has no basis for believing that it could command a price of $15.70 for its uranium.

Like HRI, the Staff takes the flawed approach of basing the minimum price of uranium on the cost of production. The Staff diverges from HRI's approach in that instead of overestimating the price HRI can get for uranium in the market, the Staff underestimates the cost of uranium production. Based on the FEIS, the Staff asserts that the fixed cost of uranium production is about $9 to $12 per pound, and then asserts that this is also the minimum price for HRI's uranium. As discussed in ENDAUM's and SRIC's February 19 presentation and in the February 11 Testimony of Dr.

Sheehan, the FEIS significantly underestimates HRI's cost of producing uranium. This is borne out by HRI's Response, which now estimates the cost of uranium production for Section 8 at $14.50 per pound, which is significantly above the approximately $9 to $12 range estimated in the FEIS.

Although the Staff's methodology is flawed, nevertheless, the $9 to $12/lb range arrived at by the Staff is within the range of spot market prices reported in the FEIS and that can reasonably be predicted for the next several years. Therefore, it is a much more realistic figure to use in evaluating the costs and benefits of the CUP. As discussed in Dr. Sheehan's testimony, an estimate for price in the $10 to $11 range over the near term appears to have a reasonable empirical foundation and to be within the range mentioned by the Staff in the FEIS.

HRI and the Staff both fail to address the fundamentally important point that if market prices are significantly below the cost of production, HRI is unlikely to operate the Crownpoint Project, and that therefore the benefits of the project are illusory. As the Staff observes:

> The important point relevant to assessing the project's potential benefits to the local community is that the benefits depend on HRI's costs being lower than the future price of U3O8, which has been quite volatile. If the price of U3O8 is less than the cost of operation, then operations may be discontinued. <u>If this happens, there will be no economic benefits to the local community.</u>

Carlson Affidavit at 2 (emphasis added). Given the flawed basis for HRI's and the Staff's "break even" and "minimal" uranium prices, any projection of benefits from those prices amounts to pure fiction.

C. Even Assuming That HRI Could Enter the Market and Sell Its Uranium at $15.70 per pound, HRI's and the Staff's Analysis of Benefits Is Inadequate, and Ignores Significant Costs.

1. HRI and the Staff ignore significant costs.

Even assuming that HRI were able to enter the market at $15.70 per pound, commencement of production at the Crownpoint Project under marginal economic conditions would create significant risks not addressed by either HRI or the Staff. As Dr. Sheehan points out, the $15.70 figure is a "spot" market price, and spot market prices vary greatly over time. Since HRI is in poor financial condition, it needs net revenues from sales to continue to build and operate its operations safely. Anything that imperils this cash flow increases environmental risk. A financially troubled company will hesitate to take the necessary measures to protect the environment if such a course would put the company in greater financial peril. The NRC has recognized this problem (as have all regulators of operations involving hazardous materials):

> [A] licensee in financially straitened circumstances would be under more pressure to commit safety violations or take safety 'shortcuts' than one in good financial shape.

Gulf States Utilities Co. (River Bend Station, Unit 1), 41 NRC 460, 473 (1995).

As discussed in Dr. Sheehan's testimony, HRI's parent, URI, is already cutting costs at its Texas operation due to falling uranium prices. HRI itself is in serious financial straits. If HRI commences operation at the Crownpoint Project, it will incur the need to take environmental and safety measures required in its license that it will not be able to afford if the market takes a downturn. Once the injection of lixiviant and

the inception of other parts of the operation with substantial environmental consequences begins, the inability to maintain consistent financing will pose a significant threat to the environment.

In sum, were HRI to begin development and production based on a spot price of $15.70 if the price were to fall again, HRI would be caught in a situation where it its poor financial condition might well result in a substantial increase in environmental risk to the community.

2. No Discussion of Primary Benefits.

It is significant that HRI and the Staff address only the secondary economic benefits of the Crownpoint Project. They are conspicuously silent on the question of whether there are any primary benefits, such as the need for the uranium. As discussed in ENDAUM's and SRIC's initial presentation on this issue, secondary benefits, standing alone, cannot be held to justify this project under NEPA. There must be some primary benefit flowing from a need for the production of uranium. As discussed at length in ENDAUM's and SRIC's presentation and the testimony of Dr. Sheehan and David Osterberg, there is no need for the uranium that would be produced by the Crownpoint Project. In fact, the Project would have a negative impact by undermining the United States' treaty with Russia to purchase Russia's bomb-grade High Enriched Uranium and blend it down for use in nuclear power plants, thereby decreasing the international weapons inventory. On this ground alone, the FEIS should be rejected as insufficient to support the issuance of the HRI license.

3. Even assuming the Crownpoint Project may confer some local economic benefits, HRI and the Staff overstate them.

Even assuming that the Crownpoint Project may confer some secondary benefits, the Staff continues to distort and overstate them. As discussed in Dr. Sheehan's attached testimony, many of the weaknesses noted in his February testimony remain. For instance, the analysis in Table 2 still assumes that there will about 100 jobs for local residents and that the jobs will pay approximately $24,000 per year. These assumptions are flawed, because (a) HRI is laying off its fully trained production work force in Texas-(why hire untrained local workers when fully trained Texas workers are available?); (b) the $24,000 wage is substantially higher than HRI is paying to its Texas workers (about $16,500 for the same job it claims it will pay $24,000 for in New Mexico)--it is anomalous that the Company would pay untrained worked substantially more than the trained work force simultaneously laid off in Texas; and (c) Given the high level of local unemployment in the project area, the company will probably be in a buyers' market and there will be no reason to pay premium wages. The Staff even admits that its numbers might be all wrong:

> The number of jobs and average salary might be lower with U3O8 prices of $9 and $12 per pound (as compared to $15.70 per pound), if HRI decides to hire fewer workers and pay less salary. The Staff has no information from HRI to make revised assumptions regarding these matters.

Carlson Affidavit at 3.

Moreover, the NRC's royalty figures of $630,000 to $840,000 depend upon production of 1 million pounds per year. Yet there is no reason to suppose that production will remain at 1 million pounds at Unit 1 when the price is assumed lower by such a large amount ($15.70 down to either $9 or $12). In addition, the

out-of-pocket cost of bringing the Church Rock property into production is well over $13 million before a single pound of uranium is produced. RAI Q.92 Response: Church Rock 1-2. Royalties to local people will only be paid after Church Rock is producing; if Church Rock does not produce there will be no royalties at Unit 1. Given the financial condition of the Company, including its plan to sharply cut back expenditures on CUP, where is the $13 million up front money to come from?

Finally, the tax amounts set forth on Staff's Tables 2 and 3 are--as the Staff notes--entirely contingent on the outcome of the jurisdictional issue of whether the mine sites are within Navajo Indian County, and therefore subject to the taxing power of the Navajo Nation. In addition, as with Royalties and employment, there is no reason to assume that at sharply lower market prices ($9 versus $15.70), output will remain at the same high level of 1 and 2 million pounds annually.

In summary, neither HRI nor the Staff has presented a reasonable basis for evaluating the costs and benefits of HRI's operation, because they have not identified realistic conditions under which HRI would enter the marketplace. In addition, they have failed to address the significant risks that would be raised by operating the facility in a marginal and highly volatile economic environment. Finally, they have not justified any primary benefits of the project. Accordingly, the FEIS should be rejected as inadequate to support the issuance of HRI's license.

Question 5.

5. Because of financial and market uncertainties, it is foreseeable that Churchrock Section 8 will be the only section developed. What are the governmental needs that arise because of the CUP? Would local governments need to make any capital expenditures that might not be recouped if the CUP suspended or terminated

mining operations without going beyond Section 8? In light of the financial situation of local governments, would environmental justice considerations require indemnification or assurances to local governments for possible losses?[10]

Response 5.

Both HRI and the Staff responded to the Presiding Officer's Question 5, but the arguments that they present are not accurate. HRI and the Staff predict that the only potentially significant public sector costs associated with the project will be those related to the license requirement for replacement of Crownpoint's water wells.[11] HRI Response at 22-23; Staff Response at 2, Carlson Affidavit at 6-8. Both parties state that HRI will bear the cost of well replacements. *Id.* HRI and the Staff argue that there are no other significant governmental costs associated with the project primarily because of the projected minimal increase in local population. HRI Response at 21; Carlson Affidavit at 6. HRI claims that if only Section 8 is developed, the economy

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[10] *See Louisiana Energy Services, L.P.* (Claiborne Enrichment Center). CLI-98-3, 47 NRC 77, 100 (1998).

[11] In its response to this question, HRI asserts that issues concerning Crownpoint's domestic water wells is "not a specific issue at this phase of the hearing." HRI's Response at 22. Intervenors disagree with this position and assert that all NEPA-related issues raised in the FEIS and implicated by the NRC Staff's licensing decision, including those affecting the Crownpoint wells, are not only ripe for determination, but must be determined at this phase of the proceeding. The Presiding Officer's Memorandum and Order (Scheduling and Partial Grant of Motion for Bifurcation) (September 22, 1998) ("September 22 Order") makes this abundantly clear. It provides in relevant part that "Intervenors may submit written presentations, within the scope of their germane concerns, with respect to **any issue that challenges the validity of the license issued to HRI** . . ." September 22 Order at 2 (emphasis added). All the NEPA-related issues which Intervenors have raised in this proceeding challenge the validity of the NRC Staff's issuance of the materials license to HRI. Either the FEIS as a whole passes muster under NEPA and the CEQ and NRC implementing regulations, or it does not, in which case the Presiding Officer must find the license invalid.

will still benefit from new business activity, although on a reduced scale. HRI Response at 23. HRI admits, however, that Section 8 property taxes will not be paid locally. *Id.* at fn. 12.

HRI argues that since there will be no costs to local government for the proposed project, there is no need for indemnification against such costs. *Id.* at 24. The Staff states that environmental justice considerations do not require "payments or assurances to local governments." Staff Response at 2. HRI relies on the affidavit of County Judge and Presiding Officer of the Commissioner's Court Edmundo B. Garcia of Duval County, Texas to show that Duval County has incurred no public sector costs associated with ten in situ leach mining operations. HRI Response at 24, Garcia Affidavit at 2. Judge Garcia also states that all of the mining companies pay county taxes. Garcia Affidavit at 2.

HRI's and the Staff's response to Question 5 repeats information contained in the FEIS regarding the lack of need for additional housing and other public infrastructure required for the project. HRI Response at 21; Staff Response, Exhibit 2 at 6. The FEIS predicts that few, if any, non-local project employees will choose to live in the Navajo communities of Church Rock and Crownpoint because of "limited housing, distance from urban services, and limited amenities." FEIS at 4-99.

HRI and the Staff's positions on these points are not correct. In fact, severe geographic and sociological inequities make the Navajo communities of Church Rock and Crownpoint more susceptible to environmental risks and therefore necessitate a

comprehensive environmental justice analysis.[12] Intervenors' Environmental Justice Brief, Vol. 1, Bullard Testimony at 11. Environmental justice guidelines stress the need for an analysis of historical and cumulative exposures to environmental and health hazards and of cultural, economic, or social factors which "amplify the natural and physical effects of proposed agency action." Council on Environmental Quality, Environmental Justice Guidance Under the National Environmental Policy Act at 8-9 (March, 1998) ("CEQ Environmental Justice Guidance"); Intervenors' Environmental Justice Brief at 9.

The FEIS instead ignores data showing that poverty, geographic isolation, poor health conditions, and ongoing radiological contamination from earlier uranium mining activities make the Church Rock community especially vulnerable to cumulative adverse environmental impacts of the project. Intervenors' Environmental Justice Brief at 2. The FEIS provides general socioeconomic information for McKinley County but fails to provide meaningful and detailed information for the communities of Church Rock and Crownpoint. *Id.* at 15. The FEIS provides health statistics for the general population served by the Navajo Area Office of the U.S. Indian Health Service but ignores specific health data available for Church Rock and Crownpoint. *Id.* at 16, 22. The FEIS fails to even provide an accurate account of the population located near the Church Rock mine site. Bullard Testimony at 24. Describing the Church Rock area, the FEIS erroneously states that there are "only a few scattered residences located

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[12] ENDAUM's and SRIC's Brief in Opposition to Hydro Resources, Inc's Application for a Materials License with Respect to Environmental Justice Issues (February 19, 1999) ("Intervenors' Environmental Justice Brief").

within 3 km (2 miles) of the site." FEIS at 3-55. In fact, there are 87 residences, representing at least 350 people, located within a 2-and-a-half mile radius of the HRI Section 8 site. Bullard Testimony at 25, Bullard Exhibit L. Finally, the FEIS fails to conduct a disparate impact analysis addressing 96 abandoned uranium mines in the Church Rock project area. Intervenors' Environmental Justice Brief at 22, Benally Exhibit P.

HRI and the Staff argue that the only impact to local governments will be the need to replace Crownpoint's domestic water wells and minimal increases in public safety and emergency services. HRI Response at 21-23; Staff Response at 2, Staff Exhibit 2 at 6-7. The FEIS does not describe whether there are any suitable locations available for new water wells that are of similar quality to current wells. Intervenors' Environmental Justice Brief at 29, 37. Instead, the FEIS proposes a groundwater restoration standard of 0.44mg/L for uranium for Crownpoint's replacement wells. FEIS Appendix B at 2, Intervenors' Environmental Justice Brief at 37. This standard is 176 times greater than the existing concentration of uranium in Crownpoint's water wells and is significantly more lax than U.S. Environmental Protection Agency water restoration standards. Bullard Testimony at 34-35. The FEIS also does not discuss the impacts of contamination of current wells or of the Navajo Tribal Utility Authority's opposition to the replacement of their water wells.

Mitigative measures such as the relocation of Crownpoint's wells and HRI's agreement to provide the Crownpoint hospital with equipment and training for uranium slurry accidents fall short of protecting public health and reducing the adverse impacts

of the mine on the environmental justice communities of Church Rock and Crownpoint. Intervenors' Environmental Justice Brief at 29-31. Environmental justice guidelines recommend "heightened agency attention" to "monitoring needs" if disparate impacts on environmental justice communities are found. CEQ Environmental Justice Guidance at 10; Bullard Testimony at 45. The FEIS does not consider this issue at all. Bullard Testimony at 45. Comprehensive health studies of Church Rock and Crownpoint residents and the clean-up of abandoned uranium mines are some of the immediate needs that exist in the proposed project area. What is conspicuously overlooked by the FEIS is whether it is acceptable to compound the environmental risk of an already disproportionately and adversely impacted minority population with additional impacts from the proposed project.

Question 6.

6. What are the financial effects of uncertainties about the application of a tax on the CUP on the Navajo Nation? In light of these uncertainties and the possibility of litigation about this tax, are the parties willing to offer to begin negotiation with relevant governments? Have negotiations begun? Are negotiations producing results?

Response 6.

NEPA requires agencies to balance a proposed project's economic benefits against its adverse environmental effects. *See, e.g.*, Calvert Cliffs' Coordinating Committee v. U. S. Atomic Energy Comm'n, 449 F.2d 1109, 1113 (D.C. Cir. 1971). NRC and CEQ regulations embody this requirement, providing that NRC Staff consider socioeconomic or "secondary" benefits in an FEIS. Louisiana Energy Services, 47 N.R.C. at 99 (citing 10 C.F.R. § 51.71 and 40 C.F.R. § 1508.8(b)). More

specifically, the regulations require the NRC Staff "to consider and weigh the environmental, technical, and other costs and benefits of a proposed action and its alternatives, and, 'to the fullest extent practicable, quantify the various factors considered.'" *Id.* at 88 (quoting 10 C.F.R. § 51.71(d)). The Staff undertook this analysis with respect to the proposed benefit that the CUP would have on Navajo Nation tax revenues in sections 4.9 (Socioeconomics) and 5 (Costs and Benefits Associated with the Proposed Project) of the FEIS, and it is that discussion that provides the proper context for an informed response to this question.

HRI and the NRC Staff have done little to actually answer question 6. HRI, in particular, never answers the questions, but rather makes a series of points seemingly calculated to confuse the Presiding Officer regarding potential tax benefits to the Navajo Nation from the CUP. However, upon careful reading, HRI's Reply actually emphasizes Intervenors' point that the potential tax benefit to the Navajo Nation is in actuality not a "significant" benefit that can be relied upon to justify the NRC Staff's recommendation of Alternative 3. *See* Final Written Presentation of Grace Sam and Marilyn Morris, February 19, 1999 (hereinafter Sam's NEPA Brief) at 24-27; ENDAUM's and SRIC's Written Presentation in Opposition to Hydro Resources, Inc.'s Application for a Material License with Respect to: NEPA Issues Concerning Project Purpose and Need, Cost/Benefit Analysis, Action Alternatives, No Action Alternative, Failure to Supplement EIS, and Lack of Mitigation, February 19, 1999 (hereinafter ENDAUM's NEPA Brief) at 43-45.

It is well-established that, in analyzing the costs and benefits of a proposed project, an FEIS must not contain misleading information on the economic benefits of a project or distorted economic assumptions that impair fair consideration of the project's adverse environmental effects. *See, e.g.*, Hughes River Watershed Conservancy v. Glickman, 81 F.3d 437, 446 (4th Cir. 1996) (EIS evaluating proposed dam construction project violated NEPA since it was based on misleading economic assumptions which impaired fair consideration of the project's adverse environmental effects). When the FEIS concludes that "[t]he potential contribution of the proposed project to the Navajo Nation would be a significant part of Navajo Nation tax revenues," FEIS at 4-103, it violates this fundamental tenet of NEPA law. HRI's Reply nevertheless urges upon the Presiding Officer the point that the potential tax benefits to the Navajo Nation from the project would be significant. HRI Reply at 24-25 (citing FEIS at 4-104).

This conclusion is erroneous and thus misrepresents any actual benefit that might inure to the Navajo Nation through the collection of taxes for two reasons: first, historical tax collection data demonstrates that the potential tax payments to the Navajo Nation from the CUP, *see* FEIS at 4-104 (Table 4.31), cannot be expected to represent a "significant part of Navajo Nation tax revenues" during the years in which HRI intends to operate the CUP; and second, the consideration of any tax benefit to the Navajo Nation from the proposed project is too speculative to even be considered a benefit in the FEIS in light of the uncertainty surrounding the Navajo Nation's taxing jurisdiction, reflected in HRI's position "that taxation over private land such as the

Churchrock Section 8 property is within the jurisdiction of [the] State of New Mexico." HRI Reply at 24.

It is projected that the Navajo Nation's General Fund gross revenues will be $104.4 million for fiscal year 1999 and $105 million per year for fiscal years 2000 and 2001. *See* Resolution of the Navajo Nation Council, Fiscal Year 1999 General Fund Revenue Projection, Exhibit "A" (attached as Exhibit 5). Total Navajo tax revenues are projected to be $26.2 million for each of these years. *Id.* In comparison, the estimated tax revenues from the CUP are relatively low, projected to be anywhere from $39,000 to $1,200,000. *See* FEIS at 4-104 (Table 4.31) (cited in HRI's Reply at 24). Thus, even in the unlikely possibility that HRI was able to produce 2 million pounds of yellowcake and the market price for yellowcake was $20 per pound, HRI's contribution would only be 4% of the Navajo Nation's total revenue from taxes and 1% of the Navajo Nation's total gross revenue. Needless to say, HRI's contribution to the Navajo Nation's revenues would not be significant. Considering that it is extremely doubtful that HRI will produce 2 million pounds of yellowcake at the market price of $20 per pound, the contribution of the CUP to Navajo tax revenues reasonably can be expected to be even more insignificant. For example, if the CUP contributed only $39,000 to Navajo Nation tax revenues in the year 2000, *see id.* (assuming production of 100,000 pounds of yellowcake at a market price of $13 per pound), the CUP would contribute only .001% of the Navajo Nation general tax revenues and .00037 % of total Navajo

Nation revenues.[13] Thus, HRI's endorsement of the FEIS's analysis of potential tax payments to the Navajo Nation from the CUP appears intended to sway the Presiding Officer into believing the Navajo Nation will see significant financial benefit from the project when in fact it will not. In truth, the potential benefits are insignificant at best and HRI has failed to provide any information in their answer that calls Intervenors' analysis of this issue into doubt.

HRI specifically fails to answer the Presiding Officer's question of whether it has begun or is willing to offer to begin negotiations with the Navajo Nation. This failure to answer can only be interpreted as an indication that HRI is not willing either to submit to the Navajo Nation's taxing jurisdiction or informally resolve this jurisdictional matter with the Navajo Nation. This interpretation is further buttressed by HRI's comments regarding taxing jurisdiction over Section 8. Despite originally touting the CUP's "significant contribution" to the tax revenue of the Navajo Nation in its reply to question 6, HRI goes on to admit that it does not believe that the Navajo Nation would see any tax revenues from Section 8. HRI Reply at 25. Such a statement provides support for Intervenors' argument that the actual tax "benefit" to the Navajo Nation is so speculative as to be no benefit at all because of HRI's likely objection to

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[13] The NRC staff submits a "conservative estimate of benefits" assuming prices of $9 and $12 per pound. Affidavit of Robert D. Carlson, ¶4 at 2. Accordingly, the Staff projects a Navajo Business Activity Tax of $540,000 annually at $9 per pound and $720,000 annually at $12 per pound. Under these projections the BAT contribution remains insignificant. At $9 per pound, the contribution to total Navajo revenue would be .005% and to Navajo tax revenues would be .02%. At $12 per pound, the contribution to total Navajo revenue would be .007% and to Navajo tax revenues would be .03%.

Navajo taxes, thus flawing the entire cost-benefit analysis in the FEIS in violation of NEPA. See Sam's NEPA brief at 26-27; ENDAUM's brief at 43-45.

HRI's assertion that Alaska v. Native Village of Venetie Tribal Gov't, 522 U.S. 520, 118 S.Ct. 948 (1998), "holds that taxation over private land such as the Church Rock Section 8 property is within the jurisdiction of the State of New Mexico" appears further calculated to muddy the waters surrounding the issue of taxing jurisdiction over the CUP. See HRI Reply at 25. This statement reveals either HRI's total lack of understanding of the relevant law or its desire to confuse the Presiding Officer into thinking he need not consider the uncertainty of these tax "benefits" in deciding issues of cost-benefit analysis in the FEIS. In truth, the question of taxing over Section 8 and all of Indian country is not nearly as simple as HRI would have the Presiding Officer believe.

First, Venetie simply does not hold that taxation over private land is within the taxing jurisdiction of the State of New Mexico. Venetie discusses the definition of "dependent Indian community" as it relates to a village in Alaska and has nothing to do with taxation over private land in New Mexico as HRI implies.

Second, even the application of the Venetie decision to Navajo Indian country in New Mexico is dubious at best. In Venetie, the Supreme Court found that all of the land owned by the Native Village of Venetie tribal government was not a dependent Indian community because it was neither set aside by the federal government nor under federal superintendence. The Court found that this land could not be set aside by the federal government because the land had been specifically revoked as a reservation

through the Alaska Native Claims Settlement Act ("ANCSA"). Even if the Native Village of Venetie repurchased in fee simple all the land which had originally comprised the reservation, the land would not be a dependent Indian community. Unlike the native villages in Alaska, Navajo Indian country has not been revoked by the ANCSA or any analogous law and none of the relevant areas in Church Rock have been repurchased by the Navajo Nation. Therefore, the application of Venetie, which deals with a uniquely Alaskan situation, is inappropriate and irrelevant to the present set of facts set in the southwestern United States.

Finally, the major effect of Venetie on Indian law was to redefine the test for determining whether an area is a "dependent Indian community" such that it meets the definition of "Indian country" in 18 U.S.C. § 1151. *See Id.*, 118 S.Ct. at 952-53. The test on which the Court settled is not a significant departure from that previously used by the majority of the courts of appeals. *See,e.g.,id.* at 952 (six-part test employed by the Ninth Circuit). Although the Venetie court found that the Alaska lands in question were not part of a dependent Indian community, and thus not Indian country, that result in no way mandates a similar finding with respect to the Church Rock Section 8 property. "The resolution of this issue involves substantial factual determinations," including a determination "of the proper community of reference for dependent Indian community analysis under [18 U.S.C.] § 1151(b)" for the Section 8 property. Pittsburgh & Midway Coal Mining Co. v. Watchman, 52 F.3d 1531, 1542-45 (10th Cir. 1995). Thus, even if the Venetie test were applied to Church Rock Section 8, it is more than likely that there would be a finding that the area is part of a

dependent Indian community in Indian country. This is one of the issues currently before the 10th Circuit Court of Appeals in the case mentioned in NRC's Reply. Affidavit of Robert D. Carlson at 9, ¶16 (referring to HRI v. USEPA, No. 97-9556 (10th Cir. petition for review filed Aug.27, 1997). However, neither the NRC Staff nor HRI mention that the basic question currently before the 10th Circuit is which government has the authority to issue **environmental permits** for operations in Church Rock, not specifically which government or governments will have taxing authority. Furthermore, the 10th Circuit case also deals with disputes involving EPA regulations and procedural rules under the Safe Drinking Water Act, the outcome of which may decide that case. Thus, even if the current 10th Circuit case is decided soon, uncertainties regarding the application of a tax on the CUP may remain an issue open to litigation.

HRI's Reply further suggests that the Presiding Officer is without authority to consider the question of Navajo Nation taxing jurisdiction on the CUP. HRI Reply at 25. Although the Presiding Officer does not have authority to decide whether the Navajo Nation has taxing authority over the CUP, he should and must consider the uncertainties of the potential tax benefit in deciding whether the cost-benefit analysis in the FEIS complies with NEPA and the applicable implementing regulations. Intervenors previously have argued that the FEIS improperly relies on erroneous assumptions to justify the proposed project, including an overstated and mistaken reliance on tax "benefits" to the Navajo Nation. Sam's NEPA Brief at 24-27; ENDAUM's NEPA Brief at 43-45. The Presiding Officer must consider the

inaccuracies of the FEIS's statements regarding Navajo tax "benefits" because, under NEPA, an FEIS must not contain misleading information on economic benefits of a project. Hughes River Watershed Conservancy v. Glickman, 81 F.3d at 446 (EIS violated NEPA since it was based on misleading economic assumptions which impaired fair consideration of the project's adverse environmental effects). As Intervenors have pointed out, this FEIS does exactly that which NEPA prohibits.

Exact quantitative financial effects of uncertainties about the application of a Navajo tax may be unknown at this time, but there are almost certain to be some. The NRC Staff is correct when it states that if Section 8 is found not to be in Navajo Indian country, the Navajo Nation will lose potential tax revenues. Affidavit of Robert D. Carlson at 9, ¶16. However, the uncertainty itself will cause the Navajo Nation to incur costs associated with pursuing litigation and any negotiations for the payment of the tax.

As pointed out above, it is unlikely that HRI will accept Navajo taxing jurisdiction or is willing to resolve the matter through negotiation. Evidence of this is found not only in HRI's assertion that the Venetie case is determinative of the issue of taxing jurisdiction over Section 8, but also in its unsupported belief that the Navajo Nation taxation requirements for properties with different ownership types may be different and that thus "this issue may involve a **good deal** of future negotiation." HRI Reply at 25 (emphasis added). In truth, the Navajo Nation does not have different requirements for different ownership types. HRI also asserts that, "[a]s discussed in the FEIS at 3-63 & 5-4, the Navajo Nation taxation requirements for each of these land

types may be different and at this time are largely unresolved." *Id.* However, the FEIS merely states that the Navajo Nation could tax off the Navajo Reservation if the production is determined to occur in Indian country. *See* FEIS at 3-63 and 5-4. There is never any mention of different taxing requirements for different ownership types. The Navajo Tax Code also offers no varying requirements based on distinctions in "ownership type." Therefore, it appears that this argument by HRI is yet another smokescreen to explain away a faulty cost-benefit analysis. Any disputes regarding Navajo Nation taxing authority can arise only from HRI itself, not the Navajo Nation.

HRI further attempts to confuse the Presiding Officer when it states that it intends to pay taxes "to the appropriate government authority with jurisdiction." HRI Reply at 26. HRI fails to mention the possibility that it may have to pay taxes to both the Navajo Nation and the State of New Mexico, thus increasing even more its motivation to elude the taxing jurisdiction of the Navajo Nation. *See* Cotton Petroleum Corp. v. New Mexico, 490 U.S. 163, 109 S.Ct. 1698 (1989) (upholding imposition of New Mexico state taxes on non-Indian lessee's oil and gas production from Jicarilla Apache reservation despite previous imposition and collection of tribal tax; in practical effect, Cotton Petroleum was found to owe both tribal and state taxes for its oil and gas production on the Jicarilla Apache reservation).

HRI and the NRC Staff in the FEIS treat the potential tax payments to the Navajo Nation which the CUP may generate as a significant secondary benefit of the proposed project that supports the NRC Staff's decision to grant HRI a source materials license. As the Presiding Officer himself has recognized in propounding this question

in the first place, however, the uncertainty surrounding the actual tax benefit that might inure to the Navajo Nation from the project is much too tenuous to be considered a real secondary benefit in the FEIS because of the open question concerning whether the Section 8 property is Indian country. This is true also of the FEIS's characterization of potential tax payments to the Navajo Nation as "significant." In truth, the potential amount of such payments is anything but that.

Question 7.

7. For Churchrock Section 8 (and 28 days later for the entire CUP[14]): What is your comparative analysis of the NRC Staff-Recommended Action to: (1) the non-action alternative, and (2) Alternative 2 (modified action) -- including a concise, descriptive summary of the advantages and disadvantages of the options? In your answers to this question, please consider the answers to the questions set forth in your overall discussion.

Response 7.

As Intervenors have pointed out in their written presentations, the FEIS submitted by the NRC does not comply with NEPA and the applicable implementing regulations because there is a lack of analysis and adequate explanation why the Staff rejects Alternative 2 (modified action) and Alternative 4 (no action) in favor of Alternative 3 (Staff Recommended Alternative). *See* Sam's NEPA Brief at 14-24; ENDAUM's NEPA Brief at 56-60. In particular, the FEIS lacks a proper comparative analysis between the NRC-Staff Recommended Action (Alternative 3) and the no-action alternative (Alternative 4) and the modified action alternative (Alternative 2). CEQ regulations require that the FEIS "present the environmental impacts of the proposal

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[14] These answers may not be required to complete the determination of whether or not HRI may proceed to mine Churchrock Section 8.

and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public." 40 C.F.R. § 1502.14. An FEIS should briefly discuss the reasons why an alternative was rejected and not further studied. Louisiana Energy Services, 47 N.R.C. at 98 (citing Tongass Conservation Soc. v. Cheney, 924 F.2d 1137,1141 (D.C. Cir. 1991)) ("By merely reciting all of the benefits expected from the [project], the "no-action" section does not indicate how the agency evaluated the relative significance of these individually cited benefits."). The NRC staff failed to provide a comparative analysis of the alternatives in the FEIS.

The NRC staff, in its May 11 Reply, attempts to answer question 7, but regarding only Section 8. Despite the Presiding Officer's request to do so, these answers must be disregarded because a comparative analysis of only Section 8 is inadequate, irrelevant, and a violation of NEPA because it in effect disregards Alternative 2 as an option.

As a practical matter, any analysis of the alternatives for only Section 8 would be inadequate and useless as a comparative tool. The primary characteristic of Alternative 2 is that it differs from Alternatives 1 and 3 in that "ISL mining would occur at only one or two of the proposed sites" under Alternative 2. FEIS at 2-31. By limiting the comparative analysis to only Section 8, the Presiding Officer has in effect changed Alternative 2 by removing the primary characteristic that sets it apart from the proposed project and the other alternatives. This renders any comparative analysis inaccurate and therefore inadequate. At the very least, limiting an analysis to only one

site changes Alternative 2 into something other than what is described in the FEIS. Such a comparative analysis is useless for determining how the agency evaluated the relative significance of the benefits of each alternative as described in the FEIS. For example, it would be equally useless if the Presiding Officer asked for a comparative analysis of the alternatives, but required an assumption that each alternative would incorporate NRC's license conditions as described in Alternative 3. In this hypothetical, Alternative 3's major difference with the other alternatives would be stripped, making any comparative analysis inaccurate. This is essentially the same kind of improper analysis that is asked for in question 7.

The fact that the Presiding Officer has decided to make a decision regarding only Section 8 at this point has no bearing at all on the inappropriateness of a comparative analysis for only Section 8. The Presiding Officer, in his September 22 Memorandum and Order, allowed Intervenors to file written presentations "with respect to any issue that challenges the validity of the license issued to HRI." Memorandum and Order, September 22, 1998 at 2, clarified and reiterated in Memorandum and Order, October 13, 1998 at 3. In full accordance with the Presiding Officer's orders, Intervenors have challenged the FEIS as inadequate under NEPA, arguing that through an invalid FEIS, the NRC improperly issued the materials license to HRI.[15]

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[15] The NRC Staff has acknowledged that the scope of Intervenors' arguments is proper in accordance with the Presiding Officer's orders in that in responding to Intervenors' NEPA arguments, the Staff waived its "usual objection" to the scope of Intervenors' presentation inasmuch as the FEIS addressed all potential operation sites. See NRC Staff's Response to Intervenor Presentations On NEPA Issues (Purpose, Need, Cost/Benefit, Alternatives, and Supplementation), April 1, 1999 at 2-3.

Specifically, Intervenors asserted that the FEIS lacks a proper comparative analysis and adequate explanation why the Staff rejects Alternative 2 (modified action) and Alternative 4 (no action) in favor of Alternative 3 (Staff Recommended Alternative). *See* Sam's NEPA Brief at 14-24; ENDAUM's NEPA Brief at 56-60. Any comparative analysis would need to address Alternative 2 as it is described in the FEIS and as it was considered by the NRC in issuing the materials license to HRI. Under NEPA and the NRC regulations, the NRC must discuss in the FEIS alternatives to HRI's proposed project. 42 U.S.C. § 4332(2)(C)(iii); 10 C.F.R. § 51.91(c). Alternative 2 has already been described as an option in the FEIS. However, by changing the scope of the comparative analysis to only Section 8, the full character of Alternative 2 is not currently being taken into account. In fact, a comparative analysis of only Section 8 essentially removes Alternative 2 from discussion, in violation of the mandate from NEPA to discuss the alternatives to the project.

Even if the analysis submitted by the NRC for Section 8 was appropriate and allowable under NEPA, the NRC Staff's latest submission still would not be a sufficient comparative analysis under NEPA. Merely reciting all of the benefits expected from the project does not indicate how the agency evaluated the relative significance of these individually cited benefits as required by NEPA. *See* Tongass Conservation Soc. v. Cheney, 924 F.2d 1137,1141 (D.C. Cir. 1991). Pursuant to the Presiding Officer's question 7, the NRC submitted a summary of the advantages and disadvantages of Alternatives 2, 3, and 4. Affidavit of Robert D. Carlson at 10. However, the NRC fails to compare any of these alternatives with each other or provide any indication of

how it evaluated the relative significance of the cited advantages and disadvantages. For example, the NRC staff indicates that Alternative 3 "would have the advantage of allowing HRI to develop Section 8, while providing more environmental protection than the Modified Action." Affidavit of Robert D. Carlson, ¶ 19 at 10. However, there is no discussion of how these listed advantages are weighed in comparison to the advantages of avoiding all environmental impacts as listed for the No Action Alternative. *See Id.* ¶21 at 10.

The NRC Staff further submits tables on the various alternatives and their impacts, but freely admits that these tables only "summarize information in FEIS Sections 4.1 through 4.12." Affidavit of Robert D. Carlson, ¶ 18 at 10. Any reliance by the NRC staff on the FEIS for a comparative analysis is faulty for the reasons previously stated in Intervenors' written presentations. No comparative analysis among the various alternatives exists in the FEIS and thus the conclusory nature of the NRC's "analysis" is equally evident in its tables. In fact, if one were to consider the NRC's Tables 4 through 15, one would have to conclude that Alternative 4 (no action) should have been the preferred alternative rather than Alternative 3. The tables clearly show that Alternative 4 will have the least amount of impacts, and there is no indication that the advantages and disadvantages of the other alternatives outweigh this benefit.

Finally, HRI's reply to question 7 is noteworthy in that it does not even attempt to provide a comparative analysis of the given alternatives at all and simply underscores one of the underlying problems with the FEIS. Following a rather lengthy regurgitation of relevant NEPA principles and a layout of the FEIS, HRI's reply to

question 7 boils down to a simple conclusion without any comparative analysis: ". . . it is sufficient to say that the FEIS adequately addresses the reasonable alternatives, giving "substantial treatment" to each in full satisfaction of the requirements of NEPA as related to the NRC in Part 51." HRI's response substitutes a simple conclusory statement for a comparative analysis and points out no language in the FEIS which indicates how the NRC Staff evaluated the relative significance of any benefits or disadvantages of any of the alternatives. As pointed out by Intervenors in their written presentations, the FEIS simply does not provide the NEPA-mandated comparative analysis of the alternatives and the mere reassurance of HRI that the FEIS is adequate does not eliminate the FEIS's flaws.

Question 8.

Intervenors Groundwater Exhibit L quotes Cowan (1991) who states that near Church Rock, channelways "15-30 m. thick" occur "which would affect fluid flow." SRIC/ENDAUM will please promptly provide a reference for the citation so that we may discover whether Cowan says anything about the width of those channelways.

Response 8.

Intervenors have provided the Cowan study, and the statements of ~~Dr. Lucas and~~ Dr. Abitz explain the importance of that study for this proceeding. Those statements also demonstrate the need for qualified witnesses to address technical questions, as opposed to the misstatements made by HRI's unsworn and unqualified counsel concerning the study.

As was pointed out above, contrary to HRI's assertions, the Cowan study does not indicate that the Westwater is made up of coalesced sandstone sheets that preclude the existence of confined elongated channels. HRI's Response at 41. ~~Dr. Lucas has~~

~~testified that HRI's position is an inaccurate reading of the study. Cowan documents the lithologic heterogeneity of the Westwater, and concludes that the Westwater deposition was in channel belts one to several km wide composed of numerous, smaller channels. Lucas Response Testimony at 5. Dr. Lucas also discredits HRI's counsel's criticism of the Cowan study based upon the amount of the Westwater Canyon that it examined; as Dr. Lucas stated, the method used by the study is "standard sedimentological procedure." Lucas Response Testimony at 7. Dr. Lucas concluded that Cowan's conclusions would be readily extended into the Church Rock area by any competent geologist, given the vast scale of the Westwater Canyon Member river system." *Id.* As was also pointed out above, HRI's counsel, who are not geologists, did not take that position.~~

Finally, the Cowan study ~~and the interpretation of it presented by Dr. Lucas, a known international authority on Jurassic sediments including those of the Morrison Formation in northwestern New Mexico (Abitz Response Testimony at 12),~~ demonstrate the heterogeneity of the Westwater Canyon Member, a heterogeneity that is not considered by the FEIS. Abitz Response Testimony at 13. The FEIS's treatment of the hydrology and contaminant transport within the Westwater is therefore flawed and inadequate. *Id.*

IV. The Presiding Officer's request for responses to Questions 1-8 requires supplementation of the FEIS.

As the Presiding Officer has implicitly conceded by asking Question 1, the FEIS should have contained additional information. For that reason, NEPA requires supplementation of the FEIS. Moreover, use of that information to make a decision

pursuant to NEPA without providing the information to the public and decision makers in a supplement to the FEIS would violate NEPA.[16]

NEPA mandates that relevant information be provided in the FEIS so that it is available to the decision maker and to the public.

> The primary function of an environmental impact statement under NEPA is "to insure a fully informed and well-considered decision," ...." In order to fulfill its role, the EIS must set forth sufficient information for the general public to make an informed evaluation ... and for the decisionmaker to "consider fully the environmental factors involved and to make a reasoned decision after balancing the risks of harm to the environment against the benefits to be derived from the proposed action."

Sierra Club v. U.S. Army Corps of Engineers, 701 F.2d 1011, 1029 (2d Cir. 1983) (citations omitted) (holding invalid as violating NEPA the Corps' reliance on an EIS whose conclusions lacked a substantial basis).

"At the very least, NEPA is an environmental full disclosure law." By enacting it, Congress "certainly intended to make ... decisionmaking more responsive and more responsible." Environmental Defense Fund v. Corps of Engineers of the U.S. Army, 325 F. Supp. 749, 759 (E.D. Ark., 1971) (prohibiting the Corps of Engineers from proceeding with a project because of the inadequacy of the environmental impact statement for the project). *See also* Committee for Nuclear Responsibility, Inc. v. Seaborg, 463 F.2d 783, 787 (5th Cir. 1971) ("[T]he [environmental impact] statement has significance in focusing environmental factors for informed appraisal by the President ... and in any event by Congress and the public.")(reversing a district court

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[16] The April 21 Order appears to recognize that supplementation of the FEIS may be necessary (April 21 Order, 4), but makes no commitment to do that.

grant of summary judgment for the Atomic Energy Commission because it precluded the plaintiffs from demonstrating that the Commission omitted scientific opinions from an environmental impact statement). *See also* ENDAUM's and SRIC's NEPA Brief at 60-62 and authorities cited therein.

For these reasons, any information that is provided in response to the April 21 Order's Questions must be presented in a supplement to the FEIS that is circulated to the public and made available for comment. The request for more information demonstrates that the FEIS must be supplemented. In addition, use of such information without supplementation of the FEIS would violate NEPA.

Dated: May 25, 1999.

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STAFF EXHIBIT B

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD PANEL

Before Administrative Judges
Peter B. Bloch, Presiding Officer
Robin Brett, Special Assistant
Thomas D. Murphy, Special Assistant

In the Matter of	
HYDRO RESOURCES, INC. 2929 Coors Road, Suite 101 Albuquerque, NM 87120	Docket No. 40-8968-ML ASLBP No. 95-706-01

RESPONSE AFFIDAVIT OF MICHAEL G. WALLACE

I, Michael G. Wallace, being duly sworn, submit the following response affidavit on behalf of Eastern Navajo Diné Against Uranium Mining ("ENDAUM") and Southwest Research and Information Center ("SRIC"), in response to the answers filed by Hydro Resources, Inc. ("HRI"), and the NRC Staff ("HRI Response" and "NRC Staff Response," respectively), to questions 3, 2, 1, and 8 posed by the Presiding Officer in his Memorandum and Order of April 21, 1999 ("April 21 Order").

1. My name is Michael G. Wallace. My qualifications are set forth in my written testimony and Exhibit A attached thereto, which were submitted on behalf of Intervenors' Written Presentation in Opposition to Hydro Resources, Inc.'s, Application for a Materials License with Respect to: Groundwater Protection (January 11, 1999) ("Intervenors' Groundwater Presentation") ("Wallace January Testimony"). I have a master's degree in hydrology from the University of Arizona and extensive knowledge

and experience in the movement of contaminants in groundwater systems, as a consultant to industry and government agencies. My experience includes development of hydrogeologic conceptual models and the application of those to the valid prediction of contaminant transport through numerical modeling. For much of the past 10 years, I have been a consultant to the U.S. Department of Energy ("DOE") working on modeling radionuclide movement through hydrogeologic formations at the proposed Waste Isolation Pilot Project (WIPP) in southeastern New Mexico. I continue to work in this capacity as a contractor within Sandia National Laboratories on an essentially full-time basis.

2. In addition to the materials listed in my January testimony in support of Intevenors' Groundwater Presentation, and the documentation cited in my April 8, 1999, affidavit in support of ENDAUM's and SRIC's Reply to HRI's and the NRC Staff's Response Presentations on Groundwater Protection ("Wallace April Affidavit" and "ENDAUM-SRIC April Reply"), I have reviewed the HRI Response and the Staff Response to questions posed in April 21 Order, including the affidavits of Craig Bartels on behalf of HRI and William Ford on behalf of the NRC Staff, and the various attachments thereto.

Question 3 of April 21 Order

3. Question 3 of the April 21 Order asks:

> **Qualitatively and, if possible, quantitatively, what are the effects on the quality of water that may reasonably be foreseen at the closest private water wells to Church Rock Section 8, resulting from the poorest foreseeable condition of groundwater after restoration is**

completed?

4. In response to this question, the Staff has little to say, other than that the FEIS identified the nearest operating well, 0.5 mile to the south, and that HRI believes the groundwater flow is northerly. Ford Affidavit at 20. HRI addresses the question by stating that the nearest downgradient well is at the United Nuclear Corporation ("UNC") millsite located about 2.5 miles northeast of Section 8.[1] Bartels Affidavit at 16. Mr. Bartels states that he calculated the groundwater travel time from Section 8 to the UNC well as 1,632 years, and concludes that restoration at Section 8 cannot have a negative effect on this well. Neither HRI nor the Staff quantifies the impact on groundwater quality from Section 8 development.

~~5. Quantitative predictions of the quality of groundwater several miles downgradient from a contaminant source such as the Section 8 ISL mine not only are possible, but it is routinely used in industry. I have conducted such an analysis using professionally accepted modeling methods and software to respond to this question. My analysis shows that contamination can reach a distance equivalent to that of the nearest private water supply well, i.e., the UNC well cited by Mr. Bartels. Hence, as I explain in detail below, I have demonstrated that HRI's Section 8 ISL mine can have an adverse effect on the downgradient groundwater quality when an initial contaminant concentration that represents "the poorest foreseeable condition of groundwater after restoration" is used in the model.~~

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[1] This fact, which I have been able to verify, was not disclosed in the FEIS and has not arisen in any previous filings by HRI or the NRC Staff.

6. My modeling analysis also makes two important collateral contributions to estimates of post-restoration adverse effects on the offsite groundwater. First, the analysis provides estimations of the total volume of water in the aquifer that would be degraded by the mine. Based on those estimations, I calculate the "cost" of this contaminated groundwater. And second, my analysis provides strong supporting evidence for the existence of isolated sand channels similar to those that I posited in my previous affidavits and in my January testimony. This evidence, in my opinion, makes the sand channel conceptualization nearly irrefutable, since it is now additionally supported by a calibration to HRI's actual Section 8 pump test data that were derived from pump tests conducted in September and October 1988.[2]

Model Development

7. In my April testimony, I presented some simple, plausible model simulations that dealt with issues of lixiviant containment during ISL operations at the Church Rock site. In response to the Presiding Officer's more recent request, I have prepared new model simulations. These simulations address the long-term water quality consequences upon the area aquifer(s) following ISL restoration activities. These types of simulations provide a quantitative means to estimate impacts of the proposed activities upon nearby water supply wells and upon the aquifer in general.

8. The simulations are comprised of a combination of two numerical codes,

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[2] The relevant pump test results were reported by HRI in Appendix E of its Church Rock Revised Environmental Report (March 1993).

MODFLOW and MT3D. MODFLOW is a finite-difference groundwater flow simulator, developed by the U.S. Geological Survey. MT3D is a solute transport simulator that is compatible with MODFLOW, and was developed through funding by the U.S. Army Corps of Engineers.

9. I developed a flow model that approximated both pre-and post-pump test conditions, as those conditions were described in HRI's December 1988 report.[3] I then incorporated into the transport model an initial distribution of post-restoration solute levels, using a dimensionless concentration value.[4] Due to the linearity of the transport solution, all concentration results can be raised or lowered by a common factor. In this manner, various assumptions about the actual post-restoration concentration value can be evaluated without resorting to additional modeling.

10. The contaminant transport model simulated the migration of a plume of contaminants to the north and northeast from Section 8. The time period of this simulation ranged from the time at end of restoration (i.e., time = 0) to 274 years into the future. I examined the model results to determine contamination values at various locations and at various times within the model domain. I also developed approximate values for the volume of contaminated groundwater. Table 1, which is attached to this affidavit as **Exhibit 2-A**, presents assumptions and parameter values used in these models. The finite difference grid is presented in Figures 1a and 1b, which are attached to this affidavit as **Exhibits 2-B** and **2-C**, along with boundary conditions and the

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[3] Id.

[4] By "dimensionless," I mean a concentration that is expressed only as a numerical value without its customary units. Accordingly, a concentration value of "1" could be 1 milligram per liter or 1 picoCurie per liter. The actual units do not matter for proper operation of the model.

Westwater Canyon wells used in HRI's Section 8 pump test.

Calibration and Model Validity

11. A model is in part a computer simulation that approximates the geology and hydrology of the area of concern. The flow of water and transport of dissolved contaminants (such as uranium) are simulated in a dynamic manner. Such models are routinely used to predict future impacts of proposed activities. The believability of the model prediction rests on the plausibility of the conceptualization, the accuracy of the simulator and the nature of the approximation of the geologic conditions in which the flow and transport take place.

12. It is not possible to effectively evaluate these features without some ground truth to compare against. In the case of groundwater models, one generally relies heavily on calibration to pump test data and so-called steady state data. Calibration in this context means the use of the simulator/predictor to re-create the dynamic water level fluctuations measured in a pump test and to re-create the ambient water levels prior to such a test. The goodness-of-fit of such a simulation can then be used to evaluate the believability of the model's future predictions. The rationale for this is that if the model can approximate dynamics of the system that are already known, then some confidence can be had in its ability to predict future phenomena.

13. HRI has not provided calibration results to support any of its groundwater models or travel time estimates. As I indicated in my April affidavit (Exhibit C to ENDAUM-SRIC April Reply, at 9), HRI cannot provide such results because it cannot

calibrate, or match, its historic water level data and pump test data to its homogeneous, perfectly confined aquifer models. To demonstrate this point, I have taken my model and assigned it a homogeneous hydraulic conductivity equivalent to the value HRI used for the area. I then ran the model, simulating steady state conditions and the Section 8 pump test. I compared the model-calculated values (in feet) for residual differences in water levels with the measured values. The results of this comparison are depicted in the "Table of Residual Differences in Water Levels" below and in Figure 2, attached hereto as **Exhibit 2-D**.

14. In the Table of Residual Differences and in Figure 2 (**Exhibit 2-D**), net differences in water levels between the model calibration results and the results using HRI's homogeneous model are expressed as "residuals" greater than or less than 0.0. In Figure 2, the horizontal black line represents a water level difference value of 0; the difference values from my calibration model are depicted by black dots, and values derived from using HRI's homogeneous model are depicted by gray crosses. The closer the differences are between the measured water levels and the model results, i.e., the closer the "residuals" are to 0, the better the match of the measured levels to the model.

15. As shown in the Table of Residual Differences and in Figure 2, in most cases, my model calibration results are closer to the actual water level values than the results from HRI's homogeneous model. In other words, my results "match" well with the measured results, while results from HRI's model match poorly. For example,

Table of Residual Differences in Water Levels (in feet)
(Presented graphically in Figure 2, attached as Exhibit 2-D)

Section 8 Monitor Wells	HRI homogeneous model (pre-pump test)	Wallace model calibration (pre-pump test)	HRI homogeneous model (post-pump test)	Wallace model calibration (post-pump test)
CR-5	-12.5	+2.0	-14.0	+2.0
CR-6	+2.0	+2.0	+11.0	+2.0
CR-8	-8.5	-5.0	+5.0	-8.0

monitoring well CR-5[5] had a measured post-pump test head (i.e., water level) that is 14 feet lower than the model head. Similarly, the post-pump test head for CR-6 was 11 feet higher than the model head. Both represent significant departures from the measured levels. In only one case, the post-pump test results for well CR-8, did my model have a residual value greater than the value resulting from HRI's model.

16. To make HRI's model fit better for the CR-5 results, I could have adjusted the hydraulic conductivity downward to improve fit, but that would in turn make the match of the other transient observation well points even worse. Unless I resorted to incorporating leakage from overlying or underlying units into the model (leakage that HRI has repeatedly asserted does not exist), there is simply no way to come close to matching all of the measured data shown with HRI's homogeneous model.

17. Why the poor matches for HRI's model? Precisely for the reasons discussed in my April affidavit (at, e.g., 7-8, and Figures A and B). Namely, that HRI

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[5] The locations of CR-5 and other Section 8 monitoring wells discussed in this affidavit can be seen in Figure 3.11 of the FEIS (at 3-37); however, this map disagrees with the well-location map marked as Figure 2 of HRI's December 1988 pump test report. The well called CR-6 in Figure 3.11 should have been marked CR-8, and the well called CR-4 in Figure 3.11 should have been marked CR-6. The locations of CR-3, the pumping well, and CR-5, an observation well, in Figure 3.11 appear to agree with those in Figure 2 of the December 1988 report.

used a model that assumed, incorrectly, that the aquifer is homogeneous, perfectly confined and of infinite width. I confirmed this from calibrating my heterogeneous model. For example, CR-8 is located closer to the pumping well, CR-3, than CR-5[6] is. One would expect drawdown to be greater in the closer observation well, unless there is some barrier between the closer well and the pumping well. After many attempts to calibrate, I found that channels seemed the only appropriate type of configuration to best match the data. In this case, a channel had to connect the pumping well, CR-3, to the observation well, CR-5, to the northeast, but a lower-permeability channel wall had to separate the pumping well from CR-8 to the southwest. When I incorporated these conditions, as shown in Figure 3, attached hereto as **Exhibit 2-E**, the difference between measured and modeled water levels CR-5 was only 2 feet. (See, also, Table of Residual Differences above and Figure 2 **[Exhibit 2-D]**.) Hence, the channelization configuration resulted in a better match to the actual water level data, indicating that my model, since calibrated to the pump test data, will provide a more reliable and accurate prediction of contaminant transport at Section 8 than any of the predictions offered to date by either the Staff or HRI. Figure 3 illustrates the final heterogeneity channel patterns used in my model.

18. No calibration to data can be considered unique. While there are an infinite number of possible configurations that can feasibly match the historic water level data, there are always an even greater number of configurations that cannot match the

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[6] According to data in Table 2 of HRI's December 1988 pump test report, CR-5 is located 536 feet from CR-3, the pumping well, and CR-8 is located 398 feet from CR-3.

data, such as the homogeneous configuration that HRI used. In fact, the solutions that are viable are often merely variations on a theme. Channel-like features are a type of theme distinctive from other types of underground porous media. I believe (with good reason) that most, if not all, of the successful Section 8 calibration possibilities would result in channel-like features. Some realizations may show even more pronounced pipeline-like effects; others might show slightly less channeling.

19. While my model is nothing more than one of many plausible configurations based on a channel theme, it is the only calibrated model used by any of the parties to date to evaluate quantitatively the groundwater impacts of just one contaminant, uranium, migrating from Section 8 after restoration. HRI and NRC did not provide a calibrated model in their responses to the Presiding Officer's request for quantitative estimates of post-restoration groundwater impacts. Moreover, both HRI and the Staff have failed to provide any new modeling or realistic calculations, whatsoever. In HRI's case, its had more than 10 years to do so but has chosen not to. The models HRI has used to date are useless for their value to predict adverse impacts, if only for the reason that they have not been calibrated against real-world conditions.[7]

20. Mr. Bartels's recent travel time estimates (Bartels Affidavit, at 18) do not

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[7] The Geraghty & Miller report, "Analysis of Hydrodynamic Control...." (1993), claims a calibration to historic conditions, but provides no direct quantitative data for evaluation. My review of what is provided shows yet even more inconsistencies, beyond those I already have identified and discussed. Notably, no calibration to the pump test is presented, and also, more telling still, no data for wells CR-6 or CR-8 are provided in Figure 21 of the Geraghty & Miller report. Data from those critical wells were certainly available, as they have been around since late 1988, whereas the report was written in 1993. In essence, there was no calibration. Because of the simplicity of HRI's model setup, my re-creation is an acceptable replicate of what HRI's calibration statistics would show, had they been properly revealed.

qualify as quantitative estimates of impacts on water quality. A travel time estimate simply does not provide any clue as to contamination values at any point along the flowpath. Perhaps he hoped to suggest that the travel times are so long that any water quality question is superfluous. However, his estimate of 1,632 years for contaminant travel to the nearest downgradient private well is based on the same old faulty, uncalibrated homogeneous HRI model. As such, he uses a relatively low uniform value of hydraulic conductivity (0.77 ft/day) and a uniform hydraulic gradient to arrive at a simplistic, nonconservative estimate of groundwater velocity. In contrast, to calibrate my model, I had to develop a channel feature having a hydraulic conductivity of 13 ft/day (about 17 times greater). This, in conjunction with the rest of the model setup, led to much faster times for contaminants to reach that well. Furthermore, my model provides direct water quality impact information. Results are detailed in a later section.

Leakage

21. Although HRI has had more than 10 years to do contaminant transport modeling and to calibrate it against actual pump-test data from Section 8, I haven't.[8] Model development and calibration are extremely time consuming. To incorporate

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[8] Based on my recommendation, Counsel for Intervenors ENDAUM and SRIC requested "excursion scenario" modeling data from HRI and the NRC Staff in the fall of 1998. See, letter from Johanna Matanich, NMELC, to John T. Hull and Mitzi Young, NRC (September 29, 1998), and Item 5 from the list of 10 information items attached thereto. In an October 16, 1998, letter to the NRC Staff, HRI's Mark Pelizza responded that ENDAUM and SRIC could buy the modeling software. He did not, however, state whether HRI had or had not done excursion modeling. Since then, I have had to assume that HRI has not done the kind of contaminant transport modeling that I've presented in this affidavit and that is routinely done by companies whose activities may affect groundwater quality. This deficiency remains, in my professional opinion, a gaping hole in the evaluation of the CUP to date, and another reason why the NRC Staff should not have issued the license in the first place.

leakage into my model, I would have to put more layers in. More layers means more variables to consider and requires far longer computational times. The model I have presented in this affidavit was built to respond, in less than one month's time, to the questions posed by the Presiding Officer in his April 21 order. Although I would like to investigate the leakage question with a model, I haven't had time to do so for this particular stage. Therefore, the model presented here does not consider leakage. Yet, that does not mean that such leakage cannot or will not exist.

Contaminant Transport Model and its Inputs

22. Although my model was calibrated to hydraulic data, its primary purpose is to address possible water quality impacts. Predicting water quality impacts is accomplished here by the companion MT3D contaminant transport model. That model incorporates several different ways to simulate contaminant transport. I chose two methods. The first was a default finite difference technique. The second employed the method of characteristics ("MOC"). At present, there are no contaminant data that can be used to calibrate either of these models. However, both of these models rely principally on the ground water velocity fields imported from the calibrated flow model. Therefore, the results are supported to a great degree by the validity of the flow calibration. This approach is standard industry practice.

23. The initial contaminant source is considered to be a roughly rectangular area that encompasses the mine zones in Section 8, and is depicted in Figure 4 attached hereto. I assumed, based on the Presiding Officer's interest in the "poorest foreseeable

condition of groundwater after restoration" (April 21 Order at 2), an initial concentration of uranium in this area of 1 milligram per liter (mg/l). I chose this value for several reasons. First, it is about 2.3 times greater than the restoration standard of 0.44 mg/l, but considerably less than the anticipated lixiviant concentration of 50 to 250 mg/l. FEIS at 2-6. Second, the January testimonies of Dr. Richard Abitz and Dr. William Staub, attached as Exhibits 1 and 2, respectively, to Intervenors' Groundwater Presentation, reported the many difficulties that operators in Wyoming have had restoring groundwater to uranium levels less than 1 mg/l. And third, should HRI have similar difficulties, my understanding is that it can always petition the NRC for alternate concentration limits. Invariably, such alternates are greater than the original license-imposed standard. I also consulted with Dr. Abitz on this question, and while he concurred that a 1 mg/l initial concentration is reasonable, he stated his belief that an even higher level could be justified as the "poorest foreseeable conditions of groundwater after restoration." Dr. Richard Abitz, personal communications, May 11 and May 19, 1999.

24. I should note here that the MT3D model does not evaluate redox (i.e., oxidation-reduction) conditions in the aquifer. While the NRC Staff has asserted strongly that redox conditions in the Westwater Canyon Aquifer downgradient of the mining zone can be counted on to re-immobilize the uranium and other constituents following restoration (see, e.g., Ford Affidavit at 7-8, 13-14), a close examination of these arguments shows that they are not supported by any actual geochemical evidence. For example, there are no dissolved oxygen ("DO") concentration data or DO contour maps in the FEIS or any other part of the HRI license application. Similarly, as pointed out by

Dr. Abitz in his May 20 affidavit, there are no studies of trace metal concentrations in site monitoring wells such that redox reactions and conditions could be calculated or predicted. Of course, the uranium now in the rock has to be reduced to be immobilized, but this natural reduction appears to be intimately related to the presence of humate deposits in the formation. When all is said and done, then, the Staff's redox argument is nothing more than sheer speculation and wishful thinking. I am justified, therefore, in using a model that does not account for redox attenuation of contaminant migration.

Discussion of Results and Conclusions

25. The initial contaminant source distribution is depicted in the shaded area of Figure 4, which is attached hereto as **Exhibit 2-F**. The contaminant source area is roughly equivalent to the central portion of the proposed Section 8 mining zone. Contaminant distribution results from the finite difference and the MOC models are depicted in two color diagrams, marked as Plate 1 and Plate 2 and attached to this affidavit as **Exhibits 2-G** and **2-H**. Both plates show the striking impact of the channel features on the transport dynamics, and track closely with the channel features shown in Figure 3 (**Exhibit 2-E**). Basically, the plume migrates northeastward, within the channel, almost as if it were a "pipeline."[9] For the MOC case (Plate 2), I modeled concentrations over time, ending at the location of the UNC well that is considered the nearest downgradient private well. See, Bartels Affidavit at 16. The modeled concentration data

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[9] What's more, the 'walls' of this channel are permeable themselves, only roughly an order of magnitude lower in conductivity than the channel they line. This is nothing close to an impenetrable wall such as that described by Bartels in his earlier critique of my work.

are included shown in Table 2, which is attached hereto as **Exhibit 2-I**. Table 2 shows that concentrations reach 0.17 mg/l at the well location in approximately 200 years; lower concentrations reach the location of this well even earlier. Assuming that the "background" concentration is approximately 0.0025 mg/l, or the equivalent of the average uranium concentration in the Town of Crownpoint municipal wells (see, FEIS at 3-26), then the modeled concentration represents nearly a 70-fold increase in concentration levels at that location at that point in time.[10]

26. As stated earlier, these results rest on the foundation of a relatively well-calibrated flow model, the *only* truly calibrated flow model for this site generated by any party in this proceeding to date. The results represent two solutions among many possible solutions that could fit the data. While alternative solutions could show lower impacts on the downgradient well, other alternative solutions could show even greater impacts at any earlier time. Also, I set up the model to be consistent with the context and direction implicit in the formal question posed by the Presiding Officer. And most important, the channel orientations incorporated in my model are consistent with the professional literature's repeated descriptions of the Westwater Canyon Member as a heterogeneous fluvial environment.

27. Finally, the model I have presented does not consider other contaminants that could reasonably be expected to be co-mobilized with uranium and migrate contemporaneously to the end point where human exposure could occur. It does not take

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[10] A December 1998 monitoring report submitted by United Nuclear Corporation to the NRC lists a uranium concentration of 0.0028 mg/l for a "Domestic Water Well" located at the UNC millsite. A copy of the relevant portions of that monitoring report are attached to this affidavit as **Exhibit 2-J**.

into account the fact that, in future years, local land users or governments could select a location for drilling a new water supply well that might coincide with the location of a contaminant plume emanating from Section 8. I should also note that the modeled contaminant plume depicted in Plates 1 and 2 (**Exhibits 2-G** and **2-H**) contains uranium concentrations exceeding the NRC restoration standard of 0.44 mg/l only a short distance from the initial source and within only a few years after restoration is complete. Accordingly, adverse impacts to a future well located, say, in the northwestern quarter of Section 8 or in the western half of Section 9, would occur shortly after restoration ends. And even if a new well is not installed in those immediate off-site areas, the groundwater itself will be contaminated, thereby potentially precluding future water supply development in a potable, high-capacity aquifer. In a later part of this affidavit, I calculate the value of this contaminated groundwater.

Question 2 of April 21 Order

28. Question 2 of the April 21 Order, which I have divided into three subquestions, asks:

> **(A) Based on local geology, what assurance is there concerning the likelihood of the existence of shears, fractures, and joints that could transmit appreciable quantities of water above or below the Westwater aquifer? (B) How much greater assurance may reasonably be anticipated prior to commencing ISL operations at Church Rock Section 8? (C) What environmental costs may reasonably be expected to result from foreseeable difficulties at Section 8?**

(Subquestion headings added.) I will reply to the parties' responses to each subquestion in the paragraphs that follow:

29. Both HRI and the NRC Staff claim that the Westwater is well-contained above and below, without a significant likelihood of faulting. HRI Response at 8; Ford Affidavit at 15. However, as noted by the Presiding Officer in his April 21 Order, one of HRI's witnesses, Mr. Lichnovsky, did not assess the risk of contaminant migration "through undetected sheers, fractures or joints." April 21 Order at 2, n. 2. My review of the available information indicates a likelihood of the existence of structural features, including shears, fractures, joints, and faults, because of several factors. Some of these factors I identified in my January Testimony, while others were recently identified.

30. In my January Testimony (at 17-18), I explained that vertical fault planes are common in the San Juan Basin, and that a fault of 70 feet or so could bring the Westwater in direct contact with the overlying Dakota. Such contact obviously could facilitate the transfer of a large amount of contaminated fluid. Given the operating pressures described by HRI, smaller faults could also conduct significant quantities of contaminants. I then explained that fractures could exist in the absence of faults, and sometimes serve as conduits for flow. I also discussed Hilpert's 1969 report that identified a series of vertical fractures extending from the mine workings in Section 17 through the Section 8 ore zones. Wallace January Testimony at 65 and Exhibit N, citing Hilpert (1969) at 77. In HRI's February 19 rebuttal, Mr. Lichnovsky argued that the Hilpert cross-section was regional in nature and lacked sufficient localized detail to prove that faults exist in the mining horizon. Yet the Hilpert cross section provides a more detailed look at the subsurface stratigraphy under Sections 17 and 8 then virtually any of

the literature cited by Mr. Lichnovsky.[11] Additionally, Hilpert used some of the same borehole logs that HRI used to construct the stratigraphic cross sections that appear in Section 2.6 of HRI's Church Rock Revised Environmental Report (March 1993). Hilpert's data were site-specific; they just happened to be incorporated into a wider discussion of regional uranium mineralization that stretched beyond the HRI Church Rock site. The discussion by Hilpert of these fractures concerns this area as well.

31. I also have demonstrated that HRI's and the Staff's claim that Section 8 is confined below the Westwater by continuous shale is inaccurate. The underlying Recapture is not a classic shale as inferred by HRI and the NRC staff, but a "complexly interbedded. . .mudstone interbedded with fine- to medium-grained. . .quartzose sandstone" that was deposited in a fluvial environment, much as the Westwater was. Kirk and Condon (1995) at 111; attached as Exhibit O to Dr. Staub's January testimony. ~~A companion affidavit by the Morrison Formation expert, Dr. Spencer Lucas, also discusses these features of the Recapture. See, Lucas Affidavit, ¶¶5-6.~~ Additionally, the

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[11] Mr. Lichnovsky's criticism of my use of Hilpert's cross-section through the Church Rock site is curious given that Mr. Lichnovsky himself relied on regional information to support many of his views about the absence of faults at the site. For example, in paragraph 28 of his February 19 affidavit, he cited Kirk and Condon's seismic studies in the area to bolster his view that no *faults* are evident in the Westwater. Yet a close examination of the Kirk and Condon's 1995 paper, which Dr. Staub attached as Exhibit O to his January testimony, shows that only a small portion of a 14-mile-long seismic cross section intersects the Church Rock mining site. The extent to which it goes through the mining zone cannot be discerned from the relevant figures or text. In contrast, the relevant cross-section in the Hilpert paper, which I attached as Exhibit N to my January testimony, is presented in a larger scale so that details about the stratigraphy that underlies Sections 17 and 8 can be readily examined. Hence, the reference I relied on presents a far more detailed picture of the subsurface than the reference Mr. Lichnovsky used. And there is nothing in the Kirk and Condon paper, or in the paper by Phelps, Zech and Huffman (1995) (attached as Exhibit Q to Dr. Staub's January testimony), that proves that localized sheers, fractures, or joints are absent from the Dakota-Brushy Basin-Westwater-Recapture sequence. Indeed, finding such features, which are much smaller geologic features than regional faults, was not the purpose of the either the Kirk and Condon study (see, abstract at 105) or the Phelps, Zech and Huffman study (see, abstract at 145).

Recapture may not even exist under most, if not all, of the mine zone in Section 8. See, Wallace January Testimony at 14-17 and 62-65, and Exhibit N, which shows Hilpert's 1969 cross-section in which the Recapture is thin to nonexistent under Sections 17 and 8.[12] Without an adequate confining layer below the Westwater under Section 8, flow of contaminants into the underlying Cow Springs aquifer, or into a water-bearing layer of the Recapture, from the mining zones would be not only likely, but inevitable.

32. Mr. Bartels states in his May 6 affidavit (at 5-6) that most vertical excursions occur due to artificial pathways, such as boreholes and well casings. Assuming this is true, the Staff has not assessed the risk that old boreholes on Section 8, which number at least 174, may serve as conduits for migration of contaminants into overlying or underlying aquifers. See, Ford Affidavit of February 20, 1998, at 9.

33. The subject of artificial penetrations and their effects brings up another discrepancy in the logic of HRI's arguments. HRI has argued that all of its boreholes and wells are properly sealed, with state of the art techniques. At the same time, HRI has, on several occasions, expressed concern about its ability to adequately seal deeper boreholes, and also expressed concern that deep boreholes that penetrate the Recapture and Cow Springs Sandstone could provide conduits for fluid migration between the mine zones

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12 In his February 19 affidavit, Mr. Lichnovsky uses the "principal of continuity" to support his position that the Recapture underlies the entire site, even though the single borehole that he cited is located at least 900 feet west of the Section 8 mining area. The principal of continuity is simply a rule of thumb that geologists use to interpret stratigraphy that they observe in the field. It cannot and should not be used to interpret geology at another location, more than 900 feet away, when additional and substantial site-specific geologic information exists. In this case, as I have stated on several occasions, HRI has data on hundreds of boreholes in Section 8, and used some of those records to construct five different stratigraphic cross sections in the southeast quarter of Section 8. However, these records, coupled with Hilpert's cross-section through sections 17 and 8, do not show convincingly that the "Recapture" is 180 feet thick and continuous throughout the area.

and the underlying aquifers. HRI has consistently relied on this argument to justify its decision not to install monitor wells into or through the Recapture unit at Section 8. However, in my experience, drilling boreholes and studying the resulting core samples may be the only tools available or affordable to clarify the small-scale geology underlying the Westwater. Furthermore, because of greater rock stresses with depth, deeper boreholes are generally easier to seal than shallow ones. Thus, HRI has it backwards. It would have us believe that hundreds of relatively shallow boreholes and injection and production wells used in the ISL process will be perfectly sealed. Yet HRI dared not drill a single, deep borehole to evaluate the characteristics and integrity of the rocks that underlie the Westwater, supposedly out of its concern for potential fluid migration.

34. The seismic profile referenced by Mr. Lichnovsky in his February affidavit, and cited by Mr. Bartels in this May affidavit (at 8), was used by HRI to support its argument that faulting does not exist at Section 8. As I discussed in footnote 11 above, the cited profile was regional in nature, and as such does not contain sufficient resolution to make any site-specific determinations. In this sense, it is similar to using a regional structure contour map to show no faulting at a much smaller local level on the scale of the Section 8 property.

35. In summary, I believe that HRI and the NRC Staff have provided very little assurance that fluid movement will not occur below the Westwater aquifer. This lack of assurance is particularly worrisome for protection of the underlying layers because of the presence of a potential underground source of drinking water in the Cow

Springs Sandstone. As I discussed in my January testimony (at 62-63), one borehole, offset from the mining zone by at least 900 feet, does not by itself prove that the Recapture is present below the Westwater, or, even if it is present, is a suitable confining layer. Given that the Recapture intertongues with the Westwater and was eroded by scouring at that contact (Kirk and Condon [1995] at 111; attached as Exhibit O to Dr. Staub's January testimony), conduits for fluid migration may exist, but are too small and localized to have been detected by earlier pump tests or by examination of borehole logs.

36. Part B of Question 2 states:

How much greater assurance may reasonably be anticipated prior to commencing ISL operations at Church Rock Section 8?

37. HRI claims that the pump tests required by its license will provide the greatest assurance that vertical excursions can be limited because the tests themselves will determine whether vertical connection exists between aquifers or whether the aquifers are confined. As I have previously explained, pump tests are the best tools to locate breaches of confining units. Wallace January Testimony at 19. Yet, I continue to have serious concerns about HRI's ability to properly perform and analyze pump tests, given the many mistakes that I have identified in HRI's aquifer characterization program to date. Id. at 43-55. Statements made by Mr. Bartels in his May 6 affidavit now give me even more discomfort about HRI's willingness to take aquifer testing seriously, or to report the results thereof accurately, at the Church Rock site.

38. In his May 6 affidavit (at 13), Mr. Bartels states that well field 2 at URI's Longoria project had no vertical or horizontal excursions, "[y]et, the pump test prior to

production of that well field showed significant vertical hydraulic communication and potential for vertical excursions." That Longoria Well field 2 had no excursions, as Mr. Bartels asserts, is irrelevant (whether true or not) to the question of whether proceeding with well-field development in the face of adverse aquifer confinement findings is prudent practice. I don't understand how the state agency in that case would allow such an operation to proceed, but it is certainly something that I trust the NRC Staff would not endorse. In any event, I fear that any assurance that additional pump testing may provide will be undermined by HRI's demonstrated inclination to proceed with ISL mining even when aquifer testing shows hydraulic communication between the mining zone and overlying or underlying aquifers. And unlike URI's experience at Longoria in Texas, a mistake by HRI at its New Mexico sites could have damaging consequences for the purity of the groundwater in Church Rock and Crownpoint.[13]

39. As I have testified previously in this proceeding, structural cross-sections, fence diagrams and structure contour maps are reliable tools to identify faults. HRI has stated that it does not have such documentation. See, letter from Mark Pelizza to Robert Carlson (October 16, 1998), attached to letter from John T. Hull to Johanna Matanich (November 13, 1998). HRI has provided only stratigraphic cross-sections. Stratigraphic cross-sections are constructed by artificially shifting geologic units to create a horizontal top, and so cannot provide information on displacements. I stated in my January

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[13] Baseline water quality at Longoria was poor compared to that at Church Rock. Average total dissolved solids concentrations ranged from 1,100 to 1,900 mg/l at Longoria, compared with an average concentration of about 370 mg/l at Church Rock. FEIS at 3-36. See, also, Texas Department of Health memorandum on restoration values for URI's Longoria and Benavides projects, attached to this affidavit as **Exhibit 2-K**.

testimony (n. 3 at 20) that HRI has represented that structural data were analyzed for faulting and no such faults were discovered, when in fact, only the stratigraphic cross-sections were consulted. Then again in HRI's Response to the April 21 Order, HRI refers to "geologic cross sections" that "show no significant geologic structure," citing the 1993 Church Rock Revised Environmental Report. HRI Response at 8. Despite HRI's adoption of the ambiguous label "geologic cross sections," the 1993 Church Rock Revised ER still contains only stratigraphic cross-sections, not structural cross-sections. For its part, the NRC Staff has contributed to the unwarranted acceptance of HRI's geological interpretative information by claiming in several parts of the FEIS that structural data were reviewed to verify the absence of faulting. See, e.g., FEIS at 3-15, 3-21, 4-42, and 4-55. Structural data could provide some of the additional assurance on Section 8 faulting that the Presiding Officer is looking for. And HRI could prepare structural contour maps and structural cross sections fairly easily, based on the hundreds of driller's logs in its possession. Unfortunately, the NRC Staff has not required that such information be incorporated in the application, as recommended in its own Draft Standard Review Plan on uranium ISL mine applications, and HRI, on grounds of confidentiality, has refused to provide the driller's logs that could be used to generate the requisite structural information.[14] HRI has not provided grounds to assert confidentiality for this information, and I can think of no valid reason for the need of confidentiality. HRI's very intransigence on this matter is to me a factor that influences the credibility of any assurances that they would now offer.

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[14] See, Pelizza letter to Carlson (October 16, 1999), at 1-2.

40. HRI and the Staff both claim that monitoring wells and regular surety updates will reduce the likelihood of contamination. HRI Response at 16; Bartels Affidavit at 15; Ford Affidavit at 17-20. It is important to point out that neither monitoring wells nor surety upgrades will reduce the likelihood of vertical excursions, although immediate detection of an excursion may mitigate the resulting environmental damage. As Dr. Abitz, Dr. Staub and I have testified repeatedly in this proceeding, the monitoring well plan for the Crownpoint Uranium Project, including for Section 8, does not assure prompt detection of horizontal or vertical excursions. The 400-foot spaced perimeter monitor well ring is not consistent with geometries of the subsurface sand channels. No monitoring of the Cow Springs aquifer is planned or required, unless HRI determines, on the basis of new pump tests, that vertical connections exist between the Westwater and the Cow Springs. See, SUA-1508, License Conditions 10.25 and 10.32. Given the confusion and continuing debate over just what does underlie the Westwater, this issue has a serious potential to be completely mishandled, with possible serious environmental detriment. As for the overlying units, monitor wells are spaced over either 4 or 8 acres. License condition 10.20; Ford Affidavit at 16. By the time excursions are detected and finally confirmed under this regime, large areas of overlying or underlying units could be impacted.

41. Part C of Question 2 asks:

What environmental costs may reasonably be expected to result from foreseeable difficulties at Church Rock Section 8?

42. HRI and the NRC Staff never reach this point of discussion in their

responses, and it appears that the FEIS also fails to address the environmental costs that can be reasonably expected.

43. As I have explained above, vertical excursions may occur at Section 8. Because the monitoring requirements are loose, significant amounts of contaminants could travel into other units in an excursion. Dr. William Staub testified in January that correction of vertical excursions can be particularly problematic, and requires lengthy restoration efforts. Staub January Testimony at 16.

44. The FEIS does not identify the costs of vertical excursions. Certainly, given the difficulties, it is foreseeable that HRI would need to create a cone of depression to contain an excursion. Depending on the size of the excursion and the number of excursions that develop, HRI may be obliged to increase its consumptive use of water. The loss of this water is an environmental cost of the project operations, and of particular concern, given the limited groundwater resources of the San Juan Basin. And finally, there is the foreseeable risk that a vertical excursion may not be corrected, leaving measurable damage to the water quality of the surrounding units.

Question 1 of the April 21 Order

45. Question 1 of the April 21 Order asks:

> **Based on the experience of Uranium Resources, Inc. (URI) and of the in situ leach mining (ISL) industry generally, as well as the laboratory work reported in the Final Environmental Impact Statement, NUREG-1508, February 1997, Tables 4.8 and 4.9 at pp. 4-32, 33, what important difficulties (including unlikely but foreseeable difficulties) may reasonably be considered for the Crownpoint Uranium Project (CUP) concerning restoration of groundwater quality at Church Rock Section 8? What environmental costs may reasonably be expected to result from foreseeable difficulties?**

46. The NRC Staff responded that it believes baseline for Section 8 will be set at high levels of uranium and radium, thereby reducing "the difficulties in restoring the uranium and radium levels in the groundwater to baseline," and given the "chemical inability" of contaminants to move outside the well field, the license requirement of a restoration demonstration, and surety updates, environmental costs resulting from lixiviant excursions would be "very low." Ford Affidavit at 14-15.

47. HRI similarly asserts that "if HRI were to fail to restore the groundwater at Section 8 to or near baseline, the practical significance would be that previously unusable water would remain unusable." HRI Response at 2-3. HRI claims that the "a priori risk that groundwater restoration will not attain baseline values probably cannot be quantified" and the FEIS communicates confidence that HRI will achieve restoration. HRI Response at 4-5. HRI also asserts that even if restoration did not occur, there would be "no significant environmental costs." HRI Response at 6.

48. As Dr. Abitz states in his Response Affidavit, however, the water quality outside of the ore zones of the Westwater is generally pristine, and the water inside the ore zones is generally very good, with the except of slightly elevated levels of uranium and radium-226. The overall superior quality of the native groundwater at the Church Rock site, coupled with the well-documented difficulties that the uranium ISL industry continues to have in restoring good quality water at commercial-scale mines in Wyoming, suggests to me that restoration at Church Rock Section 8 will be difficult. The difficulties inherent in remediating groundwater that has been willfully contaminated as a consequence of mining will be exacerbated if, as the NRC Staff suggests (Ford Affidavit

at 13-15), HRI will depend largely on natural attenuation through chemical reduction to achieve baseline or drinking water standards that it could not achieve through active remedial methods.

49. In addition, Section 8 presents certain foreseeable complications for groundwater restoration. First, as I explained in my January Testimony, the mine workings at Section 17 promise to complicate any restoration at Section 8. I further explained that any restoration of Section 17 well fields will require the mine workings to be dewatered below the regional water table. Wallace January Testimony at 66-75. This approach would also lower the water table on Section 8, reintroducing oxygen into Section 8 ore zones, and mobilizing contamination, despite any previously successful restoration efforts.[15] Second, any vertical excursions for the project would impede successful restoration. I described how undetected leaky aquifers quickly created excursion problems at other ISL mines. Id. at 50-51. And in my reply to HRI's and the Staff's responses to Question 2A above, I identified several factors that support the existence of aquifer interconnection at Church Rock, and concluded that there is little assurance that these factors can or will be mitigated to prevent contaminant migration.

50. The environmental costs of these foreseeable risks during restoration can be quantified with a minimal amount of effort, yet the FEIS was completely void of any quantitative estimate, or even qualitative description, of the cost of contaminated

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[15] In his February 1999 affidavit, Mr. Ford postulates that since dewatering had occurred in Section 17 in the past, this may have already occurred. I concur, and consider this to be a potentially important issue. However, the next time dewatering occurs (if it occurs), sodium bicarbonate (the 'paint-stripping' component of the lixiviant) will also be present, as well as oxygen. This will exacerbate the problem much more than reintroduction of only oxygen.

groundwater after restoration.

51. In a relatively short time, I developed a model to quantify the volume of groundwater that may reasonably be contaminated at the end of restoration. I employed a simple scenario, rather than introduce the foreseeable complications, such as a vertical excursion. Examination of the plumes in Plate 1 (**Exhibit 2-G**) shows at least some cases in which the plume is stretched along the entire 14,000-plus-foot length from the mining area to the water well. Dispersion has widened the plume considerably as well. However, some of this width is comprised of low-concentration solute. Giving the applicant the benefit of the doubt, I would estimate a problem zone of degraded groundwater with dimensions of 12,000 feet long by 700 feet wide by 200 feet thick. Assuming a porosity of 0.2, this is equivalent to 336 million cubic feet. That is equivalent to 7,713 acre-feet of water. Potable groundwater that is not in use as drinking water has a water rights value $3,000 to $4,000 per acre-foot. See ENDAUM's and SRIC's NEPA Presentation (February 19, 1999) at 37, n.11. At approximately $3,500 per acre-foot of treatment cost, this volume of ISL-contaminated groundwater represents an estimated environmental cost of nearly $27 million. Hence, at current uranium market prices of $10 to $11 per pound and projected production levels of 800,000 to 1 million pounds per year, HRI would have to produce uranium from Section 8 for at least 2.5 years just to raise enough money in gross revenues to pay the cost of the groundwater cleanup.

Question 8 of April 21 Order

52. In Question 8 of his April 21 Order, the Presiding Officer ordered the Intervenors to provide a reference to a 1991 paper by A. Jun Cowan. Intervenors ENDAUM and SRIC located the paper and provided a full copy to the Presiding Officer, his special assistants and the Service List on May 18, 1999. HRI chose not to provide a copy of the Cowan paper. ~~Since then, Dr. Lucas, who is recognized internationally as a preeminent expert in Jurassic paleontology and sedimentology, particularly in the San Juan Basin of northwestern New Mexico, has reviewed the Cowan paper and concluded that it fully supports the Intervenors' experts' conceptualization of the Westwater Canyon Member as a highly heterogeneous, fluvial environment of stacked, thin and narrow sand channels. Lucas Affidavit at ¶12.~~

53. Cowan's work may cause a reconsideration of important depositional history, but it does not change a thing hydrologically. Cowan's conduits, scallops, scour fills, and other small-scale geologic features observed within the regional "channel belt system" support heterogeneity more than ever. HRI's recent response, apparently willfully ignorant of differences between hydrologic and geologic nomenclature, takes one line from the abstract of the Cowan paper completely out of context, and then distorts the implications of the paper for this proceeding.[16] HRI Response at 41-43. The Cowan paper, as a geologic report, concerns the definition of what constituted a "channel" during the time of deposition of the unit millions of years ago. My testimony and affidavits in this case concern what constitutes a channel in a hydrological sense. Hydrologically, a

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[16] I don't know which Cowan paper that HRI's attorneys reviewed, but the one at issue here does not conclude, as they so assert, "that no channel systems exist in the Westwater." In fact, Cowan describes, photographs and draws dozens of sand channels averaging 30 meters (or, about 100) in width within a regional "channel belt." Cowan (1991), at 80-81; ~~Lucas Affidavit, ¶12.~~

"channel" is a conduit for increased flow. Geologically, a "channel" is basically a linear depression in the land surface through which surface water collects and flows, such as a stream or river. Cowan describes how a previous author had characterized certain fluvial features within the Westwater Canyon Sandstone as ancient channels in the geologic sense. Cowan argues convincingly that these features are actually "conduits," not channels. These conduits are nothing more than one element of the hydrologic channel features that I refer to. Even Cowan refers to these conduits as "permeability-pathway compartments". ~~Lucas Affidavit, ¶12.~~ To a hydrologist, these are basically questions of geologic nomenclature, since whatever the features in question may be called, they are still fluvial heterogeneous channel-like structures that impact groundwater flow. There is simply no way any professional hydrogeologist could misinterpret Cowan's article (see, e.g., Cowan's Figure 18) to suggest homogeneity of the Westwater in any shape or form.

LIST OF EXHIBITS

AFFIDAVIT OF MICHAEL G. WALLACE
MAY 21, 1999

EXHIBIT NO.	DESCRIPTION	NO. PAGES
2-A	Table 1. Values Used in Section 8 Model	1
2-B	Figure 1a. Grid and other model features	1
2-C	Figure 1b. Detail of grid	1
2-D	Figure 2. Observed vs. Residuals: Calibration Results for Channel Case (circles) and for Homogeneous Case (crosses)	1
2-E	Figure 3. Heterogeneity map for model	1
2-F	Figure 4. Initial contaminant source distribution (shaded)	1
2-G	Plate 1. Selected plume distributions from the Finite Difference model run (concentration shown by color bar legend)	1
2-H	Plate 2. Selected plume distributions from the MOC model run	1
2-I	Table 2. Time History of Concentration Impacts at Nearest Private Well	9
2-J	Letter from Edward H. Morales, UNC, to Ross Scarano, NRC (December 10, 1998), transmitting environmental monitoring data for 4th Quarter 1997 to 3rd Quarter 1998	3
2-K	Memorandum from Joseph F. Thiel, Texas Department of Health, to License File #8-2704 (May 4, 1987), concerning Recommended Radiological Restoration Values for Uranium Resources Inc.'s Benavides and Longoria Projects	

STAFF EXHIBIT C

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD PANEL

Before Administrative Judges
Peter B. Bloch, Presiding Officer
Robin Brett, Special Assistant
Thomas D. Murphy, Special Assistant

In the Matter of:	)	
HYDRO RESOURCES, INC. 2929 Coors Road NW, Suite 101 Albuquerque, NM 87120	)	Docket No. 40-8968-ML ASLBP No. 95-706-01-ML

AFFIDAVIT OF DR. RICHARD J. ABITZ
IN RESPONSE TO THE PRESIDING OFFICER'S QUESTIONS
IN THE MEMORANDUM AND ORDER OF APRIL 21, 1999

I, Richard J. Abitz, being duly sworn, declare as follows:

1. I am competent to make this affidavit, and the factual statements herein are true and correct to the best of my knowledge, information and belief. The opinions expressed herein are based on my best professional judgment.

2. I am making this affidavit on behalf of Eastern Navajo Diné Against Uranium Mining ("ENDAUM") and Southwest Research and Information Center ("SRIC") to provide responses within my areas of expertise to the questions on groundwater protection contained in the Presiding Officer's Memorandum and Order (Questions) dated April 21, 1999 ("April 21 Order").

3. My qualifications to make this affidavit are contained in my resume, which was

attached as Exhibit A to my written testimony of January 11, 1999 (hereafter "Abitz January Testimony"), given in support of Intervenors ENDAUM's and SRIC's amended written presentation on groundwater protection, dated January 18, 1999. My relevant education, training and experience were summarized on pages 1-3 of my January Testimony. As stated therein, I have a Ph.D. in geology and extensive professional experience in geology and geochemistry, serve as a technical expert to the U.S. Department of Energy ("DOE") on uranium mobility and remediation at the DOE Fernald, Ohio, facility, and have worked on groundwater contamination at the United Nuclear Corporation ("UNC") uranium mill tailings site located 2.5 miles from the proposed HRI Section 8 and Section 17 Church Rock ISL mine.

4. In preparing this affidavit, I reviewed the following documents: (1) the Presiding Officer's April 21 Order; (2) NRC Staff Response to Questions Posed in April 21 Order, and the affidavit of William H. Ford attached thereto (hereafter, "NRC Staff Response" and "Ford Affidavit", respectively); (3) Hydro Resources, Inc.'s Response to April 21, 1999 Memorandum and Order (Questions), and the affidavit of Craig S. Bartels, attached thereto (hereafter, "HRI Response" and "Bartels Affidavit"). In addition to these documents, I am familiar with the written testimonies of Dr. William P. Staub and Mr. Michael Wallace, which were attached as Exhibits 2 and 3, respectively, to Intervenors' Amended Groundwater Presentation, and Dr. Staub's and Mr. Wallace's reply affidavits given in support of ENDAUM's and SRIC's Reply in Response to HRI's and NRC Staff's

Response Presentations on Groundwater Protection Issues (April 8, 1999) ("ENDAUM-SRIC Reply Brief"). I also reviewed ~~the affidavit of Dr. Spencer G. Lucas, given on behalf of ENDAUM and SRIC in response to the April 21 Order,~~ and the paper by A. Jun Cowan (hereafter, "Cowan Paper"), ~~that Dr. Lucas discusses in detail.~~ Finally, I remain familiar with the professional literature relevant to groundwater issues associated with the Crownpoint Uranium Project ("CUP").

5. In the paragraphs that follow, I address Questions 1, 3, and 8 of the April 21 Order, either in whole or in part.

6. Question 1 of the April 21 Order stated:

Based on URI's experience, the experience of the ISL industry in general, and the lab work reported in Tables 4.8 and 4.9 of the FEIS, what important difficulties (including unlikely but foreseeable difficulties) may reasonably be considered for the CUP concerning restoration of groundwater quality at Church Rock Section 8? What environmental costs may reasonably be expected to result from foreseeable difficulties?

7. Based on my evaluation of the geology of the Westwater Canyon Formation, analytical data on the water quality of the Westwater Canyon Aquifer in ore and non-ore zones below Section 8, and on the relevant experience in the uranium ISL industry, it is my professional opinion that it is highly unlikely that Westwater Canyon groundwater in the southeastern quarter of Section 8 will be restored to

either primary or secondary restoration goals, as those goals are defined in the FEIS (at 4-27 to 4-29) and in the HRI license (SUA-1508, License Condition 10.21(A)). Moreover, it is unlikely that Westwater Canyon groundwater at the nearest downgradient off-site locations in Section 9 and the northeast quarter of Section 8 will be restored to baseline conditions or drinking water standards. In fact, the NRC Staff's clear intention, revealed in Mr. Ford's affidavit (at 13-15), is to hope that restoration standards can be achieved by natural attenuation through chemical reduction. This restoration approach technique is not based on any field-level redox studies or empirical data, and is likely to fail. My reasons for these conclusions follow.

8. Restoration of ore-zone groundwater to baseline or drinking water standards was not demonstrated in core leach tests for several critical parameters, even after flushing of the crushed ore more than 20 times. FEIS, Table 4.8 at 4-32 and Table 4.9 at 4-33. Complete restoration to baseline was not demonstrated after three pore volumes in the Teton field-level pilot test for 11 of 28 parameters. Abitz January Testimony, Table 1 at 12, and FEIS Table 4.12 at 4-36. Restoration to baseline was not successful after 16.7 pore volumes at the Mobil Section 9 pilot project for several critical, health-based constituents, including barium, boron, cobalt, lead, mercury, molybdenum, nickel, radium-226, uranium and zinc. FEIS, Table 4.13 at 4-36. The Teton and Mobil pilot projects are the most relevant field-level experience for predicting restoration performance at the commercial scale proposed by HRI at Church Rock and Crownpoint. At both sites, leaching was done in the Westwater Aquifer in groundwater possessing virtually the same

water quality as that at the HRI sites. Id. at 4-36, 4-38; Abitz January Testimony at 12; Staub Testimony at 40. In the Mobil case, leaching took place over an 11-month period, yet restoration efforts continued for some 6 years before NRC released Mobil from further remedial activities. Staub Testimony at 20, Exhibit L.

9. Undetected excursions outside the ore zone are highly likely for the following reasons:

(a) The pregnant lixiviant contains high concentrations of several regulated constituents, including arsenic, uranium, radium and total dissolved solids (FEIS, Table 2.1 at 2-6; Table 4-8 at 4-32; and Table 4.13 at 4-38). Once oxidized, arsenic, uranium and other mobile constituents will migrate outside of the leaching zones.

(b) Lixiviant containment will be jeopardized by reinjection of nearly all of the 1 percent bleed rate. Wallace Reply Testimony at 13-19; Staub Testimony at 34-35.

(c) The complex channel structures in the sheet sands of the Westwater Canyon Formation, which were described, photographed and drawn by Cowan (1991, at 83-85) ~~(see, also, Lucas Affidavit at ¶¶9-10),~~ will facilitate contaminant migration away from the ore zones. Wallace Reply Testimony at 19.

(d) The wide spacing of downgradient monitoring wells (i.e., one well every 400 feet) — a spacing that has no relation to the geometry of the narrow

and thin sand channels — will allow contaminant plumes to migrate undetected beyond the monitor well ring. Id. at 18; Staub Testimony at 36-38; Abitz January Testimony at 27-30, 31-33.

1. Contamination of fresh, potable groundwater, found largely in *non-ore zones*, will occur as a result of undetected excursions. This is because the bulk of the groundwater within the Westwater Canyon Formation is within *non-ore zones*, where the water quality is very good to excellent and meets all EPA drinking water standards. Abitz January Testimony at 11-15. Restoration limited to the ore zone will not address the impacts of excursions in non-ore zones of the aquifer.

2. Uranium ISL restoration to baseline levels or EPA drinking water standards has not been demonstrated in high water quality environments in Wyoming and New Mexico. See, generally, Staub Testimony at 17-22. No commercial-scale ISL mine in Wyoming has been restored to baseline or drinking water standards. Abitz Reply Testimony at 2; Staub Reply Testimony at 7. ISL operations in Wyoming did not restore selenium, radium, and uranium concentrations to baseline values after more than 20 pore volumes were passed through the mined ore zones. Abitz January Testimony at 48 and Exhibit J. Restoration at a small-scale ISL field test, the Teton Pilot site located 2 miles west of Church Rock, did not return selenium, radium, and uranium concentrations to baseline values. Abitz January Testimony, Table 1 at 12. At the Bruni Project in Texas, 25 pore volumes were processed in a reverse-osmosis circuit, yet ammonium, sulfate, and uranium concentrations

continue to exceed the restoration limits of the Texas Department of Water Resources. Abitz January Testimony at 49. Restoration schedules were lengthened and some restoration standards were relaxed to facilitate restoration at several Texas sites, including Uranium Resources, Inc.'s ("URI") Benavides Mine. Staub Testimony at 22-23.

3. In describing "baseline" water quality at its New Mexico sites, including at the Church Rock site, HRI grouped ore, non-ore, and non-Westwater groundwater samples into a single population, thereby artificially distorting upward average baseline concentrations. As illustrated in Tables 1 and 6 of my January testimony (at 12 and 26, respectively), and as I discussed at length therein, baseline values need to be calculated for ore and non-ore zones in the Westwater Canyon aquifer, and samples showing clear indication of contamination from anthropogenic activities (i.e., non-Westwater samples) must be excluded from the data set. Given HRI's past practice of averaging ore zone water quality with non-ore zone water quality, and the NRC Staff's uncritical acceptance of this practice (see, e.g., FEIS at 3-27, 3-32 and 3-36; Ford Affidavit at 13), I have serious concerns about the accuracy of formal baseline values that would be determined for each of the HRI sites pursuant to License Conditions 10.21, 10.22 and 10.25. SUA-1508 at 7-8.

4. Neither HRI nor the NRC Staff has published site-specific geochemical data to support the conclusion that redox conditions downgradient of the ore zone will enhance restoration efforts by the precipitation of uranium and other redox

sensitive metals (e.g., arsenic and selenium). At a minimum, HRI should have evaluated well-established redox "couples" (e.g., Fe^{2+}/Fe^{3+}, As^{3+}/As^{5+}, Mn^{2+}/Mn^{4+}, Se^{4+}/Se^{6+}, U^{4+}/U^{6+}) in downgradient groundwater to establish the reduction potential in all zones of the aquifer (i.e., sand channels, silt and mud in point bars, etc.). Without such geochemical studies, the NRC staff has no real basis for its view that redox reactions will attenuate any residual contamination leaving the mining zones during operations or after restoration. See, Ford Affidavit at 7-8, 13-15.

5. Rather than answering the question posed by Judge Bloch, "...what important difficulties (including unlikely but foreseeable difficulties) may reasonably be considered, . . ." HRI and the NRC Staff chose to continue to cite the incorrect conclusions in the FEIS while ignoring the substantial body of evidence on (1) the groundwater data that indicate very good water quality in the Westwater under Section 8, (2) the documented ISL history of excursions, and (3) the failure of the ISL industry to restore commercial-scale uranium ISL operations in Wyoming.

6. HRI and the NRC Staff hydrologist William Ford respond to the query on restoration of groundwater quality by simply stating that:

   (a) "Groundwater at Section 8 is not currently a source of drinking water and its future use is severely restricted due to the naturally occurring concentrations of radionuclides." HRI Response at 2.

   (b) "Given the poor water quality now present in the ore zone at Church Rock Section 8 as a result of uranium and radium concentrations [and] the chemical

inability of these groundwater constituents to move outside the well field area, . . .it is extremely likely that after in situ leach mining is completed, the groundwater quality will be restored to acceptable levels so that the water use of the aquifer is maintained." Ford Affidavit at 2.

(c) HRI and Ford are incorrect on these points. As I discussed in detail in my January testimony (at 11-15) and reiterated in Paragraph 10 above, Section 8 groundwater from the ore zone meets EPA primary drinking water standards at well CR-4, and very nearly at well CR-5 (radium-226 = 5.3 pCi/L). Further, most of the groundwater in the Westwater Canyon aquifer lies outside the ore zones and currently meets the EPA primary drinking water standards (e.g., CR-7). The poor water quality referred to by HRI and Ford is a result of HRI's mixing of ore-zone water and oxidized water surrounding the old Church Rock underground mine (see, e.g., data for CR-8, in Abitz January Testimony, Table 2 at 14) with non ore-zone water, thereby introducing statistical bias into their calculations of baseline. This practice particularly distorted levels of uranium and radium. Since HRI has not calculated baseline properly at the Church Rock sites, groundwater quality in Section 8 cannot be argued to be of poor quality simply because isolated ore zones in the aquifer occasionally yield uranium and radium concentrations that exceed their

respective EPA primary drinking water standards.[1]

16. Mr. Ford further assumes that once mobilized, arsenic, uranium, and radium are not chemically able to migrate outside the well field area. He supports his conclusion by citing the studies of Deutsch (1983 and 1985), which state that "...redox- (oxidation/reduction) sensitive ions such as uranium, arsenic, selenium, and molybdenum precipitate from solution if the restored water moves into a reducing zone. Therefore, after restoration activities, if groundwater moves into a reducing area, concentrations of these ions should rapidly decrease in the groundwater" (emphasis added). Ford Affidavit at 6-7. Mr. Ford misses the operative word "should" in Deutsch's conclusion. Uranium and other redox sensitive elements (e.g., arsenic and selenium) are placed in a highly mobile form during in situ leaching and commonly migrate outside the well field area, as demonstrated by the excursion history of ISL operations in Wyoming and Texas. See, Staub Testimony at 11-15 and Exhibits C through K. ~~Mr. Ford produces no information on reaction kinetics to support the speculation that the concentrations of uranium and redox sensitive ions will rapidly decrease in the groundwater of the Westwater Canyon aquifer as water moves away from the ore zone.~~ Further, as noted above in Paragraph 13, neither HRI nor the NRC Staff has produced geochemical data on the redox state of the Westwater Canyon aquifer

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[1] **As I have noted before in this proceeding, EPA proposed a drinking water standard for uranium of 0.020 mg/L, but never promulgated a final standard. EPA has promulgated a final uranium standard of 0.044 mg/L (or 30 pCi/L) for cleanup of groundwater at UMTRA (Uranium Mill Tailings Remedial Action) Project sites.**

downgradient from the proposed ISL operations.

17. Finally, Mr. Ford demonstrates his own confusion about the chances of successful restoration at Church Rock with two contradictory statements: First, in Paragraph 4, he concludes that "it is extremely likely" that groundwater quality will be restored "to acceptable levels" (emphasis added). Ford Affidavit at 2. Then, in Paragraph 5, he concludes from examination of the Mobil Section 9 pilot restoration data that "it is unlikely that groundwater restoration activities at the Church Rock site will achieve baseline concentrations for all groundwater parameters" (emphasis added). Id. Mr. Ford notes correctly in Paragraph 5 that groundwater restoration was not successful at the Mobil Section 9 pilot site for most chemical and radiological constituents of concern. He does not acknowledge, however, that Mobil's experience was not unique in the history of the uranium ISL industry. As Dr. Staub and I discussed at length in our January 1999 testimonies (see, Staub Affidavit at 20 and Abitz Affidavit at 47), the ISL industry has not had success in restoring uranium and radium groundwater quality at ISL mines in Wyoming, Texas, or New Mexico. Moreover, based on these discussions presented in the testimonies of Abitz and Staub, HRI is also incorrect when it states that "Intervenors...have been unable to cite credibly a single instance of significant groundwater degradation or environmental cost much less adverse public health consequences associated with ISL uranium extraction." HRI response at 3.

18. In citing the FEIS at 4-39, HRI notes: "...the staff conclude that practical

production-scale groundwater restoration activities would at most require a 9 pore volume restoration effort." This statement is incorrect and simply unbelievable, as Tables 4-8 and 4-9 in the FEIS clearly show that uranium and radium were not returned to baseline values after 16, 16.7, 20 and 28 pore volumes in both bench-scale tests and at the Mobil Section 9 pilot site. Mr. Ford corroborates the failure of restoration for the critical contaminants in Paragraph 18. Ford Affidavit at 10-11. Undeterred by the facts, HRI concludes that, "No important difficulties, including unlikely but foreseeable difficulties, concerning groundwater restoration present themselves for consideration." In a fashion true to the history of this project, HRI chooses to believe what suits its case and ignores a large body of evidence that shows excursions are prevalent in ISL operations and groundwater parameters are rarely restored to drinking water standards. And in the instances where restoration has been completed at the Texas sites, the water quality was poor to begin with, restoration goals were relaxed, and restoration schedules lengthened. Staub Testimony at 21-25.

19. Question 3 of the April 21 Order stated: **"Qualitatively, and if possible, quantitatively, what are the effects on the quality of water that may reasonably be foreseen at the closest private water wells to Church Rock Section 8, resulting from the poorest foreseeable condition of the groundwater after restoration is complete."**

20. The poorest foreseeable condition of groundwater after restoration is likely to be represented by restored values shown in Table 4.8 of the FEIS where uranium ranged from 5.1 mg/l to 10.6 mg/L and radium ranged from 231 pCi/l to 1,010 pCi/l in "restored" core leach water. ~~As Mr. Wallace has now demonstrated by modeling post-restoration transport of uranium at only 1 mg/l (Wallace Response~~

Affidavit, May 20, 1999, ¶¶24-27), post-restoration contamination will migrate offsite, far from Section 8. Given the high quality of groundwater in the Westwater Canyon Aquifer that can reasonably be expected to occur in Section 9, immediately downgradient of Section 8, and the high value of groundwater as the only drinking water source in the area, future groundwater use in Section 9 (which is virtually certain) is seriously jeopardized by contaminant migration from Section 8. Future use is an appropriate concept for groundwater protection and is embodied in many statutes, including the New Mexico Water Quality Act. Therefore, the inability of the ISL industry to restore groundwater to EPA drinking water standards endangers the future use of the Westwater Canyon aquifer as a drinking water supply.

21. The nearest locations where local residents or regional water suppliers could choose to install and complete water wells for domestic and/or municipal water supplies include that portion of Section 8 which lies north of the HRI's property boundary and that portion of Section 9 which lies immediately east of and adjacent to HRI's property boundary. As noted above in Paragraphs 10 through 18, HRI will have considerable difficulties restoring groundwater to premining, baseline values and protecting the very high quality groundwater that exists in the Westwater Aquifer at the nearest point of reasonably foreseeable future use. Therefore, the quality of groundwater at future wells placed in Sections 8 and 9 is likely to be unfit for human consumption should HRI conduct ISL operations in Section 8.

22. HRI asserts, "There will be no impact, pre- or post-restoration, on water quality at the closest private well as a result of HRI's operations at Church Rock Section 8." HRI Response at 16. Again, HRI's conclusion is based on incorrect conclusions in the FEIS on restoration capabilities and future use of the aquifer. HRI has not addressed the question with respect to the "...poorest foreseeable condition of groundwater after restoration is complete." As noted in Paragraph 20, the poorest foreseeable condition for restored groundwater is likely to be the restored concentrations reported in Table 4.8 of the FEIS. ~~Given the poor water quality reported in Table 4.8 of the FEIS, a reasonable interpretation of the architectural fabric of the Westwater sandstones (Cowan, 1991, and Lucas Affidavit at ¶¶13-14), and future wells in Sections 8 and 9, groundwater travel times are likely to be much faster than estimated by HRI's Craig Bartels (see, Bartels Affidavit at 17-18). Indeed, Mr. Wallace has now demonstrated adverse impacts of contaminant migration within a generally accepted "future use" planning horizon of 200 years. Wallace Response Affidavit, ¶¶24-27 and Exhibits 2-G and 2-H. Hence, ENDAUM and SRIC have presented credible and compelling evidence that off-site groundwater in Sections 8 and 9 is likely to be degraded beyond non ore-zone baseline levels and drinking water standards.~~

23. Question 8 of the April 21 Order states: **"Intervenors Groundwater Exhibit L quotes Cowan (1991), who states that near Church Rock, channelways '15-30 m. thick' occur 'which would affect fluid flow.' SRIC/ENDAUM will please promptly provide a reference for the citation so that we may discover whether Cowan says anything about the width of these channelways."**

24. The work of Cowan (1991), ~~and the interpretation of the Cowan work by Dr.~~

~~Spencer Lucas, a known international authority on Jurassic sediments, including those of the Morrison Formation in northwestern New Mexico,~~ clearly shows that heterogeneity exists in the Westwater Canyon Formation on the scale of tens of meters. ~~As noted in Dr. Lucas's affidavit (at ¶12 and ¶13),~~ Cowan argues that the channel systems identified by Campbell are 30 to 300 meters wide and are not primary depositional features, but instead are "post-depositional aquifer conduits, or permeability-pathway components." The aquifer conduits, or permeability pathway components, are precisely the type of hydrologic anisotropy that invalidates the groundwater transport model presented by HRI in its application and uncritically accepted in the FEIS. Moreover, the geohydrologic conceptual model of the Westwater Canyon proposed by Mr. Wallace and I in our January testimonies is corroborated by the Cowan study ~~and Lucas's interpretation of it.~~ The bottom line is that hydraulic anisotropy is present in the Westwater Canyon Formation and neither HRI nor the NRC Staff have adequately addressed its implications for the fundamental issue of lixiviant control and containment at Section 8. The FEIS remains, therefore, substantially inaccurate in its treatment of hydrology and contaminant transport issues within the Westwater sands, and therefore in a wholly inadequate document for evaluating the environmental impacts of the Crownpoint Uranium Project.

STAFF EXHIBIT D

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD PANEL

Before Administrative Judge Peter B. Bloch

In the Matter of	
HYDRO RESOURCES, INC.	Docket No. 40-8968-ML
2929 Coors Road Suite 101	
Albuquerque, NM 87120	ASLBP No. 95-706-01-ML

RESPONSE AFFIDAVIT OF DR. SPENCER G. LUCAS

I, Spencer G. Lucas, being duly sworn, make the following statement in response to Hydro Resources, Inc.'s Reply to April 21, 1999 Memorandum and Order (Questions) (May 11, 1999) and to the Affidavit of Craig S. Bartels ("Bartels Affidavit"), attached thereto, with respect to Questions 2 and 8:

1. My name is Spencer G. Lucas. I obtained a Ph.D. in geology from Yale University in 1984. I am currently the Curator of Paleontology and Geology at the New Mexico Museum of Natural History, a position that I have held since 1988. In addition, I have served as an Adjunct Professor of Geology at the University of New Mexico since 1988.

2. I have extensive knowledge of the geology for which Hydro Resources, Inc. ("HRI") proposes the Crownpoint Uranium Project. The Westwater Canyon Mem. . . Aquifer in the Morrision Formation was deposited in Late Jurassic time. I began to conduct field studies of Jurassic strata in New Mexico in 1983. In 1988, this research program expanded to a regional study of Jurassic stratigraphy,

paleontology and sedimentation in the Four Corners states. As a result of my research, I co-led three field conferences of the New Mexico Geological Society (in 1985, 1989 and 1997) in which a major focus was the Jurassic rocks. I have published several dozen articles and abstracts on Jurassic strata in New Mexico, which encompass a major re-interpretation of Middle-Late Jurassic stratigraphy, deposition and paleogeography in the American Southwest. Further details of my professional qualifications are set forth in my curriculum vitae, which is attached as Exhibit A, and in my scientific bibliography, which is attached as Exhibit B.

3. In preparation of this affidavit I reviewed the following materials:

-Intervenors' Amended Written Presentation in Opposition to Hydro Resources, Inc.'s Application for a Materials License with Respect to: Groundwater Protection and Exhibits (January 18, 1999);

-Hydro Resources, Inc.'s Response to Intervenors' Brief in Opposition to Hydro Resources, Inc.'s Application for a Materials License with Respect to Groundwater Issues, Lichnovsky Affidavit (February 19, 1999);

-The Presiding Officer's April 21, 1999 Memorandum and Order (Questions);

-Hydro Resources, Inc.'s Reply to April 21, 1999 Memorandum and Order (Questions) (May 11, 1999) and the attached Affidavit of Craig S. Bartels;

-Campbell, C. V., 1976, Reservoir geometry of a fluvial sheet sandstone: American Association of Petroleum Geologists Bulletin, v. 60, p. 1009-1020;

-Cowan, E. J. 1991. The large-scale architecture of the fluvial Westwater Canyon Member, Morrison Formation (Upper Jurassic), San Juan Basin, New Mexico: SEPM Concepts in Sedimentology and Paleontology 3, p. 80-93;

-Walker, R. G., 1992, Facies, facies models and modern stratigraphic concepts; in Walker, R. G. and James, N. P., eds., Facies models: Geological Association of Canada, St. John's, Newfoundland, p. 1-14.

4. Question 2 of the April 21, 1999 Order asks:

Based on local geology, what assurance is there concerning the likelihood of the existence of shears, fractures, and joints that could transmit appreciable quantities of water above or below the Westwater aquifer? How much greater assurance may reasonably be anticipated prior to commencing ISL operations at Churchrock Section 8? What environmental costs may reasonably be expected to result from foreseeable difficulties at Churchrock Section 8?

Michael G. Wallace responds to HRI's Response to this question in his affidavit. The following comments are intended to supplement his response.

5. HRI claims (citing the FEIS) that the mine zone in the Westwater is confined by good aquitards, with good overlying clays and underlying shale. HRI Response at 8. Specifically, HRI claims that there is little risk of excursion into the underlying Cow Springs aquifer because of the thickness of the Recapture shale. HRI Response at 10. I concur with the January 11, 1999, testimony of Mr. Wallace that the Recapture Shale is not a confining layer in this region because the Recapture is a fluvial deposit in the southern part of the San Juan Basin. The nomenclature used in this instance is misleading and outdated.

6. The rock section immediately below the Westwater Canyon Member is not shale – it is a mixture of sandstone, siltstone and thin gypsum beds that overlie the gypsum beds of the upper Todilto Formation. These gypsum beds regionally are known to be very ductile and soluble. Thus, they are easily deformed or dissolved, and this produces numerous fractures in the subsurface and at the surface. These fractures are well documented because they are conduits for groundwater flow and also sometimes serve as the loci of uranium mineralization.

7. Mr. Bartels refers to the overlying layers at Church Rock as the Poison Canyon and Dakota formations. Bartels Affidavit at 9. In fact, the Poison Canyon is the

~~designation of an ore horizon in the Ambrosia Lake/Laguna region of New Mexico. The overlying layers at Church Rock about the Westwater are the Brushy Basin B sand and the Dakota formations. This is a remarkable error, which undermines confidence in HRI's ability to understand the details of geologic conditions in Church Rock.~~

~~8. Question 8 of the April 21, 1999 Order asks:~~

> ~~Intervenors Groundwater Exhibit L quotes Cowan (1991), who states that near Church Rock, channelways "15-30 m. thick" occur "which would affect fluid flow." SRIC/ENDAUM will please promptly provide a reference for the citation so that we may discover whether Cowan says anything about the width of these channelways.~~

~~9. The citation is correct in that the Cowan study identifies channelways within the channel system which conduct fluid flow along channel boundaries. HRI's attorney criticizes the Cowan study as "mostly a two dimensional study.. that is "based on a very small portion of the Westwater Canyon Member." HRI's Response at 41. These criticisms are unfounded. HRI's statement that "Cowan's description of the Westwater Canyon as made up of coalesced sand sheets precludes the existence of confined elongated channels" is also a misreading of the article. HRI Response at 41.~~

~~9.~~ ~~10.~~ ~~Cowan is a state-of-the-art scientific study designed to reconstruct the fluvial architecture of the Westwater Canyon Member of the Morrison Formation in west-central New Mexico. In a sedimentological study such as that of Cowan, an architectural element is defined as a "morphological subdivision of a particular depositional system that emphasizes the three dimensional geometry of the facies~~

[rock environment] associations" (Walker, 1992, p. 2, 5). In other words, the term architecture is used by sedimentologists to mean the three dimensional geometry of a rock body formed in a particular environment. Indeed, both the text and the illustrations of Cowan's article (see especially his figure 18, Exhibit C) make it clear that the goal is to reconstruct, in three dimensions, the fluvial system which deposited the Westwater Canyon Member.

11. Therefore, HRI's statement that Cowan's article "is mostly a two-dimensional study..." is misleading.

12. Cowan (1991) re-evaluates an important study of Westwater Canyon Member deposition by Campbell (1976), who concluded that deposition took place in channel systems 1.6 to 34 km wide by a braided river system composed of many smaller channels with widths of 30 to 366 m. Cowan argues that the channel systems identified by Campbell are not primary depositional features, but instead are "post-depositional aquifer conduits, or permeability-pathway components" (p. 80). Cowan concludes that Westwater Canyon deposition was in channel belts one to several km wide composed of numerous, smaller channels. Cowan's article thus well documents the lithologic heterogeneity of the Westwater Canyon Member at the scale of the small channels (which are associated with lenticular bar and overbank deposits) and the continuity of long, nearly linear channel belts. A modern analogy is the depositional development of the Rio Grande and upper-middle reaches of the Mississippi Rivers, as they change course and sediments accumulate, forming sandbars. Therefore, the statement of HRI's attorney that "Cowan's description of the Westwater Canyon as made up of coalesced sand

sheets precludes the existence of confined elongated channels" is a misreading of the article.

13. What HRI fails to appreciate is that at a "small scale" (channel widths of tens to hundreds of meters), the Westwater Canyon is a three-dimensionally very complex amalgamation of many coalesced channel, bar and overbank deposits. But, at a "large scale" (widths of hundreds of meters to a few kms) the Westwater Canyon Member consists of long, discrete channel belts, just like those produced by modern braided rivers. Thus, at the small scale the Westwater Canyon is lithologically heterogeneous, consisting of numerous, interlaced ribbon-like sandstone bodies and lenses of conglomerate and mudrock, but only at the large scale can each channel belt be superficially characterized as sandstone, because the majority of the deposit is sandstone.

14. Cowan's article can be used to conclude there must be at least two levels of permeability/porosity in the Westwater Canyon Member: (1) the small scale (averaging 30 meters (100 feet)) of complex conduits; and (2) large scale conduits that correspond to the channel belts. There must also be a third scale of permeability as well according to Cowan, at the scale of Campbell's (1976) channel systems, which is up to 34 km in width. With these superimposed levels (scales) of permeability/porosity, small channel effects greatly complicate the understanding of groundwater flow in the larger channels.

15. HRI also attempts to dismiss the significance of Cowan's study by stating it is "based on a very small portion of the Westwater Canyon Member." However, Cowan's study is placed in a basinal context and examines in detail an outcrop

belt characteristic of the Westwater Canyon Member. This is standard sedimentological procedure, and there is no reason to believe that Cowan's conclusions do not apply to the Westwater Canyon throughout its depositional extent. Indeed, Cowan's study area is just east of Gallup near Red Rock State Park, only a few miles west of Church Rock. Any competent geologist would readily extend Cowan's conclusions into the Church Rock area, given the vast scale of the Westwater Canyon Member river system.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE PRESIDING OFFICER

In the Matter of	)	
	)	Docket No. 40-8968-ML
HYDRO RESOURCES, INC.	)	
2929 Coors Road, Suite 101	)	(Leach Mining and Milling License)
Albuquerque, New Mexico 87120	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of "NRC STAFF'S MOTION TO STRIKE MATERIALS FROM THE RECORD, OR, IN THE ALTERNATIVE, FOR LEAVE TO FILE A REPLY," in the above-captioned proceeding, have been served on the following by U.S. Mail, first class, or, as indicated by a single asterisk through deposit in the Nuclear Regulatory Commission's internal mail system, or, as indicated by double asterisks, via e-mail and first class mail, this 10th day of June 1999:

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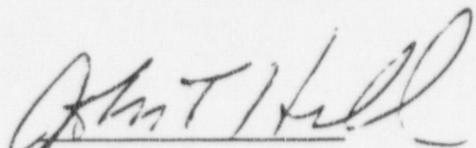

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