Staff Exhibit 1

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE PRESIDING OFFICER

In the Matter of	)	
	)	
HYDRO RESOURCES, INC.	)	Docket No. 40-8968-ML
P.O. Box 15910	)	
Rio Rancho, New Mexico 87174	)	

AFFIDAVIT OF WILLIAM H. FORD

I, William H. Ford, being duly sworn, declare as follows:

1. I am competent to make this affidavit, and the factual statements herein are true and correct to the best of my knowledge, information, and belief. The opinions expressed herein are based on my best professional judgment. A summary of my expertise pertaining to *in situ* leach (ISL) uranium mining issues has previously been submitted in this proceeding, in which I have previously submitted several affidavits. My present affidavit will serve to present my views on the affidavits of Mr. Steven C. Ingle (Ingle Affidavit) and Dr. Richard J. Abitz (Abitz Affidavit), submitted on behalf of Eastern Navajo Diné Against Uranium Mining and Southwest Research and Information Center (collectively, Intervenors), as part of the Intervenors' December 21, 2000, response to Hydro Resources, Inc.'s (HRI's) Restoration Action Plan (RAP), dated November 21, 2000.

2. In preparing this affidavit, in addition to the RAP, the Ingle Affidavit, and the Abitz Affidavit (and the exhibits attached thereto), I have reviewed the following materials:

A. Section 9 Pilot Summary Report -- containing Westwater Canyon Aquifer groundwater restoration data compiled at Mobil's Section 9 site about 20 miles northeast of HRI's Church Rock Section 8 site -- which was part of HRI's March 1993 revised Environmental Report (a copy is contained in HRI Hearing File Notebook 6.2).

B. HRI's Crownpoint Uranium Project Consolidated Operations Plan (COP), Revision 2.0., dated August 1997 (a copy is contained in HRI Hearing File Notebook 10.3).

C. Lafferty, A., Ingle, S., and Hoy, R., Pore Volume Estimate, Permit 603 - Power Resources, Inc. (1996) (copy attached to the Ingle Affidavit as Attachment B).

D. NUREG-1508, Final Environmental Impact Statement to Construct and Operate the Crownpoint Uranium Solution Mining Project (FEIS), dated February 1997 (a copy is contained in HRI Hearing File Notebook 10).

E. NUREG-1569, Draft Standard Review Plan[1] for *In Situ* Leach Uranium Extraction License Applications.

F. 10 C.F.R. Part 40, Appendix A, Criterion 9.

G. My Affidavit, dated May 11, 1999, attached as Exhibit 1 to "NRC Staff Response to Questions Posed in April 21 Order," filed in this proceeding.

H. HRI License Condition (LC) 9.5, LC 10.21, and LC 10.24 (a copy of HRI's License containing these conditions is in HRI Hearing File Notebook 11).

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[1] A final version of this Draft Standard Review Plan for ISL license applications has, to date, not been published.

I. My Affidavit, dated March 12, 1999, attached as Exhibit 1[2] to "NRC Staff's Response to Intervenors' Amended Presentation on Groundwater Issues," filed in this proceeding.

J. My Affidavit, dated February 20, 1998, attached as Exhibit 9 to "NRC Staff's Response to Motion for Stay, Request for Prior Hearing, and Request for Temporary Stay," filed in this proceeding.

K. Excerpts from Final Report on Phase I (Aquifer Restoration) of Bison Basin Decommissioning Project, submitted to State of Wyoming's Department of Environmental Quality, Land Quality Division, by Altair Resources Inc. (1988)(an excerpted copy of which is attached hereto as Attachment A).[3]

Groundwater Restoration Component of HRI's Initial Surety Amount

3. HRI's RAP proposes to establish as the initial surety an amount representing one-third of HRI's estimated costs for restoring all of its planned Section 8 well fields. As more Section 8 well fields are constructed and put into operation, the surety amounts may

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[2] Therein, at ¶¶ 2-4, I set forth my qualifications to express opinions regarding ISL mining.

[3] The excerpted copy contains the cover page, Table of Contents, List of Appendices, Sections 1.0 and 2.0, Attachment (1) (Restoration Water Quality Data for Stability Period), and Attachment (2) (Energy Laboratory Analytical Report, dated February 23, 1988).

be adjusted annually as necessary,[4] and these updated amounts will be based on more accurate estimates of surety requirements. For an ISL facility that is not yet operational, such as HRI's, the initial surety amount established is for well fields which have yet to be designed and constructed. The final design of an ISL well field is not known until after the well field is constructed. This is because as each well is drilled, further information about the aquifer and the uranium ore body therein is obtained. In turn, this information is used to plan the remainder of the ISL well field. Once an ISL facility is operating, the annual surety amount is based on the extent of the existing operations, and activities that are projected to occur in the forthcoming year. In addition, if areas of the ISL facility have been deemed reclaimed or restored by the NRC, the surety amount is accordingly reduced.

4. As an additional check on how much surety should be required, HRI committed to completing a groundwater restoration demonstration within two years of the date on which mining commences. *See* HRI's COP (Section 10.4.4), at 165-67. HRI stated there that the key elements of the groundwater restoration demonstration would be:

A. An isolated restoration demonstration pattern, completed in the ore zone, constructed to the same basic configuration as the proposed production well field pattern, and operated under the same conditions as the proposed mining procedures.

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[4] *See* 10 C.F.R. Part 40, Appendix A, Criterion 9 -- and LC 9.5, which incorporates into HRI's license the relevant Criterion 9 requirements -- whereby HRI's surety would be reviewed annually by the NRC to assure that sufficient funds are available for completion of HRI's reclamation plan. These annual reviews check whether the surety liability should be adjusted to reflect any increases or decreases resulting from inflation, changes in engineering plans, activities performed, and any other conditions affecting costs. Required surety amounts are based on the assumption that reclamation work will have to be performed by an independent contractor.

B. Leaching of the pattern will be run for at least three months under commercial activity conditions using leaching agent concentrations equal to, or greater than is expected to be required for production.

C. After [the] leaching phase, a complete chemical description of the produced fluid will be obtained, and a demonstration of a restoration will be initiated.

D. Sample analysis of key parameters, and fluids will be completed at least every week during the restoration demonstration.

E. Restoration will continue until the groundwater is restored to levels consistent with baseline.

F. With each progress report, HRI will calculate, and submit the volume of groundwater affected, expressed in pore volumes. Factors to be considered include: aerial extent, formation thickness, and porosity. Upon the completion of the restoration demonstration, the data, analysis, and conclusions will be compiled into a final report.

G. Authorization for expansion of mining into additional areas will be contingent upon the results of the restoration demonstration within the 24-month period.

COP, at 166. Results from this groundwater restoration demonstration will provide additional data that can be used to revise the surety in NRC's annual updates.

<u>The Concept of Pore Volume</u>

5. LC 9.5 states in part that "Surety for groundwater restoration of the initial well fields shall be based on 9 pore-volumes."[5] A pore volume is an indirect measure of the volume of water that must be pumped or processed to restore the groundwater quality. *See* NUREG-1569, the Draft Standard Review Plan for ISL license applications, at pages 6-2 and 6-3. A pore volume represents the water that fills the void space inside a **certain**

[5] The nine pore-volume requirement stated in HRI's license was based on data from the Mobil Section 9 pilot test. This Mobil 9 data is discussed in ¶¶ 8-9, *infra*. *See also* the FEIS, at page 4-40; and ¶¶ 42-43 of my affidavit dated February 20, 1998 (identified in ¶ 2.J above).

volume of rock or sediment. The pore volume parameter is used to represent how many times the contaminated volume of water in the rock must be displaced or processed to restore groundwater quality. For equal volumes of rock, it provides a means of comparing the level of effort required to restore the groundwater at different locations. For example, if it is determined that ten pore volumes are required to restore the groundwater in aquifer X, and five pore volumes are required to restore the groundwater in aquifer Y, then it can be concluded that for an equal volume of aquifer, twice as much effort will be required to restore the groundwater quality of aquifer X. The concept of a pore volume is useful in comparing equal volumes of rock or aquifer.

6. For the pore volume concept to be useful in estimating the cost of restoring the groundwater quality at a given site, there must a method to relate this concept to the volume of water that must be pumped or processed to achieve adequate restoration. Such a relationship may be established by (1) defining the volume of water in a pore volume; and (2) determining the volume of water required to adequately restore the groundwater at a given site. At this time there is no universally agreed upon method or formula for calculating the volume of water in a pore volume in a uranium well field. This situation has led ISL operators either to derive their own method for calculating pore volumes, or adopt a method already used by another ISL operator. However, in making the initial estimate of how much water will be required to adequately restore affected groundwater following ISL mining in a well field, the best data to use is from actual restoration experience at an analogous site. In my opinion, in order to properly extrapolate groundwater restoration experience from one site to another using the pore volume concept: (1) the restored site

should be representative of conditions in the areas of future ISL mining; (2) the volume of contaminated groundwater requiring restoration should be known; and (3) the same method for calculating the volume of water in a pore volume should be used at both sites.

7. In applying the pore volume concept to estimate restoration costs at Church Rock Section 8, HRI used the "ore area" method to determine the volume of water that a pore volume for each well field represents. In using this method, determinations are made for each well field regarding (1) the area of the well field; and (2) the thickness of the uranium ore body therein which is considered economic to mine. To account for horizontal flare, the ore area method multiplies the well field area by 1.5. To account for vertical flare, this method multiplies the ore body thickness by 1.3. These area and thickness calculations are then multiplied by the porosity of the host rock, to finally determine the volume of water that a pore volume for each well field represents. NUREG-1569 states that estimates of groundwater restoration pore volumes should take into account the effective porosity of the contaminated region, and the lateral and vertical extent of contamination. *See* NUREG-1569, at page 6-3. Accordingly, in my opinion, the ore area methodology used by HRI satisfies the NUREG-1569 guidance. Furthermore, the ore area methodology employed by HRI in the RAP relied on actual groundwater restoration data (*i.e.*, the Mobil Section 9 data discussed below), to estimate the number of pore volumes required to adequately restore groundwater quality at HRI's Section 8 site. Of course, should HRI's restoration experience prove that the nine pore-volume estimate is inadequate, the value of the surety will be adjusted upwards pursuant to the requirements of LC 9.5.

Mobil Section 9 Data

8. As indicated in ¶ 2.A above, data on the volume of water pumped and the pore volumes that were required to restore the groundwater quality at the Mobil Section 9 site -- located about 20 miles northeast of HRI's Church Rock Section 8 site -- were contained in HRI's Section 9 Pilot Summary Report.[6] As discussed in ¶¶ 5-6 of my affidavit dated May 11, 1999 (identified in ¶ 2.G above), after nine to ten pore volumes of restoration effort at the Mobil 9 site, 42% of the monitored water quality parameters were returned to baseline, and approximately 74% of these parameters met the secondary restoration goals described in LC 10.21 of HRI's license. Therefore, the basis of the nine pore volume restoration requirement stated in HRI's license is that after this amount of flushing, most if not all of the parameters are expected to be in compliance with either the primary or secondary groundwater restoration goals.

9. The Mobil Section 9 test is the largest groundwater restoration demonstration of a uranium ore body subjected to ISL mining in the Church Rock area. The ore bodies mined at Mobil's Section 9 are in the same aquifer -- the Westwater Canyon Aquifer -- as those that would be subjected to ISL mining at HRI's Section 8 site. The porosity value at the Mobil Section 9 site was identical to the porosity value used in HRI's pore volume calculations for Church Rock Section 8. Likewise, the horizontal and vertical flare factors used at the Mobil Section 9 site were identical to the horizontal and vertical flare factors used by HRI for its pore volume calculations at Church Rock Section 8.

[6] I extensively summarized the Mobil Section 9 data in ¶¶ 16-22 of my affidavit dated May 11, 1999 (identified in ¶ 2.G above).

Moreover, the pore volumes needed to restore the Mobil Section 9 groundwater were calculated using the same ore area method (described in ¶ 7 above) that HRI used to develop its surety estimate for Church Rock Section 8.

10. I am therefore of the opinion that HRI's estimates of the volume of water, the length of time, and the attendant costs to restore Church Rock Section 8 groundwater, should strongly correlate with actual groundwater restoration experience at the Mobil Section 9 site. Further, as indicated above in ¶ 9, I consider the data from the Mobil demonstration to be the most accurate information currently available in terms of predicting post-restoration groundwater quality at HRI's Church Rock Section 8 site.[7] Likewise, for the same reasons, I consider the Mobil data to be the most reliable indicator of how much it will cost -- in terms of the number of pore volumes required -- to restore the groundwater quality at HRI's Section 8 well fields once those fields are mined out.

11. Rather than using the Mobil Section 9 groundwater restoration data from New Mexico, Mr. Ingle and Dr. Abitz base much of their cost opinions on groundwater restoration experiences in Wyoming and Ohio, respectively. As discussed below, neither Mr. Ingle nor Dr. Abitz establish that this out-of-state information is more reliable in predicting HRI's Section 8 groundwater restoration costs than the Mobil Section 9 data. Accordingly, contrary to the opinions of Mr. Ingle and Dr. Abitz, I believe that the Wyoming and Ohio data they rely on have minimal relevance to HRI's Section 8 site.

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[7] *See also* ¶ 17 of my May 11, 1999 affidavit (identified in ¶ 2.G above).

Mr. Ingle's Opinions

12. Mr. Ingle contends that HRI's RAP, in relying on a horizontal flare factor of 1.5 in its pore volume calculations, "significantly underestimates the volume of water necessary for restoration." Ingle Affidavit, at ¶ 10. In Mr. Ingle's opinion, HRI should have used a horizontal flare factor of 3.0 in its pore volume calculations. *See* Ingle Affidavit, ¶¶ 10, 16, 18-19. Mr. Ingle bases this opinion largely on the results of groundwater modeling studies of the Wyoming Highland Uranium Project A and B well fields, operated by Power Resources, Inc. (PRI). Using the U.S. Geological Survey's MODFLOW computer program, Mr. Ingle developed a model to estimate the horizontal flare factor for a portion of one of PRI's well fields. *See* Ingle Affidavit, at ¶¶ 12-14. Application of this model to the PRI Highland mine suggested that the horizontal flare factor should have been 2.94, not 1.4 as PRI had claimed. *See* Ingle Affidavit, at ¶ 13. Citing similarities in ore zone lithology, baseline water quality, well field and ore body dimensions, and aquifer porosity, Mr. Ingle concluded that "the conditions at the PRI Highland Project are sufficiently analogous to those at the HRI Section 8 site to conclude that HRI should have used a much larger horizontal flare factor." Ingle Affidavit, at ¶ 16.[8] Mr. Ingle uses the 2.94 value obtained from his modeling studies at the Highland mine in recalculating the volume of restoration water for the Church Rock Section 8 site. *See* Ingle Affidavit, at ¶ 18.

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[8] Note, however, Mr. Ingle's admission that a reasonable estimate of pore volumes cannot be determined without a site-specific evaluation of the horizontal flare factor. *See* Ingle Affidavit, at ¶19. Such an evaluation relies on a detailed knowledge of the well field design, which may not be known until the well field is constructed. As noted in ¶ 3 above, no well fields have yet been designed and constructed at Church Rock Section 8.

13. As discussed in ¶ 6 above, the extrapolation of groundwater restoration experience from one site to another using the pore volume concept is subject to at least three criteria, in my opinion. Mr. Ingle's attempt to project groundwater restoration volumes and costs for Church Rock Section 8 based on his groundwater modeling studies of PRI's Highland B-Well Field fails to satisfy any of these criteria, as shown in ¶¶ 14-16 below.

14. First, the **restored** site should be representative of conditions in the areas of future mining. Mr. Ingle's models for the B-Well Field merely predicted water levels and groundwater flow paths **during uranium extraction** at this site. As stated on page 6 of the Wyoming Department of Environmental Quality Control memorandum (identified in ¶ 2.C. above), PRI had not completed any production-scale restoration of its well-fields. Moreover, the PRI Highland well fields are located in Wyoming, not New Mexico. In contrast, the data upon which HRI's pore volume estimates are based (*i.e.,* the Mobil Section 9 data, discussed in ¶¶ 8-9 above) pertained to actual production-scale groundwater restoration of the same aquifer to be mined at HRI's Section 8, and this data was obtained at a site only 20 miles away from HRI's Section 8 site.

15. Second, the total volume of water required to adequately achieve restoration of groundwater quality should be known. This volume of water is obviously unknown for the PRI site, because, at the time of the Wyoming study, PRI had not completed restoration of contaminated groundwater underlying its well fields. On the other hand, the total volume of water required for restoration in the Mobil Section 9 pilot test was known, and was used in calculating the total number of pore volumes required for restoration of the initial well fields at HRI's Section 8 site.

16. Third, when comparing groundwater restoration data (which is not available for the PRI site) from two sites, the same method for calculating the pore volume of water in a well field should be used at **both** sites. Mr. Ingle's attempt to recalculate the costs of groundwater restoration at HRI's Section 8, by using a horizontal flare factor of 3.0, fails to satisfy this criterion. HRI's estimate of the total volume of water (and cost) required for restoration used the **same** method as was applied to the Mobil Section 9 data. By roughly doubling the 1.5 horizontal flare factor used by HRI (and Mobil) in their pore volume calculations, **without** adjusting the **number** of pore volumes accordingly, Mr. Ingle effectively redefined (*i.e.*, doubled) the volume of water contained in a HRI/Mobil pore volume. As indicated in ¶ 5 above, however, redefining the volume of water contained within a pore volume does **not** change the volume of water that must be restored within a well field. Thus, if a flare factor of 3.0 instead of 1.5 had been used to analyze the Mobil Section 9 test data, the number of pore volumes calculated for restoration purposes would have been cut in half, but the amount of water actually pumped for restoration would have been the same. Therefore, instead of using nine pore volumes as the minimum number of pore volumes in its calculations, HRI would now be using 4.5 pore volumes -- a critical fact overlooked by Mr. Ingle.

17. At ¶ 44 of his affidavit, Mr. Ingle states that the HRI restoration cost estimate is not, at this time, based on what it will cost to attain baseline groundwater quality after ISL mining is done, but on the NRC's determination that the groundwater will have to be flushed nine times before the acceptable standards are attained. The FEIS assumed that

worst-case groundwater restoration would, on a parameter-by-parameter basis, return the water quality to the higher of the primary goal (average pre-uranium extraction water quality) or the secondary goal. *See* FEIS Section 4.3.2.1, at pages 4-58 to 4-60. LC 10.21 requires HRI to establish a primary and a secondary restoration goal. If a parameter cannot be returned to the primary goal, then the parameter should be returned to the secondary goal. Therefore, returning the concentration of a water quality parameter to either its primary or secondary goal satisfies the conditions stated in HRI's license. Accordingly, in my opinion, it is unreasonable to require a licensee to post as its initial surety an amount necessary to restore groundwater quality to criteria stricter than those stated in the license, especially where, as here, HRI's license criteria are supported by analyses in the FEIS.

18. Mr Ingle claims that HRI's RAP does not include costs for mechanical integrity testing. *See* Ingle Affidavit, at ¶43. LC 10.24 requires HRI to perform mechanical well integrity tests on each injection and production well: (a) before the well is first used to extract uranium; (b) after each time the well has been serviced with equipment or otherwise subjected to procedures that could damage well casing; and (c) at least once every five years the well is in use. However, mechanical integrity tests may not be as important during the restoration phase of ISL operations. Mechanical integrity tests are intended to help prevent the movement of fluids into overlying aquifers (vertical excursions) through breaks in the well casing. During uranium extraction, injection well casing failures are much more likely to cause vertical excursions than production (pumping) well casing failures. This is because in an ISL injection well, lixiviant may be in direct contact with the casing over the full length of the well and will likely be under pressure. But in an ISL production

well, water is pumped to the surface from a pump at the bottom of the well through a pipe inside the well casing. If an injection well's casing was to fail during uranium extraction, contaminated water might be injected into an overlying aquifer. However, during groundwater restoration, injection wells would be injecting clean water. A casing failure at this time might decrease the efficiency of the restoration effort by a small amount, but is unlikely to degrade the water quality of overlying aquifers.

19. Mr. Ingle claims that HRI fails to account for cleanup of leakage from evaporation ponds that HRI proposes to construct and operate at the Church Rock Section 8 satellite plant, and at the Crownpoint processing plant. *See* Ingle Affidavit, at ¶ 39. In my opinion, Mr. Ingle inappropriately assumes that (1) a pond will not be adequately designed; and (2) if pond failure occurs, contaminated groundwater will automatically result. Of course, should a pond failure result in groundwater contamination, HRI's surety would be adjusted upward pursuant to LC 9.5.

20. Relying on previously submitted opinions, Mr. Ingle states that no commercial-scale uranium ISL mining operation in Wyoming has successfully restored groundwater to premining, baseline conditions. *See* Ingle Affidavit, at ¶ 45. However, as indicated in ¶ 17 above, the NRC does not view a "successful" restoration of groundwater as requiring that all measured parameters be returned to baseline conditions. Similarly, as discussed in ¶ 21 below, and contrary to Mr. Ingle's opinion, the State of Wyoming does not (or did not) view a "successful" restoration of groundwater as requiring that all measured parameters be returned to baseline conditions.

21. As reflected in Attachment A to this affidavit, the Wyoming Bison Basin uranium ISL mine was restored on a parameter-by-parameter basis to premining primary and secondary restoration goals. The first production well field was restored by contractors (Altair Resources, Inc.) hired and administered by the State of Wyoming when the owner of the Bison Basin site went bankrupt. This site was a production scale operation and involved 70 production wells and 140 injection wells. *See* Attachment A, at 5. Groundwater restoration activities included use of reverse osmosis water treatment equipment. *Id.*, at 3. It took 13 months (August 1, 1986-September 22, 1987) to restore the water quality from the date of contract award by the State of Wyoming. *Id.*, at 1 and 3. Restoration of the groundwater took six pore volumes, with most groundwater quality parameters restored in four pore volumes. *Id.*, at 3. The State of Wyoming used surety money from the former licensee to restore the groundwater quality to the requirements in the license (either the secondary or primary goal). *See* Tables in Attachment 1 of Attachment A. This was successfully done, and restoration of the groundwater was approved by the State of Wyoming and the NRC. I had summarized the above Bison Basin activities in the following excerpt from my March 12, 1999, affidavit:

> On page 21 of his January 11, 1999, affidavit, Dr. Staub states that Wyoming Department of Environmental Quality officials he interviewed asserted that no commercial well field at any uranium ISL facility has been

successfully restored.[9] This information is incorrect. At the Bison Basin ISL mine site in Wyoming, restoration of groundwater was approved by the State of Wyoming and the NRC. *See* letter from Ramon E. Hall, Director, Uranium Recovery Field Office, NRC, dated February 20, 1990, a copy of which is attached hereto as Attachment C.

Exhibit 1 to "NRC Staff's Response to Intervenors' Amended Presentation on Groundwater Issues," at ¶ 16 (footnote number changed).

<u>Dr. Abitz's Opinions</u>

22. In ¶ 8 of the Abitz Affidavit, Dr. Abitz states that the Fernald site near Cincinnati, Ohio, provides a "useful reality check" against which to evaluate HRI's projected groundwater restoration costs at its Section 8 site in New Mexico. Dr. Abitz further states that the water quality and geochemistry of the Fernald site are similar to that of Church Rock Section 8, but that the extent of contamination at the Fernald site is of a much smaller magnitude than what could be expected as the result of the proposed ISL mining at Church Rock Section 8. In ¶ 9 of the Abitz Affidavit, Dr. Abitz states that the present goal of the Fernald restoration project is to reduce contamination levels by one order of magnitude. He notes in comparison that HRI will have to reduce contamination levels by two to five orders of magnitude at Section 8, depending on the quality of the mining fluids and on the groundwater restoration standards. *See* ¶ 10 of the Abitz Affidavit. Dr. Abitz further states

[9] This is consistent with page 4-37 of the FEIS, where it is stated that "the NRC has approved the restoration of several test patterns used to explore the feasibility of ISL mining or demonstrate the feasibility of production-scale restoration. However, NRC has not yet approved the successful restoration of a production-scale well field at any of its licensed sites." I learned after the FEIS was published that groundwater was successfully restored by the State of Wyoming at the Bison Basin ISL mine site. This site was a production scale operation that was restored by the State of Wyoming when the company that owned the mine went bankrupt.

that the restoration costs at the Fernald site exceed the costs estimated for the Church Rock Section 8 site. *See* ¶¶ 11-12 of the Abitz Affidavit.

23. I find that Dr. Abitz's comparison of the Fernald site to HRI's Section 8 site is misleading and without foundation, for the three major reasons set forth below in ¶¶ 23-25. First, Dr. Abitz presents few details to support his contention that the Fernald site experience in Ohio is relevant to the Church Rock Section 8 site in New Mexico. Crucial pieces of information essential to a valid comparison of the two sites are conspicuously absent. The methodology used to calculate a pore volume at Fernald is not presented. Moreover, aquifer descriptions, the extent of contamination, contamination history, and the contamination source term at Fernald are omitted. Data on the number of wells at Fernald, the location of those wells, pumping efficiencies, management efficiencies, and contractor administration costs there are similarly absent. Additionally, Dr. Abitz does not discuss whether any of the costs included in his calculations for the Fernald site would already be accounted for at the Church Rock Section 8 site. Many costs associated with the cleanup of the type of contaminant plume present at Fernald -- such as full delineation of a plume of unknown dimensions -- are simply not part of groundwater cleanup at an ISL mine. This is because activities associated with uranium production will have already covered these costs.[10] Furthermore, because any Section 8 injection and production wells will have been

[10] For example, plant buildings; fences; utilities (electrical, water, and sewage); injection, production, and monitoring wells; pumps; well field piping; well field control equipment (computers, valves, measuring instruments); ponds; and water quality restoration equipment, would all be in place if ISL operations begin at Section 8, and these items would therefore not have to be purchased.

placed to mine the ore body quickly and effectively, these wells should be well-placed to restore the groundwater quality changed by ISL mining. Any wells present at the Fernald site may not be so well-placed.

24. Second, Dr. Abitz assumes that uranium will be restored to a level of 0.44 mg/L or less within HRI's Section 8 well fields. However, he fails to acknowledge that existing baseline levels of uranium at HRI's Section 8 site may be higher than (1) HRI's secondary restoration goal for uranium of 0.44 mg/L stated in HRI's license (*see* LC 10.21A); and (2) EPA's new drinking water standard for uranium. As discussed in ¶ 22 of my affidavit dated May 11, 1999 (identified in ¶ 2.G above), this will make restoration of the uranium parameter at Section 8 less of a problem. Moreover, as discussed in ¶ 9 of my affidavit dated May 11, 1999, uranium is a contaminant[11] that often makes the water quality in an ISL ore zone unsuitable for drinking water use, even prior to any ISL mining.

25. Third, Dr Abitz's testimony ignores the fact that the efficiency of groundwater restoration is concentration-dependent and nonlinear. Thus, for groundwater containing high levels of uranium or other contaminants -- such as one would expect to find at an ISL mining site before any groundwater clean-up occurs -- restoration efforts can achieve much greater reductions in contaminant levels than the same efforts would yield for groundwater containing lower levels of contaminants. As lower contaminant levels are approached, a

[11] The behavior of uranium in aquifers is discussed extensively in ¶¶ 9, 12-13, 18-19, and 21-25, of my affidavit dated May 11, 1999. Additionally, in ¶ 10 of my affidavit dated March 12, 1999 (identified in ¶ 2.I above), I address contentions made earlier by Dr. Abitz in this proceeding regarding the behavior of uranium in aquifers. In his most recent affidavit, Dr. Abitz does not challenge or otherwise reference my earlier statements.

"threshold" point in groundwater restoration is eventually reached, where little reduction in contaminant levels is achieved relative to the effort expended on restoration. This phenomenon is analogous to the law of diminishing returns, and could explain what might be occurring at the Fernald site, where the United States Department of Energy contractors are attempting to reduce uranium concentrations in the groundwater there from a **maximum** level of 1.0 mg/L to a level of 0.02 mg/L. This latter level is even lower than the new United States Environmental Protection Agency drinking water standard for uranium. If contractors at the Fernald site are trying to restore groundwater concentrations at the "flat end" of the cleanup curve, then they may be achieving very little cleanup for their efforts. Thus, Dr. Abitz's implicit assertion that likely groundwater restoration rates at Section 8 would be as slow as those observed at Fernald is misleading. Accordingly, for the reasons stated above in ¶¶ 23-25, the Fernald site experience is not in my opinion "technically analogous" to the Church Rock site, as claimed by Dr. Abitz.

26. The statements expressed above are true and correct to the best of my knowledge, information and belief.

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William H. Ford ***/RA/***

Sworn and subscribed to before me
this 22nd day of January, 2001

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Notary Public
My commission expires:_______