May 11, 1999

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD PANEL

Before Administrative Judges:
Peter B. Bloch, Presiding Officer
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-ML

HYDRO RESOURCES, INC.'S REPLY TO APRIL 21, 1999
MEMORANDUM AND ORDER (QUESTIONS)

I. INTRODUCTION

Hydro Resources, Inc. ("HRI") respectfully submits the following reply to the Presiding Officer's Memorandum and Order (Questions), dated March 18, 1999 (hereinafter, "Memorandum"). In the Memorandum, the Presiding Officer posed eight (8) questions relating to Intervenors' allegations regarding groundwater, the adequacy of the Final Environmental Impact Statement, NUREG-1508 (Feb. 1997) ("FEIS"), and environmental justice. *See* Mem. at 1-4. Although the Presiding Officer indicated that parties other than the NRC Staff may choose not to answer questions one through seven, HRI responds to those questions to help clarify a record muddied by Intervenors' more than 8,000 pages of filings, to assist the Presiding Officer with relevant citations to the voluminous record, and to further the Commission's policy that "applicants for a license are [ ] entitled to a prompt resolution of disputes concerning their applications" is met. 63 Fed. Reg. 41,872 ("Policy on Conduct of Adjudicatory Proceedings; Policy Statement"). As explained in further detail below, answers to the Presiding Officer's

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questions that are relevant to this proceeding are contained in the record. Where the information is not contained in the record, the question is either irrelevant to this proceeding or not required by law. In any event, an answer to the question is provided.

II. DISCUSSION

Question 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?

The experience of Uranium Resources, Inc. ("URI") and the in-situ leach ("ISL") industry throughout the United States, as well as the evaluation of the CUP reported in the FEIS, indicates that there are no significant environmental costs that can be attributed to ISL uranium extraction at the Section 8 location. 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. This restriction on use of groundwater from Section 8 is assured by the aquifer exemption for Section 8 previously granted by EPA.[1] Thus, the possibility of significant environmental costs is negated by the simple fact that the subject groundwater is of such quality that it *cannot be used before or after any uranium extraction takes place*. Consequently, if HRI were to fail to restore the groundwater at Section 8 to or near baseline, the practical significance

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[1] Because HRI currently has an aquifer exemption for Section 8, by legal *definition*, and contrary to Intervenors' claims, there is no "drinking water" in the mining zone because of the high concentration of naturally occurring radionuclides. EPA's regulations provide that an exempted aquifer is one that "does not currently serve as a source of drinking water" and "cannot now and will not in the future serve as a source of drinking water." 40 C.F.R. § 146.4. As noted above, prior to mining the water in the ore zone is not safe to drink under relevant standards or guidance because it contains very high levels of naturally occurring radionuclides and the same will be true after mining ceases and restoration is completed. One way to show that the aquifer cannot now and will not in the future serve as a source of drinking water is to demonstrate that the aquifer contains commercially producible

would be that previously unusable water would remain unusable. This will be so even if restoration achieves baseline values.[2]

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.[3] Notably, Intervenors, despite their repeated allegations of the dire consequences to groundwater at ISL operations, 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.[4] Similarly, there are no "*important* difficulties" to be considered concerning restoration of groundwater quality at Churchrock Section 8 and issues related to groundwater restoration at Section 8 are considered adequately in the FEIS.[5]

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minerals. 40 C.F.R. § 146.4(b)(1).

[2] Moreover, even assuming arguendo that no restoration takes place, the physicochemical actions at work within the aquifer, including reduction, neutralization, precipitation, and adsorption, may restore the groundwater naturally. Randall J. Charbanau, *Groundwater Restoration with In Situ Uranium Leach Mining* (1984).

[3] Restoration in the ISL industry has been conclusively demonstrated in New Mexico, Wyoming, Nebraska, and Texas. *See* Affidavit of Mark Pelizza at ¶ 28 (attached to HRI's Groundwater Presentation). With respect to HRI's operations specifically, HRI will continuously refine and update the surety amount for restoration with the very best information that can practically be obtained. *See* Affidavit of Craig Bartels at 8-13 (attached) (pointing out that overwhelming majority of ISL mining takes place in fluvial aquifers, like Section 8, and has resulted in no public or environmental harm).

[4] It is important to note the fact that ISL mining has been conducted on a commercial scale in the United States for over twenty years and HRI's proposed operating procedures and license conditions reflect the experience gained by the NRC, Agreement States under the AEA, EPA and states with primacy under the SDWA, HRI and other producers during that time. Most importantly, ISL operations have generated no significant adverse public health or environmental impacts, such that Intervenors cannot point to *any* instance of actual harm to public health or the environment as a result of ISL mining generally or HRI's proposed operations. *Id.*

[5] The FEIS expressly evaluates three restoration cases, including the worst case, no restoration. FEIS at 4-45. This evaluation is directed at the Unit 1 and Crownpoint sites because of the concern that groundwater pumping by the town of Crownpoint controls the direction of groundwater flow in the Westwater beneath the Crownpoint and Unit 1 sites. FEIS at 4-45. "the aquifer formations located beneath the Church Rock site are similar to those beneath the Crownpoint and Unit 1 sites." FEIS at 3-35. NRC Staff's evaluation does not identify any important difficulties to restoration. This evaluation was not performed specifically for Section 8, presumably because Section 8 groundwater is not, and will not be, used as drinking water. In any event, the Presiding Officer has already ruled in this proceeding that the groundwater restoration standards are adequately addressed by the Staff as license conditions in HRI's license. *See* 98-5, *In the Matter of Hydro Resources*, Inc., Memorandum and Order (April 2, 1998). In addition, the Presiding Officer's found that with respect to the use of drinking water: the "Staff is persuasive that the standard used by NRC will assure that there will be no immediate or irreparable harm from the

While the *a priori* risk that groundwater restoration will not attain baseline values probably cannot be quantified, the FEIS expressly assesses the likelihood that ISL activities will impact groundwater and concludes that restoration will be accomplished:

> Local groundwater quality in the Westwater Canyon sandstone within the proposed mining units would deteriorate during HRI's proposed project.
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> * * *
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> Well field water quality and hydraulic data are collected before mining operations begin. The water quality data are used to set the concentrations of parameters that will be used to determine whether the well field is being operated safely. Water quality data are also used to establish the water quality standards to which the aquifer will be restored after mining. From an environmental standpoint, the hydraulic data are used to (1) determine whether the well field can be operated safely, (2) confirm that monitor wells have been located correctly, (3) design aquifer restoration activities, and (4) predict postrestoration impacts.
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> * * *
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> Final restoration water quality standards are determined using baseline water quality data. Restoration standards are unique for each well field and usually consist of restoration on a parameter-by-parameter basis to the average baseline concentration for the well field or an appropriate State or Federal water quality standard. Therefore, after successful restoration, water quality in the aquifer will not be identical to that which existed prior to mining. However, *if average baseline conditions are achieved, general water quality should be close to its original condition. If water use standards are achieved, water quality should be such that water use is preserved.*

FEIS at 4-15, 4-17 (emphasis added).

The FEIS expressly requires that, irrespective of the restoration standard to be achieved, HRI will have to demonstrate to NRC that the restoration level achieved ensures public health and safety and does not significantly degrade the use of the water:

> If a groundwater parameter could not be restored to its secondary goal, HRI would have to make a demonstration to NRC that

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proposed license activities. *See* 98-5, *In the Matter of Hydro Resources, Inc.,* Memorandum and Order (April 2, 1998).

> leaving the parameter at the higher concentration *would not be a threat to public health and safety* and that, on a parameter by parameter basis, *water use would not be significantly degraded.*

FEIS at 4-27 (emphasis added). The FEIS makes clear that restoration is *required*:

> In order to address concerns with the lack of a site-specific representative groundwater restoration demonstration, HRI proposes to complete a concurrent restoration demonstration at each of the three proposed project sites within 18 months of the date on which mining commences (HRI 1996b). The demonstration would include
>
> 1. An isolated restoration demonstration pattern, completed in a mine unit, constructed to the same basic configuration as the proposed production well field pattern, and operated under the same conditions as the proposed mining procedures.
> 2. Leaching of the pattern would be run for at least 3 months under commercial activity conditions using leaching agency concentrations equal to or greater than those expected to be required for production.
> 3. After the leaching phase, a complete chemical description of the produced fluid would be obtained and a demonstration of a restoration would be initiated.
> 4. Sample analysis of fluids would be completed at least every week during the restoration demonstration to allow observation of the concentration of various restoration parameters. Progress reports would be submitted to NRC every 6 months after the demonstration was initiated.
> 5. Restoration would continue until the groundwater was restored to levels consistent with baseline.
> 6. With each progress report, the operator would calculate and submit the volume of groundwater affected. Factors to be considered would include aerial extent, formation thickness, and porosity. Upon the completion of the restoration demonstration, HRI would submit the data, analysis, and conclusions in a final report.
> 7. Authorization for expansion of mining into additional mine units would be contingent upon the results of the restoration demonstration within the 18-month period (HRI 1996b).

FEIS at 4-39. NRC Staff concludes that restoration can be achieved:

> The restoration tests conducted to date have shown that some parameters can be restored to average pre-mining well field concentrations and that all the parameters can eventually be restored to water use standards. Therefore, NRC staff conclude that achieving the restoration standards listed in Table 4.6 would require significantly more than 4 pore volumes, as proposed by HRI. On the basis of the data submitted by HRI, the staff conclude that practical production-scale groundwater restoration activities would *at most* require a 9 pore volume restoration effort.

FEIS at 4-40 (emphasis added). No important difficulties, including unlikely but foreseeable difficulties, concerning groundwater restoration present themselves for consideration. *See* Affidavit of Craig Bartels at 15. The FEIS has evaluated groundwater restoration and addresses the likelihood that groundwater will be impacted by the ISL project and the possibility that restoration to baseline water quality may not be achievable. Nevertheless, the FEIS concludes that satisfactory groundwater restoration at Section 8 and the rest of the CUP can and will be achieved. Finally, the FEIS concludes that, even if the greatest "difficulty" were to occur (*i.e.*, no groundwater restoration), no significant environmental cost results.

Question 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? 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?

The "risk that could occur through undetected sheers, fractures or joints," of course, is the possibility that lixiviant could migrate vertically from the mine zone into the formation overlying or underlying the mine zone. This risk, which is presented by any subterranean pumping or injection activity, is evaluated in detail in the FEIS and is deemed to be negligible. *See* FEIS at 4-54-4-58. HRI's plans to address this risk by extensive aquifer testing are detailed in HRI's

Consolidated Operations Plan ("COP Rev. 2.0") and is evaluated by NRC Staff in the FEIS. *Id.* at 4-53-4-58.

Confinement of the lixiviant to the ore zone cannot be determined simply by examining local geology because analysis of local geology alone, no matter how complete, does not provide data on hydrologic communication between operating wells and perimeter monitor wells and does not provide information on the lack of communication with overlying or underlying strata. Most of all, geologic analysis provides no information on artificial pathways created from exploratory holes or mining wells. The only way to detect communication because of artificial penetrations both prior to operation and during mining is by the proposed hydrologic pump tests and continual monitoring during operation. FEIS at 4-44. "The potential for a vertical excursion into the overlying aquifer is primarily through inadvertent leakage from installed wells." *See e.g.*, FEIS at 4-55 ("strategic observations cannot detect a fault if it has minor stratigraphic displacement or determine if the fault is open to groundwater flow. Therefore, HRI would conduct pre-mining tests to confirm aquifer confinement."). Thus, geological information alone (without hydrological data) is insufficient to determine whether confinement exists.[6]

HRI's planned pump testing program is described in the COP Rev. 2.0 § 8.5. Additionally, the FEIS at 4-17 & 4-18 describes the importance of the geologic and hydrologic characterization as follows:

> Therefore, if a well field operator carefully characterizes, constructs, and tests the well field, there is a low likelihood of occurrence.
>
> The potential risk of vertical excursions is reduced by detailed geologic characterization during well field development,

[6] For this reason, Intervenor's repeated attempts to change the focus of this inquiry from a hydrological one to solely a geological exercise are based upon faulty reasoning.

> hydrologic testing, careful well construction, close monitoring of injection pressures, and periodic mechanical integrity testing of installed wells. These measures make the likelihood of vertical excursions low.
>
> HRI would conduct additional pumping tests from production or injection wells to test the confinement of a wellfield.

HRI's plan is to perform hydrological testing and detailed analysis (hydrologic and geologic) on a mine unit basis. Cop Rev. 2.0 § 8.0; *see* Pelizza Affidavit Pertaining to Groundwater Quality Issues at 7-12. The detailed mine unit level data reflect the extent of confinement and confirms that the mine zone baseline and monitor wells are functional. The existing geological data that is part of the hearing record shows that the mine zone is confined by good aquitards, that the sands are contiguous across the mine zone, and that there are no major fault features in Churchrock Section 8. *See* FEIS at 4-54-4-55.

Published geologic maps show no major faults in the Section 8 mine area (Dillinger, 1990). HRI geologic cross sections, presented in the Church Rock Revised Environmental Report, 1993 (CRRER), likewise show no significant geologic structure. Additionally, these cross sections, developed from geophysical logs of drill holes on Section 8, reflect good overlying clays and underlying shale. Additionally seismic data that was presented by Lichnovsky shows that the Churchrock location is free from any significant geologic structure. *See* Lichnovsky Affidavit Pertaining to Groundwater Issues at 24-25.

HRI also has conducted area pump tests at the Churchrock location. *See* FEIS at 4-54. The hydrologic test makes it apparent that the potential of leachate migration to zones outside of the production horizon is very low. *See* CRRER at 104-113. The CRRER at 110 also discusses the differential pressure between the mine zone (Westwater) and overlying zones (Canyon and Dakota). Differential pressure is an important indicator of confinement. The pressure data from

the pump tests "indicate that the Westwater Canyon aquifer is not hydraulically connected to either of the overlying aquifers in the area of the pump test." FEIS at 4-54.

The pump test, *see* CRRER at 104-113, also showed good drawdown in production zone monitor wells at diverse locations across the Section 8 property. This drawdown does not support any type of channel feature as speculated by the Intervenors. In addition, the cross sections mentioned above show no evidence of isolated channels as has been described.

Data compiled by HRI to date are strong evidence that the production zone at the Churchrock Section 8 is confined and is laterally contiguous. Mine unit pump tests will serve to confirm these results with actual production wells used as observation points.

The FEIS describes that water quality data will be collected before mining begins to assure safe development.

> Well field water quality and hydraulic data are collected before mining operations begin. The water quality data are used to set the concentrations of parameters that will be used to determine whether the well field is being operated safely. Water quality data are also used to establish the water quality standards to which the aquifer will be restored after mining. From an environmental standpoint, the hydraulic data are used to (1) determine whether the well field can be operated safely, (2) confirm that monitor wells have been located correctly, (3) design aquifer restoration activities, and (4) predict postrestoration impacts.

FEIS at 4-15.

The FEIS considers the possibility of lixiviant vertical migration and concludes that:

> Similarly, mine solutions are not expected to move vertically into aquifers above or below the mine zone. Where appropriate, wells would be placed in aquifers above and below the mine zone to monitor for vertical excursions. ISL monitoring programs are designed to ensure that any excursion is detected long before mining solutions can seriously degrade groundwater quality outside the well field area.

FEIS at 4-16.

> If there are no vertical pathways present, vertical excursions generally do not occur. Therefore, if a well field operator carefully characterizes, constructs, and tests the well field, there is a low likelihood of occurrence.
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> * * *
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> The potential risk of vertical excursions is reduced by detailed geologic characterization *during well field development*; hydrogeologic testing, careful well construction, close monitoring of injection pressures, and periodic mechanical integrity testing of installed wells. These measures make the likelihood of vertical excursions low.
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> * * *
>
> HRI would conduct additional pumping tests from production or injection wells to test the vertical confinement of a well field.

FEIS at 4-17, 4-18 (emphasis added). The FEIS also concludes, following detailed review, that "there should be little risk of a vertical erosion into the Cow Springs aquifer" because of the "thickness of the Recapture Shale and the low potential that drill holes within the Church Rock site boundary have penetrated the Recapture Shale. FEIS at 4-56 - 4-57. As a safeguard, HRI's "monitoring plan should provide adequate detection of potential vertical excursions." FEIS at 4-56. The FEIS notes that horizontal excursions are readily controlled.

> In addition, horizontal excursions are relatively easy to control because the wells located in the aquifer can pump the well field at an increased rate to pull back the contaminants and correct the excursion. If a well field operator takes prompt action after a horizontal excursion has been detected, the excursion should be easy to correct long before any serious water quality changes occur in the aquifer outside the well field area.

FEIS at 4-17. The FEIS evaluated and described the potential for horizontal excursions at Churchrock.

> The potential to detect horizontal excursions at the Churchrock site should be high. . . .The potential for horizontal excursions should be low with a properly balanced well field.

FEIS at 4-54.

Having determined that an excursion, horizontal or vertical, is unlikely, the FEIS provides a detailed analysis of corrective action.

- Excursions and Corrective Actions. Identification and confirmation of excursions at the proposed project sites would involve the following steps:

  1. An excursion would be deemed to have occurred if any two excursion indicators in any monitor well exceeded their respective UCLs or a single excursion indicator exceeded its UCL by 20 percent.
  2. A verification sample would be taken within 24 hr after results of the first analyses were received.
  3. If the second sample did not indicate that UCLs were exceeded, a third sample would be taken within 48 hr after the second set of sampling data was acquired.
  4. If neither the second nor the third sample indicated that UCLs were exceeded, the first sample would be considered in error.
  5. If the second or third sample contained indicators above UCLs, an excursion would be confirmed (HRI 1996a).

- In the event of an excursion at any of the proposed project sites, the following corrective action programs would be applicable:

  1. When excursion status was confirmed, corrective action would be required to return the water quality to the applicable UCL. During corrective action, sample frequency would be increased to weekly for the excursion indicators until the excursion was concluded.
  2. An excursion would be deemed to have been corrected when all control parameters were reduced to their UCLs or below (HRI 1996a).

- When an excursion was confirmed at any of the proposed project sites, the following procedures would be applicable:

1 . In the event a lixiviant excursion were confirmed by groundwater monitoring, NRC would be alerted by telephone within 24 hr and by letter within 7 days from the time the excursion was confirmed.

2. A written report describing the excursion event, corrective actions taken, and the corrective action results would be submitted to NRC within 60 days of the excursion confirmation. If wells were still on excursion when the report was submitted, the report would also contain a schedule for submittal of future reports to the NRC describing the excursion event, corrective actions taken, and results obtained. In the case of a vertical excursion, the report would also contain a projected completion date when characterization of the extent of the vertical excursion would be completed.

3. In the event that an excursion were ...it corrected within 60 days of confirmation, HRI would terminate injection of lixiviant within the well field until aquifer cleanup was complete, or would provide an increase to the reclamation surety in an amount that was agreeable to NRC and which would cover the full cost of correcting and cleaning up the excursion. The surety increase would remain in force until the excursion was corrected. The written 60-day excursion report would state and justify which course of action would be followed (HU 1996b; HRI 1996h).

If wells were still on excursion at the time the 60-day report was submitted to NRC and the surety option chosen, well field restoration surety would be adjusted upward. To calculate the increase in surety for horizontal excursions, it would be assumed that the entire thickness of the aquifer between the well field and the monitor wells on excursion had been contaminated with lixiviant. It would also be assumed that the width of the excursion was the distance between the monitor wells on excursion plus one monitor well spacing distance on either side of the excursion. When the excursion was corrected, the additional surety requirements resulting from the excursion would be removed.

To calculate the increase in surety for vertical excursions, an initial estimate of the area contaminated above background would be made. All estimates would assume that the entire thickness of the upper aquifer had been contaminated. As characterization of the extent of contamination proceeded, surety might be increased or decreased as appropriate. Once the extent of contamination had been determined, the area which had been contaminated above background would be the area used to calculate the increased level

> of surety. When the vertical excursion had been cleaned up, the additional surety requirements resulting from the excursion would be removed.
>
> In calculating the increase in bonding for horizontal and vertical excursions, the same formula used to calculate the number of pore volumes required to restore a well field would be applied to the assumed areas of contamination. This approach is consistent with 10 CFR Part 40, Appendix A, Criteria 9. Increased surety provides assurance that cleanup would be accomplished in the event of licensee default and can be adjusted downward once cleanup is complete. In calculating the area impacted by an excursion and the volume of water required to effect restoration, a conservative estimate is taken to ensure that adequate funds are available to clean up the groundwater should the licensee fail to correct and clean up the excursion.

FEIS at 4-21 - 4-22.

In fact, as stated in the FEIS, the Westwater Canyon aquifer at Churchrock is confined, but the FEIS also concedes that the potential for small faults as points of interformational transfer is not non-existent. *The FEIS concludes, however, that pump tests would confirm confinement and that monitoring would verify confinement during operations*:

> Communication between the Westwater Canyon aquifer and the overlying aquifers was not detected during a 72-hr pump test of the Westwater Canyon aquifer. These data indicate that the Westwater Canyon aquifer is not hydraulically connected to either of the overlying aquifers in the area of the pump test.
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> * * *
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> However, the potential for faults to act as vertical pathways is not non-existent. This is because stratigraphic observations cannot detect a fault if it has minor stratigraphic displacement or determine if the fault is open to groundwater flow. Therefore, HRI would conduct pre-mining tests to confirm aquifer confinement. Pre-mining tests for confinement at the Church Rock site would be the same as those described for the Crownpoint site.
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> The risk of a vertical excursion occurring outside the area of former mining activities should be low given the thick aquitards

> over and under the production zone, the planned well integrity testing program, and the potential for old boreholes to squeeze shut. HRI proposes to monitor water levels and water quality in the overlying aquifer to detect leaks. Further, in the event of a vertical excursion, HU proposes to proceed immediately to determine the cause of the leakage and reverse the trend (HRI 1996a). The potential for an upper aquifer excursion to go undetected should be small, as discussed for the Unit I site in Section 4.3.1.2.
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> This monitoring plan should provide adequate detection of potential vertical excursions.
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> * * *
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> There should be little risk of a vertical excursion into the Cow Springs aquifer.

FEIS at 4-54, FEIS at 4-55. The FEIS evaluates the scope of the HRI mine unit pump tests:

> HRI has stated that after a mine area has been identified, monitor wells (both overlying and in the production zone) and baseline mining wells would be installed (HRI 1996b). A hydrologic test would then be designed and conducted by pumping a single well relatively central to the proposed mining area. This well would be pumped at a constant flow rate so that the pressure drawdown (cone-of-depression) caused by water production would stress the formation and any potential hydraulic boundaries or barriers, such as the overlying confining clays and possible non-sealing faults.
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> If the proposed mine area is sufficiently small, then the stress induced by pumping from a single well would test potential barriers. However, if it is determined that the observed maximum water level drawdowns across the proposed mine area are inadequate to test for confinement, a second pump test would be conducted (HRI 1996b). This test would involve producing multiple wells concurrently across the area, and observing the composite effect of the resulting pressure drawdown on the various monitor wells.
>
> Plots of the water levels versus time of pumping would be made for the overlying monitor wells and evaluated for pressure responses to pumping from the mine zone. Maximum drawdowns would be tabulated for each of the production zone monitor wells

> to ensure that adequate response was achieved for those wells (HRI 1996b). A Mine Unit Hydrologic Test Document would be assembled and submitted to the New Mexico Environmental Department for review. In accordance with NRC requirements, the Mine Unit Hydrologic Test Document would be reviewed by an HRI Safety and Environmental Review Panel to ensure that the results of the hydrologic testing and the planned mining activities are consistent with technique requirements and do not conflict with any requirement stated in the NRC license (HRI 1996b). After appropriate review of the Mine Unit Hydrologic Test Document and subsequent authorization by the New Mexico Environmental Department and HRI's Safety and Environmental Review Panel, injection of lixiviant would begin in the new mining unit (there would be no field recirculation prior to adding oxygen). Water levels would be taken on all monitor wells prior to each routine, bi-weekly water sampling and reviewed for unusual water level changes denoting any hydraulic connection with the mining zone.

FEIS at 4-43.

As described above, the FEIS takes considerably more than the required "hard look" at the issue of "shears, fractures, and joints" and has concluded that field pump testing program to be performed, as supplemented by the existing database, provides adequate assurance that no migration of "appreciable quantities of water above or below the Westwater aquifer" will occur.

With respect to the question of what environmental costs may reasonably be expected to result from foreseeable difficulties at Churchrock Section 8, leakage into an overlying or underlying zone is an excursion. FEIS at 4-15. As described in FEIS at 4-16, it is important for a company to monitor excursions and detect them early. Excursions will be monitored per LC 10.2 and 10.25 and if detected corrective action (cleanup) will be required.

In the event an excursion as defined by LC 10.12 is detected, the requirements of LC 10.13 are invoked. Notably, if an excursion is not corrected within 60 days of confirmation, the licensee shall either: (a) terminate injection of lixiviant within the well field until aquifer cleanup is complete; or (b) increase the surety in an amount to cover the full third-party cost of correcting

and cleaning up the excursion. The surety increase for horizontal and vertical excursions shall be calculated using the method described on page 4-22, Section 4.3.1 of the FEIS. The surety increases shall remain in force until the NRC has verified that the excursion has been corrected and cleanup satisfactorily completed.

Moreover, LC 10.13 requires HRI to remediate excursions to their respective UCL values or provide surety for the entire cleanup of an excursion. The necessary remediation will ensure that there is no environmental contamination (and therefore no environmental cost) left behind. The posted surety will ensure that there will be no cost to the public in the unlikely event that an excursion should occur.

Question 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?

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 Churchrock Section 8.

The FEIS describes the distance of water wells. With the exception of HRI-owned wells, there are no wells within the Churchrock site boundary. This site is far away from any towns, and any operating private wells in the area are widely dispersed. The nearest operating private well is located outside the southern boundary of the site and is completed in the Dakota Sandstone. There are no other wells within 1.6 km (1mile) of the site. FEIS at 3-31.

Figure 2.7-1 in the Churchrock Revised Environmental Report shows water wells in the vicinity of the Churchrock Section 17 and Churchrock Section 8 property boundaries. The closest downgradient water well to the Churchrock Section 8 property (and thus the well theoretically in greatest danger of impact from poor groundwater quality after restoration) is the

UNC well, at a distance of 14,200 feet from the northeast corner of Section 8.

Assuming the existence of no mitigating factors, the affect on this water well is easily calculated. According to the FEIS at 3-35, natural water flow at the Churchrock site is 8.7 feet per year. Given the distance of the UNC well, mine water from Section 8 would not reach the UNC well for 1632 years. *See* Affidavit of Craig Bartels at 16.

In fact, HRI's license requires HRI to mitigate impacted groundwater upon completion of uranium extraction activities. Groundwater restoration will be conducted to the satisfaction of the NRC. As set forth in the FEIS at 4-121 - 4-122 and as made an express condition of HRI's license LC 10.28, 10.29, groundwater restoration is required. The FEIS acknowledges and accepts that there may be minor changes in the post-restoration concentration of common ions and trace metals in the mine zone, but these concentrations will be below drinking water standards. As has also been discussed many times, post restoration water quality at Section 8, like pre-mining water quality, will be limited for future use (just as it is for present use) because of the concentrations of radionuclides in the groundwater. These radionuclides will include radon, radium 226 and uranium.

The common ion concentrations that will be left behind after mining must meet restoration standards <u>in the mine zone</u>. FEIS at 4-39; LC 10.21. Consequently, they could not have a negative affect on the use of the water 14,200 ft down gradient. As trace metals are mobilized during the ISL process because of the oxidized leach solution, when lixiviant injection ceases, the absence of oxygen will cause trace metals again to become immobile and precipitate. FEIS at 4-39. The UNC "worst case" well is down gradient and deeper into the San Juan basin. It is highly unlikely that as water travels downdip from the Churchrock mine site that it will

encounter oxidized water at greater depth.[7] Therefore, as the mine water travels downdip through reduced sediments any minor amounts of trace metals that are present will become insoluble. *See* FEIS at 4-39.

Uranium is subject to reduction and precipitation. *See* FEIS at 4-39. As with the discussion with trace metals above, uranium in mine waters that travel down dip into the deeper reduced sediments will become insoluble and be precipitated long before reaching even the nearest well. FEIS at 4-49. Other radionuclides that are expected to remain in the mine water are essentially immobile. Radium and radon are associated with uranium orebodies in the natural state and do not migrate far from the source rock. FEIS at 4-57. In the cases presented in the Pelizza Affidavit, the migration was limited to several hundred feet. In the same way, after restoration, radium and radon would not be expected to migrate to the "worst case" water well 14,200 ft. away. NRC Staff reach the same conclusion in the FEIS:

> An active uranium ore body is one where reducing conditions exist on one side of the ore body and oxidizing conditions exist on the other side. Current research (Deutsch 1985; Deutsch 1983) indicates that for active ore bodies, the redox-sensitive ions (such as uranium) which have been mobilized by uranium solution mining would rapidly be adsorbed and removed from groundwater when they encounter reducing conditions in the rock. So if the post-mining groundwater flow direction is from the oxidized side of the ore body to the reduced side, these ions should be rapidly attenuated after solution mining activities.

FEIS at 4-57.

Question 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

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[7] The Churchrock uranium ore body is present because the oxidized water flowed downdip to meet the zone of reduced rock.

uranium fluctuates and a reasonable cost/benefit picture requires an assessment of benefits at more than one arbitrary price.)

The expenditures made by HRI in the preparation for and cost of production are the primary economic benefits that a resource production company such HRI brings to a given locality. Employment income, services, supplies, utilities, *etc.* are all expenditures that would directly benefit the local economy.[8] In addition to the direct costs of production that are paid locally, royalties and taxes would increase with increased sales price. Taxes are paid locally (or within the State). On the Section 8 property royalties are not paid locally.[9]

Shown in FEIS Table 5-1, p. 5-2, depending on the option chosen, production costs for Churchrock range from 11.30 $/lb. to 11.36 $/lb.[10] In addition to direct production costs, HRI would be required to pay approximately 1.15 $/lb. in taxes and royalty for the Section 8 property and escrow approximately 2.00 $/lb. for future restoration activities. Production costs, taxes, royalty, and restoration are fixed costs. The fixed cost to bring the Section 8 property into production is approximately 14.50 $/lb. FEIS devotes Chapter 5 to an evaluation of costs and benefits to the communities, Navajo Nation, and local governments. In this evaluation, a production schedule of two million pounds per year was assumed, along with a market price of 15.70 $/lb. 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.

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[8] *See* FEIS at 5-1, *e.g.*, the NRC Staff believes that "up to 100 jobs could be filled by members of the local community." *Id.* at 5-3.

[9] *See* FEIS at 5-4, § 5.1.3 Benefits from tax revenues. ("As indicated in Table 5.4, significant tax revenues would be collected from McKinley County and possibly the Navajo Nation. Although not shown in Table 5.4, the State of New Mexico could also collect about $1.5 million annually from severance and natural resources taxes. The Navajo Business Activities Tax and Construction Tax apply to activities that occur on the Navajo Reservation and in areas outisde the Navajo Reservatiuon that meet the definition of "Indian Country." The proposed project would not be located on the Navajo Reservation; however, the gross reciepts of the project may be taxed by the Navajo Nation if it is determined that the project is located within "Indian Country." The local communities, such as the town of Crownpoint or the Crownpoint Navajo Chapter, do not have any taxing authority." FEIS at 5-4.

In addition to the 15.70 $/lb. breakeven price described above, the benefits of more than one sales price scenario, as well as several production rate scenarios were considered in the FEIS. The FEIS, for example, begins with an assessment based on a one million-pound production schedule and a market price of 15.70 $/lb. FEIS at 4-96 to 4-99. The FEIS then projects the various benefits (through increased taxes) that would be associated with the project given three different market values ($13/lb., $15.70/lb., and $20/lb.). In addition to this, the FEIS evaluates four different production rates. FEIS at 4-102). A review of pages 4-103 and 4-104 further shows that the FEIS evaluated scenarios involving multiple market values of yellowcake and multiple production rates. Throughout these evaluations, the FEIS discusses the potential benefits to the local communities, county, state and Navajo Nation. Emphasis in the FEIS is correctly placed on tracking the potential benefits through tax increases, employment, and purchases of local goods and services. It is acknowledged that with a higher market price, the duration of the project may be longer. With longer duration, benefits from longer periods of employment, longer periods of tax collection, and longer periods of local purchases would be realized. FEIS at 4-96.

As the sales price of yellowcake rises the cost of production does not change. Rather, except for taxes and royalties, sales price increases would benefit the company in the form of increased profits or additional capital that is available for reinvestment into the project. Incremental tax payments based on three price forecasts were discussed in FEIS at 4-101 through 4-104. Profits cannot be subjected to a cost/benefit analysis because the use of these proceeds is discretionary. These funds may be used for a number of purposes including replacing reserves through exploration or acquisition, upgrading old equipment, as dividends to shareholders, or simply as money to be saved. Benefits and costs internal to HRI were not evaluated in the FEIS in that they are not subject to government regulation. FEIS at 5-1.

Locally an increase in uranium prices would have the benefit of converting lower grade marginally uneconomic uranium resources into economic property, which ultimately would extend the life of the facility, FEIS at 4-96, and prolong the economic benefit of the operation. The Company may use discretionary funds for exploration of new reserves that would employ local contractors. If new reserves extend the existing orebody then the mine life would be extended and the economic benefit of the operation would be prolonged.

Question 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?

As demonstrated in the FEIS, there will not be any significant social cost (public sector) associated with HRI's project. FEIS at 4-18, 4-100, 4-126 and 5-6. As stated in the FEIS at 4-100:

> Typically, most of the demand for public infrastructure associated with a proposed project would be related to increases in population, housing, demand, and transportation. As discussed above, increases in population and housing demand associated with HRI's proposed project would not be significant relative to the existing situation. Therefore, no significant or detrimental effects on schools, utilities, or other public services are expected to occur as a result of project related population growth in Crownpoint or other communities in the project vicinity (VanDyke 1996i).

Since HRI's project will not significantly change the population, demand on local governments is minor.

> Because of the very limited population increase, there will be a correspondingly slight change in demand for public health/safety services. This slight increase, however, is further minimized by HRI's written commitment to provide the hospital with equipment,

> training and a separate room equipped for decontamination as described in the FEIS p. 4-100 as follows: " . . . there would be only slight changes in demand for emergency, fire, and police protection . . . the radioactive of the processed material would result in the need for additional standby emergency services that are currently not required or available in the Churchrock or Crownpoint area. It would be necessary to have contingency plans in case such an accident occurred. HRI has provided a detailed contingency plan for uranium transportation accidents. Some additional equipment and training of local hospital personnel would be required to deal with radioactive contamination. *HRI has made a written commitment to provide the local hospital with the proper equipment, ongoing training for hospital staff, and a separate room equipped for decontamination (Pelizza 1996a). Similarly, HRI has made a written commitment to the Crownpoint Volunteer Fire Department to provide appropriate training and equipment to respond to a slurry truck accident (Pelizza 1996b).*"

Id. (emphasis added). Likewise, the FEIS at 4-100 through 4-101 has described the affects of additional traffic as follows:

> Traffic on roads near the three project sites would increase as project employees commute during the work week. Existing traffic on the roads accessing the project is very light and the additional traffic associated with the project would not cause congestion or traffic problems.[11]

While not a specific issue at this phase of the hearing, certainly the highest potential public cost of the project would be the Crownpoint water wells. However, as clearly expressed in the FEIS at 4-100, HRI will bear this cost:

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[11] It should be noted that in the Preamble to Part 51, the Commission concludes (based in part on a DOT environmental assessment that:

> The Commission finds from these studies and other available information, like DOT, that the transport of radioactive materials will not have a significant adverse environmental impact.

49 Fed. Reg. 9352, 9374 (March 21, 1984).

> Mitigation includes HRI paying for well replacement and reimbursing the community for operating costs that would occur because of the drawdown of the water table.

The FEIS goes on to state that:

> . . . NRC Staff would require that HRI replace the town of Crownpoint water supply wells before mining at the Crownpoint site (Section 4.3.1.1). Thus, the community would not have to bear the costs of replacing these wells.

FEIS at 5-7.

If the project were restricted to the development of Section 8, the same conclusions, in a reduced scope, would remain valid. Namely, the economy would benefit from HRI's new business activity through the purchase of goods and services, increased employment, and the public sector would have a new revenue source. Since local governments would not incur any expense, the new tax stream associated with HRI's project would have more beneficial impact.[12]

HRI sees no reason *why the development of Section 8, alone, would cause local governments to make capital expenditures that might not be recouped.* It goes without saying that if development were restricted to Section 8, the overall economic benefits would be smaller relative to full project development. However, there is no correspondence between reduced project scope and the need for local government to make expenditures. In fact, as stated in the FEIS at 5-6:

> [t]he local communities would require increased emergency response and medical treatment capabilities because of the small risk of a slurry truck transport accident on public highways. HRI is committed to provide training and/or cover the costs of the training of the Crownpoint health clinic (Section 3.9). Similarly, HRI has

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[12] As stated above in response to question 4, the expenditures made by HRI in the preparation for and cost of production are the primary economic benefits that a resource production company such HRI brings to a given locality. Employment income, services, supplies, utilities, *etc.* are all expenditures that would directly benefit the local economy. In addition to the direct costs of production that are paid locally, royalties and taxes would increase with increased sales price. Taxes are paid locally (or within the State). On the Section 8 property royalties are not paid locally. FEIS at 5-1, 5-3.

> made a written commitment to the Crownpoint Volunteer Fire Department to provide appropriate training and equipment to respond to a slurry truck accident (Section 3.9). Therefore, these requirements should not result in additional costs to the local community.

The impact of ISL operations in south Texas reinforces the analysis of the project in the FEIS. URI has been in the ISL uranium business in Texas for over 20 years. Duval County, Texas has been the location of a number of ISL mining companies who operated ten commercial ISL mines over the past 20 years. No other county in the United States that has hosted this many ISL projects. This being the case one would expect the greatest ISL related strain on governmental resources to be in Duval County. Yet, as shown in the attached statement of Edmundo B. Garcia, Duval County Judge and Presiding Officer of the Commissioner's Court who oversees all county government departments and approves annual budgets for the County, no county resources have ever been required for ISL operations. Affidavit of Edmundo B. Garcia at ¶ 4 (attached).

With regard to the last inquiry in question number 5, it can be concluded that since local government will not face any cost, there is no need for indemnification against such an event. In light of the fact that there will be no cost to local government, environmental justice considerations in this context are not warranted.

Question 6. What are the financial effects of uncertainties about the application of a tax on the CUP by 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?

The potential economic impact of a 3% business activities tax levied by the Navajo Nation has been addressed in the FEIS using three different market value prices for yellowcake

($13/lb., $15.70/lb. and $20/lb.) and five different annual production rates (100,000; 300,000; 500,000; 1,000,000; and 2,000,000 lbs.). FEIS at 4-103 and 4-104. The FEIS concludes on page 4-104 that, "the potential contribution of the proposed project to the Navajo Nation would be a significant part of the Navajo Nation's tax revenues."

This portion of the hearing addresses Section 8 and HRI's mining plans for the foreseeable future will be limited to Section 8. As stated in COP Rev. 2.0, Section 8 is comprised of 174.546 ac. of patent Mining Claims. As such, HRI owns this property in fee simple. Controlling caselaw, including, most recently, *Alaska v. Native Village of Venetie Tribal Gov't et al.*, 522 U.S. 520 (1998), holds that taxation over private land such as the Churchrock Section 8 property is within the jurisdiction of State of New Mexico. The State of New Mexico concurs in this view.

The uncertainties associated with this tax issue are directly linked to the legal question of taxing authority and jurisdiction. The question of the Navajo Nation's authority to assess a business activity tax on gross receipts of businesses located in "Indian Country" is discussed in the FEIS. *See* FEIS at 4-101 and 4-103. As stated in the FEIS, the matter of taxing authority remains an unresolved legal issue between the Navajo Nation and tax authorities and is beyond province of the NRC, much less the Presiding Officer.

To date there has been no attempt by the Navajo Nation to levy any type of taxes over HRI's properties in general and Section 8 in particular. HRI believes that this issue may involve a good deal of future negotiation because HRI's other properties are comprised of various ownership types including private, federal claims, split estate with private minerals and the surface owned in trust by the Navajo Nation and allotted lands. As 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. As the Section 8 operation will be undertaken before any other operations are conducted, HRI has not sought out final resolution of the taxing jurisdiction for its other properties that may be produced some time in the future.

In any event, and perhaps most importantly, HRI has no preference over who the taxing jurisdiction is at a given project, including Section 8, as HRI intends to pay taxes to the appropriate government authority with jurisdiction.

Question 7. For Churchrock Section 8 (and 28 days later for the entire CUP[13]): 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? *See* CEQ "Memorandum to Agencies; Answers to 40 Most Asked Questions on NEPA Regulations," 46 Fed. Reg. 18,026; *see also* 40 C.F.R. § 1502.14 (Council on Environmental Quality, guidance). *Louisiana Energy Services, L.P.* (Claiborne Enrichment Center), CLI-98-3, 47 NRC 77, 98 (and 97-99) (1998). In your answers to this question, please consider the answers to the questions set forth above in your overall discussion.

Before addressing the Presiding Officer's question specifically, it is necessary to first understand the requirements of National Environmental Policy Act of 1969 ("NEPA") 10 C.F.R. Part 51 with respect to the consideration of alternatives in an NRC environmental impact statement ("EIS").

As stated in many of HRI's previous presentations, NEPA was intended to establish a national commitment to ensuring and promoting environmental quality. *See, generally*, 115 Cong. Rec. 40,416 (1970) (Remarks of Sen. Jackson); 42 U.S.C. § 4331. To make certain that federal agencies incorporate this commitment into their decision-making, NEPA mandates specific "action-forcing" procedures. *Robertson v. Methow Valley Citizens Council*, 490 U.S.

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[13] Judge Bloch indicated in his Memorandum & Order that these answers may not be required to complete the

332, 348 (1989) (citing remarks of Sen. Jackson, *supra.*). Foremost among these procedures is the Environmental Impact Statement ("EIS"). NEPA requires federal agencies to prepare an EIS for any proposal that would "significantly affect [] the quality of the human environment." *Louisiana Energy Services, L.P.*, 47 N.R.C. 77, 87, citing 42 U.S.C. § 4332 (2)(C). The EIS is to describe the potential environmental impact of the proposed project and discuss *reasonable alternatives. Id.; see also, 42 U.S.C. § 4332.*

The primary purposes of an EIS are to force agencies to take a "hard look" at the environmental consequences of proposed projects and to allow the public to participate in the agency's decision-making process. *Public Utilities Commission v. FERC,* 900 F.2d 269, 282 (D.C. Cir. 1990); *Louisiana Energy Services,* L.P. 47 N.R.C. 77, 87; *Robertson, supra, at 349-50.* NEPA does not mandate that an agency evaluate "every impact or effect of its proposed action, but only the impact or effect on the environment." *LES, 47 N.R.C. 77, 88, citing Metropolitan Edison Co. v. People Against Nuclear Energy,* 460 U.S. 766, 772 (1983).

"Determination of economic benefits and costs that are tangential to environmental consequences are within [a] wide area of agency discretion." *L.E.S. 47 N.R.C. 77, 89, citing South Louisiana Environmental Council, Inc. v. Sand,* 629 F.2d 1005, 1011 (5th Cir. 1980). NRC promulgated its own regulations for implementing NEPA in 1984 at 49 Fed. Reg. 9352 *et seq.* These requirements are incorporated in NRC regulations at 10 C.F.R. Part 51. As discussed in the Preamble to NRC's regulations, NRC intends that NEPA's requirements be implemented in a manner that is sufficiently flexible to address appropriately the *reasonably foreseeable risks* posed by a particular project.

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determination of whether or not HRI may proceed to mine Churchrock Section 8.

> [T]he amount of detailed information needed to make a reasoned decision on each of the many issues presented varies substantially among issues *but is in each case commensurate with the nature of the issue addressed.* With respect to most issues, with the possible exception of those relating to radiological matters, information need not be presented in the same degree of detail as that furnished in support of the applicant's proposal. In the review of alternative sites, for example, the Commission has found that reconnaissance-level information is adequate to assure that these alternatives are accorded substantial deference.

49 Fed. Reg. 9354 (March 12, 1984).

In promulgating its own regulations implementing NEPA, NRC clearly was mindful of the pronouncements of the courts regarding the nature and level of scrutiny required of the NEPA environmental review. "The courts have consistently held that the test of an agency's NEPA obligation to consider *alternatives* is subject of a rule of reason." 49 Fed. Reg. 9355. Citing the Supreme Court, the preamble to the regulations states:

> The term "alternatives" is not self-defining. To make an impact statement something more than an exercise in frivolous boilerplate the concept of alternatives must be bounded by some notion of feasibility. As the Presiding Officer of Appeals of the District of Columbia Circuit has itself recognized:
> There is reason for concluding that NEPA was not meant to require detailed discussion of the environmental effects of "alternatives" put forward in comments when these effects cannot be readily ascertained and the alternatives are deemed only remote and speculative possibilities. . . . *Natural Resources Defense Council v. Morton,* 148 U.S. App. D.C. 5, 15-16, 458 F.2d 827, 837-838 (1972).
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> * * *
>
> Common sense also teaches us that the "detailed statement of alternatives" cannot be found wanting simply because the agency failed to include every alternative device and thought conceivable by the mind of man. Time and resources are simply too limited to hold that an impact statement fails because the agency failed to ferret out every possible alternative, regardless of how uncommon

> or unknown that alternative may have been at the time the project was approved. . .

Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519 at 551 (1978); *accord, Seacoast Anti-Pollution League v. Nuclear Regulatory Commission*, 598 F.2d 1221 at 1223 (1st Cir. 1979).

In a similar vein, the Fifth Circuit, in *Sierra Club v. Morton*, 510 F.2d 813 at 820 (5th Cir. 1975) stated:

> The courts have approached their review of claims that congressionally specified detail of environmental effects was lacking in an EIS with a view that Congress did not intend to mandate perfection, or intend "for an impact statement to document every particle of knowledge that an agency might compile in considering the proposed action. (footnotes omitted).

Citing *Sierra Club v. Morton*, an NRC Appeal Board reasoned that *alternatives likely to result in similar or greater harm than the proposed action need not be evaluated*

> As we read it, the NEPA mandate that alternatives to the proposed licensing action be explored and evaluated does not come into play in such circumstances – in short, there is no obligation to search out possible alternatives to a course which itself will not either harm the environment or bring into serious question the manner in which this country's resources are being expended.

Portland General Electric Company (Trojan Nuclear Plant), 9 NRC 263 at 266 (1979).

NRC has adopted a like-minded view of the level of detail that must be reflected in the information presented in the EIS:

> With respect to the requisite level of detailed information, the courts have held that the detail required ". . . is that necessary to establish that an agency in good faith objectivity has taken a sufficient look at the environmental consequences of a proposed action and at alternatives to that action."

49 Fed. Reg. at 9355, citing *Save Our Sycamore v. Metropolitan Atlanta, Etc.*, 578 F. 2d 573, 576 (5th Cir. 1978). "Information has been considered sufficient if it permits a reasoned choice to be made among different courses of action and if it provides enough detail to enable those who did not have a part in compiling the information to understand and consider meaningfully the pertinent environmental influences involved." 49 Fed. Reg. 9355.

The overarching principle of NRC, indeed, all agency NEPA review, is "that the environmental review mandated by NEPA is subject to a 'rule of reason' and as such need not 'include all theoretically possible environmental effects arising out of an action,' but rather 'may be limited to effects which are shown to have some likelihood of occurring.'" *Northern States Power Company* (Prairie Island Nuclear Generating Plant, Units 1 and 2), 7 N.R.C. 41, 1978 NRC LEXIS 117, *15 (1978); citing *Long Island Lighting Co.* (Shoreham Nuclear Power Station), 6 AEC 831, 836 (1973) (affirmed by unpublished order of the District of Columbia Circuit, November 7, 1976; remanded on other grounds). "The appropriate inquiry here, then, is not into whether it is 'theoretically possible' . . . [w]hat must be decided instead is whether it is reasonably probable . . . . " *Northern States Power Co.*, 1978 NRC LEXIS 117 at *17.

Thus, NRC and the courts have determined that NEPA requires that an EIS reflect a reasoned inquiry, commensurate with the anticipated level of risk, into the reasonably probable harms that may result from the proposed action.

When questioning about the adequacy of the consideration of alternatives, it is important to remember that ISL uranium recovery has generally been recognized to be a relatively low-risk activity. "The potential for environmental impacts due to in-situ uranium mining appears to be

minor."[14] In fact, HRI is aware of no other ISL licensee that has submitted an EIS in more than fifteen years. In each case, NRC has granted licenses to conduct in-situ leach uranium mining on the basis of environmental assessments, having determined that an EIS was unnecessary and having issued a Finding of No Significant Impact ("FONSI"). This result is consistent with the "rule of reason" with which NEPA must be applied and the "risk-informed" decision-making advocated by NRC. [15] Here, HRI voluntarily chose to engage in the EIS process in this case to provide a more complete evaluation of potential environmental impacts. As noted above, NRC has determined that proposed in-situ leach uranium recovery operations are low-risk activities unlikely to cause serious environmental harm. Consequently, NRC has not required EIS' of ISL license applicants. BIA, as the trustee for Navajo lands, pursuant to its own regulations requiring an EIS in connection with any lease of Navajo territory, required that an EIS be prepared as a part of its standard procedure for approval of HRI's application to lease Unit 1. As discussed in greater detail in the Affidavit of Mark Pelizza attached to HRI's NEPA presentation, HRI proposed to NRC that the EIS to be generated in conjunction with the Unit 1 lease application be expanded to provide a more detailed environmental evaluation of the entire CUP.

Moreover, it is important to remember that the Presiding Officer in this proceeding, ruling on waste disposal issues after briefing by the Parties, considered Intervenors' assertions regarding the adequacy of the FEIS:

> As the Staff argues, the FEIS has not been brought seriously into question by the arguments of the Intervenors. Page 30 of the Staff Response declares:

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[14] "Economic and environmental implications of leakage upon in-situ uranium mining," Popielak, R.S. and Siegel, J., "Mining Engineering," August 1987 at 804 (attached hereto as Exhibit 1).

[15] *See, e.g.,* HRI's Waste Disposal Brief.

> "The 1997 FEIS contains over 250 pages of analysis, not including appendices. Even if all of the criticisms offered by ENDAUM and SRIC regarding the FEIS (see SRIC Disposal Brief at 38-53) were valid (which, as discussed below, they are not), their arguments would fall far short of establishing that the NRC failed to take the "hard look" required by the National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321 et seq. (NEPA)."
>
> Indeed, I have reviewed the FEIS carefully and I am impressed by its attention to technical detail and its thoughtful consideration of environmental risks. Intervenors have failed to demonstrate any significant deficiencies.

Hydro Resources, Inc., LBP 99-1 (February 3, 1999) (emphasis added).

NEPA does not require NRC to ferret out and evaluate every conceivable alternative, but merely to weigh all of the reasonable alternatives. *See, e.g., Strycker's Bay Neighborhood Council v. Karlen, 444 U.S. 223, 227-28, 62 L.Ed. 2d 433, 100 S. Ct. 497 (1980); Davis v. Latschar*, 1998 U.S. Dist. LEXIS 21086 (D.D.C. 1998). The agency must include only those environmental alternatives that are readily identifiable by the agency considering the time and resources available to complete the EIS. *See Natural Resources Defense Council, Inc. v. Morton,* 458 F.2d 827, 837 (D.C. Cir. 1972). The agency has discretion to decide when the information it has is sufficient to authorize a license. *See State of Alaska v. Andrus*, 580 F.2d 465 (D.C. Cir. 1978). The agency must make decisions while discounting remote or speculative possibilities. *See id.* As stated in *Louisiana Energy Services*, L.P. (Claiborne Enrichment Center), CLI-98-3, 47 NRC 77, 98 (and 97-99) (1998), CEQ's implementing guidance provides that an EIS must "rigorously explore . . . all *reasonable alternatives*." 40 C.F.R. at 1502.14(a) (emphasis added). For those alternatives that have been eliminated from detailed study, the EIS is required merely to "briefly discuss" why they were ruled out. *Id.* Where (as here) "a federal agency is not the sponsor of a project, the federal government's consideration of alternatives may accord

substantial weight to the preferences of the applicant and/or sponsor in the siting and design of the project." *City of Grapevine v. DOT*, 17 F.3d 1502, 1506 (D.C. Cir. 1994), *cert. denied*, 513 U.S. 1043 (1994) (internal quotation marks omitted). Under NEPA, the FEIS must include a statement on the alternatives to the proposed action. *See* 42 U.S.C. at 4332(2)(C)(iii). Generally, this includes a discussion of the agency alternative of taking "no action." *See* 40 C.F.R. at 1502.14(d). The "no-action" alternative is most easily viewed as simply maintaining the status quo. *Association of Public Agency Customers v. Bonneville Power Administration*, 126 F.3d 1158, 1188 (9th Cir. 1997). In this case, then, "no action" would mean denial of the license to construct and operate the ISL mining operation.

The extent of the "no-action" discussion is governed by a "rule of reason." *See Citizens Against Burlington, Inc. v. Busey*, 938 F.2d 190, 195 (D.C. Cir.), *cert. denied*, 502 U.S. 994 (1991). It is clear that the discussion "need not be exhaustive or inordinately detailed." *Farmland Preservation Association v. Goldschmidt*, 611 F.2d 233, 239 (8th Cir. 1979). Overall length, therefore, is not of special significance, and such discussions frequently are relatively short. *See, e.g., id.* (two-paragraph discussion adequate because "there was not much to say about that alternative . . . adoption of the alternative would simply have left things as they were"); *Headwaters, Inc. v. Bureau of Land Management*, 914 F.2d 1174, 1181 (9th Cir. 1990) (brevity of "no-action" section may reveal only that agency thought "concept of no-action plan was self-evident").

An FEIS should "briefly discuss" the reasons why an alternative was rejected and not further studied. *See Tongass Conservation Soc'y v. Cheney*, 924 F.2d at 1141. These reasons "shall be written in plain language . . . so that decisionmakers and the public can readily understand them." *Id.* at 1142. The "no-action" discussion should contain a comparative

analysis, "a concise, descriptive summary" comparing the advantages and disadvantages of the no-action alternative to the proposed action. *See* CEQ "Memorandum to Agencies," *supra*, 46 Fed. Reg. 18,026; *see also* 40 C.F.R. at 1502.14 ("CEQ guidance"); *LES* at 80.

The FEIS need not document every problem and alternative "from every angle." *Anson v. Eastburn*, 582 F. Supp. 18, 21 (S.D. Ind. 1983); *LES* at 99. The discussion [of alternatives] must be moored to 'some notion of feasibility.'" *Citizens Against Burlington, Inc. v. Busey*, 938 F. 2d at 195. Perhaps most importantly, because:

> The possible actions which the Commission itself may take are limited [with] their scope determined in the first instance by the nature of the application . . . the available alternatives [to be considered] are to grant the application, grant the application subject to certain conditions, or deny the application, either with or without prejudice . . .
>
> In the usual case, these alternatives include the alternative of no action (denial of the application) and reasonable alternatives.

49 Fed. Reg. at 9353 (emphasis added).

With this legal background in mind, we turn now to the Presiding Officer's question and the FEIS for our response. A "summary of the advantages and disadvantages of the options," *i.e.* alternatives, is discussed in detail in the FEIS in full satisfaction of the requirements of NEPA. Before turning to the FEIS' discussion of the "advantages and disadvantages" of the alternatives as discussed in the FEIS however, it is first important to identify the alternatives discussed.

Following a discussion of the purpose and need for the proposed action at the CUP, including a description of the proposed action and discussion of the scoping process and cooperating state and federal and native entities, the FEIS discusses at length the alternatives including the proposed action. *See* FEIS at 2-1 – 2-32. Specifically, the FEIS considers the proposed action (Alternative 1), the modified action (Alternative 2), the NRC-Staff

recommended action (Alternative 3) and the no-action alternative (Alternative 4).[16] As stated in the FEIS at xx – xx and 2-1, under Alternative 1, "the NRC would issue HRI a license for the construction and operation of facilities for ISL uranium mining and processing at Church Rock, Unit 1, and Crownpoint as proposed by HRI in the license application and related submittals." Under Alternative 2, the modified action, NRC would issue HRI a license for the construction and operation of facilities for ISL uranium mining and processing as proposed by HRI, but at alternative sites and/or using alternative liquid waste disposal methods." The Staff's recommended action, Alternative 3, envisions the Staff issuing a license for the construction and operation of facilities for ISL uranium mining and processing as proposed by HRI, but with additional measures required and recommended by NRC Staff to protect public health and safety and the environment." Finally, under the no-action alternative, Alternative 4, the NRC would not issue HRI a license for the construction and operation of facilities for ISL uranium mining and processing at the Church Rock, Unit 1, or Crownpoint sites." *See* FEIS at xx-xxi; 2-32.

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[16] No alternatives other than these were discussed in the FEIS as they were ruled out. *LES* at 98 (For those alternatives that have been eliminated from detailed study, the EIS is required merely to "briefly discuss" why they were ruled out. *Id.* Where (as here) "a federal agency is not the sponsor of a project, the federal government's consideration of alternatives may accord substantial weight to the preferences of the applicant and/or sponsor in the siting and design of the project." *City of Grapevine v. DOT*, 17 F.3d 1502, 1506 (D.C. Cir. 1994), *cert. denied*, 513 U.S. 1043 (1994) (internal quotation marks omitted). The identification of the alternatives section is based on the information and analysis in the environmental consequences section in part , but should not duplicate that section. 40 CFR § 1502.14. FEIS should discuss "reasonable alternatives." *See Tongass Conservation Soc'y v. Cheney, 924 F.2d 1137 (D.C. Cir. 1991)* (court upheld and agency's finding that only one alternative was reasonable because the others were infeasible). With respect to alternative mining techniques, as the FEIS states, the FEIS did not "evaluate alternative mining methods. The DEIS determined that surface and open pit mining are not reasonable alternatives because the ore bodies at the proposed sites are too deep to be extracted economically. Further, underground mining would have more significant environmental impacts than ISL mining, and the ore from underground mining would require processing at a conventional uranium mill to produce the final product. Significant quantities of tailings would be produced by conventional mining, which are normally disposed of on-site at the conclusion of the mill's operating life . . . [t]he environmental impacts of underground mining and conventional milling would be more severe than those of ISL mining. Consequently, underground mining and conventional milling are not evaluated in the FEIS." FEIS at 2-1. With respect to alternative locations, as discussed previously in this proceeding, Church Rock Section 8 is where the ore body is located and where HRI owns land in fee simple. Moreover, the various options regarding where to mine on the lands or at alternative sites are discussed in Alternative 2 (Modified action). *Id.*

First, with respect to the proposed action (Alternative 1), the FEIS initially spends twenty-eight (28) pages describing HRI's proposed action at the CUP, including a description of the proposed ISL process and facilities, including well field procedures and equipment, lixiviant chemistry, processing plant facilities, uranium recovery processes, the use of waste retention ponds and instrumentation. *See* FEIS at 2-1 – 2-28. In this section, the FEIS also describes the proposed waste management and effluent control system, including the systems for gaseous effluents and airborne particulates, liquid effluents, wastewater treatment, and liquid waste disposal options. The FEIS goes on to describe aquifer restoration, land reclamation and plant decontamination and decommissioning before describing the proposed sites and site development. *Id.*

Second, the FEIS describes in detail Alternative 2 (Modified Action). As stated above, under Alternative 2, the NRC would issue HRI a license for the construction and operation of a modified version of the proposed project. As stated in the FEIS at 2-28, "the modified project could consist of alternatives to the proposed project in three primary areas: sites for ISL mining, sites for yellowcake drying and packaging, and liquid waste disposal methods." FEIS at 2-28. The FEIS describes each of these options separately at 2-28 – 2-31, the difference between the options, and the significance of choosing one of the options. *Id.* at 2-31.

Third, the FEIS defines Alternative 3 wherein the Staff would issue a license for the construction and operation of the proposed project, but with additional measures required and recommended by NRC Staff to protect public health and safety and the environment. The additional measures required and recommended by the Staff are discussed for each proposed area of the project in Section 4.1 through 4.12 (pages 4-1 – 5-1 (over 100 pages)) of the FEIS and listed for the entire project in Appendix B. FEIS at 2-32.

Finally, the FEIS describes Alternative 4, the no-action alternative. Quoting 46 Fed. Reg. 18,026, CEQ "Memorandum to Agencies; Answers to 40 Most Asked Questions on NEPA Regulations," the FEIS states that the no action alternative means that "the proposed activity would not take place, and the resulting environmental effects from taking no action would be compared with the effects of permitting the proposed activity or alternative activity to go forward." FEIS at 2-32. Based on the guidance, the FEIS concludes that "the no-action alternative for NRC is not to issue HRI a license for the construction and operation of facilities for ISL uranium mining and processing at the Church Rock, Unit 1, or Crownpoint sites. The no-action alternative for the BLM and BIA is not to approve HRI's application for minerals operating rights and leases on Federal and Indian lands involved in the proposed project." FEIS at 2-32.

Following the discussion of the alternatives described above and a detailed analysis of the affected environment, *see* FEIS at 3-1 – 3-86, rather than just providing "a summary of the advantages and disadvantages of the options," the FEIS rigorously explores and objectively evaluates the potential environmental impacts of the "reasonable alternatives" -- the proposed action, the modified action, the NRC Staff recommended action and the no-action alternative -- giving "substantial treatment" to each.[17] As stated in the FEIS at xxi; 1-3, the evaluation of the

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[17] "Substantial treatment," rather than equal treatment of "reasonable alternatives" is required by NEPA since the treatment must necessarily vary with the degree of impact. *See* 40 C.F.R. § 1502.14(d); *Tongass Conservation Soc'y v. Cheney,* 924 F.2d 1137 (D.C. Cir. 1991). For example, the "substantial treatment" of the no action alternative need not be exhaustive because no action would merely result in the maintenance of the status quo. *See Association of Public Agency Customers v. Bonneville Power Administration,* 126 F.3d 1158, 1188 (9th Cir. 1997) (the "no-action" alternative is most easily viewed as simply maintaining the status quo. In this case, then, "no action" would mean denial of the license to construct and operate the ISL mining operation.); *see also, Citizens Against Burlington, Inc. v. Busey,* 938 F.2d 190, 195 (D.C. Cir.), *cert. denied,* 502 U.S. 994 (1991). (The extent of the "no-action" discussion is governed by a "rule of reason."); *Farmland Preservation Association v. Goldschmidt,* 611 F.2d 233, 239 (8th Cir. 1979) (It is clear that the discussion "need not be exhaustive or inordinately detailed."); Overall length, therefore, is not of special significance, and such discussions frequently are relatively short. *See, e.g., id.* (two-paragraph discussion adequate because "there was not much to say about that alternative . . . . adoption

alternatives is based on "the requirements of [NEPA] as amended, NRC's "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions" (10 C.F.R. Part 51), and BLM's "Surface Exploration, Mining and Reclamation of Lands" (25 C.F.R. Part 216) and "Solid Minerals Exploration and Mining Operations" (43 C.F.R. Part 3590) and a "comprehensive review of HRI's license application, environmental reports, related submittals, independent information sources, and written and oral comments on the draft EIS." FEIS at xxi, xix; 1-4.

Specifically, the FEIS gives "substantial treatment" to each alternative with respect to the following "environmental consequences, monitoring and mitigation"[18] issues: air quality and noise (§ 4.1), geology and soils (§ 4.2), groundwater (§ 4.3), surface water (§ 4.4), transportation risk (§ 4.5), health physics and radiological impacts (§ 4.6), ecology (§ 4.7), land use (§ 4.8), socioeconomics (§ 4.9), aesthetics (§ 4.10), cultural resources (§ 4.11), environmental justice (§ 4.12), cumulative impacts (§ 4.13), and includes a cost-benefit analysis for the proposed action. FEIS at 1-3, 4-1 – 4-126. Rather than re-state the more than 130 pages of discussion here, or try to summarize the discussion by taking snippets out of context, 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. *See* 49 Fed. Reg. at 9353..

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of the alternative would simply have left things as they were"); *Headwaters, Inc. v. Bureau of Land Management*, 914 F.2d 1174, 1181 (9th Cir. 1990) (brevity of "no-action" section may reveal only that agency thought "concept of no-action plan was self-evident"); *LES* at 97, ("We do not find the FEIS's incorporation by reference approach unreasonable as such. We agree with LES and the NRC Staff that it was not necessary for the "no-action" discussion to repeat lengthy assessments of adverse environmental impacts contained elsewhere in the FEIS. *See* CEQ's "Memorandum to Agencies: Answers to 40 Most Asked Questions on NEPA Regulations," 46 Fed. Reg. 18,026 (Mar. 1, 1981) (Question No. 7)").

[18] While a discussion of mitigation is not an absolute requirement, it is typically important to the NEPA process for many projects. *See Robertson v. Methow* Valley *Citizens Council*, 490 U.S. 332 (1989) (mitigation is not an absolute requirement.); *C.A.R.E. NOW, Inc. v. Federal Aviation Administration*, 844 F.2d 1569 (11th Cir.

Following its "hard look" and detailed description and "substantial treatment" of the "reasonable alternatives," and consideration of the costs and benefits of the proposed project (*see* § 5 of the FEIS), the NRC Staff concluded that the potential significant impacts of the proposed project can be mitigated and that HRI should be issued a combined source and 11e.(2) by-product material license and mineral operating leases from BLM and BIA. According to the Staff, the license, however, should be conditioned on the commitments made by HRI in its license application and related submittals (which are attached to the FEIS as Appendix B) and the various NRC staff mitigation requirements and recommendations discussed in Section 4 and Appendix B of the FEIS. *See* FEIS at xxi; 4-1 - 4-126 and B-1 - B-16. Thus, the Staff properly issued HRI a license following a rigorous NEPA review.

Question 8. Intervenors Groundwater Exhibit L quotes Cowan (1991), who states that near Church Rock, channelways "15-30 m. thick"[19] 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.

Several geology references have been cited in the discussion concerning the hydrologic characteristics of the Westwater Canyon Member of the Morrison Formation in the area of Church Rock Section 8. It is important to note that the discussion and description of outcrop morphology of the host unit serves only one purpose in the technical review of hydrologic continuity and effective mine solution control during the operation of the Churchrock Section 8 project, and that is to grossly describe the rock types (sandstone versus shale) that demonstrate the overwhelming percentage of sandstone that makes up the aquifer Beyond this general

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1988) (discussing importance of mitigation to NEPA process).

[19] The correct measure is 15-30 feet thick. *See* Exhibit L to Intervenors Groundwater Brief quoting Cowan (1991).

observation of the outcrop, only hydrologic testing as proposed in the mine plan for Churchrock Section 8 and ongoing monitoring could characterize the subsurface fluid continuity for the purpose of determining subsurface solution control. FEIS at 4-18.

Turning now to the Cowan article, Cowan introduces his article as follows:

> [t]he purpose of this article is to describe the architecture of the Westwater Canyon Member at two scales. 1. The first deals with the structures at the member scale and describes the largest architectural component of the Westwater Canyon Member, namely 5-10m-thick sandstone sheets. 2. The second scale of description details the internal architecture of the sheet sandstones . . . .

Cowan at 80 (emphasis added). In the introduction, Cowan relies on earlier descriptions of the Westwater:

> [t]hese channel systems were described by Campbell (1976) to be vertically and laterally coalesced, and to range in *width* from *1.6 to 34 km* and in thickness from 6 to 61 m (Campbell (1976)). On the basis of detailed outcrop studies, this paper shows that the channel systems of Campbell (1976) do not represent depositional channels, but are post-depositional aquifer conduits or permeability-pathway compartments. The *conduits* (identified on the basis of color, which reflect the state of sandstone oxidation) *are up to several tens of meters thick* and were formed by the vertical coalescence of channelbelt deposits.

Id. Cowan at 80 (emphasis added).

Under "[t]ypical fluvial-sandstone body dimensions, Friend classified channels into three types: fixed, meandering, and braided, which result in two different types of sandstone-body morphology. Channels that are stable between avulsive events-commonly create ribbon bodies, whereas channels that migrate laterally within a channelbelt will create sheet-like sandbodies, whether they are meandering or braided." *Id.* at 87. Further, under the heading: "Interpretation of the internal sandstone-sheet architecture," Cowan states the following: "[i]n some areas, it is

difficult to determine if the fifth-order bounding surfaces are the expression of individual sheet-channel fills within a larger sheet-channelbelt sandstone body, or if they represent bases of amalgamated channelbelt sandstone deposits. In the absence of overbank fine deposits between the sandstone sheets, it was difficult to determine with certainty which is the case." *Id.*

In the Churchrock area, specifically the internal shales in the Westwater Canyon aquifer (as opposed to the overlying shales of the Brushy Basin which form the upper aquitard discussed in the FEIS), are discontinuous and are not traceable over large areas because they have not been preserved in the high-energy depositional environment that characterizes braided channel sheet deposits. The preservation of overbank shale deposits would not be expected in a sweeping, sandy-braided channel belt where new channels scour away these deposits.

It is important to note that Cowan's study was completed based on a very small portion of the Westwater Canyon Member. Moreover, it is mostly a two dimensional study which limits the ability to observe the three dimensional geometry of the coalesced sandstone sheets deeper into the basin. Even with these limitations, the Westwater Canyon Member of the Morrison Formation is still determined by Cowan as made up of coalesced sheet sandstones: "[t]he member is composed of amalgamated, individual fining-up sandstone sheets each about 5-10 m thick. The absolute widths of the sheet sandstone bodies are at least 1 km and possibly exceed several kilometers." *Id.* at 80. Thus, Cowan's description of the Westwater Canyon as made up of coalesced sandstone sheets precludes the existence of confined elongated channels.

III. CONCLUSION

As set forth above, and in detail in the FEIS, the possibility of significant environmental costs that may reasonably be expected to result from the restoration of groundwater at the Church

Rock Section 8 is negated because, as is evidenced by HRI's UIC permit for Section 8, the mining zone neither serves as a source of drinking water now nor can serve as a source of drinking water in the future. Thus, even assuming *arguendo* that HRI were to fail to restore the groundwater at Section 8 to baseline levels as is required by its license, the practical significance would be that previously unusable water would remain unusable. In addition, based on the geology of the mining area, and hydrological testing supplemented by geological analysis and pump tests, the likelihood that shears, fractures and joints could transmit appreciable quantities of water above or below the Westwater aquifer is negligible. In any event, before commencing operations, HRI will conduct additional testing to ensure that water is not transferred in such a manner and to ensure excursion control. With respect to the effects on the quality of water at the nearest private water well resulting from the poorest foreseeable condition of the groundwater following restoration, there is no possible impact as even assuming no restoration were completed (the worst case scenario), mine water from Section 8 would not reach the well for 1632 years, if at all. As evidenced above, the cost/benefit analysis in the FEIS with respect to various prices of yellowcake is adequate and the governmental needs that arise due to the project are minimal, as HRI has agreed to pay for most of the project related costs. Similarly, the FEIS adequately addresses the alternatives to the proposed project giving a rigorous review and substantial treatment to all reasonable alternatives. Finally, Intervenors' reliance on Cowan in

support of their "channel theory" is clearly misplaced as Cowan concludes that no channel systems exist in the Westwater.

Respectfully submitted this 11th day of May, 1999.

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ON BEHALF OF HYDRO RESOURCES, INC.

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD PANEL

Before Administrative Judges:
Peter B. Bloch, Presiding Officer
Thomas D. Murphy, Special Agent

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	)	
	)	

AFFIDAVIT OF CRAIG S. BARTELS

1. My name is Craig S. Bartels. The statements herein are true and correct to the best of my knowledge, and the opinions expressed herein are based on my best professional judgment.

2. My education and experience have been described in my other affidavits of February 17, 1998 and February 19, 1999. To summarize, I have a Bachelor of Science degree from Montana College of Mineral Science and Technology in Petroleum Engineering. I received my registration as a Professional Engineer through testing in the State of Illinois. I have worked in the in-situ leach ("ISL") uranium recovery industry for over twenty years and am familiar with all aspects of the ISL process, including well design and construction, well pattern design and development, well test analysis, pump test design and analysis, computer modeling of flow processes, and wellfield and plant operations. I have supervised and trained others in the design

and operation of ISL projects. I have evaluated numerous ISL properties and operations of other companies, and, as such, am familiar with their operations and procedures.

3. The purpose of this affidavit is to respond to Questions 2 and 3 raised in the Presiding Officer's Memorandum and Order dated April 21, 1999.

4. Question #2 of Memorandum and Order of April 21, 1999 states: "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?" The first two parts of this question are closely related and are therefore answered together below:

5. Regulatory Framework:

The regulatory framework, developed across a quarter century of actual uranium ISL operations, makes the likelihood that "appreciable quantities" of water will be transmitted above or below the Westwater aquifer, <u>for any reason</u>, very remote. The regulatory requirements for aquifer testing and monitoring have been stated numerous times.

The FEIS states at 4-17 and 4-18:

> The potential risk of vertical excursions is reduced by detailed geologic characterization during well field development, hydrologic testing, careful well construction, close monitoring of injection pressures, and periodic mechanical integrity testing of installed wells. These measures make the likelihood of vertical excursions low.
>
> * * *
>
> HRI would conduct additional pumping tests from production or injection wells to test the confinement of a wellfield.

FEIS at 4-17, 4-18.

In the NRC License for the Churchrock Section 8, License Condition 10.23 states:

> Prior to injection of lixiviant in a well field, groundwater pump tests shall be performed to determine if overlying aquitards are adequate confining layers, and to confirm that horizontal monitor wells for that well field are completed in the Westwater Canyon aquifer.

License Condition 10.23.

As stated in my February 17, 1998 Affidavit at 3-4:

> . . . An ISL project proceeds in phases, in a simple, orderly fashion. First, only very general data is gathered to characterize the flow properties and confining clays on a regional scale for the aquifer. This data is presented to regulatory authorities to obtain appropriate permits and licenses. After initial permits and licenses are received, a much more detailed analysis of aquifer characteristics, confining zones, and water quality is performed for each separate and distinct production area (recovery unit). <u>This detailed analysis ensures that any variability in characteristics of the aquifer and confining clays, from recovery unit to recovery unit within the larger regional area, will be accounted for during actual uranium recovery operations and the concurrent monitoring process.</u> Again, after all initial permits/licenses are obtained, the actual operating parameters for a single, proposed recovery unit are developed by installing and testing the monitor wells for the production area or recovery unit. This includes the monitor wells surrounding the uranium recovery zone, those over and under the uranium recovery zone, as well as baseline water quality wells within the uranium recovery area itself. Baseline water quality samples are taken from each of the wells (including all monitor wells) and a pump test is conducted. (License Condition No. 10.21).
>
> Once these tests are conducted, actual uranium recovery is not permitted until the data is analyzed; vertical confinement of the uranium recovery zone is demonstrated (i.e., no vertical "leakage" of mine solutions); pressure communication with monitor wells surrounding the uranium recovery area is demonstrated, the upper control limits (UCL) for water quality in all monitor wells are determined; and finally, necessary regulatory authorization is given to begin operation. This is done at each unit within the larger region of the initial permit/license.
>
> For over twenty years, this phased development and testing for purposes of ISL uranium recovery has been the standard at all ISL projects in Texas and Wyoming of which I am aware. This is also true for every ISL project that URI/HRI has been associated with since entering the industry over 20 years ago in 1977. In addition, the NRC has accepted this approach

as the method of proposed operation in New Mexico (see response Q2/81 and also, the Consolidated Operating Plan (COP), Rev. 2.0 (pages 82 - 84), - both of which were noted as reviewed by Messrs. Abitz and Wallace).

As noted in § 8.5 of the COP, HRI's Hydrogeologic Testing Plan:

HRI considers that the primary goal of pump testing in new mine areas for ISL is to determine the degree of communication between the mine zone and (1) the overlying zones, and (2), the production zone monitor wells. This will reflect the effects of hydraulic pathways, such as unplugged holes and non-sealing faults, to the overlying zones, as well as ascertain the ability of production zone monitor wells to respond to changing flow conditions within the mining area. The degree of communication at the production zone monitor wells surrounding the mine zone will also directly indicate the magnitude of horizontal formation anisotropy."

Bartels Affidavit 2/17/98 at 3-4 (emphasis added).

And, in my February 19, 1999 Affidavit at 7-8:

The hydrologic (groundwater) focus of the ISL application and the regulating agencies is to ensure that the monitoring practices and monitoring well system used during actual operations are effective. As a result, pumping tests have become the standard for uranium ISL sites as described in the Crownpoint Operating Plan (COP, Rev 2.0), and accepted by the NRC (as reiterated in License Condition 10.23:

Prior to injection of lixiviant in a well field, groundwater pump tests shall be performed to determine if overlying aquitards are adequate confining layers, and to confirm that horizontal monitor wells for that well field are completed in the Westwater Canyon aquifer.

What HRI has proposed in its application is already the standard adhered to by the NRC and other regulating agencies for uranium ISL: a regional pump test prior to licensing, followed after licensing by a more detailed pump tests for each individual mine area ("mine unit") prior to its production as described in COP Rev. 2.0 Section 8.5.

In a mine unit, monitor wells will encircle the mine zone, overlie the mine zone, and underlie the mine zone [if a vertical connection (which will be tested) exists to the underlying zone per License Condition 10.25]. Thus, many more wells, than in a area pump test that have already been described in the applications, will be involved in determining the reservoir (aquifer) flow characteristics (leakage, horizontal anisotropy, "channel" flow, etc.) of the site specific mine unit. This ensures that the site specific reservoir characteristics are accounted for, rather than relying on results from the more general regional pumping tests.[1] Knowledgeable analysts of aquifer (reservoir) flow tests, know that flow boundaries that must exist in

> connection with the "pipelines" opined by Wallace & Abitz, would be instantly recognized in single well or multiple well aquifer tests. The investigation of the aquifer does not end with the area and subsequent mine unit aquifer pump tests, since those "mine unit" monitor wells will continue to be observed throughout the ISL production and restoration operations. These additional pump tests and monitoring requirements, critical to Intervenor's concerns, are reiterated over and over, the Intervenor's largely ignore them."
>
> * * *
>
> The general regional pump tests submitted as part of uranium ISL applications were never meant to provide the detail (using many more monitor and observation wells) of the more site specific "mine unit" reservoir tests. That standard was set by the regulatory agencies over more than two decades, not by HRI.

Bartels Affidavit 2/19/99 at 7, 8 and n. 1.

7. Regional Pump Tests:

Hydrologic properties across the "region" are likely to vary compared to the smaller individual production areas, called "mine unit." Prior to licensing, only a very general "regional" pump test is conducted across the proposed ISL area. It consists of a pumping well and few observation wells, and provides general information as to the hydrologic characteristics and leakage potential of the host aquifer. The regional pump test was never intended to be the definitive determination of the specific, local leakage potential within an ISL project. The various reasons for this, and other methods for assessing leakage, are discussed below.

8. Artificial Pathways:

Most, if not all, vertical excursions at ISL mining operations have been caused by artificial pathways (unplugged exploration boreholes, leaking well casings, *etc.*), not by hypothesized shears, fractures, or joints. Memorandum of J. Holonich, NRC, to P. B. Bloch (April 20, 1998) at 3-4.

> Historically, almost all vertical excursions at ISL mining operations have been caused by faulty well completions or unsealed exploration boreholes. The staff is aware of only one ISL site (Irigaray, Wyoming) where vertical excursions may have been caused by stratigraphic interconnections. In this instance, the licensee tried to prevent lixiviant from moving across a

> confining unit of one to 3 feet in total thickness. However, even in this case, it could not be established that the failure of the confining unit was the cause of the excursion. This was because open exploration boreholes and badly constructed injection wells were also found to be contributing to the excursion.
>
> To quickly detect excursions, vertical monitor wells are placed inside the well fields so they will be near the injection wells which could be the cause of vertical excursions.
>
> * * *
>
> It is important to note that in NUREG-1508, the staff did not assume vertical excursions cannot occur at the Crownpoint site. Instead, at 4-17, the NUREG contains a description of the causes of vertical excursions. Additionally, at 4-40 to 4-58, for each of the three sites, a description of the relative potential for vertical excursions to occur as the result of each cause is provided. The NUREG concludes that given the tests to be conducted prior to lixiviant injection in each well field, the potential for vertical excursions to occur is considered low. However, the NUREG further states that should a vertical excursion occur, it would be detected by the overlying monitor wells and the licensee would be required to (1) stop the excursion, and (2) restore the water quality in the upper aquifer."

Id. (emphasis added).

At Section 8, most holes or wells, "artificial" pathways, will not be drilled or completed until after licenses and permits have been granted, i.e., until after the "regional" pump test has been conducted. Since vertical excursions are primarily caused by "artificial" pathways, the most important aspect for the prevention and detection of vertical excursions, regardless of the cause, is the use of monitor wells completed above the host aquifer (and below if applicable) during ISL production and restoration. And this has been the focus, and is the standard, of regulatory oversight of the uranium ISL industry. The continued and regular observation of pressure changes (water levels) in these monitor wells during ISL production and restoration is the key to prevention of vertical excursions, regardless of the cause, since those pressure changes are the precursor to any vertical excursion.

In addition, at the time of the "mine unit" pump test after licensing, all monitor wells will have been installed for that mine unit, and will be tested to ensure that they are effective for monitoring the ISL process. This large number of wells, in a smaller area than the regional pump test, will allow a much more detailed evaluation of the "leakage" potential (whether from shears, joints, unplugged exploration holes, leaky casings, etc.) in the "mine unit" pump test.

Mr. Wallace appears to agree with the usefulness of the more detailed pump tests (although, he disagreed with the timing), when he stated in his affidavit:

> 6.1: Pump tests, if properly implemented, are an excellent tool for the identification of breaches of confining units....
>
> 6.4: The best analytical method for determining whether or not hydraulic connections exist between two aquifers . . . is the Modified Hantush Method.
>
> * * *
>
> 6.9: Pump tests and pump-test data are the best tools for determining aquifer interconnections (i.e., if done properly, they can detect the existence of an interconnection, whether it is due to faulting, leaking boreholes, or any of a host of other reasons). Evaluation of historic water-level data is useful to complement analysis of pump test results, but never to supplant it. Wallace Written Testimony, January 8, 1999 at 19, 48, 58.

But even these tests by themselves are not sufficient, and monitoring of the overlying (and underlying, if applicable) zones continue throughout ISL production.

9. Shears, Fractures and Joints

As described my February 19, 1999 Affidavit at Footnote 9:

> Numerous aquifer flow tests of the Westwater Canyon aquifer have been conducted over decades (Stone et al., 1983, Table 5; Mr. Wallace references this publication in his Written Testimony, p. 4; more telling, possibly, is that Dr. Abitz does not). The Westwater Canyon aquifer has been intensively tested and studied over decades by the New Mexico State Engineer's Office (which administers water rights), the U.S. Geological Survey (USGS), U.S.

> NRC, and private industry. As noted in Stone et al.(1983, page 48): "In 1980, 45 mines and 5 mills produced 7,407 tons [14.8 million pounds] of yellowcake [uranium oxide] in New Mexico, mostly from the Morrison Formation [mostly the Westwater Canyon aquifer] in the San Juan Basin.". Each of these underground mines would require dewatering of the aquifer, typically involving testing and analysis of the aquifer's flow characteristics. Approximately thirty of these "drawdown" and "recovery" aquifer tests are noted in Table 5 of Stone et al. (1983), and more have been conducted since then.

(Emphasis added).

Leakage, as caused by "shears, fractures, and joints," would be critically important to the underground miner. Not only would these "pathways" dramatically increase the water volumes and costs for dewatering, but would also be dangerous in the day to day work of the underground miner. Yet, I am aware of nothing (from pump tests, USGS, State of New Mexico, individual mining companies, literature), indicating that "leakage" from such pathways was ever a factor in the extensive underground mining operations in the Westwater aquifer.

General geologic "descriptions" in the literature of ISL host sands and confining layers have never been accepted by ISL permitting authorities as proof of hydraulic confinement, that is the purpose of hydrologic testing and ongoing monitoring. It is equally unacceptable that general geologic descriptions, in the literature, of desiccated and weathered outcrops (we all know that clays crack when dried), or dewatered host sands, be considered as proof of leakage. Given the proven regulatory safeguards in use at all active uranium ISL projects, HRI simply proposes those same testing and monitoring standards at Churchrock Section 8.

10. Water Level Difference:

Page 110 of the Church Rock Revised Environmental Report, 1993 (CRRER) discusses the differential pressure between the mine zone (Westwater) and overlying zones (poison Canyon and Dakota). Differential pressure is an important indicator of confinement. Contrary to the large differential pressure that is present at the Churchrock site, if the confining clay was grossly leaky, one would expect pressures to be equal. This is also the case for both Unit 1 and Crownpoint sites, and the general conclusion drawn in my February 17, 1998 Affidavit is true for Churchrock Section 8:

> In both cases, the overlying Dakota sand is at a higher water pressure than the Westwater sand. In either case, if "leakage" was as dramatic as described by Mr. Wallace, and water was strongly leaking from one zone to the other, the Dakota wells would show a general decrease in water levels, while the Westwater wells would show a related increase in water levels, corresponding in time. Thus, the data do not support Mr. Wallace's conclusion.

Bartels Affidavit 2/17/98, ¶ 9 at 4 (emphasis added).

The Dakota formation, overlying the Westwater aquifer, shows a rising water level, not a general decreasing in water levels.

11. All ISL Projects Are In Similar Geologic Environments:

Every uranium ISL project operating in the U.S. today is contained within a fluvial aquifer, most operating in drinking water aquifers, and some located very near drinking water wells. The ongoing possibility of vertical excursions and contamination exists at each operating ISL site. Every possible environmental catastrophe attributed to Churchrock Section 8 by the Intervenors, is as likely for those ISL operations. Yet, the regulatory framework, developed by the regulating agencies across 25 years of uranium ISL operations, and evidenced by the continued operation, has been found to protect the public health and safety.

Much catastrophe at Churchrock Section 8 has been theorized by those never before associated with the operation or regulation of ISL mining. The Intervenors' perceived issues of hydrology and geology are not "new." As described in my February 19, 1999 Affidavit at 9-13, the Lichnovsky Affidavit of February 19, 1999 at 25-27, and the Pelizza Affidavit of February 19, 1999 at 33-41, all uranium ISL sites active today, and the overwhelming majority of past ISL operations, are situated in fluvial aquifers, such as the Westwater Aquifer at Churchrock Section 8.

> MOST URANIUM ISL OPERATIONS IN U.S. IN FLUVIAL GEOLOGY. The overwhelming majority of uranium ISL projects in the U.S. operate in fluvial aquifers. A partial list of U.S. uranium ISL projects is shown in Tables 1 and 2. This list is not exhaustive, but is an indication of the information available in the public record. As shown, most of those ISL mines operate in fluvial systems, many in drinking water aquifers, with nearby active domestic and municipal water wells. The geologic and hydrologic settings of these fluvial aquifers are practically identical to the proposed Churchrock Section 8 ISL operation in New Mexico and the environmental problems promised by Mr. Wallace, caused by his conceptual "pipelines", "scour zones", have not materialized in over two decades of uranium ISL operations

Bartels Affidavit of February 19, 1999 at 9-10. Tables 1 and 2 presented from that affidavit exhibiting as such are reproduced below.

Table 1

Uranium ISL Mining Operations in Texas

Company	ISL Mine Name	Status[1]	Regional USDW[2]	Aquifer Geology Type	Restoration Demo Conducted[3]	Domestic / Municipal Water Wells Completed in Mine Aquifer Within MILES[4]			
						0.6	1	2	5
Caithness Mining	McBride	Restored	Oakville	Fluvial					
Conoco	Trevino	Restored	Oakville	Fluvial					
Everest Minerals	Hobson	Restored	Jackson	Marginal Marine					
Everest Minerals	Las Palmas	Restored	Oakville	Fluvial					
Everest Minerals	Mt Lucas	Restored	Goliad	Fluvial					
Everest Minerals	Tex-1	Restored	Jackson	Marginal Marine					
IEC	Pawnee	Restored	Oakville	Fluvial					
IEC	Zamzow	Restored	Oakville	Fluvial					
Mobil / Cogema	Holiday	RP	Catahoula	Fluvial					
Mobil / Cogema	El Mesquite	RP	Catahoula	Fluvial					
Mobil / Cogema	O'Hern	Restored	Catahoula	Fluvial					
Tenneco / Cogema	West Cole	RP	Catahoula	Fluvial			1 M; 23 D		
URI	Alta Mesa	ND	Goliad	Fluvial					
URI	Benavides	Restored	Catahoula	Fluvial					
URI	Kingsville Dome	Operating	Goliad	Fluvial	D, R	9 D	25 D		10 M
URI	Longoria	Restored	Catahoula	Fluvial					
URI	Rosita	Operating	Goliad	Fluvial	D, R		40 D		
URI	Vasquez	ND	Oakville	Fluvial					
U.S.Steel	Boots	Restored	Oakville	Fluvial					
U.S.Steel	Burns	RP	Oakville	Fluvial					
U.S.Steel	Clay West	Restored	Oakville	Fluvial					
U.S.Steel	Mosier	RP	Oakville	Fluvial					
U.S.Steel	Pawlik	Restored	Oakville	Fluvial					
Union Carbide/Chevron	Palangana	Restored	Goliad	Fluvial					
Westinghouse	Bruni	Restored	Catahoula	Fluvial					
Westinghouse	Lamprecht	Restored	Oakville	Fluvial					

1 RP = Commercial production finished; Restoration is in progress. Restored = Groundwater restoration has been approved by the State of Texas. ND = Property has been permitted but is not developed.

2 USDW = Underground Source of Drinking Water

3 D = restoration demonstration conducted; R = Groundwater restoration approved by the State of Texas.

4 D = Domestic drinking water well. M = Municipal drinking water well.

Table 2

Uranium ISL Mining Operations in Colorado, Nebraska, New Mexico & Wyoming

[Partial List]

Company	State	ISL Mine Name	Status[5]	Regional USDW[6]	Aquifer Geology Type	Restoration Demo Conducted[7]	TDS Restoration Demonstration	
							< 1000 mg/l	> 1000 mg/l
Crow Butte Resources	NE	Crow Butte	Operating	Chadron	Fluvial	D, R		1187
Mobil	NM	Section 9	Rest Demo	Westwater	Fluvial	D, R	264	
Nuclear Dynamics	WY	Sundance	Rest Demo	Fox Hills	Marginal Marine	D, R		
Pathfinder / Cogema	WY	North Butte	ND	Wasatch	Fluvial			
PRI / Cameco	WY	Highland	Operating	Ft. Union	Fluvial	D, R	366	
Rio Algom	WY	Bill Smith	Operating	Ft. Union	Fluvial	D, R	388	
Rocky Mtn Energy / IUC	WY	Reno Creek	Rest Demo	Wasatch	Fluvial	D, R		1460
Teton	WY	Leuenberger	Rest Demo	Ft. Union	Fluvial	D, R	513	
Uranerz USA	WY	Ruth	Rest Demo	Wasatch	Fluvial	D, R	345	
URI	WY	North Platte	Rest Demo	Ft. Union	Fluvial	D, R	324	
Westinghouse / Cogema	WY	Irigaray	RP	Wasatch	Fluvial	D, R	374	
Westinghouse / Cogema	WY	Christensen Ranch	Operating	Wasatch	Fluvial	D, R	425	
Wyoming Minerals	CO	Glover	Rest Demo	Fox Hills	Marginal Marine	D, R		

[5] RP = Commercial production finished; Restoration is in progress. Restored = Commercial groundwater restoration has been approved by the State and NRC. ND = Property has been permitted but is not developed. Rest Demo = restoration approved from demonstration area.

[6] USDW = Underground Source of Drinking Water

[7] D = Restoration demonstration conducted; R = Groundwater restoration approved by NRC.

These ISL sites have been, and are, regulated by the NRC, EPA, and multiple agencies in various states. The environmental disaster claimed as "conservative" reasoning by the Intervenors has just not occurred in the 25+ years of ISL operations.

Lichnovsky also compared the Westwater aquifer to the other permitted operating ISL sites in the U.S. and concluded:

> All of the permitted and licensed ISL uranium properties in the United States are in host sandstone units almost identical in hydrologic character to HRI's Westwater Canyon deposits. With the exception of Nebraska, I have worked first hand, in the field and/or underground in the US uranium districts and am intimately familiar with their geological characteristics.

Lichnovsky at 27. The hydrologic risk associated with Churchrock Section 8 is the very same risk associated with the ongoing operations of every other ISL project operating in the U.S. There has been nothing presented by the Intervenors that suggests otherwise. The regulatory safeguards and standards, developed over more than two decades, and used at all existing ISL operations, is the same standard that HRI has requested be applied to the Churchrock Section 8 ISL project.

12. Comparison of Regulatory Oversight on Other Projects:

In the effort to stop HRI's ISL project, the risks of leakage due to "shears, fractures, and joints" is greatly exaggerated by the Intervenors.

In fact, URI's Longoria, Wellfield 2, uranium ISL project was successfully produced and restored with <u>no</u> excursions, vertical or horizontal. Yet, the pump test prior to production of that wellfield showed significant vertical hydraulic communication and potential for vertical excursions.

The BHP copper ISL mine at Florence, Arizona has been recently permitted by that State, and the U.S. EPA, Region 9 for ISL operations. That ISL project is located in <u>fractured</u> rock,

and uses sulfuric acid as the lixiviant (as compared to the neutral pH lixiviant of uranium ISL to be used at Section 8). The fractured leach zone required an aquifer exemption from the U.S. EPA, as is required for Churchrock Section 8. There is no confining layer between the fractured leaching zone and the overlying aquifer used for irrigation, and it is in hydraulic communication with the overlying drinking water aquifer. The U.S. EPA was required under the SDWA to review and grant a Underground Injection Control (UIC) permit for that project, the same permit as required for all uranium ISL projects.

The Longoria and Florence projects demonstrate what ISL operators and regulators have long recognized: individual well flowrates relative one to another, in combination with the amount and placement of bleed, allow wellfields to be operated without excursions, regardless of leakage. If excursions do occur, it is this very wellfield management which allows excursions to be recovered. Bartels Affidavit of February 19, 1999 at 9-54.

In a paper on the subject of aquifer leakage (Popielak, R.S., and Sigel, J., *Economic, and Environmental Implications of Leakage Upon In-Situ Uranium Mining*, Mining Engineering, August 1987 at 800-804 (referenced in Pelizza Affidavit 2/19/99 at 57, and also attached as part of HRI's response to the NRC's Additional Information Request #70, 2/96), it was concluded that "the potential for environmental impacts due to in situ uranium mining appears to be minor."

In fact, the risks associated with such leakage are so low, one operating ISL project in the U.S., Crow Butte is allowed to rely solely on regional pump testing and monitoring during ISL production, and is not required at all to conduct detailed hydrologic testing, mine unit by mine unit, as proposed for Churchrock Section 8.

13. With respect to the final part of Question #2: "What environmental costs may reasonably be expected to result from foreseeable difficulties at Churchrock Section 8?" A response to this question is provided below.

As described in the FEIS at 4-15, leakage into an overlying or underlying zone is an excursion. As described in the FEIS at 4-16, it is important for a company to monitor excursions and detect them early. Cleanup is costly, and as described below, the consequence of prolonged excursions presents severe regulatory costs. Excursions will be monitored per License Condition 10.2 and 10.25 and if detected, corrective action (cleanup) will be required.

In the event an excursion as defined by License Condition 10.12 is detected, the requirements of License Condition 10.13 will prevail. Notably, if an excursion is not corrected within 60 days of confirmation, the licensee shall either: (a) terminate injection of lixiviant within the well field until aquifer cleanup is complete; or (b) increase the surety in an amount to cover the full third-party cost of correcting and cleaning up the excursion. The surety increase for horizontal and vertical excursions shall be calculated using the method described on page 4-22, Section 4.3.1 of the FEIS. The surety increases shall remain in force until the NRC has verified that the excursion has been corrected and cleaned up.

HRI will be required to remediate excursions, pursuant to License Condition 10.13, to their respective UCL values or provide surety for the entire cleanup of an excursion. The necessary remediation will ensure that there is no environmental contamination (and therefore no environmental cost) left behind. The posted surety will ensure that there will be no public monetary cost.

14. Question #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 condition of groundwater after restoration is completed?" This question is addressed as follows:

15. After restoration, there is no reasonable negative impact on the closest private well as a result of HRI's operations at Churchrock Section 8.

16. Figure 2.7-1 in the Churchrock Revised Environmental Report shows water wells within 1 mile of the Churchrock Section 17 and Churchrock Section 8 property boundaries. The closest down gradient water well to the Churchrock Section 8 property is the UNC Well at a distance of 14,200 ft. from the northeast corner of Section 8.

17. Restoration will be conducted at the CUP to the satisfaction of the NRC. As a result of restoration water will be returned to its previous use quality. The common ion concentrations remaining will meet restoration standards for the mine zone. As such, they could not have a negative affect on the use of the water 14,200 ft. down gradient.

18. The FEIS at 3-35 shows that natural water flow at the Churchrock site is 8.7 feet per year. Given the distance of the UNC well, the Churchrock mine water would not reach the well for 1,632 years. It is unreasonable to assume that restored ISL waters, additionally equilibrating to the rock of the Westwater aquifer for 1,632 years, would have a negative impact on a water well after this time.

19. NRC Additional Information Request #29 "the OCR [Old Church Rock] mine workings were subject to years of ventilation, which resulted in a highly-oxidized ore zone, and water quality which would resemble oxidized leach water." These workings are to the south of Churchrock Section 8. Normal air, pressured to ventilate those dewatered mine workings <u>for years</u>, contains about 21% oxygen, or about 210,000 parts per million (ppm), as compared to the typical oxygen used in uranium ISL lixiviant of approximately 400 ppm. Yet, as with <u>all</u>

conventional mines located in the Westwater aquifer, the groundwater in the OCR mine workings was never restored. Any movement of groundwater in the area would affect those unrestored mine waters, whether or not the Churchrock Section 8 ISL project is ever operated. It is unreasonable to argue that the impact on any nearby water well of restored waters from an ISL project would even begin to approach the impact of the unregulated and unrestored groundwater from underground conventional mining.

20. Intervenors have discussed a water well at 1.5 miles from the Churchrock site. It is apparently a well used just for livestock and is located to the east-southeast of Churchrock Section 8, while the natural groundwater gradient is to the north-northeast. That is, the existing, unrestored groundwater of the OCR mine workings, and the restored waters of the proposed ISL Section 8 mine site, will naturally move away from this well. The use of this well has not caused the groundwater to move from the OCR mine workings toward the well (even with that well, the water at OCR mine workings and Section 8 is moving away from it). In my February 19, 1999 Affidavit at 55, as revised, it was demonstrated that any domestic water well within 1 ½ miles of the Churchrock Section 8 and OCR mine workings had an insignificant affect on groundwater movement at those sites:

> AFFECTS ON WATER WELL NEAR CHURCHROCK
>
> Page 9 of Intervenor's Legal Brief states: "Within approximately 1.5 miles of the Church Rock site, there is a domestic water supply well . . ." To show the affect of a domestic water well on groundwater velocities at various distances from the well, Table 7 includes water velocity changes caused by a domestic water well operating continuously at 5 gpm. As in the discussion above, the Principle of Superposition applies and the velocities in that table are "added" to existing groundwater movement. Using Dempster, Practical Engineering, p. 5 as a guide, and assuming 6 people and numerous livestock using the well daily, domestic water requirements were estimated for the well totaling 702 gallons per day (0.5 gpm). To be ultra conservative in analysis, this was than arbitrarily increased by ten times to 5 gpm on a

continuous flow basis. Table 7 shows that under these conditions the affect of producing such a water well would be to increase water velocity at the ISL site toward that well by less than 0.2 feet per year. Consequently, a domestic well 1.5 miles away would have almost no affect."

Table 7 from that Affidavit at 53, is reproduced below as it shows the effects of a water well, producing continuously at 5 gpm compared to a more likely 0.5 gpm, on groundwater movement at various distances from the well.

Table 7

Maximum Water Velocities

Due to Reinjection at 40 gpm

And Domestic Water Well Producing at 5 gpm

Distance from Injection or Extraction Well	Reinjection 40 gpm 200 ft thick 21% porosity	Reinjection 40 gpm 200 ft thick 25% porosity	Water Well 5 gpm 200 ft thick 21% porosity	Water Well 5 gpm 200 ft thick 25% porosity
	Steady-State Water Velocity Feet per YEAR	Steady-State Water Velocity Feet per YEAR	Steady-State Water Velocity Feet per YEAR	Steady-State Water Velocity Feet per YEAR
500 feet	-21.3	-14.3	2.7	1.8
750 feet	-14.2	-9.5	1.8	1.2
1000 feet	-10.7	-7.2	1.3	0.9
¼ mile	-8.1	-5.4	1	0.7
½ mile	-4	-2.7	0.5	0.34
1 mile	-2	-1.4	0.25	0.17
1 ½ miles	-1.3	-0.9	0.17	0.11
2 miles	-1	-0.68	0.13	0.08

FURTHER AFFIANT SAYETH NOT.

I swear under penalty of perjury that the foregoing is true and correct to the best of my knowledge.

Dated this 6th day of May 1999.

Craig S Bartels

Voluntarily signed and sworn to before me this 6th day of May 1999, by the signer, whose identity is personally known to me or was proven to me on satisfactory evidence.

OFFICIAL SEAL
Anne M. Thompson
NOTARY PUBLIC
STATE OF NEW MEXICO
My Commission Expires: 3-31-2003

Anne M Thompson
NOTARY PUBLIC

My Commission expires: 3-31-2003

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD PANEL

Before Chief Administrative Judge
B. Paul Cotter, Jr., Presiding Officer

Administrative Judge
Thomas D. Murphy, Special Assistant

In the Matter of	)	
	)	
HYDRO RESOURCES, INC.	)	Docket No. 40-8958-ML
2929 Coors Blvd., N.W.	)	
Suite 101	)	ASLBP No. 95-706-01-ML
Albuquerque, NM 87201	)	

AFFIDAVIT OF EDMUNDO B. GARCIA, JR.
PERTAINING TO GOVERNMENTAL COSTS ASSOCIATED WITH ISL URANIUM MINING

Before me, the undersigned notary on this day appeared Edmundo B. Garcia, Jr., a person known or identified to me, and who after being duly sworn deposes and says the following:

A. PERSONAL

My name is Edmundo B. Garcia, Jr., I am over the age of 18 years, have never been convicted of a felony and am otherwise fully competent to make this affidavit. The factual matters set out herein are within my personal knowledge or my knowledge within my official capacity as set out herein.

B. QUALIFICATIONS

I am county Judge of Duval County, Texas. The County Judge is the presiding officer and a voting member of the Commissioners Court and also of the Constitutional County Court. In Duval County the County Judge presides in County Court to hear misdemeanor cases, hear probate matters, and holds juvenile detention hearings, mental illness hearings and guardianship hearings.

In the role of presiding officer of the Commissioners Court, the County Judge oversees all county government departments through the Court's responsibility for approving annual budgets for the County.

C. OPINION

1. In Situ Uranium operations have been conducted in Duval County for approximately 25 years.

2. Operating companies have included Arizona Public Service, Co., Caithness Mining Co., Chevron, Cogema, Inc., CONOCO, Everest Minerals, Mobil Oil, Corp., TOTAL Minerals Corp., Union Carbide, Uranium Resources, Inc., Westinghouse Corp.

3. These Companies have paid appropriate county taxes.

4. ISL operations have not resulted in any governmental cost to Duval County as these activities take place on private land and the companies bear the cost of utility construction and any additional infrastructure they require.

FURTHER AFFIANT SAYETH NOT.

I swear under penalty of perjury that the foregoing is true and correct to the best of my knowledge.

Dated this 5th day of ~~April~~ May 1999.

Voluntarily signed and sworn to before me this 5th day of ~~April~~ May 1999, by the signer, whose identity is personally known to me or was proven to me on satisfactory evidence.

NOTARY PUBLIC
COUNTY OF DUVAL
STATE OF TEXAS

IMELDA G. LUERA
MY COMMISSION EXPIRES
May 13, 2000

My Commission Expires: 2000

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD PANEL

Before Administrative Judges:
Peter B. Bloch, Presiding Officer
Thomas D. Murphy, Special Agent

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-ML

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing documents, HYDRO RESOURCES, INC.'S REPLY TO MEMORANDUM AND ORDER (QUESTIONS), in the above-captioned proceeding were sent to the following by overnight mail on this 11th day of May, 1999.

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