Joint Intervenors' Motion For Summary Disposition on Contention 1
Exhibit 2

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
STRATA ENERGY, INC.,	)	Docket No. 40-9091-MLA
	)	
(Ross In Situ Recovery Uranium Project)	)	

SECOND DECLARATION OF DR. RICHARD ABITZ ON BEHALF OF THE NATURAL RESOURCES DEFENSE COUNCIL & POWDER RIVER BASIN RESOURCE COUNCIL

I. INTRODUCTION

I, Dr. Richard Abitz, declare that the following statements are true and correct to the best of my knowledge.

1. I previously submitted a declaration in support of Petitioners' motion to intervene and contentions in this proceeding, and that declaration explains my background and experience relevant to this proceeding. *See* Oct. 23, 2011 Declaration of Dr. Richard Abitz ¶¶ 1-3.
2. The Natural Resources Defense Council has contracted my services to supply technical analysis and comments on both Strata the Energy's Ross Project In Situ Uranium Recovery[1] License Application before the Nuclear Regulatory Commission (NRC) and on the NRC's Draft Supplemental Environmental Impact Statement (DSEIS) for the Ross Project.
3. My expert opinions and comments in this declaration are based both on my professional experience and on my review of relevant portions of the NRC's DSEIS, Strata's application, and other documents listed in the References Cited section of this declaration.

[1] *In situ* recovery ("ISR") is also commonly referred to as *in situ* leaching ("ISL"). For the purposes of this declaration, the two phrases are used interchangeably.

4. My declaration focuses on the technical issues at the foundation of each of Petitioners' admitted contentions in this proceeding. I begin with the overarching observation that in terms of technical presentation and analysis, there are few differences between Strata's ER and the Staff's DSEIS with respect to the Petitioners' admitted contentions. And what few differences exist are not substantial and do not in any way alter the nature of the dispute between the parties as they relate to the admitted contentions pertaining to baseline water quality, analysis of the environmental impacts of alternative concentration limits, fluid migration, or cumulative impacts.
5. Included in my initial assessment of the lack of substantive difference in the two documents is a review of Strata's Responses to NRC Staff's Requests for Additional Information submitted since the admission of the four contentions and reference to the Declarations submitted by Drs. Moran and Sass.

Contention 1 – Baseline Water Quality

6. An element of the first contention addressed the lack of pre-industrial (pre-Nubeth) baseline water quality. *See* Moran Decl. ¶¶ 36-41, at 12 of NRDC's and PRBRC's Petition to Intervene (hereinafter "Petition"); Sass Decl. ¶¶ 22-23, Petition at 14. The DSEIS first states that "in the case of the Ross Project, because an earlier uranium-recovery operation was conducted within the Ross Project area, this operation could potentially have impacted 'background values.'" DSEIS at 2-24. But later the DSEIS claims: "[t]he similarity between the pre-licensing baseline concentrations in the ore zone and aquifer above the ore zone suggests that Nubeth did *not* alter the baseline water quality." DSEIS at 3-42 (emphasis added).
7. First, and most importantly, there are no 'background' values from Nubeth (1978) or Strata (2010). Background values can only be determined if statistically valid, random groundwater

samples are collected from wells that are constructed and developed without the addition of oxidizing fluids and air. This was not done by Nubeth or Strata. Second, Buswell (1982, p.25) notes that in 1976 Nubeth initiated a single-well, push-pull study (i.e., the injection and extraction of lixiviant from a single well), nearly two years *before* the first baseline samples were collected in April 1978 (Nubeth 1978). Therefore, the ore was injected with lixiviant *before* baseline water-quality samples were collected and pre-mining baseline does not exist for the Nubeth pilot-scale study.

8. The DSEIS's lack of analysis on the pre-industrial baseline water quality issue is similar to the lack of analysis on this issue in Strata's application and ER. The DSEIS simply presents a range of values for water quality, and no discussion on how baseline will be developed from these measurements, or data obtained from other wells, until *after* the license has been issued. Thus, Petitioners' fundamental concern with the pre-industrial baseline water quality aspect of the analysis remains. Specifically, in Section 3.5.3, "Ground-Water Quality," the DSEIS references Strata (2011a, 2012a) and Nuclear Dynamics (1978) for average concentrations of the major ions (Table 3.6), and for ranges for the trace ions and radionuclides (Table 3-7), for the six monitor-well clusters (SA, SM, OZ, and DM horizons) and for the Nuclear Dynamics data for the Nubeth Pilot Project. The NRC does not present the 2011 water-quality data but notes that "The data from 2011 are generally consistent with the 2009 and 2010 data, indicating a representative characterization of ground-water quality." (DEIS at p.3-39, lines 11-12). In my expert opinion, this statement is likely in error. Water quality results could not be located for the 2011 quarterly data from the Strata six regional wells (Strata 2012a) in a publicly accessible location. The Strata 2012b reference cited in the DSEIS (p. 3-118) was also searched, and 2011 quarterly water-quality data were not found. The NRC staff requested an

update to all monitoring data (ER RAI EM-1; Strata 2012b), but the Strata response indicates that the request for additional data beyond the 12 months of pre-license monitoring (i.e., 2010) is not a requirement of 10 CFR Part 40, and they questioned why this additional data request is necessary for NRC staff's review. It is my finding that the NRC should not, without the public having an opportunity to review, state that the 2011 data are consistent with 2009 and 2010.

9. Additionally, it is my finding that water quality data are not presented for all of the existing monitoring wells. The DSEIS states 51 pre-licensing ground-water monitoring wells are present as of the end of August 2011 (DEIS, p. 4-23, lines 15-18). The data presented in the DSEIS pertains only to six regional cluster wells each containing four monitoring wells (24 wells), which leaves a balance of 27 monitoring wells for which water-quality data are absent. In my expert opinion, the absence of data from more than half of the ground-water monitoring wells must be explained, and analyzing the missing half of the ground-water monitoring data could plausibly alter expert conclusions on the interpretation of the entire set of measurements.
10. Remarkably, with no presentation of the new water-quality data, the DSEIS concludes there is a small impact on the groundwater resources even though: (1) these are not the data that will set baseline water quality (as such a standard will not be known until after licensing) and, in any event, (2) there is no discussion of the following water-quality issues, which would have to be addressed to ensure that the proper scientific and statistical methods are utilized to establish valid baseline values:
    - The impact of the use of oxidizing fluids during drilling operations, and the impact of air-lifting during well development - processes which can cause uranium ore to be oxidized during the drilling and development of monitoring wells and therefore alter true baseline water quality values (Abitz, 2010; Laaksoharju et al., 2008);

- Inclusion of a statistically sufficient number of randomly located wells to collect representative groundwater samples from the proposed aquifer exemption zone (VSP 2013);
- Assurance that baseline wells are screened through the entire sand interval of the aquifer horizon, in order to eliminate a high bias towards ground-water contamination when the sample is obtained only from the ore-rich interval of the aquifer horizon;
- Inclusion of proper statistical analysis and methods to establish valid baseline values (Gilbert, 1987; Matzke et al., 2007; ASTM, 1998; EPA, 1989; 1992a; 1992b; 2009; NRC, 2003);
- Inclusion of the explanation for the anomalous results that the Nubeth average values in Tables 3-6 and 3-7 of the DSEIS exceed the Nubeth high baseline values as given in Addendum 1.2-A in the Strata TR (note that by mathematical definition it is not possible for an average value to exceed a maximum value).

11. Although page 2-24 of the DSEIS (lines 15-44) notes that post-licensing/pre-operational baseline values and excursion upper-control limits (UCLs) would be established for each separate well field, there is no indication in the DSEIS as to how the NRC will ensure that Strata collects representative samples prior to mining (as noted in the above list), and then applies proper statistical methods to establish the pre-mining baseline and excursion UCL values. Moreover, the DSEIS does not present the scientific basis to support sequential establishment of baseline water quality and excursion UCLs in new well fields after mining has taken place in adjacent well fields. It is my finding that if NRC allows Strata to proceed in this fashion these actions would be inconsistent with accepted scientific methodology for definition of pre-mining baseline water quality.

12. While specific terminology used in the DSEIS to describe the Applicant process for establishing baseline water quality has changed somewhat from the ER, the issues raised in Petitioners contentions (concerning the ER's failure to document the establishment of a scientifically valid baseline for groundwater quality and assess a full range of plausible environmental outcomes from the proposed "aquifer restoration" process) remain unaddressed.
13. The DSEIS states (at 2-24, line 14): "Prior to commencing ISR operations, these [monitoring] wells [around the perimeter of each wellfield] would allow sampling and analysis of ground water and, in this DSEIS, this type of monitoring is called 'post-licensing, pre-operational.' The resulting post-licensing, pre-operational data would be used to determine concentration-based baseline levels and upper control limits (UCLs) that would permit identification of any excursions from the respective wellfields. These post-licensing, pre-operational baseline values would be established for each separate wellfield (and they would be codified in the Applicant's license)." In my expert opinion, these "post-licensing, pre-operational baseline values" have not been clearly stated to be the functional equivalent of the "Target Restoration Values" (TRVs) referenced in the ER at 6 -11 as "defin[ing] the aquifer restoration goals." (ER at 6-10). Too little information is provided about either to make this assessment.
14. The DSEIS also states (at 2-24, line 41): "Later, prior to actual uranium-recovery wellfield operation, but after the initial NRC license is issued for wellfield construction, the ground water in each wellfield would be analyzed for the post-licensing, pre-operational baseline concentrations of constituents specified by the NRC (NRC, 2003a), and (at 2-32, line 18): "The purpose of aquifer restoration is to restore the respective aquifer to its baseline conditions, as defined by post-licensing, pre-operational constituent concentrations…so as to ensure public health and safety."

15. From these descriptions in the DSEIS, it apparently remains the case that monitoring to determine baseline values (i.e., TRVs), and excursion UCLs to guide individual wellfield aquifer restoration efforts, would be undertaken only when a given wellfield's construction and testing is complete and a perimeter ring of monitoring wells has been established around the wellfield. In my expert judgment this scenario raises a consistent set of concerns that Petitioners lodged against the ER. The DSEIS offers no valid scientific or technical rationale for using "post-licensing, pre-operational," rather than "pre-licensing baseline" measurements, to establish "baseline" water quality data.
16. Moreover, if these excursion UCLs and post-licensing baseline concentrations are to be established "prior to commencing ISL operations….for each separate wellfield" as described on page 2-24 of the DSEIS, and there are "15-25 wellfield areas" in the "Ross Project" alone, as described on page xix of the DSEIS, how can all these multiple well-field limits simultaneously be "codified in the Applicant's NRC license," as the DSEIS asserts, when the "Applicant" must logically become the "Licensee" upon commencing operation of the first wellfield?
17. The DSEIS does not explain how the Applicant and/or the terms of its NRC License will prevent such "post-licensing, pre-operational baseline" water quality measurements from being contaminated by the combined effects, prior to sampling, of drilling, casing and testing large numbers of injection and recovery wells, and from the effects of previous and ongoing exploratory drilling to delineate the boundaries of the economically recoverable uranium resource. Nor does the DSEIS address how, in the course of simultaneously constructing, operating, and "restoring" numerous individual wellfields in sequence over many years, the Applicant and the License terms will avoid the obvious pitfall of operational wellfields degrading the "post-licensing, pre-operational" water quality baselines in subsequent adjacent

monitoring wells targeting the same aquifers. As demonstrated by the statistically invalid baseline values reported for the Kingsville Dome ISL operations in Texas (TWC 1988; TWC 1990)[2], this flawed methodology will have the effect of creating a cascading deterioration in nominal "baseline" water quality measurements from wellfield to wellfield in the course of building-out the "Ross Project," and pursuing adjacent "Lance District Development." In my expert opinion, the effect of this flawed methodology will be to permit Strata Energy to pollute ground-water in a manner inconsistent with the NRC's regulatory intent.

18. Another element of the Petitioners' first contention is the failure of the NRC materials license process to accurately and independently assess the ore zone. *See* Sass Decl. ¶ 15, Petition at 13. The review in the DSEIS primarily relies on the data in the application, which in my expert judgment is insufficient to conclude that the regional water quality in the ore zone exceeds the EPA drinking water Maximum Concentration Limits (MCLs) for uranium and radium-226. Although NRC admits that data are available, the NRC simply states: "The data from 2011 are generally consistent with the 2009 and 2010 data, indicating a representative characterization of ground-water quality." (DSEIS at 3-39). The 2011 data are not provided in the DSEIS and, until they are provided, it is my finding that these data are insufficient to establish representative water quality in the regional baseline wells.

19. Another element of the Petitioners' first contention was the failure of the NRC materials license process to provide a scientifically sound sampling regime prior to the issuance of a license and during the course of the public environmental review. See Abitz Decl. ¶¶ 16-19, Petition at 14. As with a number of other elements in dispute, there has been no substantive change between

[2] Baseline for Kingsville Dome Production Area Authorization (PAA) 1 and PAA 2 were established two years apart and much higher values were measured for PAA2 (PAA1: uranium = 0.164 mg/L; radium-226 = 22 pCi/L. PAA2: uranium = 1.89 mg/L; radium-226 = 92 pCi/L). Note that baseline was established for these PAAs with invalid statistical methods, as outlined in paragraph 10 of this declaration.

the ER and the DSEIS. As noted in our original declaration, in my expert judgment, Strata must lay out a systematic grid covering the project area, and select at random points in that grid to locate baseline wells. Existing water-quality data from Strata's six regional wells can be used to estimate the approximate standard deviation of the population (which must be done for each quarter to eliminate temporal trends), and this methodology can be used to estimate the number of wells needed to reach the stated statistical confidence for obtaining a representative number of samples from the regional project area aquifer.[3] Such an industry-standard, statistical sampling approach, with a stated level of decision confidence, is the only valid scientific method available to Strata if they wish to conclude that the water quality in the ore zone does not meet the EPA MCLs for uranium and radium-226.

20. We provide an example (using VSP software) and subsequent explanation of how this sampling might look.

2010 Uranium Results (ug/L)

	1st Q	2nd Q	3rd Q	4th Q
22-18OZ	0.070	0.033	0.069	0.033
14-18OZ	0.096	0.109	0.109	0.085
21-19OZ	0.017	0.008	0.024	0.005
34-7OZ	0.041	0.038	0.044	0.028
34-18OZ	0.062	0.059	0.046	0.041
42-19OZ	0.011	0.010	0.010	0.009
Median	0.052	0.036	0.045	0.031
Mean	0.050	0.043	0.050	0.034

[3] NRC guidance is to place one baseline well in every four acres (NRC, 2003; p. 5-39), but Petitioners are not suggesting that 312 wells (1248 acres proposed for ISL well fields divided by 4) are strictly necessary to obtain representative water samples. Fewer locations can be achieved with good statistical design, but no such effort has been made or suggested by the NRC. In any event, a systematic grid and well-designed statistical sampling plan is necessary.

std dev	0.033	0.038	0.035	0.029
SW test statistic 95% conf	0.952	0.883	0.948	0.892
SW critical value 95% conf	0.788	0.788	0.788	0.788
95% LCL mean	0.023	0.012	0.021	0.010
95% UCL mean	0.076	0.074	0.080	0.057
t stat	1.46	0.837	1.42	0.298
t critical value 90% conf	1.48	1.48	1.48	1.48
Conclusion	accept null hypothesis because t stat < t crit value			
Null hypothesis	regional groundwater < 0.03 mg/L			
Type I error (alpha)	0.1; 90% confident we will accept null hypothesis when it is true			
gray area	0.005 above uranium MCL (0.035 mg/L)			
Type II error (beta)	0.5; 50% chance to accept null hypothesis if the true mean is 0.035 mg/L			
Sample Requirements	73	96	82	57
Null hypothesis	regional groundwater < 0.03 mg/L			
Type I error (alpha)	0.1; 90% confident we will accept null hypothesis when it is true			
gray area	0.01 above uranium MCL (0.04 mg/L)			
Type II error (beta)	0.5; 50% chance to accept null hypothesis if the true mean is 0.04 mg/L			
Sample Requirements	19	25	21	15
Null hypothesis	regional groundwater < 0.03 mg/L			
Type I error (alpha)	0.1; 90% confident we will accept null hypothesis when it is true			
gray area	0.01 above uranium MCL (0.04 mg/L)			
Type II error (beta)	0.2; 20% chance to accept null hypothesis if the true mean is 0.04 mg/L			
Sample Requirements	50	66	57	39

21. The statistical summary in paragraph 20 indicates that the six regional monitor wells are an insufficient number of wells to conclude, with a stated level of confidence (90% in this example), that uranium exceeds the EPA MCL in the OZ aquifer. To perform this analysis with parametric statistical tests (e.g., student t test), the data must be evaluated with the Shapiro-Wilk (SW) test to determine if the distribution is normal or lognormal. If the data are neither normal nor lognormal, non-parametric test methods must be used. The SW test statistic is greater than the SW critical value, which indicates that the six results for each quarter follow a normal distribution, and the 95% lower control limit (LCL) of the mean is below the EPA MCL, which indicates that the true uranium mean of the regional aquifer could be below 0.03 mg/L. Because the data are normally distributed, the student t test can be used to test the hypothesis (90% confidence level used in this example) that the true uranium mean is less than the EPA MCL (0.03 mg/L). The results of the student t test show that the t statistic is above the t critical value, and we have to accept the null hypothesis that the true uranium mean for the groundwater in the OZ horizon is less than the EPA MCL of 0.03 mg/L. If Strata believes the true uranium mean in the OZ horizon is above the EPA MCL, they must collect additional random samples and rerun the SW and Student t tests to determine if the null hypothesis can be rejected, which would demonstrate that the true uranium mean is above the EPA MCL. The sample requirements for different Type II errors and contamination scenarios indicate a minimum of 15 and maximum of 96 locations would be needed to test the alternative hypothesis that the true uranium mean is above the EPA MCL.

22. Another element of the Petitioners' first contention is the statistically invalid biased collection of non-representative samples from screens placed through part of the OZ water horizon that only sample water in contact with the ore zone, rather than the entire column of water in the OZ

sand interval. *See* Abitz Decl. ¶ 22, Petition at 14. Regarding this element, little has changed between the ER and DSEIS, as screen lengths for the existing six monitor wells in the OZ zone are approximately ¼ to ½ the thickness of the OZ sand (Table 1 in Abitz 2011) and centered on the ore zone. This has the effect of biasing the groundwater sample to high values for uranium, radium-226 and other uranium progeny and associated ore metals (e.g., arsenic, molybdenum, vanadium, etc) due to the disturbance and oxidation of the ore during well construction and development. I am aware that NRC Guidance (2003; p.5-43) also recognizes this bias and the NRC states that fully screened intervals are more accurate in their representation of the water quality that a user of the water will encounter. Therefore, in my expert opinion, the present monitor wells in the OZ horizon do not collect a representative groundwater sample.

23. Further, the lack of analysis found in the DSEIS exacerbates the dispute between the parties over the need for a meaningful environmental review of baseline water quality prior to any final licensing decisions. For example, in Tables 3.6 and 3.7 of the DSEIS, Strata's six cluster wells are grouped together to report average and ranges for each water horizon, and there is no mention of the proper statistical methods for evaluating individual wells prior to grouping them and calculating an average or range for the aquifer horizon (Gilbert, 1987; Matzke et al., 2007; ASTM, 1998; EPA, 1989; 1992a; 1992b; 2009; NRC, 2003). A simple averaging or simply reporting a range of the values from all wells is inappropriate, unless it can be shown with proper statistical methods that (i) the samples from the individual wells follow a normal or log-normal distribution, and (ii) an analysis of the data variance of each well demonstrates that the wells can be combined into a single population for statistical calculations. These standard statistical practices for the environmental industry (random grid sampling, statistically significant number of sampling locations, proper statistical tests, etc) are routinely and easily

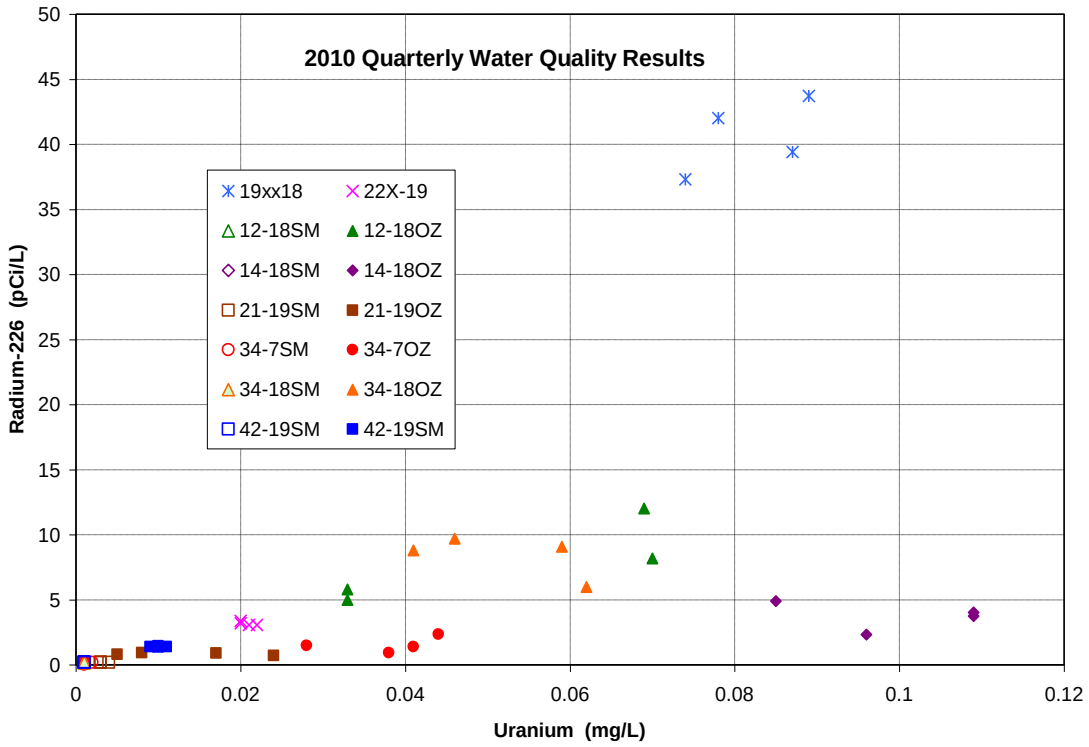
carried out using available statistical software (e.g., Visual Sampling Plan, available free from Pacific Northwest National Laboratory: http://vsp.pnnl.gov), and I note that the use of these standard industry practices is enforced by EPA when groundwater and soil samples are collected at CERCLA and RCRA sites (DOE 1998a-e; DOE 1999a-e; DOE 2000a-e; DOE 2001a-e; DOE 2002a-c; DOE 2003a-c; DOE 2004a-f; DOE 2005 a-d; DOE 2006a-o; DOE 2007a-j; DOE 2008a-b; DOE 2009).

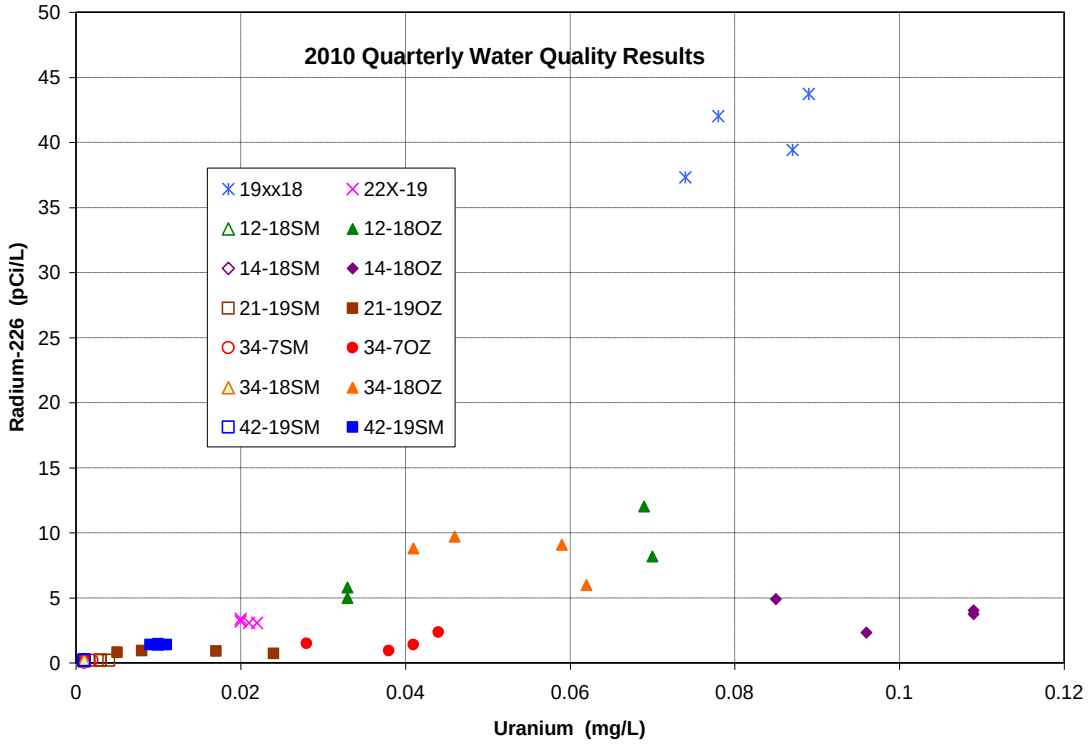
Contention 2 – Analysis of Environmental Impact of Alternative Concentration Limits

24. An element of the Petitioners' second contention, which concerns uncertainty as to the detailed procedures employed for aquifer restoration (*see* Moran Decl. ¶ 70, Petition at 17), has not been functionally altered by treatment in the DSEIS. Indeed, it is my finding that the same elements that precipitated Petitioners' contentions are found in the DSEIS. As an example, Strata "estimates that aquifer restoration for each wellfield would take approximately eight months" (DSEIS at 2-33, but *see*, suggestion of six months at 4-34). However, the DSEIS treatment of restoration is based on what Strata informed the agency, and not an independent analysis of how long restoration would take. The DSEIS provides a general description of aquifer restoration techniques but does not say which would be deployed in which wellfield for how long and why; and there is no differentiation in aquifer restoration techniques between the 15-25 estimated wellfields. It is well established that no pilot-scale or full-scale ISL mining operation has restored their contaminated groundwater to the baseline values cited in the initial license permit (Hall, 2009; Staub et al., 1986; Deutsch et al., 1984). Importantly, ISL operators are unable to restore the groundwater to baseline values, even erroneously poor baseline values that are biased by high by oxidation of the ore zone during drilling and well development, invalid sampling protocols, and improper statistical manipulation of analytical results.

Examining the established scientific facts it is apparent, in my expert judgment, that the probability is vanishingly small that ISL-contaminated groundwater can be restored to baseline values when those values are properly determined with valid scientific and statistical techniques (*i.e.*, lower concentrations than heretofore presented by Strata or NRC).

25. Failure to restore the groundwater under the Nubeth pilot-scale ISL operation is clearly evident in the consistently elevated uranium and radium-226 concentrations observed in samples from industrial well 19xx18 (Figure 1), which served as the extraction well to the Nubeth pilot-scale test (Figure 3.15 in the SEIS). The uranium-radium-226 trend observed for all Strata cluster wells from the OZ horizons and industrial well 22x19 lies well below the radium-226 values for 19xx18, and the high radium-226 values can only be explained by the capture of the contaminated plume that remains from Nubeth's failure to restore groundwater after their six-month pilot-scale test. In my expert opinion, failure to restore the groundwater after a short six-month pilot-scale project should have clearly communicated to the NRC staff that it will not be possible to restore a full-scale ISL operation in 8 months (DSEIS at 2-33).
26. Figure 1. Variation plot for uranium and radium-226 showing distinct radium-226 values for 19xx18, which are due to the capture of the Nubeth contamination plume.





27. Given overwhelming scientific evidence of the failure of the ISL industry to restore groundwater to pre-mining water-quality standards, NRC should be analyzing the actual

likelihood of restoring groundwater to true baseline conditions, and not simply accept Strata's position that restoration to baseline values is possible because of the Nubeth project "demonstration of successful ground-water restoration and site reclamation." *See* DSEIS at 2-11 line 43.

28. Another element of the Petitioners' second contention, the failure to adequately define the specific aquifer restoration criteria/standards during the NEPA process and prior to licensing the facility (see Moran Decl. ¶ 70, Petition at 17), is also unaltered by treatment in the DSEIS. Here, NRC Staff admits that the restoration criteria are not known at this time. *See* contention 1 above: "The purpose of aquifer restoration is to restore the respective aquifer to its baseline conditions, as defined by post-licensing, pre-operational constituent concentrations." DSEIS at 2-32

29. Another element of the Petitioners' second contention, the suggested six-month restoration period, is far too short given the past history of failed ISL restoration at all ISL sites, including the Nubeth pilot-scale project (see Abitz Decl. ¶ 28, Petition at 18). Again, the DSEIS does not discuss or analyze the credibility of Strata's estimated restoration timeframe.

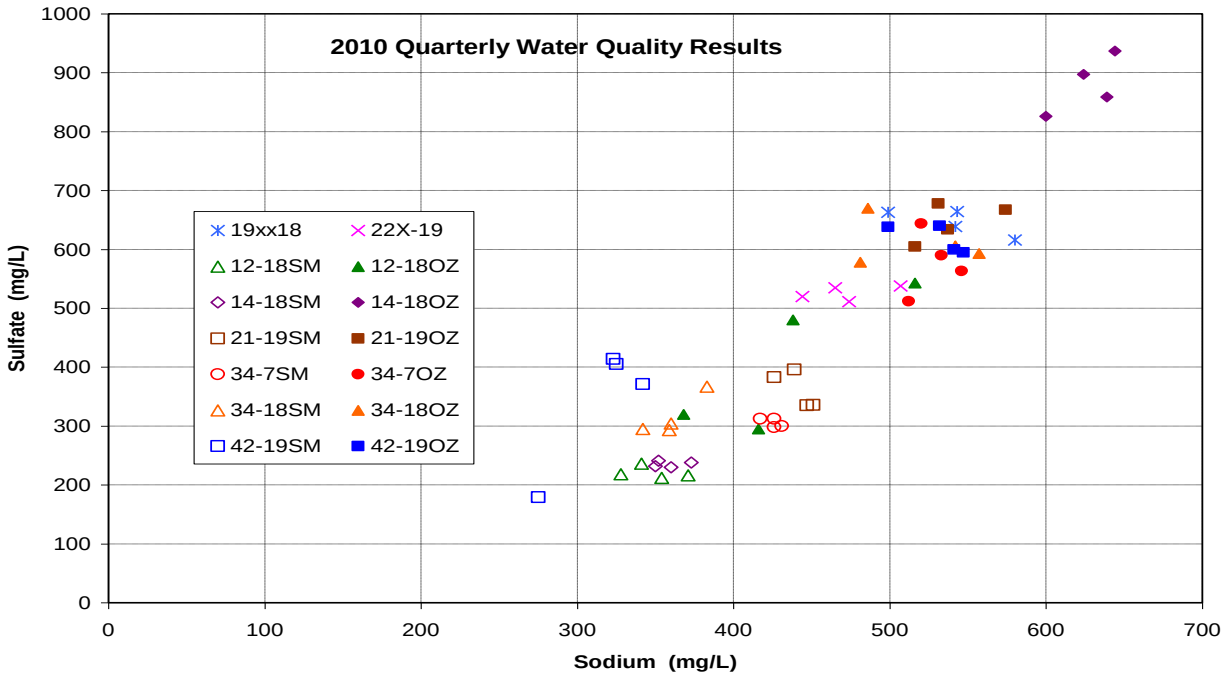
Contention 3 – Fluid Migration

30. With respect to Petitioners' third contention, Strata's failure to sufficiently describe and analyze information about boreholes and aquifer isolation to demonstrate that fluids would be contained during and after mining operations, Petitioners focused on the over 5,000 exploration boreholes drilled in the area which can serve as pathways for fluid migration. *See* Moran Decl. ¶¶ 22,31; Abitz ¶13 Petition 21-23. Again, there is little alteration in this fundamental dispute with the issuance of the DSEIS.

31. The DSEIS admits there are abandoned wells but does not disclose any total amount beyond information Strata has relayed to the agency. Indeed, the DSEIS discloses that hydrologic connection between the OZ aquifer and DM aquifer exists "due to improperly plugged previous exploration drillholes that have not yet been properly abandoned." DSEIS at 4-35. But, DSEIS does not consider the water quality impacts of these wells in relation to the Ross Project because NRC says groundwater impacts would be "minimized by the Applicant locating the drillholes within the wellfields beneath the Proposed Action as well as plugging and abandoning them." DSEIS at 4-36. In short, the DSEIS simply assumes the feasibility of locating and plugging these thousands of drillholes and relies on the applicant to correctly perform these actions, stating that, "[t]o prevent communication between aquifers during uranium-recovery operation, the Applicant proposes to actively locate and plug all exploration drillholes prior to beginning wellfield operations." DSEIS at 3-38.[4]
32. Strata constructed and developed six monitor-well clusters within the project boundary and performed 24-hour pump tests on four of these wells in July 2010 (12-18OZ, 21-19OZ, 34-7OZ, 42-19OZ; Addendum 2.7-J of Strata TR 2011). In my expert opinion, neither the number of wells tested for hydrological parameters nor the short duration of the pump test establish adequate hydrological information to demonstrate control of groundwater over 1,866 acres of complex fluvial stratigraphy (Addendum 2.6-C of Strata TR 2011). Moreover, hundreds of exploration boreholes remain unplugged and there is no clear indication that all the boreholes will be found and abandoned in accordance with proper procedures (Addendum 2.6-B of Strata TR 2011).

[4] However, "As of October 2010, the Applicant has located 759 of the 1682 holes thought to exist from Nubeth exploration activity and has plugged 55 of them." DSEIS at 2-44.

33. The DSEIS does not at all address any of the significant data gaps in the conceptual and numerical hydrologic models put forward to support Strata's license application. This silence is inexcusable because the DSEIS does note that horizontal and vertical excursions of mining fluids occur at all ISL operations, and the vertical excursions were traced to thinning of the confining layer in the complex fluvial stratigraphy and improperly abandoned exploration bore holes (SEIS, p. 4-32, lines 41-43).
34. Demonstration of adequate hydrologic control is not a trivial matter because groundwater communication between the SM and OZ horizons is evident in the 24-hour pump test data from well 12-18OZ and the water-quality results for sodium and sulfate (Figure 2). Groundwater from the ore horizon (OZ; solid symbols) generally has higher sodium and sulfate, relative to the overlying groundwater (SM). However, mixing of the groundwater from these two horizons is clearly indicated by the linear trace of the sodium and sulfate trend on Figure 2. In my expert opinion this is unquestionably demonstrated by the mid-location of plotted samples from 22X-19, a well that is screened through the OZ and SM zones (Section 2.7.3.3.1, p.2-169, Strata TR). If 14-18OZ is taken as the unmixed groundwater from the ore horizon, all other OZ samples are shown to have a component of SM water, as they lie between 14-18OZ and 22x-19. Note that the strong mixing between the horizons is unequivocal for samples from 12-18OZ, which plot with the samples from 22x-19 and the SM horizon.
35. Figure 2. Water-quality results for sodium and sulfate indicate groundwater mixing of the ore zone (OZ) and overlying horizon (SM).



36. Figure 2 also illustrates that, the closer that a pair of samples plots for a given cluster well (e.g., 12-18SM and 12-18OZ), the higher the probability for groundwater contamination by communication between the two groundwater zones during ISL operations. In contrast to mixing between the 12-18 horizons, 14-18SM and 14-18OZ samples cluster tightly and are well separated on the plot. An explanation for the distinct separation of the 14-18 horizons on the sodium-sulfate plot may be that the density of exploration boreholes is lower around this cluster well and less communication between the SM and OZ horizons has occurred (*i.e.*, 14-18 may provide a snapshot of the distinct chemistry of the horizons prior to the drilling of thousands of exploration boreholes).

37. Additionally, it is also known that 22x19 is screened through the SM and OZ zones, and there is no detailed engineering analysis to show the effect of the industrial well operation on the ISL operations. <u>The complexity of the stratigraphy coupled with hundreds of unplugged boreholes, established mixing between the SM and OZ zones, and the high-yield industrial wells requires</u>

many more test wells over the 1,866 acres and much longer pump test intervals to obtain the needed hydrologic data to assess the control of mining fluids during ISL operations. The DSEIS is silent on these complexities and provides no convincing hydrologic data to support Strata's contention that mining fluids will be controlled to prevent groundwater pollution.

Contention 4 – Cumulative Impacts

38. With respect to the Petitioners' fourth admitted contention, the failure to sufficiently describe cumulative groundwater quantity impacts and the failure to quantitatively evaluate impacts of the proposed Lance District expansion and the project as a whole reflects a problematic perspective. While the DSEIS acknowledges cumulative impacts will occur from foreseeable projects (see DSEIS at 2-13), there is a dearth of meaningful analysis in the agency's document and the petitioners' concerns remain unaddressed.

39. The DSEIS briefly notes cumulative impacts to water drawdown from future "satellite" projects: stating consumption could increase to 356 gal/min from the 122 gal/min estimated for the Ross Project. DSEIS at 5-24. This estimate is based on aquifer yield that is proportional to uranium recovery amount, and the DSEIS lacks specific analysis about projected drawdown amounts. The DSEIS also lacks analysis about irreversible trends - it simply estimates that quantity "would also be essentially restored within 24 years after the issuance of the NRC license" and therefore suggests impacts would be small. DSEIS at 5-25. Further, there is no analysis of cumulative water quality impacts - just the Nubeth pilot-scale ISL operation, but no analysis of the prospective parts of the entire Ross project or even the greater Lance District project.

40. Indeed, what NRC does look at is essentially limited to the OZ zone, due to the proposed confining layers (p.5-22, lines 44-46). This conflicts with scientific data and NRC statements

that horizontal and vertical excursions of mining fluids occur at all ISL operations, and that the vertical excursions were traced to thinning of the confining layer in the complex fluvial stratigraphy and improperly abandoned exploration bore holes (DSEIS, p. 4-32, lines 41-43). Therefore, the layers are not confining due to complex fluvial stratigraphy (Addendum 2.6-C of Strata TR 2011), unplugged boreholes (Addendum 2.6-B of Strata TR 2011), hydrological evidence for connection between OZ and SM during the July 2010 24-hr pump test on 12-18OZ, and water quality analyses that show mixing between SM and OZ (Figure 2).

41. Further, NRC considers cumulative groundwater impacts for the Ross Project to occur over 24 years. DSEIS at 5-23, lines 9-15. The agency notes average consumption of 122 gal/min over 6 years for the Ross Project; but the basis and calculation to derive the quantity of groundwater over this period is absent (p. 5-24, lines 12-14). NRC then states the average increases to 356 gal/min when including the Kendrick, Richards, and Barber satellite areas; based on scaling water consumption to uranium production between Ross Project and all satellite operations, but no period of consumption is given by the agency. It is perplexing why there is a lack of mass balance calculations, because information is given to estimate total gallons consumed (i.e., 356 gal/min over 24 years equates to 4.5 billion gallons of groundwater, or enough water to cover 13,800 acres to a depth of 1 foot). Note that NRC and Strata are mute on groundwater loss due to failure to restore aquifers to true baseline conditions, which could be another 56,000 acre-ft (assuming 1866 acres multiplied by 100 feet of sand thickness with a porosity of 0.3)
42. NRC states that Strata cannot estimate the current withdrawal of groundwater from the Lance and Fox Hills formations because the geological interval is not recorded by the Wyoming engineer's office (p. 5-24, lines 23-28). It is my finding that this conclusion is grossly disingenuous, as location and depth of wells are given (line 24) and both the NRC and Strata

have intimate knowledge of the regional geology to correlate these locations and depths with the geological interval.

43. Again, without any independent analysis, NRC cites Strata on concluding that the OZ horizon is unattractive as a groundwater source due to depth (400 fbgs), and due to the presence of overlying aquifers (p. 5-24, lines 31-33). This statement contradicts the NRC statement (p.5-24, lines 1-4) on the city of Gillette, which extracts groundwater from the Fox Hills Formation at a depth of 500 fbgs and mixes this high TDS water with groundwater of lower TDS to produce potable water for the city. The use of Fox Hills groundwater by the city of Gillette also exposes the fallacy of the NRC/Strata argument that the groundwater in the OZ is unsuitable for human consumption. Clearly, the groundwater from the OZ horizon can be blended with lower TDS water to produce potable water for human consumption.

/s/ Dr. Richard Abitz (electronic signature approved)

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