[ORAL ARGUMENT NOT YET SCHEDULED]

No. 16-1298

IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

NATURAL RESOURCES DEFENSE COUNCIL, INC. AND
POWDER RIVER BASIN RESOURCE COUNCIL,

Petitioners,

v.

UNITED STATES OF AMERICA AND
NUCLEAR REGULATORY COMMISSION,

Respondents.

PETITION FOR REVIEW OF FINAL ORDER OF THE UNITED STATES NUCLEAR REGULATORY COMMISSION

JOINT APPENDIX – VOLUME 2

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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	)	
STRATA ENERGY, INC.,	)	Docket No. 40-9091-MLA
	)	
(Ross In Situ Recovery Uranium Project)	)	
(Materials License Application)		

DECLARATION OF LINDA LOPEZ

I, Linda Lopez, declare as follows:

1. I am the director of membership at the Natural Resources Defense Council, Inc. (NRDC). I have been the director of membership for twenty-three years.

2. My duties include supervising the preparation of materials that NRDC distributes to members and prospective members. Those materials describe NRDC and identify its mission.

3. NRDC is a membership organization incorporated under the laws of the State of New York. It is recognized as a not-for-profit corporation under section 501(c)(3) of the United States Internal Revenue Code.

4. NRDC currently has approximately 357,472 members. There are NRDC members residing in each of the fifty United States and in the District of Columbia. NRDC has 696 members in Wyoming and 523 members in South Dakota.

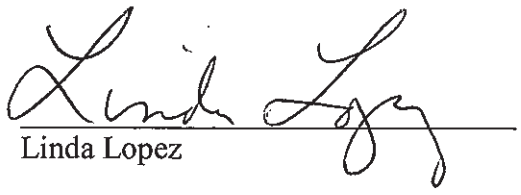
5. NRDC's mission statement declares that "The Natural Resources Defense Council's purpose is to safeguard the Earth: its people, its plants and animals, and the natural systems on which all life depends." Furthermore, NRDC "strive[s] to protect nature in ways that

advance the long-term welfare of present and future generations," and "work[s] to foster the fundamental right of all people to have a voice in decisions that affect their environment."

6. Since its inception in 1970, NRDC has, as one of its organizational goals, sought to improve the environmental, health, and safety conditions at the nuclear facilities operated by the Department of Energy and the civil nuclear facilities licensed by the Nuclear Regulatory Commission and their predecessor agencies. To that end, NRDC utilizes its institutional resources (such as its capacities for legislative advocacy, public outreach and education, and litigation) to minimize the risks that nuclear facilities pose to its members and to the general public.

I declare under penalty of perjury that the foregoing is true and correct, to the best of my knowledge, information, and belief.

Dated: October 20, 2011



Linda Lopez

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)	)	

(Materials License Application)

DECLARATION OF WILMA TOPE

I, Wilma Tope, declare as follows:

1. I am the Chair of the Powder River Basin Resource Council ("Powder River") Board of Directors. I have been the Chair since November 2010. I have been a Powder River board member since 2007.

2. I also serve as an officer for Ranchers and Neighbors Protecting Our Water, a local affiliate organization of Powder River consisting of members in Crook County, Wyoming who are concerned about proposed uranium projects. My husband, Jay, and I are founding members of Ranchers and Neighbors Protecting Our Water because we are concerned about proposed uranium development in our county.

3. Powder River is a grassroots membership organization incorporated under the laws of the State of Wyoming. It is recognized as a tax-exempt, not-for-profit corporation under section 501(c)(3) of the United States Internal Revenue Code.

4. Powder River currently has approximately 1,000 members, most of whom live in Wyoming.

5. Powder River's mission statement declares that the organization is committed to: the preservation and enrichment of Wyoming's agricultural heritage and rural lifestyle; the conservation of Wyoming's unique land, mineral, water, and clean air resources consistent with responsible use of those resources to sustain the livelihood of present and future generations; and the education and empowerment of Wyoming's citizens to raise a coherent voice in the decisions that will impact their environment and lifestyle.

6. Since the early years of Powder River, our members have worked for responsible development of Wyoming's vast mineral resources. In order to be responsible, development activities must not sacrifice the protection of air, land, and water resources.

7. Powder River adopts policy positions by vote of the membership at our Annual Meeting, held each November. In 2005, Powder River members adopted a policy position stating that the organization "supports a stronger public role in all phases of uranium exploration and mining activities." Organization members also stated that "no in-situ leach mining, uranium milling or storage [should] be permitted near home sites or in areas where such mining, milling, or storage would threaten to contaminate aquifers" and that "state and federal regulators [should] require that operators post sufficient bonding or other surety to guarantee the cleanup of hazardous or radioactive contaminants and full restoration of mined, milling, or storage areas." In 2008, Powder River members adopted another resolution on uranium mining supporting an increased oversight role of state and federal regulators to address problems at uranium mining and milling sites.

8. The Powder River Board of Directors has authorized our organization's intervention in the NRC licensing of Strata Energy's in-situ uranium mining and milling project. Powder River's intervention is consistent with our organizational policies about uranium mining and our mission to protect human health and the environment during energy development activities.

I declare under penalty of perjury that the foregoing is true and correct, to the best of my knowledge, information, and belief.

Dated: 10/24/11

Wilma Tope

Wilma Tope

DECLARATION OF PAMELA VIVIANO

I, Pamela Viviano, do hereby declare as follows:

1. My home address is:

735 New Haven Road
Hulett Wyoming 82720
307-467-9291

This property is located in Crook County, 10 miles Northeast of Strata Energy's proposed In-Situ Leach or uranium site, known as the Ross Project. Our property has two wells that serve as domestic and stock water. The main well, which is used for both domestic and stock purposes, is at the depth of 298 feet. This well has been tested, and currently meets Environmental Protection Agency (EPA) primary drinking standards. The second well is approximately 300 feet and provides water for livestock.

2. Since 2007, I have volunteered as an officer for Ranchers & Neighbors Protecting Our Water; an affiliate organization of Powder River Basin Resource Council. My husband and I are also members of The Powder River Basin Resource Council and the Natural Resources Defense Council. Our affiliate was formed primarily to inform and educate the public about the potential negative impacts from in-situ leach (ISL) uranium mining and milling sites that are proposed for our county and our state. In order to provide information to the public, our members and I have studied and researched the ISL uranium mining process, both at past and current sites throughout Wyoming, Nebraska, and Texas. I have also reviewed many of the annual reports from the currently operating ISL sites in Wyoming, as well as WDEQ reports of violations and other issues. As a result of this research, my husband and I have been become concerned about the impacts of ISL uranium mining and milling. We are concerned about Strata Energy's proposed ISL project and its probable impacts to our land, water, and other interests. We therefore support Powder River Basin Resource Council and Natural Resources Defense Council's intervention in the Strata Energy ISL uranium licensing case before the Nuclear Regulatory Commission's Atomic Safety and Licensing Board as a way to protect our interests.

3. Eleven years ago, my husband and I purchased our dream property here in Wyoming, with the intention of spending the rest of our lives here. We had worked and saved for over 21 years, in order to buy this 260 acre property, complete with hay fields, pastures, and ponds. Since that time, we have worked continuously on our place, repairing fences and out buildings, building wildlife ponds and planting feed plots, and remodeling the older home that was here. Now, we feel that the dream of living here and enjoying the place we worked so hard to purchase and to restore is threatened by Strata Energy's proposed ISL site, only 10 miles to the southwest.

4. The threats I see are due to the numerous negative impacts of the ISL uranium mining process that is proposed. I am concerned about the fact that within the Ross project area there are over 5,000 old drill holes from decades ago, many of which were improperly plugged and abandoned. Strata Energy's application states that their process will be feasible and safe, as it will be in a "confined" aquifer. However, we are deeply concerned that Strata Energy will be unable to locate and properly plug all of these abandoned drill holes. Further, there are hundreds of these drill holes outside the mining area and throughout our neighbors' private properties, and we are concerned that

those also will not be located and properly plugged. Since these old drill holes can serve as a connection between the aquifers, the Fox Hills aquifer that Strata is proposing to use as an ore zone for its mining and milling operations may not be a "confined" aquifer at all. These connections between the aquifers could allow cross contamination from the Fox Hills aquifer to the aquifer in which our wells are located. Contamination of our domestic and stock water would cause our water to be unusable for drinking, washing, watering our garden, as well as for our livestock.

5. Another potential negative impact is that these ISL sites have a long history of spills, leaks, and excursions of the contaminated leach solutions. Once again, these problems could cause contamination of our well water, as well as the surface waters that run northeast from the mining area.

6. Another potential negative impact that we are concerned about is the threat of aquifer depletion. There is an extremely high consumptive use of water during the ISL processing and restoration phases, which has the potential to draw down the aquifers. Industry often states that during the processing phase, the waste water is only 3% of the water used. However, this amounts to millions of gallons of water per year for the planned duration of up to 20 years. At one meeting with Strata Energy, they stated that "the water consumption for the processing phase is minimal, compared to the restoration phase." This is something that we had already learned in our research; that the restoration phase is even more consumptive, as the initial phase uses a method termed "groundwater sweep" and then continues with another process called "reverse osmosis." As I understand it, significant amounts of water are used. I have reviewed reports that show that one site currently is in its 9th year of attempting to restore the water for a site that was originally estimated to take less than 2 years in the restoration phase. I'm concerned because Strata Energy's process will be the same as these other companies. Therefore, we expect that the water waste for this phase can be in the billions of gallons and this is of great concern to us. Strata Energy states that "the pre-mining drawdown of the Fox Hills aquifer, since 1980, due to the presence of the oil field water supply wells is already 200 feet". The consumptive use of water during the ISL process and restoration has a potential to drop the Fox Hills aquifer even further, which in turn could deplete the aquifers above it. Again, the loss of water for domestic and stock use would cause us to have to haul water or to re-drill our well; either one would be an extremely expensive solution just to provide ourselves with drinking water, and would be infeasible for watering our garden, yard, trees, and livestock.

7. Another potential negative impact, based on our research, is that groundwater restoration remains difficult and has taken longer than expected at operating mines in Wyoming. To date there is no example of an aquifer being returned to pre-mining conditions at a commercial-scale ISL uranium mining operation. I have reviewed documents that show that at one site in Wyoming a reported restoration value of uranium for one wellfield was 70 times the baseline value. Based on what I have seen, I believe that restoration of the water for all parameters has proven impossible. The elements that ISL operators have been unable to return to baseline are the ones that are of the most concern to me as a landowner who uses the local water supply, including a mix of radioactive and toxic heavy metals such as uranium, arsenic, and radium-226. Again, the inability to restore the aquifer to pre-mining conditions is a potential threat to our aquifers in the future.

8. Another concern is I have reviewed documents that show that currently operating ISL uranium mining sites in Wyoming are having difficulties in stopping the leaching process. After extracting all the economically feasible uranium and attempting to restore the water, they are having problems with removing the excess oxygen from the solution and stopping the leaching process. In the 09-10

annual report, Cameco's Smith Ranch-Highland ISL site stated that they are still trying to come up with a way to do this. To my knowledge, Strata Energy has not proposed anything different for its restoration and decommissioning phase. Therefore, if this process can continue, then there is a possibility that the contamination of the aquifers could continue for decades, long after the uranium companies are gone, and may therefore threaten our wells in the years to come.

9. We have considered the possibility of selling our property prior to Starta's ISL uranium mining site becoming a reality. However, another potential impact is that the value of the property will drop, due to the close proximity of a uranium operation. Even if the value does not drop, the pool of potential buyers could shrink, as many people are not willing to buy close to a uranium operation. Therefore, we could suffer a negative financial impact from reduced property values due to the proposed site.

10. Another potential negative impact from this site would be the increase in traffic on our road during the construction of the site and the operational phase. These roads are dirt and gravel, and any traffic results in a dust problem. The increased traffic would cause a health hazard to us and to all those with homes along these roads.

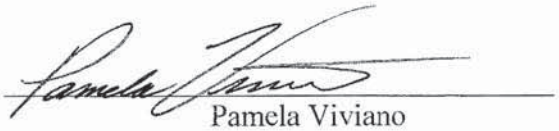
11. A final negative impact will be from light pollution. At this time, the night skies in our area are free of any lights, as the closest town of only approximately 400 people is over 10 miles away. The Ross site is directly 10 miles southwest of our property, and lights from operating on a 24 hour schedule could interfere with the clear views of the night skies that we now enjoy.

12. Besides the property that we call our home, we own a second, 92-acre property in Crook County, Wyoming, on Thorn Divide, which is approximately 7 miles to the southwest of the Ross project. This property was purchased in 2006 as an investment to increase our retirement funds. The primary reason that we purchased this particular property was the fact that it has a working well, which is fairly rare for that particular area. Many other property owners in this area do not have wells and are forced to haul water. This is due to the depth of the water in this area, which makes drilling a well cost-prohibitive for many. The well on this property is at 710 feet. Based on my review of Strata Energy's application, and especially Figure 4.4-2 of the Environmental Report, it appears that our well is at the same depth as Strata Energy's proposed ore zone in the Fox Hills aquifer. This is of great concern to use because it means that the water in this well could become contaminated due to either horizontal or vertical excursions from the mining site. Second, the well could dry up due to a drop in the aquifer level from the removal of huge amounts of waste water. We paid more for this property in comparison to other area parcels due to the fact that it had a working well. If either of the aforementioned scenarios should come to pass, then the value of this property would drop dramatically, since the well is the primary reason that it is worth as much as it is at this time. Even before the Ross project begins, this could have a negative impact on the value of the property, as many potential buyers are not willing to look at a property that would be close to an ISL uranium mining site, and they may also have the same concerns about the contamination or drawdown of the aquifer. This would make it much more difficult to find a buyer for this property. A loss of value in this property will result in the loss of much of our invested retirement money, and thus cause us a great deal of economic hardship for our future retirement.

13. I support Powder River Basin Resource Council and Natural Resources Defense Council's intervention in this case because I believe with their participation, the Nuclear Regulatory Commission will be better positioned to fully review the possible impacts of Strata Energy's

proposed ISL mining and milling project and based on the Council's and their experts' information, may address concerns and mitigate impacts to our water, land, and other resources.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, information and belief and that this declaration was executed on October 21, 2011 in Hulett, Wyoming.



Pamela Viviano

UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

NATURAL RESOURCES DEFENSE COUNCIL, INC. and POWDER RIVER BASIN RESOURCE COUNCIL,	)	
Petitioners,	)	No. 16-1298
v.	)	
UNITED STATES NUCLEAR REGULATORY COMMISSION and the UNITED STATES OF AMERICA,	)	
Respondents.	)	

Declaration of Pamela Viviano

I, Pamela Viviano declare as follows:

1. I live in Crook County, Wyoming at 735 New Haven Road. This property is located 10 miles northeast of Strata Energy's in-situ leach (ISL) uranium site, known as the Ross Project. The current Ross Project is located within a larger area called the Lance District, which Strata Energy plans to develop.
2. Our property has two wells that serve domestic and stock water. The main well, which is used for domestic and stock purposes, is at a depth of 298 feet. This well has been tested and currently meets Environmental Protection Act primary drinking water standards. The second well is approximately 300 feet and provides water for livestock.

3. Since 2007, my husband, James Jones, and I have volunteered as officers for Ranchers and Neighbors Protecting Our Water, an affiliate organization of Powder River Basin Resource Council. We are also dues-paying members of the Powder River Basin Resource Council and the Natural Resources Defense Council.
4. Our local affiliate organization was formed primarily to inform and educate the public about the negative impacts of ISL uranium sites in our county and state. In order to provide information to the public, I have studied the ISL uranium process, at both past and current sites in Wyoming, Texas, and Nebraska. I have also reviewed annual reports, information from permits and licenses, and other publicly available information provided by government regulators. As part of this information, I have reviewed notices of violation and other issues related to ISL uranium sites in Wyoming and other states. As a result of this research, my husband and I became concerned about the impacts of ISL uranium projects.
5. We are concerned about the potential impacts of Strata Energy's ISL project to our land, water, and air resources.
6. We have followed the progress of Powder River Basin Resource Council's and Natural Resources Defense Council's challenge to the NRC's licensing of the Strata project closely. We have reviewed the NRC's draft and final

environmental documents and many of the documents from the litigation. We support Powder River Basin Resource Council and Natural Resources Defense Council's appeal of the NRC's approval of Strata Energy's project as a way to protect our interests.

7. Sixteen years ago, James and I purchased our dream property here in Wyoming, with the intention of spending the rest of our lives here. We had worked and saved for over 21 years, in order to buy this 260 acre property, complete with hay fields, pastures, and ponds. We made significant improvements to the property, including remodeling the older home that was here. Now we feel that the dream of living here and enjoying the place that we worked so hard to purchase and improve is threatened by Strata Energy's project, only 10 miles to the southwest.

8. The threats to our land, water, and air resources are numerous due to the negative impacts of the ISL uranium process operating there. For instance, I am concerned that there are over 5,000 old drill holes from decades ago, many of which were improperly plugged and abandoned. We are deeply concerned that Strata Energy will be unable to locate and properly plug all of these abandoned drill holes. Further, there are hundreds of these drill holes outside the mining area and throughout our neighbors' properties, and we are concerned that those wells will not be located and properly plugged

either. Since these old drill holes can serve as a connection between aquifers, the aquifer that Strata is using for its ISL project is likely not "confined" the way the company says it is. These connections between the aquifers could allow cross-contamination from the aquifers Strata is deliberately contaminating during the ISL mining process to other aquifers in and near my and my neighbors' community. Contamination of our domestic and stock water could cause our water to be unusable for drinking, washing, cooking, watering our garden, as well as for our livestock.

9. We are also concerned that the company and agency have not properly established baseline water quality conditions at the site, which would permit them to declare the site fully remediated even though it remains contaminated.

10. Another potential negative impact is that these ISL sites have a long history of spills, leaks, and excursions of drilling and production fluids. Once again, I am concerned that these problems could cause contamination of the local aquifers, and contaminate wells on my neighbors' properties, as well as impact the surface waters that run northeast from the mining site and in close proximity to our property and many of my neighbors' properties.

11. I am also concerned that Strata Energy's project will deplete local aquifers. My husband and I, along with most of our neighbors, rely on groundwater

for household and other uses. Crook County is very arid, and does not have available surface water to meet local water needs. Aquifer depletion would negatively impact our local area.

12. Based on our research, another negative impact of ISL uranium sites is that groundwater restoration remains difficult and has taken longer than expected at ISL sites in Wyoming. To date, there is no example of an aquifer being restored to pre-mining conditions at a commercial-scale ISL uranium operation. Based on our research, I believe that restoration of the water for all parameters has proven impossible. The elements that are not restored are the ones that concern me the most as a landowner who uses the local water supply; these include a mix of radioactive and toxic heavy metals such as uranium, arsenic, and radium-226. Because this contamination lingers long after the ISL project is over, the inability to restore the aquifer to pre-mining conditions is a potential threat to our aquifers in the future.

13. I am also concerned about the plans for expanding the Ross project into other areas of the Lance District, which will mean additional ISL mining and compound all of our environmental concerns. To date the agency has never considered the overall adverse environmental impacts that will come from the Ross project, including the eventual expansions that will occur.

14. In addition to potential water impacts, we will also experience quality of life impacts from Strata Energy's project. For instance, we have already experienced an increase in traffic on the roads in the area since Strata Energy's Ross Project has started. We anticipate that during construction of the planned expansions and during operations traffic impacts will continue. The county roads in our area are comprised of dirt, shale, and gravel; therefore, dust from increased traffic will create air pollution and visibility impacts. We are concerned that these dusty conditions will only continue and increase with Strata Energy's work on the Ross Project and planned expansions.

15. Since Strata Energy's Ross Project has started we have also noticed an increase in light pollution coming from the southwest, and are concerned that light pollution will only increase with the planned expansions. James and I live in the country because we value the aesthetic beauty of Wyoming's night skies. The closest town of less than 400 people is over 10 miles away, which means our night skies did not have much light impact when we moved here. Strata Energy's 24-hour operations and expansion will alter the clear views of the night sky we currently enjoy.

16. We are also concerned about impacts to property values in the area because of Strata Energy's project. My husband and I recently sold our second piece

of property, which was closer to Strata Energy's planned expansions because we wanted to sell it sooner, rather than to wait and try to sell it while all of the uranium projects are up and running. Because we sold it sooner than we planned to, we may have lost some of the investment income we planned to make from the property. We are also concerned that the value of our main property where we live has already decreased because of the Ross Project and planned expansions in the Lance District, as well as others being planned in the area – projects which are in close proximity to our property. Even if the value does not drop, the pool of potential buyers could shrink, as many people would not be willing to buy property close to a uranium operation. Therefore, we could suffer a negative financial impact from reduced property values due to the project.

17. I support Powder River Basin Resource Council and Natural Resources Defense Council's appeal of this project because I believe with their participation, the NRC will be better positioned to fully review the possible impacts of Strata Energy's project and proposed expansion of their ISL mining and milling project and based on the Councils' and their experts' information may address concerns and mitigate impacts to our water, land, air, and other resources.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, information, and belief and this declaration was executed on September 26, 2016 in Crook County, Wyoming.

Pamela Viviano

December 5, 2011

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* Uranium Recovery Site)	)	ASLBP No. 12-915-01-MLA
	)	

NRC STAFF RESPONSE TO PETITION TO INTERVENE AND REQUEST FOR HEARING BY THE NATURAL RESOURCES DEFENSE COUNCIL & POWDER RIVER BASIN RESOURCE DEFENSE COUNCIL

INTRODUCTION

The Staff of the Nuclear Regulatory Commission (NRC Staff) responds to the Natural Resources Defense Council (NRDC) and Powder River Basin Resource Defense Council's (PRBRC) (collectively the Joint Petitioners or Petitioners) October 27, 2011 Petition to Intervene and Request for Hearing. On November 2, 2011, an Atomic Safety and Licensing Board (Board) was designated to preside in this proceeding.[1] The Joint Petitioners request a hearing on Strata Energy, Inc.'s (Strata or Applicant) Application for an NRC license to be used in connection with a proposed *in situ* uranium recovery (ISR) project to be located in Crook County, Wyoming (the Ross project or Ross site). Because the Petitioners have not demonstrated standing to intervene, the Board should deny the Petition.[2]

BACKGROUND

On January 4, 2011, Strata submitted its Application for a combined NRC source and

[1] 76 Fed. Reg. 69295 (November 8, 2011).

[2] Should the Board grant standing, the proceeding should be limited to the issues raised in contention 4 and a portion of contention 5, as specified below. All other contentions are inadmissible.

their claims should not be admitted. 10 C.F.R. § 2.309(f)(1)(iv), (v), (vi).

4. Contention 4 is Admissible in Part

> Contention 4: The application fails to adequately document negative impacts on groundwater quantity.
>
> The Petition goes on to say that:
>
> The application violates 10 C.F.R. § 51.45 and NEPA by failing to properly analyze the project's impacts on groundwater quantity. Furthermore, the application presents conflicting information on groundwater consumption, precluding accurate evaluation of the project's impacts in this area.

Petition at 24. Petitioners have provided a specific statement of the factual issue they are raising, and have provided a basis for the contention. 10 C.F.R. §§ 2.309(f)(1)(i)-(ii). The Petition relies upon Dr. Moran's declaration, paragraphs 59-63. Paragraph 60 states, in part:

> Similar information on cumulative volumes pumped and cumulative predicted water level declines with cumulative predicted aquifer recharge rates should also be presented assuming that several additional phases of ISL uranium development occur within the regions surrounding the Ross Project (i.e. neighboring Lance areas).

Dr. Moran further challenges the Applicant's Figure 4.4-2 as being an insufficient estimate of impacts on groundwater quantity. Moran Decl. at ¶ 60 n.7. Figure 4.4-2 and the accompanying analysis project the cumulative impacts of drawdown of the wells within the project area's aquifers. The analysis includes one other current operation in the area, Merit Energy Oil, which draws from wells in the ore zone aquifer and deeper Fox Hills Formation sandstones, as well as the deep monitoring aquifer. ER at 4-64.

While the Staff does not entirely agree with contention 4, it believes that the contention is admissible in part. As a legal matter, the Applicant has not violated Part 51, and an Applicant cannot violate NEPA. But the Staff will need more information about Strata's groundwater use in order to complete its environmental review. While materials license applicants are not explicitly required by § 51.45 to address cumulative impacts, the Staff's guidance for environmental reports, NUREG-1748, calls for an analysis of cumulative effects to include "past,

present, or reasonably foreseeable future actions that would result in cumulative impacts when combined with the proposed project." NUREG-1748, § 6.2.3.

Strata has indicated that it will likely develop more uranium recovery sites within the Lance District. TR at 1-7 to 1-8. Because those future ISR projects are reasonably foreseeable, the Staff must evaluate their cumulative impacts in its SEIS. The Staff will need more information about groundwater consumption of reasonably foreseeable activities in the Lance District in order to fully assess the cumulative environmental impacts of the Ross project. Thus, the portion of contention 4 disputing the cumulative impacts of Strata's groundwater consumption is within the scope of the NRC's review and is material to its decision whether or not to issue a license. 10 C.F.R. §§ 2.309(f)(1)(iii)-(iv). The Petitioners have also provided an expert opinion detailing the portions of the Application that they dispute. 10 C.F.R. §§ 2.309(f)(1)(v)-(vi).

While the Staff agrees with Petitioners that more information is needed regarding the cumulative impacts of groundwater usage, the Staff does not agree with all of the Petitioners' assertions in contention 4. For instance, the Petition cites paragraph 63 of Dr. Moran's declaration, which challenges Strata's use of computer models to determine groundwater quantity impacts. The NRC does not prescribe any particular method for calculating groundwater impacts, and the Petitioners have not specifically addressed what inaccuracies Strata's computer model creates. Rather, the issue raised is with computer models generally. Also in paragraph 63, Dr. Moran states that he would like to know what the declines in wells would be out to a two-mile radius around the Ross site. While Dr. Moran asserts that Strata is required to discuss drawdown of wells within a two-mile radius of the site, there is no NRC requirement for ISR applicants to perform modeling of wells to that distance. Without more, the Petitioners' assertion has no basis.[46]

[46] The cumulative impacts from future ISR expansion is the only basis for contention 4 that is admissible. All other bases, including past and current activities in the area and Strata's methodology for calculating

May 13, 2013

Via Electronic Mail

Ms. Cindy Bladey
Chief, Rules, Announcements, and Directives Branch
Office of Administration
Mail Stop: TWB-05-B01M
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

RE: NRDC Comments on *Draft Supplemental Environmental Impact Statement* for the Ross ISR Project in Crook County, Wyoming, Docket ID NRC-2011-0148.

Dear Ms. Bladey:

The Natural Resources Defense Council (NRDC) writes today to comment on the Nuclear Regulatory Commission's (NRC) *Environmental Impact Statement for the Ross ISR Project in Crook County, Wyoming; Supplement to the Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities; Draft Report for Comment* (hereinafter "Draft SEIS" or "DSEIS"). *See* 78 Fed. Reg. 19330 (March 29, 2013). NRDC respectfully urges NRC to withdraw the Draft SEIS as the agency's actions fail to meet the requirements of the National Environmental Policy Act (NEPA) 42 U.S.C. § 4321 *et seq.,* and further direct the applicant for this NRC's materials license to re-submit an Environmental Report that adequately addresses the scope and extent of the proposed major federal action.

Summary of Comments

The Draft SEIS is a deficient presentation that fails a federal agency's basic duties to both define the scope of a major federal action and take a "hard look" at the significant environmental impacts associated with that action. These requirements—properly defining the scope of the major federal action, and taking a searching look at the associated environmental impacts of "in-situ leach" (ISL) mining and reasonable alternatives to avoid or mitigate those impacts–comprise the heart of a federal agency's NEPA obligations.[1] Indeed, NEPA is clear in its well-established

[1] NEPA directs that DOE take a "hard look" at the environmental impacts of its proposed program and compare them to alternative means of fulfilling the same purpose and need for agency action that may avoid or mitigate environmental harms or risks posed by the Proposed Program. "What constitutes a 'hard look' cannot be outlined with rule-like precision, but it at least encompasses a thorough investigation into the environmental impacts of an agency's action and a candid acknowledgement of the risks that those impacts entail." *Nat'l Audubon Soc. V. Dept of the Navy*, 422 F.3d 174, 185 (4th Cir. 2005).

mandates. NEPA characterizes environmental impacts broadly to include not only ecological effects, such as physical, chemical, radiological and biological effects, but also aesthetic, historic, cultural, economic, and social effects. 40 CFR § 1508.8. NEPA requires an agency to consider both the direct effects caused by an action and any indirect effects which are reasonably foreseeable. Effects include direct effects caused by the action and occurring at the same time and place and indirect effects caused by the action, but later in time or farther removed in distance, but still reasonably foreseeable. 40 CFR § 1508.8.

Rather than comply with these well-established NEPA requirements, the Draft SEIS submits a set of quantitatively baseless environmental conclusions (that impacts will largely be "SMALL" and in a few specific instances "MODERATE") concerning an arbitrarily truncated segment of a project that is quite obviously the first step in a much larger plan for mining uranium in eastern Wyoming. Our detailed comments follow a brief explanatory background that ensures a full agency record.

Background

As NRC is aware, we are currently admitted parties in this matter in an Atomic Energy Act hearing before the Atomic Safety & Licensing Board ("ASLB" or the "Board"). On October 27, 2011 and pursuant to 10 C.F.R. § 2.309 and NRC's Federal Register notice published at 76 Fed. Reg. 41,308 (July 13, 2011), NRDC and the Powder River Basin Resources Council (PRBRC) submitted a Petition to Intervene and Request for a Hearing in the Strata licensing matter. Petitioners articulated five contentions in their Petition. These contentions address various deficiencies in Strata Energy, Inc.'s (Strata) source materials license application, for the proposed Ross In Situ Recovery (ISR) Uranium Project in Crook County, Wyoming, that have now carried over into the Staff's DSEIS.

Following briefing on standing and the admissibility of each contention, the Board conducted a day-long hearing on these matters on December 20, 2011. On February 10, 2012, the Board issued LBP-12-3, "Memorandum and Order, Ruling on Standing and Contention Admissibility." This 53-page opinion held that Petitioners had established standing and admitted two of their five contentions in whole while admitting the remaining three in part. *See* LBP-12-3 at 1–2, 18–25, 28, 32, 36, 37, and 39–40. On February 21, 2012, both Strata and NRC Staff filed appeals of LBP-12-3 and argued Joint Petitioners had not demonstrated standing to challenge Strata's application for a license for an in situ uranium recovery project in Crook County, Wyoming. Strata also asked the Commission to eliminate two contentions from the proceeding, should it decline to reverse the Board's standing determination. NRDC and PRBRC opposed both appeals. On May 11, 2012 the Commissioners issued CLI-12-12 and affirmed the Board's standing determination and declined to consider Strata's remaining claims. See CLI-12-12 at 1-2.

On March 21, 2013, Staff issued the Draft SEIS for the Ross ISR Project. Amended or new contentions on the DSEIS were due on May 6th, 2013 and today we attach those pleadings and the two supporting declarations for consideration as part of our comments on the DSEIS. The

legal pleading before the ASLB and the two supporting technical declarations from Dr. Richard Abitz and Christopher E. Paine speak for themselves, but NRC staff should be aware that the documents identify numerous NEPA deficiencies specifically related to the four admitted contentions and with respect to the new contention – NRC's failure to consider the environmental impacts of, and appropriate alternatives to, the applicant's actual proposed project, and instead to improperly segment the project by framing the Proposed Action under review as only a small part of the Applicant's planned and scheduled In Situ Recovery (ISR) activities in the Lance District.

However, the previous timely filed pleadings appended as part of our comments today comments are only that – they are intended to complement and enlarge upon the deficiencies noted herein on the Draft SEIS. With the obligation to file our new and amended contentions on May 6th, we were only able to develop this larger set of comments on the DSEIS in a short timeframe, but we suggest the document is so deficient the agency should withdraw it and direct the applicant to resubmit an ER of proper scope. During that interim, we also suggest NRC invest in developing an EIS process that provides a quantitative basis for analysis, consistent with its own regulations. *See* 10 C.F.R. § 51.71(d) (The analysis for all draft environmental impact statements will, to the fullest extent practicable, quantify the various factors considered. To the extent that there are important qualitative considerations or factors that cannot be quantified, these considerations or factors will be discussed in qualitative terms.).

Specific Comments

Executive Summary

1. P. xviii, line 6. "The purpose and need for this proposed action is to provide an option that allows the Applicant to recover uranium and produce yellowcake at the Ross Project area."

> **NRDC Comment**:
> This odd wording, evidently adopted to enable a vague scope for the project that facilitates future expansion with minimal or no further environmental analysis, potentially via FONSI's covering future license amendments to permit additional well-fields. The Ross Project will also allow, and it is Strata's declared intention, to recover and produce significant quantities of vanadium, but this activity is not mentioned in the statement of purpose and need.
>
> More importantly, this statement seems an oddly vague and amorphous description for an NRC-proposed major federal action that triggers the need for this SEIS, which action is the exercise of federal authority to grant or deny a license to construct, operate, and decommission a uranium recovery facility and restore the site and mined aquifer in accordance with its statutory mandate under the AEA to ensure "adequate protection of the public health and safety" from the hazards posed by such activities, and to ensure that these activities are not inimical to the "common defense and security." Thus one might logically expect the statement of purpose and need to say something like this:

> "The purpose and need for the proposed action -- the granting of an NRC license to recover uranium from [name well-field areas] and process it at [name Central Processing Facility} for [x years] -- is to ensure, through a rigorous nuclear safety and NEPA review process prior to licensing, that the uranium recovery activities and associated environment, safety, and health risks and environmental impacts described in the license application and applicant's Environmental Report, faithfully represent the full range of activities, risks, and impacts that will arise as a result of the licensed activity, and that all these activities will be conducted in a manner that: (1) ensures adequate protection of public health and safety and the common defense and security; (2) identifies and seeks to avoid or minimize all reasonably foreseeable environmental impacts, while mitigating any unavoidable adverse environmental impacts.

2. P. xviii, lines 20 -25. "Strata's Proposed Action, the Ross Project, would occupy 697 ha [1,721 acres] in the north half of the approximately 90-km2 [56-mi2] Lance District, where the Applicant is actively exploring for additional uranium reserves. Strata has also identified four other uranium-bearing areas that would extend the area of uranium recovery to the north with the Ross Amendment Area 1 and to the south of the Lance District with the Kendrick, Richards, and Barber satellite facilities. *These areas are not a component of the Proposed Action in this SEIS* (emphasis added)."

> Lines 42 – 47: "The Proposed Action includes the option of the Applicant operating the Ross Project Facility beyond the life of the Project's wellfields. The facility could be used to process uranium-loaded resins from satellite projects within the Lance District operated by the Applicant, or from other offsite uranium recovery projects not operated by the Applicant (i.e. "toll milling), or from offsite water-treatment operations. With that option, the life of the facility would be extended to 14 years or more."
>
> **NRDC Comment:**
> This additional processing at the "Ross Project Facility" is described as an "option" within the scope of the Proposed Action, but analysis of the environmental impacts of the additional wellfields and facilities needed to produce feedstock for this processing are not "a component of the Proposed Action in this SEIS." Later in the document we learn that the presently proposed Central Processing Plant (CPP) facility is being sized to accommodate the additional processing expected from "other offsite uranium recovery projects" or "offsite water-treatment operations." Note also that the term of this additional processing, and any connected environmental impacts associated with producing the uranium-loaded resins that are expected to be shipped to this enlarged facility, is given as "14 years *or more*," and thus is essentially open-ended with respect to the connected environmental impacts of the additional well-field operations that produce these uranium-loaded resins.
>
> However, meaningful consideration of impacts in the SEIS is limited to the Ross Project well-fields only, even though the capacity of the proposed CPP has been sized to accommodate a throughput four times greater than that required by the Ross Project alone, and will thus enable the simultaneous ISL mining of additional areas. If the ISL

mining were to occur sequentially over many years, as "reasonably foreseeable" future mining areas are developed in series, there would be no need to build the facility with four times the capacity need for the Ross Project alone.

This already planned mining, coincident with the Ross Project, is a clear and obvious consequence of the NRC's proposed licensing action that must be analyzed in detail in an original ER and in a Draft SEIS. In reality, the Proposed Action effectively encompasses this additional ISR activity, which vastly exceeds the scope of the "Ross Project" itself, because it is planned to be carried out through the establishment of multiple "satellite" ISR operations via multiple Ross Project license amendment amendments that would most likely invoke "No Significant Hazards Consideration," and thus potentially be granted without a contested hearing opportunity, and be supported by multiple NEPA "Findings of No Significant Impact" (FONSIs) for each additional satellite operation. See also, Paine Declaration, filed May 6 in this proceeding.

Further, the Paine declaration substantiates our claim that both the near-term and ultimate size and geographic extent of the uranium mineralization that Peninsula is intent on recovering from the Lance District deposits are much larger than what is analyzed in the DSEIS, and thus the scale of environmental impacts will be proportionately larger, nearer in time than hitherto described, longer lasting, and potentially more damaging to the environment than assessed in the DSEIS.

3. P. xix. "The ore zone is that portion of the aquifer that has been permanently exempted by the U.S. Environmental Protection Agency (EPA) from requirements as an underground source of drinking water under the Safe Drinking Water Act."

NRDC Comment:
The geographic extent and boundaries of the "ore zone" that has been "permanently exempted" and subject to water quality degradation is not given with any precision in the SEIS. We understand separately from EPA that the current extent of the application for permanent exemption extends only to the smaller Ross Project. Are there separate filings NRC is aware of where the SDWA exemption proposed or granted for the aquifer to be mined by the Ross Project already cover some or all of the additional "satellite areas?" What is the basis for the applicant's confidence to build a CPP facility that is four times the size of that needed for the Ross Project and twice the size of the facility analyzed in the GEIS?

4. P. xix. "Once uranium recovery is complete, the ore-zone's ground water is restored to NRC-approved ground-water protection standards, which are protective of the surrounding ground waters."

NRDC Comment:
Neither the specific restoration standards that will be applied to the ore zone's ground water, nor any analysis demonstrating that such "restoration" will be "protective of the surrounding ground waters," is provided in this DSEIS. On the contrary, the penetration

of the mined and surrounding aquifers in the Ross Project Area by some "3000 drill-holes and wells" at an average density of "1.7 wells per acre" [p. xxvi] suggests the potential for substantial fluid migration and degradation of water quality beyond the ore zone.

5. P. xx. "The significance of potential environmental impacts is categorized as follows: "Small: …Moderate:…Large:…."

NRDC Comment:
While the NRC's taxonomy (small, moderate, or large impacts) for classifying and characterizing environment impacts has been established for some time, the way it has evolved in its use is inadequate and the DSEIS illustrates these problems. Specifically, such terms are no longer tied to any consistent set of quantitative or otherwise objectively ascertainable metrics for assessing and comparing the impacts of ISL activities on groundwater or any other environmental resource, or on human health.

For example, what is the difference, in terms of measurable impacts on human health and the environment, between "altering noticeably" and "destabilizing important attributes of" the resource considered? If construction and operation of one ISL-related activity (one well-field "module," for example) is assessed as having a "small" environmental impact on "land use" and "geology and soils" because it represents only a small fraction of "disturbed" land within a given area, does it necessarily follow that 5000 such wells, and the piping and roads that connect them, will likewise have only a "small" impact? If the impacts of one well field penetrating a "shallow aquifer" are assessed as "small," does that mean that the impacts of scores of such well fields penetrating the same aquifer are also "small"? If all the impacts to each of the affected resources (Land, soils, groundwater, ecology, air quality, noise, etc. are assessed individually as being "small," does it follow that the aggregate and cumulative impact of all these "small" changes on a given area is likewise "small?" The NRC's methodology leads ineluctably to such "conclusions" based on no quantitative data.

6. P. xxiv, line 5. "Construction: Impacts would be SMALL. A total of 113 ha [280 acres] of land, which represents 16 percent of the Ross Project Area, would be disturbed during the construction of a CPP, surface impoundments, and other auxiliary structures such as storage areas and parking lots. The well-fields would be sequentially developed over the Ross Project lifecycle. All disturbed areas would be fenced, and thus, somewhat limit grazing by livestock, access by wildlife, and recreational opportunities. Operation: Impacts would be SMALL….Areas where Ross project uranium production activities would take place would remain fenced, somewhat limiting grazing and crop production."

NRDC Comment:
The total land area, including wellfields, which would remain fenced and limit access by wildlife, and its percentage of the total project area, are not given. Thus there is no basis for the conclusion that the impact on wildlife, crop production, and livestock grazing would be "Small."

7. P. xxiv, line 19: "No new facilities would be constructed that would result in additional land disturbance during operation, although well drilling would continue as the wellfields would be sequentially developed."

NRDC Comment:
This is a misleading statement. Figure 2.6 on page 2-8 shows "facility construction" occurring during "facility operation," but more to the point, continuing well-field development involves continuing construction of "module buildings" and "valve manholes" and continuing trench excavation for burying the extensive pipeline network that carries lixiviant to potentially thousands of injection well and retrieves it from thousands of recovery wells. Also, up to five deep disposal wells are permitted over the life of the project. Each one of these is an industrial installation mounted on a 250 x 250 ft. asphalt or gravel pad with storage tanks, pumps, filtration systems, I &C systems, and injection equipment for process chemicals. In other words, construction activity will be almost continuous throughout the first eight years of the project, according to Figure 2.6-16.

8. P. xxvii, line 40: "Operation: The impact [on groundwater] would range from SMALL to MODERATE (depending upon whether excursions occur)."

NRDC Comment:
No empirical evidence or reference is provided for this conclusion, and thus the statement is meaningless. If a major excursion occurs and remains undetected for an extended period, for example, why would the impact not be "LARGE?" Again, this NRC methodology for assessing and comparing impacts has evolved to a degree where it is baseless.

9. P. xxvii, line 49: "The Applicant's implementation of BMPs during Ross Project operation would reduce the likelihood and magnitude of spills or leaks [getting into shallow aquifers] and facilitate expeditious cleanup."

NRDC Comment:
The SEIS is examining only the best case. What if the price of uranium drops and the Applicant does not follow "Best Management Practices" in order to save money and maintain profit margins? What if the operation leaks like a sieve and plant personnel cover up the leaks, or never bother to investigate them? What damage could be done then to shallow aquifers?

10. p. 1-9, line 25:

NRDC Comment:
Please provide in these SEIS the USFWS recommendations "for protective measures for threatened and endangered species" and "recommendations concerning migratory birds." Which of these measures and recommendations will be incorporated as binding conditions of the proposed license?

11. p. 1-9, line 35: "Impact mitigation measures were discussed" [with Wyoming Game and Fish Department (WGFD)] regarding "invasive species and impacts to wildlife due to power lines, evaporation ponds, and increased traffic."

NRDC Comment:
Please provide in the SEIS a discussion of what specific mitigation measures were recommended by WGFD staff to protect big game animals, raptors, migratory birds, and small mammals, and which of these measures have been incorporated as binding conditions of the proposed Ross Project license?

12. p. 2-13, line 50: "[the CPP]…would be designed to process approximately 1.4 million kg/yr. (3 million lb./yr. of yellowcake (Strata, 2011b), which is about four times the capacity necessary to recovery (sic) uranium from the Ross Project. The excess capacity in the yellowcake production circuit would allow processing of loaded IX resins brought to the Ross Project from other ISR or water treatment facilities."

NRDC Comment:
This statement provides incomplete and misleading information. The loaded resins "brought to the Ross Project" would be brought there, in the first instance, by Strata Energy Inc., itself, from its own satellite operations, and not from "other ISR or water treatment facilities." Moreover, the excess capacity is likely to be applied first to additional uranium bearing lixiviant arriving by pipeline at the CPP from contiguous Strata well-field operations. NRC Staff should provide straightforward clarity with respect to Strata's near term expansion plans.

13. p. 2-16, line 9: "The Applicant notes that the final areal extent of the constructed wellfields is expected to be greater as additional ore-zone delineation occurs (Strata, 2011b)."

NRDC Comment:
How much greater? And please provide specifics. This is not a minor matter, as it would increase environmental impacts for almost every project phase and affected resource.

14. p. 2-21, line 33: "In the event that recovery, injection, and/or monitoring wells must be located within a floodplain…."?

NRDC Comment:
How many, and what percentage of the total wells are planned and/or likely to be located "within a floodplain?"

15. p. 2-21, line 45: "The Applicant expects that the water produced during well development would meet Wyoming's temporary Wyoming Pollution Discharge Elimination System (WYPDES) discharge standards, which would allow this water to be discharged directly to the ground surface (WDEQ/WQD, 2007).

NRDC Comment:
(a) Please provide the empirical basis for the Applicant's "expectation," and do the NRC and EPA agree with it? (b) Are WYPDES discharge standards sufficiently protective that the produced water will not cause any harm to wildlife, surface water quality, or shallow aquifers if discharged directly to the ground surface?
(c) What is the NRC's licensing requirement in the event that the water produced during well development does not meet WYPDES discharge standards? (d) Please describe any contingency plans and capabilities required under the proposed license for safely disposing of the produced water from well development if the Applicant's "expectation" proves to be incorrect.

16. p. 2-22, line 8: "After initial testing by the Applicant, the well would be retested at five year intervals."

NRDC Comment:
What reassurance is to be derived from the 5-year retesting interval, given that the operating life of the average ISL injection or recovery well is considerably less than five years? Please provide data on how many wells, as a percentage of the total licensed and operated for ISL injection or recovery in the NSDWUMR region, or in Wyoming, have been retested for well casing integrity prior to well plugging and abandonment.

17. p. 2-23, line 14: "The applicant would test for leaks with fresh water on the pipelines prior to their burials, in order to ensure the pipelines' mechanical integrity."

NRDC Comment:
(a) Please describe the specific standards, approved test protocols, and inspections that the NRC (a) generally requires and (b) specifically intends to apply to the "Ross Project," and to further already planned "Lance District Development" that will be undertaken pursuant to the License for the "Ross Project," to ensure the mechanical integrity of buried ISL pipelines;
(b) What kind of leak detection/warning systems will the NRC require to ensure that the Applicant reacts promptly to any leaks?

(c) How will the NRC Staff verify the licensee's compliance with buried pipeline integrity requirements?

18. p. 2-24, line 14: "Prior to the submittal by an Applicant of its license application to the NRC, an Applicant performs site-characterization environmental monitoring efforts for at least a year…the values measured by Strata prior to its submitting its license application are called 'pre-licensing baseline values' in this SEIS."

NRDC Comment:
(a) Please provide in the SEIS a map showing the name, location and targeted aquifers of all pre-existing wells and purpose-drilled monitoring wells that contributed pre-licensing baseline ground-water-quality data to the Applicant's site characterization of the Ross Project area.
(b) Please describe the specific regulatory function of these "pre-licensing baseline" measurements of water quality in NRC's regulatory scheme to guard against aquifer degradation.
(c) Are they the standard by which lixiviant "excursions" outside the ore zone and/or aquifer restoration to pre-mining conditions are to be judged under the Proposed License? If not, why not?

19. p. 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 SEIS, this type of monitoring is called 'post-licensing, pre-operational.' The resulting…data would be used to determine concentration-based levels that would permit identification of any excursions from the respective wellfields; these would be called the Ross Project's upper control limits (UCLs). These post-licensing, pre-operational baseline values would be established for each separate wellfield (and they would be codified in the Applicant's license)" [emphasis added].

NRDC Comment:
From the description in the SEIS, it is apparent that monitoring to set these UCLs would be undertaken only when a given wellfield's construction is complete and a perimeter ring of monitoring wells has been established around the wellfield. This methodology raises a number of important issues that are not discussed in the SEIS.
(a) What is the scientific and technical rationale for using "post-licensing, pre-operational," rather than "pre-licensing baseline" measurements, to establish baseline water quality data to detect excursions?
(b) Since the construction of multiple individual wellfields is a sequential operation taking place over several years, how will NRC and the applicant avoid the obvious potential problem of each operational wellfield degrading the "post-licensing, pre-operational" baseline water quality of subsequent down gradient monitoring wells targeting the same aquifers, creating a potentially cascading deterioration of baseline water quality standards from wellfield to wellfield in the course of building-out the "Ross Project" and already scheduled "Lance District Development?

(c) For any given wellfield, how will NRC/Applicant prevent the "post-licensing, pre-operational baseline" water quality measurements from being contaminated by the effects of drilling, casing and testing the injection and recovery wells, and from the effects of previous and ongoing exploratory drilling?

20. p. 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)."

NRDC Comment:
Comment 20 and its many parts, directed at the above sentence in particular, focuses on establishing baseline water quality prior to licensing and as an important component of NEPA review.
(a) Are the "post-licensing, pre-operational baseline concentrations of constituents" referenced in the above excerpt from the SEIS the same as the "Ross Project's upper control limits (UCLs)" described in the preceding paragraph? If not, why and how would they differ?
(b) When and how would the NRC employ these "post-licensing pre-operational baseline concentrations" to measure and mitigate adverse impacts on groundwater from (1) "the Ross Project;" (b) the "Lance District Development" shown in Figure 2.6.
(c) Please provide a map showing the sequence, timing and locations of the "pre-operational baseline" measurements for each well field proposed or planned for development under (1) the Ross Project; (2) the "Lance District Development" shown in Figure 2.6
(d) The baseline concentration of monitored constituents in Ross Project aquifers of interest as given in Table 3.7 on page 3-41 is frequently given as a range, rather than a single value:

(1) Please describe in detail the scientifically valid techniques the NRC will employ to translate such range bound data into a single value for the purpose of establishing UCL's and "pre-operational baseline concentrations of constituents " in the Proposed License for groundwater monitoring purposes.
(2) When and how will the NRC select the constituents to monitor for (i) "the Ross Project, and (ii) "Lance District Development."
(3) When in the ISL uranium recovery licensing process, and how will NRC employ the values that are established for each constituent, to control excursions and establish target restoration values for aquifer restoration?
(4) For the purpose of ensuring that this SEIS complies with NEPA, how does the NRC evaluate and compare the environmentally protective efficacy of prospective UCLs and "post-licensing pre-operational baseline concentrations" that it has not yet established?

(i) If these UCLs and post-licensing baseline concentrations are to be established "prior to commencing ISR operations….for each separate wellfield" as described on page 2-24, and there are "15-25 wellfield areas" in the "Ross Project" alone, as described on page xix, how can all these

multiple well-field limits simultaneously be "codified in the *Applicant's* NRC license," when the "Applicant" must logically become the "Licensee" upon commencing operation of the first well-field?
(ii) Legally speaking, is a "Licensee" at one and the same time also a perpetual "Applicant" when it comes to the licensing of subsequent well-fields? If so, please cite one or more specific instances in which the NRC has revoked or suspended an initial ISR materials license for a Licensee's failure to agree to environmentally protective UCLs and TRVs for subsequent wellfields developed under the license that was granted for operation of the first well-field?

(e) Please state the case why the public should repose any confidence whatsoever in the environmental protection afforded by this "bass-ackwards" regulatory scheme?

(f) The ER (p. 6-11) contains a reference to "Target Restoration Values (TRVs)," a term that does not appear to be used in the SEIS. The Draft SEIS does not include this acronym in its "List of Abbreviations" on p. xxxix. Please provide an adequate response in the Final SEIS to the following requests for relevant environmental information:

(1) What is the definition of a "TRV," exactly how does it relate to the term "post-licensing pre-operational baseline concentration" used in the Draft SEIS, and why was use of the term "TRV" not employed in the draft SEIS?;
(2) Who within NRC establishes a TRV?
(3) What, if any, peer-reviewed and widely accepted scientific and technical methodologies are used to establish it?
(4) Can TRV's for different constituents be established at different times, or are they all determined at the same time?
(5) Please describe in detail the process that ensues when Licensee does not achieve the "Target Restoration Values" specified for each wellfield in its license.
(6) Please provide a schedule showing when during the licensing process for the "Ross Project" and subsequent planned "Lance District Development" TRVs were/will be established, and how does the timing and technical methods of this procedure compare to those used in previously -licensed ISL operations;
(7) Was a comparative analysis of the technical feasibility and environmental benefits and costs of setting and achieving various alternative TRVs for the "Ross Project" performed in connection with this Draft SEIS?
(8) Is an analysis like the one described in (vii) above germane to NRC's NEPA evaluation of the comparative environmental impacts involved in granting, denying, or modifying the terms of the proposed license for the "Ross Project?" If not, why not? Please provide detailed information in the Final SEIS documenting any methodologies used and results obtained in such an analysis.
(9) Please explain how the "post-licensing" determination of "upper control limits"(UCL's) and Target Restoration Vales (TRVs) for the "Ross Project" and "Lance District Development" would inform the NRC's required pre-licensing NEPA analysis of reasonable alternatives, including mitigation alternatives for limiting unavoidable adverse impacts, that by law must precede and inform an NRC materials licensing decision?

(10) (i) Is a "wellfield" the same as a "wellfield area"? If not, what is the distinction? How does the term "wellfield module" relate to the aforementioned terms?

(ii) How many distinct "well-field modules," "well-fields," and "wellfield areas" are contained in Figure 2.4 ("Proposed Ross Project Facility and Wellfields") on page 2-6 of the SEIS?

(iii) Are the shaded areas marked "Wellfield Perimeter Accounting for Future Drilling" in Figure 2.4 included in the SEIS detailed analysis of environmental impacts from the proposed "Ross Project"? If not, why not?

(iv) Are the shaded areas described in the preceding paragraph included in the analysis of "cumulative impacts" from reasonably foreseeable drilling activity ostensibly contained in Section 5 of the Draft SEIS? If so, please provide the page and line number reference.

(g) Please explain why it is (1) scientifically indicated for "baseline" pre-mining water-quality monitoring purposes , and (2) advantageous for a NEPA-informed licensing decision, for the NRC to establish UCL's after well-field licensing and construction, rather than before, given the availability of both existing "pre-licensing baseline" measurements, and the obvious ability to establish additional environmental sampling wells over relevant portions of the site prior to the construction of the first complete well field.

21. p. 2-25, line 31:

NRDC Comment:

Figure 2.4 on page 2-6 of the SEIS shows the location of 5 "proposed deep disposal wells" within the "Ross Project Area" alone.

(a) Please provide a map(s) showing the number, locations and required capacities of all Class 1 deep disposal wells and target aquifer(s) associated with disposal of wastes from the scheduled "Lance District Development" shown in Figure 2.6, including any currently planned and reasonably foreseeable ISR operations in the Lance District that are not reflected in Figure 2.6. (Please consult the attached "Declaration of Christopher E. Paine" for the names and approximate locations of future Lance District ISL projects planned by the Applicant, according to its Australian parent company, Peninsula Energy, Ltd.)

(b) Please provide a map(s) showing the number, proposed locations and required capacities of all Class 1 deep disposal wells and target aquifers that would dispose of wastes from full utilization of the currently proposed CPP capacity (4x greater than required by the "Ross Project" alone) over its "reasonably foreseeable" full operating lifetime.

(c) Please provide a scientifically and technically adequate discussion of the cumulative environmental impacts of such a vastly increased volume of uranium mining waste disposed via deep well injection, including a cumulative impact assessment that includes the adverse impacts of other deep well injection activities in the same NEPA region of interest.

(d) Please provide all the information related to Applicant's UIC Permit No. 10-263, dated April 4, 2011, that was requested in the EPA's Region 8 Scoping Comments letter to the Commission of 12/29/2011, including:

(i) Discharge zones, well locations, groundwater classifications;
(ii) Monitoring requirements, plugging and abandonment procedures;
(iii) The permitted injection formation, and descriptions of any underground sources of drinking water (USDWs) that may occur above or below the permitted injections zones;
(iv) Relevant information on existing aquifer exemptions in the vicinity that have been approved by the permitting agency;

(e) A full and adequate discussion of the process by which UIC permits are issued and the environmental and safety factors are considered in their approval;
(f) A full and adequate discussion of design features and/or mitigation measures required under the permit to prevent potential adverse impacts to groundwater resources from deep disposal well operations.

22. p. 2-25, line 31:

NRDC Comment:
Figure 2.4 on page 2-6 of the SEIS shows the location of a large number of overlapping "wellfield perimeters" representing potentially thousands of UIC Class 3 Mining Wells within the "Ross Project Area" alone.
(a) Please provide tables and map(s) showing the number and locations of all prospective UIC Class 3 mining wells (or "wellfield modules' and/or "well-fields" if specific well locations are not yet known) and the targeted aquifer(s) that would be part of the impending "Lance District Development" shown in Figure 2.6, and classify them as one of the following:

(1) Part of the Applicant's current schedule and business plan for near-term development (defined as initiation of well-field construction within 10 years of "Ross Project" licensing) of proven and/or indicated uranium resource areas within the Lance District utilizing the processing capacity of the "Ross Project" CPP;
(2) Targeted for future development based on the Applicant's currently inferred uranium resource estimates in the Lance District and utilization/expansion of the planned processing capacity of the Ross Project CPP;
(3) Any other reasonably foreseeable ISR projects in the Lance District.

(b) Please provide a map(s) showing the additional number and proposed locations of all UIC Class 1 Mining Wells (or "wellfield modules" and/or "wellfields") and target aquifers that could potentially be drilled premised on the availability of the proposed Ross project CPP capacity (4 x greater than required by the "Ross Project" alone) over its "reasonably foreseeable" full operating lifetime.
(c) Please provide a scientifically and technically adequate discussion of the cumulative full life cycle environmental impacts that this number of UIC Mining Wells for uranium extraction could have on the NEPA-defined region of interest surrounding the Ross Project, including the adverse impacts of all other reasonably foreseeable UIC Class III

Mining Wells and UIC Class I Disposal Well activities in the same NEPA region of interest.

23. Page 2-26, line 14: "The Applicant proposes that each [disposal well] location would consist of a 76 m x 76 m [250 ft. x 250 ft.] pad [asphalt or gravel] with a storage tank (Strata 2011b; Strata 2012b). Surface equipment for the deep-disposal wells would include storage tanks, pumps, filtration systems, instrumentation and control systems, and equipment for injection of process chemicals (Strata, 2011b).

NRDC Comment:
A gravel or asphalt pad measuring 250 ft. x 250 ft. is equivalent to an area of 1.43 acres, and the UIC permit for the Ross Project reportedly allows for five such deep-well waste injection sites. So, more than 7 acres (not including associated service roads and pipelines) of the Ross Project area could be industrialized via the construction and operation of such deep disposal sites.
(a) Are the land use-impacts of these, and any planned and reasonably foreseeable disposal wells required for the "Ross Project" and "Lance District Development," included in the SEIS estimate of land area disturbed by ISR mining? Please provide the page and line numbers where these impacts are included.
(b) How and when will the concrete or gravel pads surrounding the deep disposal wells be reclaimed?
(c) What is the licensed disposal capacity of liquid wastes for each UIC-permitted well, and what is the total licensed disposal capacity of the five permitted wells mentioned in the SEIS for the "Ross Project?"
(d) If five such deep-disposal sites have been permitted for waste disposal from operation of the CPP in connection with the Ross Project, how many additional deep disposal wells, with what disposal capacities, targeting which formations, are required in connection with processing of pregnant lixiviant and/or loaded resins from the following planned "satellite projects" that would utilize the CPP: Ross "Amendment Area 1;" Kendrick Satellite Area; Richards Satellite Area; Barber Satellite Area.
(e) Please provide a table showing the above information, and when construction, operation, and abandonment of each disposal well is planned, or could reasonably be expected to occur.
(f) Please provide a map showing the planned or reasonably foreseeable locations of the disposal wells described in (d) and (e) above.
(g) How many additional deep-disposal wells, targeting which formations, at which locations, would be required to dispose of the wastes from processing loaded resins from the following potential ISR facilities within 50 miles of the Ross Project's CPP: Aladdin ISR Project, 41 miles from the CPP, under consideration by Powertech; Elkhorn ISR Project, 16 miles from the CPP, under evaluation by NCA Nuclear, a wholly owned subsidiary of Bayswater Uranium Corp; Hauber ISR Project, 14 miles from the Ross project, also owned by NCA Nuclear, in a joint venture with Ur-Energy Inc; Alzada Project, 39 miles from the Ross Project, also owned and operated by NCA Nuclear?

24. Page 2-26, line 39: "As shown by the proposed schedule in Figure 2.6, uranium recovery during the proposed Ross Project would follow a 'phased,' where one group of well modules could be in operation, while preceding well modules are being engaged in aquifer restoration (Strata, 2011b). During the operation phase, three major phases would occur involving the wellfields: an operation-only phase, a concurrent operation- and aquifer-restoration phase, and an aquifer-restoration-only phase."

NRDC Comment:

(a) The referenced Figure 2.6 contains no reference to a proposed "Ross Project," but rather its title states that it describes a "Schedule for Potential Lance District Development."

(1) Please explain this discrepancy.

(2) Is the current title for Figure 2.6 in error, or is it the figure itself that is erroneous?

(b) Figure 2.6 shows an "aquifer-restoration only phase" being attained about 11.75 years after regulatory approval.

(1) If the figure actually refers to the "Ross Project," as mistakenly claimed above, is this a correct estimate for the "Ross Project?"

(2) If the figure refers to "Lance District Development," as currently stated, is 11.75 years a correct estimate for the currently planned and reasonably foreseeable "Lance District Development"?

(3) (i) What fraction of the Applicant's "reasonably foreseeable" mining activities in Wyoming involve development of the "Lance District," and

(ii) What fraction of these Lance District activities are already planned and included in the business plan of the Applicant for this area?

(4) Would construction of the CPP be economically viable if its feedstock were limited to the "Ross Project" as currently defined in the SEIS? If not, why is the scope of the "Proposed Action" in this SEIS limited to the "Ross Project"?

(5) What fraction of the potential production areas that the Licensee has identified in the "Lance District" must be developed to ensure economic viability of the Licensee's investment in the CPP, and hence a financial capacity to comply with all environmental mitigation, monitoring, and restoration undertakings undertaken in connection with the "Ross Project" license?

(c) Why did the NRC limit the scope of its detailed environmental analysis in the SEIS to the "Ross Project," when the proposed licensed capacity for the CPP is clearly designed to process uranium recovered from a much wider area than the Ross Project?

(1) Please provide the most recently updated schedule(s) for "Lance District Development" planned by this or any other Applicant for an NRC license.

(2) Please provide a detailed map showing the cumulative extent of the planned and contemplated "well-field areas" to be mined and enclosed by fences in the course of "Lance District Development" that would utilize the proposed CPP to be licensed pursuant to the "Ross Project."

(3) Which specific geographic areas will be mined when, and to what extent does this schedule overlap that of the "Ross Project"?

25. Page 2-27, line 22: "…Table 2.4.1 of the GEIS shows consistency between the Ross project and the GEIS, except for higher concentrations of uranium and vanadium that could be present in the pregnant lixiviant at the Ross Project (Strata 2011b); NRC, 2009)."

NRDC Comment:
(a) What accounts for these "higher concentrations of uranium and vanadium" (than were analyzed in the GEIS), and what are they?
(b) Are they a function of the particular ISR process to be employed, or are they also present in the ore body to be mined pursuant to (1) the "Ross Project;" (2) "Lance District Development"?
(c) Please provide an adequate NEPA discussion of the adverse environmental impact these "higher concentrations" could have on (1) post-mining concentrations of key constituents of groundwater quality in the mined aquifer? (2) Radiation exposure to site workers; (3) waste disposal.

26. Page 2-27, line 30: "The excess water, referred to as 'production bleed,' is a radioactive byproduct material that must be properly managed and disposed (NRC 2009). For the Ross Project, the Applicant proposes production-bleed range from 0.5 percent to 2 percent, and averaging 1.25 percent of the injection volume (Strata, 2011b).

NRDC Comment:
Please provide a NEPA-compliant quantification and sensitivity analysis of environmental consequences in the event that:
(a) The required bleed range to prevent excursions exceeds that "proposed" by the Applicant by technically plausible margins; and/or
(b) The average bleed rate exceeds 1.25 percent of the injection volume;
(c) What is the maximum observed peak bleed rate and maximum bleed volume for an ISR well-field to date in the Nebraska-South Dakota-Wyoming Uranium Milling Region?
(d) What is the maximum observed average bleed rate and total bleed volume for an ISR wellfield in this region?
(e) Please provide the proposed and/or estimated total "injection volume" for the Ross Project, and the technically supported range of uncertainty that surrounds this number?
(f) What is the proposed or estimated total "injection volume" for the full "Lance District Development "referenced in Figure 2.6, and a technically-supported range of uncertainty that surrounds this number?
(g) What is the relationship between, on the one hand, expected versus actual well-field bleed rates, and:
(1) The maximum safe capacity of the RO circuit in the CPP;
(2) Higher than expected excess permeate and the capacity of planned surface impoundments;
(3) Higher than expected brine production and the capacity of planned storage impoundments prior to deep well injection;
(4) The licensed capacities of deep injection wells.

(h) (1) At what bleed rates and injection volumes would the inbound capacity of the CPP-RO circuit be exceeded, and where would this excess bleed be stored until it could be processed in the CPP?

(2) What types of temporary waste storage capacity, if any, are contemplated to deal with higher-than-expected "bleed" production?

27. Page 2-27, line 43: (a) "The Applicant proposes a maximum injection pressure … less than the pressure rating for operation of the pipes and other equipment (Strata, 2011b).''

NRDC Comment:
(a)What is the pressure rating for operations of the pipes and other equipment to be used in the injection and recovery circuits of the "Ross Project" and the scheduled "Lance District Development" described in Figure 2.6.
(b) "…pressure requirements within a specific wellfield generally tend to increase with time." Please provide a discussion of wellfield injection pressure requirements over time, including the range of expected and maximum plausible values for minimum, maximum, and average wellfield injection pressure over the life of the wellfield.
(c) What is the relationship, if any, between injection pressure, wellfield pressure, wellfield balance, and the likelihood of excursions?
(d) Does the likelihood of excursions increase with increasing with increasing injection pressure?
(e) Does the available regulatory record of ISR excursions show any correlation between injection pressure and the likelihood of excursions?

28. Page 2-27, line 48. "The Applicant suggests that, in order to maintain flow rates and wellfield balance, some wellfields would require flexibility in their allowable injection pressure."

NRDC Comment:
(a) What does the phrase "flexibility in their allowable injection pressure" mean in practice?
(b) How would this "flexibility" be administered?
(c) Would this flexibility encompass exceeding the Applicant's proposed "maximum injection pressure" of 140 pounds-per-sq.-in.?
(d) If so, by how much, and for how long?
(e) What specific purpose is served by allowing this "flexibility" under the License?
(f) Does operating at such elevated injection pressures increase the likelihood and/or potential severity of leaks?

29. Page 2-28, line 1: "To specifically avoid the injection restriction problems that plagued the Nubeth operation, the Applicant has proposed several improvements to well-design, well development, and filtration (Strata 2011a; Strata, 2011b)."

NRDC Comment:
(a) Please describe the "injection restriction" problems that plagued the Nubeth operation.

(b) Please describe the specific primary purpose and function of each improvement to well-design, well-development, and filtration proposed by the Applicant.
(c) Which improvements are directed primarily or exclusively at increasing production efficiency, and which are directed primarily or exclusively to improving safety and reducing the risk of environmental contamination?
(d) For the purposes of preparing this SEIS, which improvements, if any, did NRC assume as being accepted and incorporated in the license?
(e) How do these "improvements," taken individually and together, affect the risk of environmental contamination from the "Ross Project" and scheduled "Lance District Development?"

30. Page 2-28, line 40: "The monitoring of water levels that would be performed would serve to avert a potential excursion."

NRDC Comment:
Please explain further:
(a) Which specific "water levels" would be monitored, how would they be monitored, where would they be monitored, in order to "avert" a "potential" excursion?
(b) How does NRC infer scientifically from "water levels" alone than an excursion is about to occur, as opposed to detecting one already in progress?
(c) What has been the record in ISR operations of using such water level measurements to "avert" (i.e. prevent) excursions from occurring.
(d) How many of the excursions that were later confirmed to have occurred via exceeding UCLs, were correctly forecast by such water level measurements, and why did such water level measurements fail to avert them?

31. Page 2-28, line 41: "Water quality indictors in the ground water from monitoring wells that would be established after wellfield installation (i.e. post-licensing, pre-operational baseline concentrations defined as excursion indicators) would also be used to detect whether an excursion has occurred."

NRDC Comment:
Please clarify the meaning of this inherently ambiguous sentence.
(a) Is it the "water quality indicators," or the "monitoring wells," or both that would be "established after wellfield installation?" Are not "monitoring wells" an inherent part of "wellfield installation? Why would they be established "after wellfield installation?"
(b) If the water quality indicators are in fact established after wellfield installation but prior to "operation," what prevents the prior drilling, construction, and pressure testing of hundreds or potentially thousands of previously constructed injection and recovery wells from polluting the baseline measurement of the "water-quality indicators" to be used as "excursion indicators?"
(c) If these "water-quality indicators" are "also used to detect" whether an excursion has occurred, what is the other method implied by the use of the word "also" in this context, given that "water level measurements" have been previously described as "averting a potential excursion," as opposed to "detecting" one that has already occurred?

32. Page 2-30, line 10: "If a vertical excursion occurs, then the Applicant's injection of lixiviant would cease, and for any excursion, corrective action would be initiated."

NRDC Comment:
Why would NRC Ross Project license conditions require cessation of lixiviant injection only in the case of a "vertical excursion," rather than all excursions?

33. Page 2-30, line 20: "If an excursion cannot be recovered within 60 days of confirmation (measured by a concentration of more than 20 percent of any excursion indicator)…."

NRDC Comment:
(a) Is "confirmation" of an excursion the same as initially "detecting" it?
(b) What constitutes "confirmation" of an excursion for the purpose of triggering the Licensee's 24 hour notice requirement to the NRC?
(c) How soon after "confirmation" of a vertical excursion would lixiviant injection be required to cease?
(d) How soon following the 60 day period for "retrieving" horizontal excursions does the Licensee have to decide whether to "terminate lixiviant injection within the wellfield" or "increase the surety for the ISR project by an amount sufficient to cover the full-third party cost of correcting and remediating the excursion?"

NRDC Comment 33a:
Figure 2.4 shows many contiguous and overlapping "Ross Project" wellfields that appear to share common boundaries at the ground surface.
(a) If a horizontal "excursion" occurs into a neighboring well-field that is under construction or into an area designated for future uranium well-field development, does this count as an "excursion"?
(b) Can a hydrologic "cone of depression" to prevent excursions encompass multiple contiguous wellfields, so that horizontal excursions are deemed to occur only along a more restricted azimuth along the conjoined external boundaries of the contiguous well-fields, as shown in Figure 2-6?

34. Page 2-31, line 26: "The off gases generated during the drying cycle would be filtered and scrubbed to remove entrained particulates."

NRDC Comment:
Are these off-gases then released to the open air through a stack? What are the radioactive and/or other potentially hazardous constituents of these off –gases, if any, and would prolonged exposure to them over the lifetime of the CPP pose an incremental health risk to plant workers or nearby residents?

35. Page 2-32, line 5: "The Applicant estimates that 0.1 – 2 kg of V_20_5 would be produced for every 1 kg. of U_3O_8.

NRDC Comment:
What accounts for the extreme variability in the estimated yield of co-produced vanadium?

36. Page 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."

NRDC Comment:
Please point to the specific pages and lines of the Draft SEIS – because we have been unable to locate them – wherein it is demonstrated (or in the alternative provide in the FSEIS an adequate NEPA-complaint analysis showing) that—
(a) Yet-to-be-defined "post-licensing, pre-operational constituent concentrations" in groundwater will fairly represent the baseline water quality of the target aquifer before wellfield development activities commence under the "Ross Project" and scheduled "Lance District Development;"
(b) Irrespective of any avowed "purpose" of "aquifer restoration," it would actually restore the small segment of the mined aquifer within each wellfield to the NRC's *ex-post facto* determination of "baseline conditions," much less any scientifically credible representation of pre-ISR water quality;
(c) The integrated summation of all these hundreds of individually variable wellfield target restoration values, even if achieved in practice, would actually restore the overall pre-mining water quality over the entire extent of the aquifer that has been mined and adversely affected by mining;
(d) There is reason to conclude from the record of previous NRC-regulated mining operations that the Target Restoration Values (TGVs), established *seriatim* in a private post-licensing consultative process between the NRC and the Licensee as wellfield expansion proceeds, will be achieved in practice prior to wellfield abandonment, and will ensure that the License by its terms protects "public health and safety," as the NRC is mandated to do by the Atomic Energy Act.
(e) That any fallback standards (e.g., "Maximum Concentration Limits," "Alternative Concentration Limits") subsequently employed in an amended License to terminate aquifer restoration efforts short of achieving TGVs will nonetheless ensure adequate

protection of the "public health and safety," as the NRC is mandated to do under the Atomic Energy Act, and avoid, minimize, or mitigate other adverse environmental impacts, as required under NEPA

37. Page 2-33, line 11: "The Applicant proposes that concurrent ISR operations and aquifer restoration would occur when several of the first well modules have been depleted and are ready for restoration activities (Strata, 2011b). As aquifer restoration occurs in depleted well modules, ISR operations would be ongoing in subsequent well modules."

NRDC Comment:

(a) (1) Please clarify the difference between a "well module" and a "well-field" for the purposes of establishing accountable units for implementing and assessing aquifer restoration.

(2) How many lixiviant injection and uranium recovery wells will comprise a typical Ross Project "well module," and how many such "well modules" will comprise a "wellfield," and how many wellfields will ultimately be deployed pursuant to the granting of a license to the "Ross Project?"

(b) Will the "post-licensing, [i.e. post-drilling, post-construction, post-testing] pre-operational constituent concentrations" found in perimeter groundwater monitoring wells and so-called "baseline recovery wells" [ER, p. 6-11] be applied—for the purpose of determining the Target Restoration Values (TRVs) obliquely referenced on page 6-11 of the Applicant's ER—to individual "well modules," or to a group of "several well modules," or to a "well-field?" Please be specific in your answer.

(c) What has been the NRC's established practice to date in regard to the question posed in (b) above, prior to the proposed licensing of the "Ross Project?"

(d) How many discrete environmental accountancy areas – i.e. groups of location-specific UCLs and TRVs—will be established within (1) the Ross Project, and (2) within the scheduled "Lance District Development" that is directly tied to the use of the Ross Project CPP—to detect and control excursions and set standards for aquifer restoration?

(e) Who is responsible for establishing and maintaining this large and complex data set of water quality measurements, and where will it be maintained?

(f) Who initially formulates and proposes module -specific UCLs and TRVs based on these measurements—the Licensee or NRC?

(g) How will the relevant UCLs and TRVs applicable to each specific module be communicated to the field personnel responsible for detecting and preventing excursions and assessing aquifer restoration at particular sites.

(h) With a small workforce covering so many individual environmental compliance units that must monitored and assessed, how will the Applicant and NRC avoid the confusion or misapplication of standards between units?

(i) Please provide a full and NEPA compliant description of the NRC's process for reviewing and validating the environmentally protective character of UCLs and TRVs proposed for inclusion in the Ross project license over time;

(j) If there are differences in view between NRC and the Applicant on the establishment or revision of UCLs and TRVs, how will these differences be adjudicated and resolved? Who within NRC holds the final decision authority on such matters?

(k) How will NRC verify the authenticity of the large number of site-specific data sets required under the module-by-module standard-setting approach?

(l) Please identify prior NRC-licensed uranium ISR operations that

(1) Have conducted "aquifer restoration" activities in the manner described in the Draft SEIS: i.e. "as…restoration occurs in depleted well modules, ISR operations would be ongoing in subsequent well modules." (SEIS, 2-33, line 13).

(2) Please provide a detailed discussion of historical evidence, if any, showing that such parallel production and aquifer restoration efforts pursued at the "well module" level, with TRVs tailored to each well module or "wellfield," have been successful at restoring groundwater to pre-mining baseline values over the full extent of the mined aquifer.

(m) Please provide a map showing the location and planned restoration sequence of the Ross Project "well modules" that would undergo restoration, relative to those modules in which "ISR operations would be ongoing" at the same time.

(n) Please provide detailed topographic and stratigraphic maps showing the location, relative to the "Ross Project," of all "subsequent well modules" in contiguous areas currently scheduled for "Lance District Development" in which "ISR operations would be ongoing" while "Ross Project" well modules are undergoing "aquifer restoration."

(o) Which subsequent ongoing ISR operations, if any, would be hydrologically up-gradient of well modules undergoing simultaneous "aquifer restoration?"

(p) Would all "well modules" undergoing restoration be hydrologically up-gradient of well modules in which ISR operations would be ongoing?

(q) (1) Please define and describe a "baseline recovery well," as the term is used in the Applicant's ER.

(2) Is the use of "baseline recovery wells" included in the "post-licensing, pre-operational" scheme (for characterizing baseline water quality and establishing UCLs and TGVs for each "well module" or "wellfield") that is partially and inadequately described in the SEIS?

(r) If so, please provide a detailed description of how and when data from these "baseline recovery wells" will be acquired and used in concert with other data sources to establish TRVs for each "Ross Project" well module or wellfield, provide the number of such recovery wells that will be used for baseline sampling in each discrete baseline monitoring and excursion control area, and where these wells would be located in an actual Ross project well module or wellfield design, relative to the perimeter monitoring wells.

38. Page 2-33, line 31: "The pumping rates used would depend on the hydrologic conditions at the Ross Project, and the duration of the aquifer sweep and the volume of water removed would depend on the volume of the aquifer affected by the ISR process."

NRDC Comment:
(a) Please provide an explanation of the specific existing, planned or expected "hydrologic conditions" at the Ross Project that will affect the pumping rates, duration, and volume of water removed during "aquifer sweep."
(b) Please explain why these particular hydrologic conditions have not already been ascertained or modeled based on the results of pre-licensing site investigations;
(c) How do these hydrologic uncertainties affect the forecast efficacy of the NRC's efforts to ensure environmentally protective "aquifer restoration;"
(d) Please provide a detailed and adequate NEPA discussion that relates the prevailing uncertainties in hydrologic knowledge of the "Ross Project" and "Lance District Development" areas to the Licensee's ability to achieve, and the NRC's ability to enforce, Target Restoration Values (TRVs) that will be sequentially established "post-licensing" and added incrementally to the terms of Applicant's NRC License.
(e) What is the range of potential environmental outcomes, in terms of the restoration of the relevant baseline water quality concentrations, arising from uncertainties in "hydrologic knowledge" of (1) the "Ross Project" area and (2) the wider area encompassed by scheduled "Lance District Development" (see Figure 2.6)?
(f) Based on the record of previous and ongoing uranium ISR operations in (1) this GEIS "Milling Region," and (2) within the state of Wyoming, please compare and weight the likelihood of achieving representative alternative sets of post-mining water quality concentrations for the relevant constituents that must be monitored and controlled to ensure public health and safety and minimize harmful environmental impacts and the irretrievable commitment of natural resources.

39. Page 2-33, line 36: "The Applicant's aquifer restoration plan calls for removing up to 0.5 pore volumes of water during ground-water sweep (Strata, 2011b). Additional pumping would occur in select areas that would be identified during facility operation. The pumping rate is estimated at 284 L/min [75 gal/min] from well modules in the ground-water sweep stage."

NRDC Comment:
This paragraph discloses almost nothing about the likely range of environmental impacts from aquifer restoration activities.
(a) If an Applicant's aquifer restoration plan "calls for" the removal of "up to" 0.5 pore volumes during ground-water sweep, does this mean that this number represents a hard and fast regulatory limit on the amount of water that will actually be removed during ground-water sweep?
(b) Please provide a table showing the actual pore volumes removed from prior and still ongoing ISR operations in:
(1) This GEIS Milling region; and
(2) Within the State of Wyoming; that have undergone "aquifer restoration."

(c) Please provide a table showing "expected" and "maximum allowable" pore volumes per "well module" (or other applicable unit for aquifer restoration) that would be removed in the course of aquifer restoration activities for the "Ross Project," translate these values into total gallons of water removed per well-module, per well-field, and for the "Ross Project" as a whole, and estimate the time required for the full extent of the Ross Project's mined aquifer to recover to its natural background or pre-mining pore volume, based on this range of requirements for "groundwater sweep."

(d) Please provide a discussion --

(1) Comparing the environmental risks and benefits from high levels of pore volume removal from the mined aquifer with the environmental risks and benefits of failing to attain License-specified TRVs (or lesser fallback standards) for aquifer restoration.

(2) Please describe the methodology the NRC and/or the Applicant will employ to evaluate environmental restoration decisions regarding this tradeoff, and the point at which concerns regarding the consumptive use of groundwater may trump the achievement of particular Target Restoration Values.

(e) To enable an adequate NEPA assessment of water quantity impacts, please provide the same pore volume and gallons withdrawn estimates as in (b) above for the projected numbers of "restored" well-field modules falling into the following two categories,

(1) included in the contiguous (to the Ross Project) and already scheduled "Lance District Development;" (see Figure 2.6)

(2) Other "reasonably foreseeable" "Lance District Development" that would likewise utilize the "Ross Project" CPP; and provide an explanation of the methodology used in producing these estimates.

40. Page 2-33, line 40: "The Applicant proposes to use ground-water sweep selectively (for example, around the perimeter of the wellfield) rather than throughout the entire well module to minimize the consumptive use of groundwater."

NRDC Comment:
This statement again gives rise to ambiguity regarding what the environmental baseline accounting unit for aquifer restoration will be: a "wellfield," an "entire well module," as stated above, or a group of several "well-modules" as suggested in lines 11-14. Please clarify the ambiguity.

41. Page 2-34, line 41: "The need for aquifer stabilization would be determined on a case-by-case basis and would depend upon how effectively the sweep and recirculation processes restore the affected aquifer to the license required standards."

NRDC Comment:
What are the NRC's "license required standards" for the "Ross Project," and for the scheduled "Lance District Development" shown in Figure 2.6 on page 2-8 of the Draft SEIS? I cannot find these "standards" listed anywhere in the SEIS.

42. Page 2-34, line 43: "Following aquifer restoration, the Applicant would monitor the ground water by quarterly sampling to demonstrate that the approved standard for each constituent has been met, and that any adjacent nonexempt aquifers are unaffected."

NRDC Comment:
(a) What is the "approved standard for each constituent" that will be subjected to monitoring "to demonstrate that the approved standard…has been met" for aquifer restoration?"
(b) Please provide the specific water quality standards that will be used "to demonstrate…that any adjacent nonexempt aquifers are unaffected?"
(c) What happens if "quarterly sampling" demonstrates that one or more "adjacent nonexempted aquifers" are affected?
(d) Who would conduct this quarterly sampling, and if it is the Licensee, how would the NRC obtain independent verification of the results?
(e) What do the mutually agreed terms of the proposed NRC license for the "Ross Project," issued to the Applicant in late 2012, require the Licensee to do in the event "adjacent non-exempted aquifers" are adversely affected by ISL mining or aquifer restoration efforts?

43. Page 34, line 32: "If the oxidized (i.e. the more soluble) state is allowed to persist after uranium recovery is complete, metals and other constituents such as arsenic, selenium, molybdenum, uranium and vanadium could continue to leach and remain at elevated levels. To stabilize these constituent concentrations, the pre-operational oxidation state in the ore zone must be reestablished as much as is possible."

NRDC Comment:
(a) For the purposes of this SEIS analysis, what has the NRC deemed to be "elevated levels" for the above-named constituents?
(b) Please provide the range of historically- and geotechnically-indicated minimum, maximum, and most-likely (expected) "elevated levels" for each of the above named constituents that could result from the NRC's decision to grant the "Ross Project" license, and discuss the scientific and technical basis for the information provided?
(c) What is the "pre-operational oxidation state" in the proposed ore zones of the "Ross Project" and scheduled "Lance District Development" shown in SEIS Figure 2.6?
(d) Would the "pre-operational oxidation state" of these ore zones differ from their baseline "pre-licensing state?"
(e) If so, please identify the known and likely factors contributing to this difference? If not, why does the NRC not employ the measured "prelicensing" baseline oxidation state of the ore zone as the value to be "reestablished as much as possible?"
(f) How much is "as much as possible?" What are metrics that the Applicant will employ, and/or the NRC will enforce, to establish that "the pre-operational oxidation state in the ore zone" has been "reestablished as much as is possible?"
(g) Would "as much as possible" be less that the TRVs specified in the Applicant's NRC license? If so, what elevated concentrations of the "dissolved metals" enumerated on page 2-34, line 33-34 of the SEIS would be deemed acceptable for terminating the

"aquifer stabilization" phase of aquifer restoration under the proposed Ross Project license?

44. Page 2-34, line 45: "The Applicant would reinitiate the entire aquifer restoration phase if stabilization monitoring determines it is necessary. Both WDEQ and the NRC must review and approve all monitoring results before aquifer restoration would be considered to be complete."

NRDC Comment:
This vague statement leaves many obvious and important environmental questions unaddressed—
(a) What are the specific environmental monitoring benchmarks that will determine whether it is "necessary" to "reinitiate the entire aquifer restoration phase" for the "Ross Project" and scheduled follow-on "Lance District Development" efforts;
(b) Please provide a list or table showing any and all historical instances in which the NRC has directed the recipient of an ISL license to "reinitiate the entire aquifer restoration phase" following a failure of the first aquifer restoration phase to achieve the TRVs specified in the license, and the resulting improvements in measured environmental benchmarks obtained thereby.
(c) The SEIS states that the NRC "must review and approve all monitoring results." How will the NRC go about independently confirming or otherwise verifying the authenticity, accuracy, and completeness of the "monitoring results" that it will "review and approve" for the "Ross Project" and other scheduled "Lance District Development?
(d) Please provide a complete list of the water quality standards and criteria that the NRC will apply when it makes a determination on whether "Ross Project" aquifer restoration "would be considered to be complete." Which of these standards or criteria are considered binding on the Agency and the applicant, and which can be abandoned or modified at will using the agency's enforcement discretion?
(e) Which official or officials within NRC are entrusted with the responsibility and authority to approve monitoring results and declare aquifer restoration "to be complete?"
(f) What does "aquifer restoration" really mean if uranium ISR wellfield construction and testing and ISR operations are ongoing in adjacent portions of the same hydrologically connected formation, and neither the starting nor finish lines for assessing groundwater degradation and restoration have been established in advance as being both environmentally protective and legally binding on the Applicant and the NRC.
(g) For how long will the proposed license require the Applicant "to monitor the groundwater by quarterly sampling to demonstrate that the approved standard for each constituent has been met and that any adjacent nonexempt aquifers are unaffected?"
(h) Please provide the "approved standard for each constituent" that will be used to conduct this quarterly monitoring, and the standards for determining that "any adjacent nonexempt aquifers are unaffected."
(i) What does "adjacent" mean in this context?

45. Page 2-35, line 9: "Prior to the Ross Project's facility decontamination, dismantling, and decommissioning…"

NRDC Comment:
(a) Please provide the earliest and latest dates at which this facility D & D could reasonably be expected to occur based on the current mining plans of the Applicant in the Lance District?
(b) Is the "Ross Project facility" named above the same as the "Lance Projects Central Processing Plant (CPP)" described by Applicant Strata Energy's parent company, Peninsula Energy, Ltd., in releases to the global investing community?
(c) If so, why is it referred to in this DSEIS by a different name?

46. Page 2-35, line 10: "…appropriate cleanup criteria for surfaces would need to be established in concert with NRC requirements."

NRDC Comment:
(a) What are the current NRC requirements, if any, for "appropriate cleanup criteria for surfaces" of ISL plants in the D&D phase?
(b) When and how would the criteria required for cleanup of surfaces at the "Ross Project facility" be determined?
(c) Please provide a table showing the expected levels of radioactive and chemical contamination before and after decontamination of a typical ISL facility similar in size to the Ross CPP.
(d) If the data requested in (c) is time dependent, please present showing how the contamination levels pre- and –post decontamination may vary with the plants operating history.

47. Page 2-35, line 12: "…a Ross Project-specific decommissioning plan (DP) would need to be accepted by the NRC. The Applicant has committed to satisfying these NRC requirements for decontamination and decommissioning."

NRDC Comment:
(a) When would a "Ross Project-specific decommissioning plan DP)…need to be proposed by the Applicant?
(b) When would it "need to accepted by the NRC?"

48. Page 2-35, line 17: "…to identify those areas at the Ross Project that would need decontamination to meet applicable cleanup criteria or those that cannot economically meet the criteria (Strata, 2011b)."

NRDC Comment:
(a) Please describe the difference between "cleanup criteria" and "applicable cleanup criteria." When would cleanup criteria in the DP not be "applicable?"
(b) What happens when a contaminated area "cannot economically meet the criteria" established in the DP?

49. Page 2-35, line 21: "The onsite excavated pits, or "mud pits," used for disposal of drilling fluids and muds (or "cuttings" during the installation of wells, would be included in the survey to ensure no long-term radiological impacts (Strata, 2011a)."

NRDC Comment:

(a) Please estimate the total number, land area, and approximate locations of all mud pits that will be created in the complete cradle-to-grave life cycle of drilling for the following: the "Ross Permit Area;" "Ross Amendment Area # 1;" "Kendrick Production Unit (Amendment Area #2);" Richards Production Unit (Amendment Area # 3); Barber Production Unit (Amendment Area # 4); all "Lance District Development," including the preceding named areas and units, plus "the Warren Project," the "Richards Project," the "Osborne Project," the "Chatterton Project," the "Brooks Project," the "Carey Project," the "Houx Project," the "Clark Project," the "Lucas Project," and the "Emerson Project; " all of the preceding, plus ISL mining-to-depletion of the entire "Lance District" uranium resource under the control of the Applicant?

(b) What about any long-term chemical as well as radiological impacts of these drilling "mud-pits?" Please describe the specific chemical as well as radiological constituents of the "Ross Project" and "Lance Projects" drilling muds, and any potential short and long-term hazards they may present to the human and natural environment, including crops, livestock, and wildlife, from leaving them in place.

(c) Are these radiological and chemical constituents of drilling muds expected to be consistent across all uranium-ore bearing areas of the "Lance District," or could they vary significantly depending on local drilling conditions and the specific characteristics of the ore-bearing formations?

(d) Please provide expected ranges for the concentrations and activity levels for all constituents of these drilling muds, including radioactive decay products over time, for every area planned to be mined under the Proposed License and any planned amendments thereto.

(e) Which constituents present the highest risk of mobilization in the event of (i) erosion and flooding; (ii) dessication and wind- blown dispersion?

(f) Which constituents present the greatest risk of uptake in the food chain?

(g) Are these mud-pits subject to the "applicable cleanup criteria" in the Applicant's NRC-approved "Ross-Project-specific" decommissioning plan (DP)?

(h) What standards would be applied to these mud pits in the Applicant's decommissioning plan to determine whether they present "no long-term radiological (and chemical) impacts" if left in place?

(i) If the "radiation survey" referenced in lines 16 – 25 documents the existence of a long-term radiological or chemical hazard at some or all of these "mud-pits," what will the Applicant's NRC-approved DP require in the way of cleanup?

(h) Could some or all of these mud pits qualify for a determination that they "cannot economically meet the criteria" for cleanup?

(i) If a survey documents that some or all mud-pits will have long-term adverse environmental impacts, and some or all of these mud pits qualify for a determination that they "cannot economically meet the criteria" for cleanup, what steps will be taken, if any, to mitigate their environmental risks?

(j) Please briefly summarize and provide detailed citations to technical literature demonstrating that the cumulative impacts of many thousands of such contaminated mudpits in an area of 90-120 km2 does not present an elevated risk of environmental harm.

50. Page 2-36, line 6: "However, at the Ross Project, complete decontamination...and decommissioning…could occur years after the wellfields begins to be decommissioned and the aquifer begins to be restored."

NRDC Comment:
(a) Could occur or would occur? Why the use of the conditional tense? Don't the economic rationale for the "Ross Project" CPP and the Applicant's licensing strategy both depend on bringing numerous additional wellfields into production beyond the initial Ross Permit area considered in this SEIS?
(b) How long would the CPP remain in operation after the first "Ross Project" wellfield "begins to be decommissioned" if the Applicant's business plan for mining the entire Lance District region is realized?

51. Page 2-36, line 32: "All wastes and the equipment associated with surface impoundments….disposed of appropriately or released for unrestricted use…The soil beneath the surface impoundments would be analyzed for radioactive contamination, and any areas that exceed the cleanup criteria for unrestricted release would be excavated and disposed of at a licensed radioactive waste disposal facility."

NRDC Comment:
(a) Would the "soil beneath the surface impoundments" be examined for chemical contamination?
(b) How wide an area around and down gradient from the mudpits will be examined for contamination that may have migrated through seepage, leaching and erosion?
(c)What are the specific criteria that would be applied to determine the choice between "disposed of appropriately" and "released for unrestricted use?"
(d) With 750 to 1000 individual wells estimated for the Ross Project, how many total acres of: (1) "excavated mudpits;"and (2) surrounding land; will be examined for radioactive and/or chemical contamination?
(e) Please provide the data requested in (d) for all planned "amendment area" expansion wellfields (including all disposal and monitoring wells) with output that would be processed in the "Ross CPP" (aka the "Lance Projects Central Processing Plant") with the next 10, 15, 20, 25, 50, and 70 years.
(f) Would these mudpit zones be subject to the same radiation survey and evaluation process mentioned on page 2-35, line 18, which could result in a determination that some or all of them requiring cleanup "cannot economically meet cleanup criteria?"
(g) Would mudpit areas that meet cleanup criteria be suitable for reseeding and livestock grazing? If not, how will they be identified to prevent same?
(h) If mudpit areas that do not meet cleanup criteria are left in place because they "cannot economically meet cleanup criteria," do they present any future contamination threat to

the livestock or wildlife food chains, or to surface or shallow groundwater resources? Please characterize the chemical and radiological nature of this threat?

52. Page 2-38, lines 8 – 41, Airborne Emissions:

NRDC Comment:
(a) Please provide the full lifecycle CO2 –equivalent emissions per-pound-of-yellowcake to be produced from the "Ross Project, including in this calculation all on-site and off-site sources of electricity and fossil-fueled thermal combustion required for all phases of the Ross Project, including aquifer and site restoration. Please make all components of this calculation transparent.
(b) What is the estimated lifetime output, measured in pounds of yellowcake, of the "Lance Projects Central Processing Plant," (aka the "Ross Project" CPP)?

53. Page 2-39, line 10: "The Applicant has committed that these [radon] discharges would meet all local, State, and Federal requirements related to air quality as well as occupational health and safety (Strata, 2012b)."

NRDC Comment:
(a) Please describe how the NRC, or if not the NRC, other government agencies will monitor and confirm the Applicant's compliance with these requirements?
(b) Please describe any and all historical instances in which the NRC or another agency has cited or fined an ISR facility for failure to comply with radon-monitoring, -ventilation, or -personnel protection requirements.

54. Page 2-39, line 39: "The composition and quantities of liquid waste from Ross Project processes related to uranium recovery are similar to those ranges provided in Table 2.7-3 of the GEIS (NRC, 2009);"

NRDC Comment:
Attempting to quantify the output of liquid wastes from the "Ross Project" by saying that it is "similar to a range" provided in some other document conveys no useful information and fails to comply with NEPA, which requires that important environmental parameters be quantified wherever possible.
(a) Please provide estimates of the total quantity and composition of liquid waste requiring deep well disposal from:
(1) The "Ross Project,"
(2) All future "Lance Projects" that would utilize the CPP;
(3) All "satellite IX facilities" planned by the Applicant in connection with future use of the CPP.
(b) Please provide the number, planned locations, target aquifers, and required capacities of all deep disposal wells that would be created by executing:
(1) The Applicant's current plan to solution-mine the Ross, Kendrick, and Barber "amendment areas;"
(2) the Applicant's future plans to mine all the projects identified in its corporate parent's long range business plan for "Lance District Development," including

"the Warren Project," the "Richards Project," the "Osborne Project," the "Chatterton Project," the "Brooks Project," the "Carey Project," the "Houx Project," the "Clark Project," the "Lucas Project," and the "Emerson Project; " (3) All of the preceding, plus ISL mining-to-depletion of the entire "Lance District" uranium resource under the control of the Applicant?

55. Page 2-40, line 36: "The applicant expects the capacity of each of the five Class 1 wells to range between…" You have expressed the "capacity" of a disposal well as a flow-rate, not as a limit on the total amount of liquid wastes injected.

NRDC Comment:
(a) What determines the actual amount of liquid waste that each deep injection well can accommodate, and how is this limit expressed?
(b) Is there a limitation imposed on the maximum injection pressure, or on the resulting water pressure in the deep formation that is receiving the waste, and what is (are) this limit(s) for the Ross Project and for subsequent "Lance Projects"?
(c) Would all deep disposal wells associated with uranium yellowcake produced pursuant to the proposed license be targeted in the same formations (Deadwood and Flathead) as targeted by the five deep disposal wells permitted for the "Ross Project."?

56. Page 2-40, line 41: "Net annual evaporation of brine in the surface impoundments would be 5.3 L/min-ac [1.4 gal/min-ac] which would reduce the volume of brine injected in the disposal wells (Strata, 2011b)."

NRDC Comment:
(a) Please provide the total quantity and percentage of total produced brine that would be disposed via evaporation.
(b) Please quantify the amounts of radon or other hazardous gases that might be released via evaporation from the "surface impoundments."

57. Page 2-41, line 27: "The Applicant estimates that a volume of 22,000 L (6,000 gallons) of water and 12 m3 [15 yd3] of drilling muds would be produced per well."

NRDC Comment:
Please explain the derivation of these numbers.
(a) Do they represent an average value of "produced water" and drilling muds per well sunk into the ore zone only, or do they include the deep wells, which one would expect to be about 16 times greater, based on a ratio of their respective depths.
(b) Please provide separately the values for produced water and drilling muds from the drilling of deep disposal wells into the Deadwood and Flathead formations.

58. Page 2-41, line 30: "The Applicant expects the production of ground water during operations and decommissioning of wells completed outside of the aquifer exempted for uranium recovery (Strata, 2011a). This ground water would be discharged under a temporary WYPDES Permit."

NRDC Comment:
(a) How many wells, of what type, into which formations, are covered now under the terms of this "temporary permit?"
(b) How many wells will be drilled and covered by this permit in the future;
(c) How long is the term of the renewed permit?
(d) Where and how is the groundwater "discharged" under the terms of this permit?

59. Page 2-43, 44, lines 39-9 "Financial Surety."

NRDC Comment:
With a history of failures in efforts to adequately restore contaminated aquifers at ISL uranium mining sites, the subject of financial surety is of concern. Please provide:
(a) A full (and comparative) accounting of each and every original financial surety required by NRC or relevant state agencies for ISL uranium mines, including the type of surety arrangement (e.g., bonds, cash deposits, certificates of deposit, parent company guarantees, etc.).
(b) What was the basis for the initial surety requirement?
(c) Were there license conditions requiring each of these surety arrangements?
(d) Were the surety estimates for funding the entirety of groundwater restoration and decommissioning the facility adequate in each instance? If not, why not?
(e) How often were updates required of each surety at each ISL mining site?
(f) If at any point a surety was not adequate to meet the costs of restoration and decommissioning, what entity provided funding for continuing restoration?

60. Page 2-44: "As of October 2010, the applicant has located 759 of the 1682 holes thought to exist from Nubeth exploration activities and has plugged 55 of them (Strata, 2011b)."

NRDC Comment:
(a) Based on historical records, how many previous drill holes from all sources (e.g. oil, gas, uranium, water exploration and extraction) are believed or known to exist on (1) the Ross Project site; (2) the area encompassed by future planned "Lance District Development?" Please provide a map showing the boundaries of this wider area.
(b) How many of the preceding holes described in (a) have been located, and how many have been plugged?
(c) Does the total of 1682 holes from "Nubeth exploration activities" include the wells that were drilled for Nubeth's abortive production operation? How many of the latter are there?
(d) (1) Of the known subset of holes associated with Nubeth exploration activities, how many has Strata located to date (May 9, 2013);
(2) How many of these have been plugged?
(3) How many of these have been correctly plugged or replugged to modern well abandonment standards?
(e) Of the larger number of drillholes from all sources, how many of these has Strata located, and how many of these have been correctly plugged to ensure that no vertical or horizontal migration of lixiviant occurs, or any migration of otherwise altered water outside the permitted area of the mined aquifer?

61. Page 2-44, line 2: "Alternative 3: North Ross Project."

NRDC Comment:
The ER and DSEIS contains no evidence that other CPP location alternatives were screened for their environmental advantages and disadvantages prior to selecting the "North Ross Project" for detailed NEPA analysis.
(a) Please explain why this alternative, and not others, was deemed more reasonable than other potential CPP location alternatives, and provide evidence that an environmentally-based screening process was used to identify environmentally preferred sites;
(b) What environmental or other criteria elevated the North site and the chosen Ross site above other alternative sites?
(c) Please provide a detailed discussion of why the selected Ross Site is the environmentally preferred site within the Lance District areas acquired, optioned, or leased by Peninsula Energy Ltd/Strata Inc., for ISR of uranium.
(d) Strata's Australian parent company, Peninsula Energy, Ltd., has proposed ["Lance-Development Model," March 21 presentation 2013 Hong Kong Mines and Money conference] that a satellite ion exchange facility will be part of the planned "Barber Production Unit" in the southern part of the Lance District. A location in this area, closer to the towns (Gillette and Moorcroft) where the plant workers are likely to live, would appear to offer environmental advantages in terms of minimizing dust and transport emissions during construction, operations, product shipments, workforce commuting and decommissioning. What consideration, if any, was given to locating the CPP here, much nearer to paved roads and the main I90 east-west transportation corridor?

(e) Please describe the comparative environmental and other factors, relative to other candidate CPP sites considered, that led to the selection of the (south) Ross project site as the preferred site for building the CPP and the first wellfields to be constructed under the proposed licensing action.

62. Page 2-46, line 35:

NRDC Comment:
In discussing the alternative (eliminated from detailed analysis) of possibly employing conventional mining and milling to extract the Lance District resource, the DSEIS states that "the uranium ore in the Lance District is low-grade…" and located at "nearly the maximum depth for surface mining to practically recover uranium from an open pit."
(a) Please give the definition of "low-grade" uranium ore used here.
(b) Is uranium mineralization of 4 to 5 feet at 1000-1300 parts per million (ppm) considered "low grade?"
(c) If the Ross Project uranium is indeed "low-grade," please provide a NEPA analysis showing that on balance, developing this Lance District resource, at the cost of incurring some measure of unavoidable adverse environmental impacts, particularly on groundwater, is worth the socio-economic benefits that would flow from this decision in light of available alternatives to the proposed licensing action.
(d) For example, if Canadian uranium imports from the Athabasca Basin can be tunnel-mined from an ore body that is on the order of 200 times richer than the Lance District's (concentration of 0.1% versus 20% at MacArthur River) thus in principle incurring significantly fewer environmental impacts per ton of U308 product extracted, and this rich mining district is located in a remote area that is literally saturated with vast surface and groundwater resources, why then does it make environmental sense to impair relatively scarce groundwater resources to mine uranium in a semi-arid region of eastern Wyoming, water that would otherwise be available to support livestock, crop irrigation, and human consumption (the city of Gillette even today, much less at some parched time in the future, taps the Fox Hills/Lance aquifers for water that is blended Madison formation water with lower TDS values to yield potable water, and thus the aquifers to be degraded by the licensed mining comprise a source of human drinking water.)?
(e) Could the extended mining contemplated by Applicant in the planned southern "Barber Production Unit" of the Lance District, under so-called "amendments" to this proposed License, threaten future use of the above-mentioned municipal, and other actual and potential wells in the area, as a source of drinking water via blending? A planned "Warren Project" at the far southern end of the Lance District [avg. 10 ft. of mineralization @ 700 ppm eU308] would apparently come even closer to the town of Moorcroft. Please provide a technical justification for your answer.
(e) Please provide a detailed map showing the location of the Moorcroft and Gillette wells tapping the Fox Hills/Lance formations and or nearby aquifers in relation to the planned southern "Amendment Areas" that could be added to the proposed "Ross Project" license.

63. Page 2-50, line 46: "The Applicant has estimated that the 2.5 ha [6.3 ac] available for evaporation in the Proposed Action would provide 33.3L/min [8.8 gal/min] of average annual

evaporation. Linear extrapolation suggests that 65 ha [160 ac] is the minimum surface area required for evaporation of all brine and other byproduct waste generated at the CPP."

NRDC Comment:
How was the proposed surface area of 6.3 acres for the CPP surface impoundments arrived at? Why was not a larger or smaller acreage proposed? What were the environmental and operational factors considered?

64. Page 2-52, line 18: "During operations there would be a MODERATE impact to ore-zone aquifer water quality due to excursions…"

NRDC Comment:
(a) What is the technical basis for the apparent view expressed here that a "moderate" degradation of mined aquifer water quality would be "due to excursions," rather than to the real time effects of mobilizing uranium and other constituents of the ore-bearing sandstones (like radium and selenium) known to be harmful to human and animal health?
(b) Expressed quantitatively, as a deviation from the pre-licensing site-characterized baseline levels, what does a "MODERATE" impact on mined aquifer water quality mean in this context?

65. Page 2-52, line 20: "…however, with measures in place to detect and resolve excursions, the impacts would be reduced."

NRDC Comment:
(a) Please quantify the meaning of "reduced" in this context – from what to what?
(b)With the ability in place to "detect and resolve excursions," does this mean that the impacts on the mined aquifer would be no longer "MODERATE," and therefore "SMALL"? What does "SMALL" mean quantitatively in this context, expressed as a deviation from pre-licensing site-characterized baseline levels?
(c) Does anyone in NRC have the intestinal fortitude to acknowledge the utterly circular and syllogistic nature of this ludicrous mode of fact-free environmental analysis?
(d) "During aquifer restoration there would be a MODERATE impact to ore-zone aquifer water quantity to short-term drawdown..." Please define the possible range of time that NRC associates with "short-term" drawdown of an aquifer, and explain why this length of time would impose only a "moderate" environmental impact on current and potential future users of the aquifer. If a "restored" aquifer fails to recharge fully after thirty years, is this a "moderate" impact?
(e) What about impacts to ore-zone aquifer water quality during and after "restoration?" The NRC staff's conclusions stated on page 2-52 include water quality impacts during operations, but say nothing about these impacts during and after "restoration?" Are we to presume that there are no water quality impacts arising from and/or enduring past the restoration phase of the Ross Project?
(f) Since it is well known that there are such lasting impacts, expressed as prolonged deviations from pre-mining baseline levels for key constituents whose concentrations determine the relative human potability and other uses of groundwater, please describe the

deviations from baseline water quality values expected in the Ross Project, and subsequent Lance Projects."

66. Page 2-53, line 1-6: "Regarding groundwater, the portion of the aquifer(s) designated for uranium recovery must be exempted as underground sources of drinking water before ISR operations begin."

NRDC Comment:
(a) Why is this exemption necessary if, as claimed in the same paragraph, "Strata would also be required to restore groundwater parameters affected by the ISR operations to levels that are protective of human health and safety?"
(b) In other words, if Strata must restore groundwater parameters affected by ISR operations to levels that are "protective of human health and safety," why is it necessary to exempt the aquifer in the future from serving as a potential source of drinking water? Please explain this apparent contradiction.
(c) What are the levels for key constituents of the "restored" mined-out aquifer that the NRC deems "protective of human health and safety?" If these levels are truly protective of human health and safety, why can't the restored aquifer serve as a source of drinking water? If it can't serve this function, is it reasonable or legitimate to say that the aquifer has been "restored" to a level that is "protective of human health and safety," including future uses that humans depend on, such as watering livestock and crop irrigation?
(d) The only way to decipher and make sense of this apparent contradiction, which arises from purposefully vague writing, is to interpret the phrase "restore groundwater parameters affected by ISR operations" as excluding the mined aquifer itself. Then the problematic phrase reduces to, "Strata will protect human health and safety as it relates to current and future uses of aquifers beyond the ore zone." Although no quantitative demonstration is provided showing Strata's pathway to achieving even this more limited goal, at least read this way the assertions in this problematic paragraph begin to make logical sense! Please clarify that this is what the paragraph at the top of page 2-53 is intended to convey, even though it is drafted to leave an impression of a more robust groundwater restoration capability.

Section 3: Affected Environment

67. Page 3-1, line 38: "The Ross Project area encompasses approximately 697 ha [1,721 ac] as described in the SEIS Section 2.1.1."

NRDC Comment:
(a) Please provide (and show on a map) the total land area encompassed and affected by Applicant Strata Energy's proposed "Lance District Development" (referenced in Figure 2.6) and "The Lance Projects," given by sources other than this deficient DSEIS as the following: the "Ross Permit Area;" "Ross Amendment Area # 1;" "Kendrick Production Unit (Amendment Area #2);" Richards Production Unit (Amendment Area # 3); Barber Production Unit (Amendment Area # 4); "the Warren Project," the "Richards Project," the "Osborne Project," the "Chatterton Project," the "Brooks Project," the "Carey Project," the "Houx Project," the "Clark Project," the "Lucas Project," and the "Emerson Project."

(b) Please provide the total land area and show on a map the boundaries of the area that would be affected by mining the entire "Lance District" to depletion, and discuss all the existing human settlements and existing land uses that would be affected within this wider area designated by the Applicant for uranium development.
(c) Please revise this entire section (Sec. 3) on the "Affected Environment" to encompass a description of all the important environmental attributes of the wider area that could be solution-mined as a direct or foreseeable consequence of the NRC's proposed licensing action.

68. Page 3-4, line 24:

NRDC Comment:
Include in this paragraph all of the "potential projects" planned for the Lance District by Strata Energy's corporate parent, Peninsula Energy, Ltd.

69. Page 3-9, line 15 -18:

NRDC Comment:
Please provide the JORC-compliant uranium resource estimates for "recoverable uranium" in the area encompassed by future planned "Lance District Development."

70. Page 3-38, subsection on existing Groundwater Quality:

NRDC Comment:
The data and discussion in this section is vague, disconnected, and entirely inadequate. It never forthrightly discusses historical and current water quality data from a representative sample of existing wells completed in the Lance and Fox Hills aquifers outside of the previous Nubeth exploration and mining zone, and the sparse data from such existing wells appears to have been dropped from Tables 3.6 and 3.7, which includes only "Nubeth Data" and "Ross Project Monitoring Well Data."

71. Page 3-43, lines 19 -22:

NRDC Comment:
(a) Please provide a map showing the locations and current uses of the "identified 29 currently operable water-supply wells within the Ross Project area and the surrounding 2-km (1.2 mi) area."
(b) Provide a similar map for the wider area proposed for uranium ISR by the Applicant, as described earlier in these comments.

72. Page 3-43, line 32 -34: "Domestic wells are generally deeper than stock wells, ranging from 46-180 m [150 – 600 feet] The limited information available on these wells precluded a determination of which aquifer was supplying water to the domestic wells."

NRDC Comment:

This data gap seems a little too convenient. The referenced depth range of these domestic wells could easily include the Lance/Fox Hills formations. Please provide more information on the supply aquifers and water quality of these domestic wells.

73. Page 3-43, line 37 -38: "The results of the water –quality analyses are provided in the Applicant's ER…"

NRDC Comment:
Please provide and discuss these results in this SEIS. The public does not read the Applicant's ER, and it is not a NEPA document.

74. Page 3-43, line 41: "As described below for each type of well, these analyses showed that the local water supply's contaminants *generally exceeded* EPA's drinking water standards and *often exceeded* Wyoming's less stringent quality standards for agricultural use."

NRDC Comment:
(a) These are tendentious and unsubstantiated conclusions based on the data provided. Sulfate exceeded the standards in 54% of the wells sampled – given inherent measurement and sampling errors, and the small size of the sample, this is hardly a basis for concluding that these wells "generally exceeded EPA's drinking water standards." Gross alpha was exceeded in only "4 of the 13 domestic wells," or 31 % of the wells, again hardly the basis for a conclusion that these wells "generally exceeded" EPA or WDEQ standards.
(b) Likewise, the conclusion for the stock wells that "the water quality of stock wells is variable" does not substantiate the conclusion that water from these wells "often exceeded Wyoming's less stringent quality standards for agricultural use." The results summary on page 3-44, line 19, states that "gross alpha exceeded both the Class II standard and the MCL in 7 of the 15 stock wells," or only 45% of the wells. In other words, more than half the time, they complied with this standard. Selenium exceeded these standards in only 1 of 15 (7%) of wells, which hardly comports with the descriptor "often exceeded."

75. Page 3-44, line 16: "TDS often ranged from 370 to 1,610 mg/L, often exceeding the EPA Secondary MCL standard…"

NRDC Comment:
Please describe what "often" means in this context. Provide a numerical value to substantiate the claim.

76. Page 3-44, line 16: "Sulfate, ranging from 28 to 679 mg/L, often exceeded …"

NRDC Comment:
Please describe what "often" means in this context, and provide a numerical value to substantiate the claim.

77. Page 3-103, line 27: "Twenty-nine *local drinking water wells* were also sampled quarterly, beginning in July 2009…"

NRDC Comment:
Please provide a map and tables showing the locations and results, respectively, from this quarterly sampling program of local drinking water wells. If this is an erroneous reference to the sampling of 29 *water supply wells* for all uses given at pages 3-43/44 of this section, then correct the error.

Sec. 4 Environmental Impacts and Mitigation Measures

78. Page 4-3, line 18: "The GEIS defined land-use impacts to be SMALL when they ranged from 50 -750 ha [120 – 1,880 ac]."

NRDC Comment:
This is an arbitrary, capricious, and frankly ridiculous statement. Without a detailed consideration of the environmental attributes of a land area, irrespective of its size, one cannot "define" land use impacts as being anything, much less "Small."

79. Page 4-3, Table 4.1:

NRDC Comment:
The implication of this misleading chart, that only 280 acres of the total Ross Project area will be "disturbed" by the Proposed Action, is palpable nonsense. Apparently the faulty environmental premise being utilized here is that the land disturbance impacts of the proposed action are limited to only those specific areas which are physically occupied by facilities, equipment, and roads associated with the project, rather than the denial or alteration of existing land uses imposed by the project as a whole. Even on the basis of the narrower phony premise, Table 4.1 fails, as it fails to include the direct land use impacts of mudpits, well-pads, and fenced-in areas. The area occupied by 5 permitted deep injection wells is given as 5 acres, but should be 7 acres based on the given wellpad area of 250 x 250. Compare Table 4.1 with the graphical depiction of the "Ross Project Facility and Wellfields" in Figure 2.4, showing the perimeters of the proposed wellfields occupying what looks to be at least 60% of the Ross permit area.

80. Page 4-6, Transportation:

NRDC Comment:
Reasonable alternatives for locating the CPP to diminish transportation impacts (e.g. dust, carbon emissions, and probability of vehicle accidents) are not examined.

81. Pages 4-11/12, beginning line 48 on page 4-11:

NRDC Comment:
The conclusion in this paragraph that upping the shipment of resins received at the CPP daily from one to four would not affect the risk of accidents is unsubstantiated, and the increased risk arising from shipping four times the yellowcake output obtainable from the Ross Project alone is not even evaluated.

Section 5 Cumulative Impacts

NRDC Comment:
In numerous locations throughout the cumulative impacts discussion the DSEIS foregoes attempts at quantitative analysis of cumulative environmental impacts, or even substantive discussions of qualitative factors. The document achieves this dubious distinction by relying on blanket assumptions that, for a given action or impact (*i.e.*, deep-well waste storage, geologic/soil impacts, etc.), the Applicant will adhere to relevant regulations and monitoring programs. The Staff then interprets this as yet to be demonstrated adherence – an adherence with no basis in historical practices at ISL mines[2] – as offering some guarantee that the cumulative impacts associated with this action will not rise to a significant level that merits detailed analysis in the EIS, by virtue of the regulation's or program's underlying intent to prevent impacts in the first place. It is obvious that the Applicant's intent to adhere to existing regulations and guidelines should be assumed during the life of the Ross Project; however, this assumed adherence should not serve as a substitute for thorough analysis of impacts and presentation of findings within the SEIS.

82. Page 5-2, line 20: Other Past, Present, and Reasonably Foreseeable Future Actions
NRDC Comment:

[2] *See*, NRDC's *Nuclear Fuel's Dirty Beginnings*, at 26-33, for historical treatment of ISL mining practices and associated environmental harms. For example, we noted "[e]xcursions and leaks have been serious ongoing problems for many ISL facilities. In issuing a 2007 Notice of Violation to the Cameco Corporation's Smith Ranch-Highland ISL mine, the state of Wyoming noted: '[O]ver the years there have been an inordinate number of spills, leaks and other releases at this operation. Some 80 spills have been reported, in addition to numerous pond leaks, well casing failures and excursions. *Unfortunately, it appears that such occurrences have become routine*. The LQD [Land Quality Division] currently has two large three-ring binders full of spill reports from the Smith Ranch- Highland operations.'" (citations omitted and emphasis added). *Found* online at http://www.nrdc.org/nuclear/files/uranium-mining-report.pdf , and please incorporate by reference the report as a whole.

The statement is that other industrial activities near Crook County could have environmental impacts that could be greater than the individual impacts of the Ross Project. Because these additional activities are stated to include similar uranium recovery projects, as well as other activities known to impact environmental systems (e.g. oil and gas recovery), it should be assumed that the proposed action is necessarily smaller than the sum of all impacts due to external activities, as opposed to ambiguously representing the proposed action as potentially inconsequential within the context of cumulative impacts analysis.

83. Page 5-4, lines 1-6:

NRDC Comment:
Is the Richards Satellite Area anticipated to serve as replacement capacity to retiring wells, as with the Ross Amendment Area 1, or is it expected to run concurrently, thereby increasing the production rate of the CPP?

84. Section 5.6 Geology and Soils, page 5-18, line 3:

NRDC Comment:
Where is the data presented, or referenced, that shows both the initial (baseline) and post-decommissioning conditions regarding geology and soil on the Ross Project site, thus allowing the conclusion that the geologic and soil conditions of the Nubeth area are no longer relevant in a cumulative impacts analysis for the proposed action?

85. Page 5-18, line 13:

NRDC Comment:
What is the basis for concluding that the geology/soil impacts would dissipate quickly once site restoration is complete? Please provide examples of geologic/soil "disturbances" that are expected in the Ross Project along with previously observed instances in similar projects and their observed recovery times. In light of this data, is a 5-year recovery buffer conservative?

86. Page 5-18, line 46:

NRDC Comment:
Is there not enough information presently available regarding future development of satellite areas and their operational characteristics to more accurately estimate the area of soil disturbance, in contrast to assuming all four sites are identical?

87. Page 5-19, line 3:

NRDC Comment:
To what extent does the cumulative geologic impacts analysis change when considering successive (or replacement) operational capacity versus concurrent operations in potential satellites areas? What justification is there to conclude there will be a SMALL impact as a result of drilling, plugging, and abandonment of holes for either of these operational scenarios, which were both recognized by the Applicant as foreseeable?

88. Section 5.7 Water Resources, page 5-19, line 39:

NRDC Comment:
(a) Does limiting the geographic area of study to the upper reaches of the Little Missouri River Basin preclude or unnecessarily limit the scope of study on impacts that could be experienced beyond this area of data collection and monitoring?
(b) What additional watersheds are implicated in the Applicant's plans for extended ISR operations in the Lance District, and what are the cumulative demands on water resources from those projects in conjunction with all other reasonably foreseeable sources of water consumption and/or water quality degradation in the same area?

89. Section 5.17 Waste Management, page 5-48, line 26:

NRDC Comment:
(a) What methodology was used to determine the 20-year timeframe for evaluating the cumulative impacts of deep-well injection of liquid wastes? Why not a longer timeframe?
(b) What analysis has been performed specific to the formations existing in the Ross Project area that studies the potential for migration of liquid wastes and the associated timelines for this migration and/or transformation into acceptable forms?

90. Page 5-50, lines 26-33:

NRDC Comment:
(a) Describe why only using the physical geographic footprint (approximately 0.4 km around each well) in relation to the overall project area is appropriate for assessing the cumulative impacts of 17 deep-injection wells within the Ross Project site and potential expansions, and concluding they are SMALL?
(b) What data are available on the failure rates and historical performance of deep-well waste storage, particularly in industrial activities similar to ISR? Does this data, when incorporated into the Ross Project cumulative impacts analysis over the entire lifecycle, still allow for the conclusion that these effects are SMALL?

Conclusion

As we noted at the outset, rather than comply with well-established NEPA requirements of taking a "hard look" at the environmental impacts of a clearly defined major federal action, the Draft SEIS submits quantitatively baseless set of environmental conclusions (that impacts will be SMALL or MODERATE on a temporary basis) about an arbitrarily truncated segment of a project that is quite obviously the first step in a much larger plan for mining uranium eastern Wyoming. Complete responses to our detailed comments will commence the process of creating a lawful agency record, but rather than attempt to patch the holes of a leaking ship that lacks the coordinates of its ultimate destination, or, in NEPA terms, the actual scope of the major federal action under review, we urge NRC Staff to withdraw the Draft SEIS, as the agency's actions fail to meet the requirements of NEPA, 42 U.S.C. § 4321 *et seq.* Further, we urge NRC to direct the applicant to re-submit an Environmental Report that adequately addresses the full scope, duration, and extent of the all the uranium ISR activities and impacts that it plans to conduct pursuant to the major federal action of receiving an NRC license to begin CPP and wellfield construction and operations.

Sincerely,

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY & LICENSING BOARD

In the Matter of	)	Docket No. 40-9091-MLA
	)	
STRATA ENERGY, INC.,	)	ASLBP No. 12-915-01-MLA-BD01
	)	
(Ross In Situ Recovery Uranium Project)	)	May 6, 2013

NATURAL RESOURCES DEFENSE COUNCIL'S & POWDER RIVER BASIN RESOURCE COUNCIL'S JOINT MOTION TO RESUBMIT CONTENTIONS & ADMIT ONE NEW CONTENTION IN RESPONSE TO STAFF'S SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT STATEMENT

I. INTRODUCTION

Pursuant to 10 C.F.R. § 2.309, and Scheduling Order dated April 12, 2013, Intervenors Natural Resources Defense Council (NRDC) and Powder River Basin Resource Council (PRBRC) hereby move for the admission of updated and amended contentions regarding the Draft Supplemental Environmental Impact Statement (DSEIS) for Strata Energy's proposed Ross Project in-situ leach (ISL)[1] uranium mine issued by Nuclear Regulatory Commission Staff (NRC or the Staff) on March 21, 2013.

NRDC and PRBRC respectfully submit these updates to previously admitted contentions (*i.e.*, Contentions 1-A, 2-A, 3-A, and 4-A), and one new contention. The amended contentions simply assert that the DSEIS fails to address previously-identified inadequacies contained in the applicant's Environmental Report and that NRC Staff failed to adequately address those inadequacies in its DSEIS. The new contention concerns the failure to properly define the major federal action at issue in this DSEIS in light of the now concrete plans and schedule for Strata

[1] In situ leach (ISL) is also referred to as in situ recovery (ISR). For the purposes of this motion, the terms are used synonymously.

Energy's "Lance District Development," and therefore the failure to consider the full scope of the proposed uranium recovery and processing activities at issue.

While recognizing NRC regulations may not require NRDC and PRBRC to resubmit our contentions, we file these resubmitted contentions as all our objections that applied to the ER now apply to the DSEIS. We present them now out of an abundance of caution to preclude any subsequent assertion by the Staff, the Applicant or a reviewing tribunal that Petitioners have not pursued their rights as secured by the U.S. Constitution, the National Environmental Policy Act ("NEPA"), 42 U.S.C. § 4323 *et seq*., or regulations promulgated by the Council on Environmental Quality ("CEQ") or NRC. As to this category of contentions, Petitioners raise them at this juncture in order to preserve these issues for further litigation and to create a complete record. These contentions are denoted with an "A" (i.e., Contention 2-A supplements NRDC-PRBRC-2 with arguments under NEPA).

II. BACKGROUND

A. Procedural Background

On October 27, 2011 and pursuant to 10 C.F.R. § 2.309 and the Nuclear Regulatory Commission's (NRC, or Commission) Federal Register notice published at 76 Fed. Reg. 41,308 (July 13, 2011), Petitioners NRDC and PRBRC submitted a Petition to Intervene and Request for a Hearing in the above-captioned matter. To safeguard their and their members' environmental, aesthetic, health-based and economic interests, Petitioners articulated five contentions in their Petition. These contentions address various deficiencies in Strata Energy, Inc.'s (Strata) source materials license application for the proposed Ross In Situ Recovery (ISR) Uranium Project in Crook County, Wyoming.

Following briefing on standing and the admissibility of each contention, the Atomic Safety & Licensing Board (ASLB, or the Board) conducted a day-long hearing on these matters on December 20, 2011. On February 10, 2012, the Board issued LBP-12-3, "Memorandum and Order, Ruling on Standing and Contention Admissibility." This 53-page opinion held that Petitioners had established standing[2] and admitted two of their five contentions in whole while admitting the remaining three in part. *See* LBP-12-3 at 1–2, 18–25, 28, 32, 36, 37, and 39–40. On February 21, both Strata and NRC Staff (or Appellants) filed appeals of LBP-12-3 and argued Joint Petitioners had not demonstrated standing to challenge Strata's application for a license for an in situ uranium recovery project in Crook County, Wyoming. Strata also asked the Commission to eliminate two contentions from the proceeding, should it decline to reverse the Board's standing determination. NRDC and PRBRC opposed both appeals. On May 11, 2012 the Commissioners issued CLI-12-12 and affirmed the Board's standing determination and declined to consider Strata's remaining claims. *See* CLI-12-12 at 1-2.

On March 21, 2013, Staff issued the Draft Supplemental Environmental Impact Statement for the Ross ISR Project (DSEIS). Comments on the DSEIS are due on May 13, 2013 and amended or new contentions on the DSEIS are due this day. *See* Order of Apr. 12, 2013.

B. Legal Standards

Consistent with provisions in 10 C.F.R. § 2.309(f)(2), a timely new or amended contention must be based on information that previously was unavailable, arise from information that is materially different from previous information, and be filed in a timely fashion. 10 C.F.R.

[2] NRDC's and PRBRC's standing was confirmed in this Board's Order of February 2012 and the Commission's Order of May 2012. See LBP-12-3, "Memorandum and Order, Ruling on Standing and Contention Admissibility" at 1–2, 18–25; and CLI-12-12. As such, pursuant to 10 C.F.R. § 2.309(c)(4), NRDC and PRBRC are not required to address standing in this filing.

§ 2.309(f)(2)(i)-(iii). In addition to Section 2.309(f)(2) or (c)(1)'s standards, a new or amended contention must also satisfy the general contention admissibility requirements of 10 C.F.R. § 2.309(f)(1).

NRC regulations dictate that contentions arising pursuant to the National Environmental Policy Act (NEPA) must initially be "based on the applicant's environmental report [ER]." 10 C.F.R. § 2.309(f)(2). If admitted, those contentions may be amended, or new contentions proffered, as long as "there are data or conclusions in the NRC draft or final environmental impact statement . . . or any supplements relating thereto, that differ significantly from the data or conclusions in the applicant's documents." *Id.* In the April 12, 2013 Order, the Board set a schedule that new or amended contentions that are properly based on significantly new data or conclusions in the DSEIS will be considered timely if filed on or before May 6, 2013. We file one new contention this day and update our existing, admitted contentions to apply to the Staff's DSEIS.

III. CONTENTIONS

Pursuant to 10 C.F.R. § 2.309, Petitioners offer updates to the previously admitted contentions. Each contention challenges the sufficiency of the DSEIS under NRC regulations, as specified therein, as well as its compliance with NEPA.

The law of admissibility for this proceeding is well established. "[I]n passing on the admissibility of a contention. . . 'it is not the function of a licensing board to reach the merits of [the] contention.'" *Sierra Club v. NRC.*, 862 F.2d 222, 226 (9th Cir. 1988) (quoting *Carolina Power and Light Co.*, 23 N.R.C. 525, 541 (1986)). Instead, the Board evaluates the admissibility of contentions in a manner similar to a federal court's review of claims in a well-pled complaint:

> The relevant inquiry is whether the contention adequately notifies the other parties of the issues to be litigated; whether it improperly invokes the hearing process by raising non-justiciable issues, such as the propriety of statutory requirements or agency regulations; and whether it raises issues that are appropriate for litigation in the particular proceeding.

Sierra Club, 862 F.2d at 228 (citing *Tex. Utils. Elec. Co.*, 25 N.R.C. 912, 930 (1987) and *Phila. Elec. Co.*, 8 A.E.C. 13, 20–21 (1974)); *see also* LBP-12-3 at 25 and *Crow Butte Res.,* Nuclear Reg. Rep. P 31589, 2009 WL 1393858 at *11, 14 (May 18, 2009) (holding that the applicant's "arguments go to the merits" and that "[w]hether the [petitioner] has proved its claim is not the issue at the contention pleading stage").

Pursuant to 10 C.F.R. § 2.309(f)(2), Petitioners styled their original NEPA contentions as against the ER. S*ee id.* ("On issues arising under the National Environmental Policy Act, the petitioner shall file contentions based on the applicant's environmental report."). Because an applicant's ER generally serves as the basis for the Commission's eventual DSEIS, Petitioners raised NEPA considerations at that time in order to preserve any objections if flaws found in the ER also appear in the Draft SEIS. And in fact, those flaws have appeared in the DSEIS, and thus today we submit updates to our previously admitted contentions. In addition, the DSEIS reveals a new concern for which we submit a new Contention.

Environmental Contention 1-A: The DSEIS fails to adequately characterize baseline (*i.e.*, original or pre-mining) groundwater quality.

CONTENTION: The DSEIS fails to comply with 10 C.F.R. §§ 51.45, 51.70 and 71, 10 C.F.R. Part 40, Appendix A, and NEPA because it lacks an adequate description of the present baseline (*i.e.*, original or pre-mining) groundwater quality and fails to demonstrate that groundwater samples were collected in a scientifically defensible manner, using proper sampling

methodologies. The DSEIS's departure from NRC guidance serves as additional evidence of these regulatory violations. NRC, NUREG-1569, Standard Review Plan for In Situ Leach Uranium Extraction License Applications, §§ 2.7.1, 2.7.3, 2.7.4 (2003).[3]

A. Bases and Supporting Evidence and the Board's Admission of Contention 1

This contention is supported by the original declarations of Drs. Moran, Sass, and Abitz, particularly Moran Decl. at ¶¶ 36–56, Sass Decl. at ¶¶ 8–15, 22–23, and Abitz Decl. at ¶¶ 15–27. It is further supported by a second declaration from Dr. Abitz filed this day. *See* Second Declaration of Dr. Richard Abitz ("2d Abitz Decl."), ¶¶ 6-23. The declarations explain both that baseline water quality data is necessary to properly evaluate environmental impacts in the SEIS, and that collecting this data later risks allowing the further deterioration of the baseline as a result of activities that may occur in the area in the meantime. *Id.*

Our Petition to Intervene explained the requirements that must be satisfied for the Applicant to adequately consider the environmental impacts associated with groundwater quality, and need not be repeated here. *See* Petition to Intervene at 10-12. However, based on those standards and the deficiencies in the ER the ASLB admitted Contention 1, explaining that the "question framed by this contention – whether NRC regulations and NEPA require a groundwater baseline characterization for an ISR site – is not new to NRC adjudications." LBP-12-3 at 28. In particular, the Board explained that in the *Dewey-Burdock* proceeding the applicant had similarly asserted that it need not collect baseline water quality data prior to licensing, and that Board had rejected the argument. *Id.* at 28-29.

[3] The resubmitted contention is the precise contention admitted by this board in LBP-12-3 on February 10, 2012. The only difference is resubmission with the regulatory cite of 10 CFR §§ 51.70 and 51.71 as they apply to the staff's NEPA responsibilities regarding the DSEIS.

Agreeing with that earlier Board, the ASLB admitted Contention 1, explaining that the applicant and Staff are "*incorrect* in their assertion that 10 C.F.R. § 40.32(e) prohibit[s] the applicant from gathering complete information on baseline water quality." *Id.* at 28 (emphasis added). To the contrary, because the applicable regulations *permit* the collection of such data, and the data is plainly critical to a meaningful analysis of the environmental impacts associated with the project, the Board concluded that this Contention should be admitted. The effect of the Board's conclusion was the admission of the contention and agreement that Joint Petitioners have framed an admissible contention that has a factual dispute, *i.e.*, the adequacy of the baseline water quality description in the ER and whether the applicant must take any additional steps to fulfill its legal responsibility under 10 C.F.R. § 51.45 to provide information in its ER outlining a description of the existing water quality baseline sufficient to enable the staff to prepare its own environmental impact statement. *Id.*

B. The DSEIS's Failure to Resolve Contention 1, Necessitating Contention 1-A

Rather than take the necessary steps to resolve this critical gap in the environmental analysis for the project, in the DSEIS the Staff adopts the review of baseline water quality found in the ER, and adheres to the position previously rejected in this proceeding – *i.e.,* that the baseline water quality assessment can permissibly occur in great measure *after* Strata receives its license.[4] Thus, the DSEIS states that although some minimal and wholly inadequate pre-

[4] In its December 5, 2011 filing, NRC Staff averred that Criterion 5B(5)(a) requires no pre-license characterization of baseline water quality, but offered no support or citation for this claim. NRC Resp. at 16–17. The Staff further argued that NUREG-1569's standards for baseline water quality assessments "are not requirements," and that the "acceptability of programs proposed in applications are instead determined by NRC Staff on a case-by-case basis during the individual licensing review." *Id.* at 17. In sum, both Strata and the Staff argued that the original authorities Petitioners properly cited—10 C.F.R. § 51.45, Criteria 5 and 7, and NUREG-1569—do not require the kind of technical adequacy or sufficiency of detail that Petitioners assert the

licensing baseline values will be collected,[5] only *after* licensing will the necessary groundwater quality data be collected to determine "concentration-based levels that would permit identification of any excursions from the respective wellfields." DSEIS at 2-24, line 14.[6]

Simply put, multiple authorities mandate that an application include an adequate assessment of baseline water quality prior to licensing. 10 C.F.R. § 40.32(e) requires a pre-license evaluation of "any appropriate conditions to protect environmental values," which, in the case of ISL uranium mining, necessarily entails an analysis of existing water quality. Similarly, 10 C.F.R. § 51.45(b) and 71 requires a "description of the environmental effects of the proposed action;" and neither Staff nor Strata can plausibly claim that "the affected environment" does not encompass the groundwater in its current qualitative state. Criterion 5B(5)(a) of 10 C.F.R. Part 40, Appendix A specifies that "the concentration of a hazardous constituent must not exceed . . . [t]he Commission approved background concentration of that constituent in the ground water," a determination that necessitates an initial, adequate characterization of baseline water quality. As

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regulations require with regard to a baseline water quality assessment, Strata Resp. at 45–46, NRC Resp. at 17–19, and attacked the technical conclusions provided by Petitioners' experts. Strata Resp. at 46–47; NRC Resp. at 19–21. The Board rejected these arguments. LBP 12-13, at 28-32.

[5] Our original declarations explained why the baseline data collected for the ER is inadequate. *See* Moran Decl. at ¶¶ 36–56, Sass Decl. at ¶¶ 8–15, 22–23, and Abitz Decl. at ¶¶ 15–27. As explained in our Supplemental Declaration those deficiencies have not been remedied in the DSEIS. 2d Abitz Decl. ¶¶ 6-23.

[6] *See also,* "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). DSEIS, at 2-24, line 41 (emphasis added); *accord id.* at 6-8, line 7 ("The Applicant proposes a ground-water monitoring program to acquire post-licensing, pre-operational data in order to establish the parameters necessary to detect excursions outside the ore zone during active uranium-recovery operation and to observe aquifer-restoration performance as it proceeds").

the *Dewey-Burdock* opinion explains, Criterion 7 of Appendix A requires an applicant to provide "complete baseline data on a milling site and its environs." *Dewey-Burdock*, Docket No. 40-9075-MLA at 64. Finally, NUREG-1569 discusses in several sections the need for "reasonably comprehensive" data shown to have been "collected by acceptable sampling procedures." NUREG-1569 §§ 2.7.3; *accord id.* at §§ 2.7.3, 2.7.4; *see also* 2d Abitz Decl. ¶¶ 6-23.

General NEPA principles also dictate that baseline water quality data be collected *before* NRC makes a final decision on the license, not afterwards, as currently planned. Indeed, the CEQ regulations implementing NEPA's mandates require that where there is information that "is essential to a reasoned choice among alternatives and the overall costs of obtaining it are not exorbitant, *the agency shall include the information in the environmental impact statement*." 40 C.F.R. § 1502.22(a) (emphasis added). Thus, as reviewing courts have explained, "an agency is required to engage in reasonable research *to supply missing information* about negative impacts that a project may produce." *Ocean Mammal Inst. v. Cohen*, No. 98-CV-160, 1998 WL 2017631, at *5 (D. Haw. Mar. 9, 1998) (emphasis added); *see also id.* (federal agencies "have an affirmative duty under NEPA and its implementing regulations to undertake research in order to prepare a comprehensive EIS that federal government officials can use to make a reasoned decision"); *State of Idaho By and Through Idaho Pub. Util. Commn v. ICC*, 35 F.3d 585, 596 (D.C. Cir. 1994) (promise to address potential impacts in the future is "no substitute for an overarching examination of environmental problems at the time the [original] decision is made").

Thus, Contention 1A, the same Contention as admitted Contention 1 but directed against the DSEIS, meets the legal standards described in 10 C.F.R. § 2.309(f)(1). The Board should affirm this updated contention so that Petitioners may argue the merits of their claim that DSEIS lacks an adequate description of the present baseline for groundwater quality.

Environmental Contention 2-A: The DSEIS fails to analyze the environmental impacts that will occur if the applicant cannot restore groundwater to primary or secondary limits.

CONTENTION: The DSEIS fails to meet the requirements of 10 C.F.R. §§ 51.45, 51.70, 51.71 and NEPA because it fails to evaluate the virtual certainty that the applicant will be unable to restore groundwater to primary or secondary limits.[7]

A. Bases and Supporting Evidence, And The Board's Admission of Contention 2.

This admitted contention is supported by the original declarations of Drs. Moran and Abitz, particularly Moran Decl. at ¶¶ 66–67, 70–75 and Abitz Decl. at ¶¶ 28–29.

It is further supported by a second declaration from Dr. Abitz filed this day. 2d Abitz Decl. ¶¶ 24-29. The declarations explain that the applicant and NRC staff have neither substantiated their claim that impacts on groundwater quality will ultimately be small, nor have they provided analysis that demonstrates how they arrive at or even quantify such a determination (*see, e.g.*, DSEIS at 4-37, "[t]he potential impacts of the operation of the Proposed Action to ground-water quality in the confined aquifers above and below the ore zone would, therefore, be SMALL.")).

Our Petition to Intervene explained the legal requirements that must be satisfied for the applicant to adequately address this water quality restoration issue, and need not be repeated here. *See* Petition to Intervene at 16-18. The Board admitted Contention 2, finding that NEPA and NRC implementing regulations require an analysis of "irreversible and irretrievable commitments of resources which would be involved in the proposed action." LBP-12-3 at 33 (internal quotation omitted). In the context of ISR uranium mining, NEPA regulations

[7] The resubmitted contention is the precise contention admitted by this board in LBP-12-3 on February 10, 2012. The only difference is resubmission with the regulatory cites of 10 CFR §§ 51.70 and 51.71 as they apply to the staff's NEPA responsibilities regarding the DSEIS.

necessarily implicate groundwater; thus, the Board rightly observed that "unless the baseline can be restored, there will be an 'irreversible and irretrievable' commitment of a resource the parameters of which must, under NEPA and agency regulations, be outlined in the applicant's ER." *Id.* Grappling with the implications of Contention 2, the Board reasoned that any environmental analysis of the impacts resulting from an "alternative concentration limit" (ACL) would necessitate

> … some determination about what that ACL would be. But, as SEI and the staff assert, given the differences that exist among well fields, it likely cannot be known at this juncture exactly what alternative concentration will be deemed necessary to protect human health and the environment under the nineteen factors of Appendix A, Criterion 5B(6). Joint Petitioners, on the other hand, suggest that the magnitude of the endeavor could be narrowed to a range of possible ACLs based on the historical experience of other ISL/ISR sites. What this essentially calls for is a bounding analysis, something that is not unheard of in the context of NEPA analyses and does not seem untoward in this instance, given the importance of NEPA as a mechanism for providing information regarding the parameters of "irreversible and irretrievable" resource commitments. As such, we do not consider this concern a reason for precluding this contention's admission.

Id. at 34 (citations omitted). Finally, cognizant of the fact that at some distant future date Petitioners might have an opportunity to challenge the sufficiency of a specific, proposed ACL, the Board found "the ability of any interested person to obtain an AEA hearing at that point would not provide the relief Joint Petitioners *should be able to obtain now*, consistent with NEPA, *i.e.*, a public explanation of the impacts of being unable to restore the mined aquifer to primary or secondary baseline and, instead, having to use an ACL, as that alternate limitation might be implemented per a reasonable bounding analysis." *Id.* at 35 (emphasis added).

B. The DSEIS's Failure to Resolve Contention 2, Necessitating Contention 2-A

The DSEIS does not substantially differ from the ER in its treatment of the underlying matters in Contention 2. The restoration process, which relies heavily on the generic analysis of

restoration processes described in the Generic EIS, is described in the DSEIS at 2.1.1.3. The affected environment is described in a manner similar to that in the ER in the DSEIS at 3.5.3 and 3.12.1.

In contrast to this, Drs. Moran and Abitz both provided specific historical and technical evidence demonstrating why Strata is unlikely to achieve primary (baseline water quality) or secondary (EPA-issued safe drinking water levels) restoration standards during decommissioning. *See* Moran Decl. at ¶¶ 66–67, 70–75; Abitz Decl. at ¶¶ 28–29; *see also* 2d Abitz. Decl. ¶¶ 24-29. Neither Strata nor the NRC Staff have provided any evidence suggesting that the Ross Project will not cause significant aquifer degradation, even if Strata complies with an NRC-provided ACL. In short, the starting and finishing lines for measuring the degradation of water quality as a result of the project are not disclosed.[8]

Contention 2A meets the legal standards described in 10 C.F.R. § 2.309(f)(1). The Board should affirm this updated contention so that Petitioners may argue the merits of their claim that Strata's ER and Staff's DSEIS require a bounding analysis and explanation of the environmental impacts that result from the eventual adoption of an ACL rather than primary or secondary groundwater standards.

[8] In reality, ISL mining operations have yet to achieve either primary or secondary groundwater restoration standards, but have thus far always required the Commission (or the relevant Agreement State) to establish an alternative (that is, more lenient) restoration standard. As Petitioners' experts attest, all the available information indicates that the operators of the proposed Strata ISL mining facility will be no more likely to achieve primary or secondary groundwater restoration standards during decommissioning than any of their predecessors, unless the bar is set very low, by employing "pre-operational" Target Restoration Values that are established post-licensing, postdrilling, and post-casing and pressure-testing of each individual wellfield or possibly even each individual "wellfield module" – the DSEIS is unclear on this point.

Environmental Contention 3-A: The DSEIS fails to include adequate hydrological information to demonstrate SEI's ability to contain groundwater fluid migration.

CONTENTION: The DSEIS fails to assess the likelihood and impacts of fluid migration to the adjacent groundwater, as required by 10 C.F.R. §§ 51.45, 51.70, 51.71 and NEPA, and as discussed in NUREG-1569 § 2.7.[9]

A. Bases and Supporting Evidence, and the Board's Admission of Contention 3

This admitted contention is supported by the original declarations of Drs. Moran, Sass, and Abitz, particularly Moran Decl. at ¶¶ 14-31; Sass Decl. ¶¶ 8-15 and 24-26, and Abitz Decl. at ¶¶ 7-15. It is further supported by a second declaration from Dr. Abitz filed this day. 2d Abitz Decl. ¶¶ 30-37. The declarations explain the bases for the Contention that the applicant and NRC staff have failed to demonstrate that Strata can contain fluid migration that may pollute the environment as a result of the project.

Our Petition to Intervene explained the legal requirements that must be satisfied for the applicant to adequately address this fluid migration issue, and need not be repeated here. *See* Petition to Intervene at 19-20. The Board admitted Contention 3, explaining that "[t]he declarations of Drs. Moran, Sass, and Abitz contain detailed discussions regarding boreholes and aquifer isolation in the immediate vicinity of the Ross facility that raise questions about the groundwater hydrology associated with the site as detailed in the SEI application sufficient to establish a material issue of fact." LBP-12-3 at 36.

[9] The resubmitted contention is the precise contention admitted by this board in LBP-12-3 on February 10, 2012. The only difference is resubmission with the regulatory cites of 10 CFR §§ 51.70 and 51.71 as they apply to the staff's NEPA responsibilities regarding the DSEIS.

B. The DSEIS's Failure to Resolve Contention 3, Necessitating Contention 3-A

The DSEIS does not resolve the concern regarding the risk of fluid migration. The DSEIS reveals that the testing done to insure protection against fluid migration *failed* – in fully one-third of the tests conducted, "pumping of the OZ aquifer showed a possible response in the DM aquifer." DSEIS at 4-35, lines 40-41. Moreover, the Applicant claimed that this failure was due to "improperly plugged previous exploration drillholes that have not yet been properly abandoned." *Id.* at lines 42-43.

This is one of the precise concerns raised in the admitted Contention – the risks of fluid migration due to the thousands of drillholes in the area. *See* Pet. to Intervene at 21-22. The information in the DSEIS only serves to heighten that concern, for several reasons. First, while the applicant earlier estimated there were approximately 5,000 of these holes, *see* Moran Decl. ¶ 22, the DSEIS lowers that number to less than 2,000, without explanation as to why more than 3,000 holes apparently are of no concern. Second, while the DSEIS states that the applicant will properly plug *all* these holes, there is no information provided to demonstrate either that the applicant will be able to identify all the holes, or that it will be able to fill them in a manner that insures they do not continue to contribute to fluid migration. 2d Abitz Decl. ¶¶ 30-37.

Moreover, the DSEIS also does not address Petitioners' more fundamental concern that irrespective of these holes, the hydrological connections between the aquifers in the area pose a serious risk of fluid migration. Indeed, while the applicant claims that the failed fluid migration tests are due to exploratory wells that will be plugged, the DSEIS contains no information demonstrating that the failure was not due to the hydrological connectivity that exists irrespective of these wells. *Cf. Center for Biological Diversity v. BLM*, 698 F.3d 1101 (9th Cir.

2012) (rejecting agency's refusal to consider the hydrological connectivity between groundwater and surface water).

The DSEIS attempts to address this concern by asserting that the Applicant will be required to "install a ring of monitoring wells around each wellfield" to "allow monitoring of the SM and DM aquifers as well as the OZ aquifer around their perimeters." DSEIS at 4-36, lines 15-18. However, as with the groundwater quality issue more generally, *see supra* at 7-10, the agency cannot avoid studying vital environmental concerns related to a project by promising to collect data on the matter *later*. *Id (citing State of Idaho,* 35 F.3d at 596 (promise to address potential impacts in the future is "no substitute for an overarching examination of environmental problems at the time the [original] decision is made"). Rather, the data must be collected and included in the DEIS to inform the decision to be made.

Contention 3A meets the legal standards described in 10 C.F.R. § 2.309(f)(1). The Board should affirm this updated contention so that Petitioners may argue the merits of their claim that Strata's ER and Staff's DSEIS fails to adequately address the risks of fluid migration.

Environmental Contention 4/5A-A: The DSEIS fails to adequately assess cumulative impacts of the proposed action and the planned Lance District expansion project.

CONTENTION: The DSEIS violates 10 C.F.R. § 51.45, 51.70, 51.71 and NEPA, and the Council on Environmental Quality's (CEQ) implementing regulations for NEPA because it fails to consider adequately cumulative impacts, including impacts on water quantity, that may result

from the proposed ISL uranium mining operations planned in the Lance District expansion project.[10]

A. Bases and Supporting Evidence, and the Board's Admission of Contention 4/5A.

This admitted contention is supported by the original declaration of Dr. Moran, particularly ¶¶ 7-8, 59-63, 69, 76-78, 96-98. It is further supported by a second declaration from Dr. Abitz filed this day 2d Abitz Decl. ¶¶ 38-43, and by the Declaration of Christopher E. Paine, filed this day as well. The declarations explain the bases for the Contention that the applicant and NRC staff have failed to consider the cumulative effects on the environment, including on groundwater quantity, associated with the full scope of ISL uranium mining anticipated to occur in the foreseeable future in the Lance District.

Our Petition to Intervene explained the legal requirements associated with considering cumulative effects and need not be repeated here. *See* Petition to Intervene at 25, 27-28. The Staff agreed that Petitioners had submitted an admissible contention regarding cumulative impacts associated with groundwater quantity, LBP-12-3 at 38, and the Board admitted that aspect of this Contention, citing the "specific criticisms of SEI's water use and restoration analysis" in the ER, *id.* at 37, which "presents a material dispute with SEI's application that is within the scope of this license proceeding." *Id.* at 38; *see also id.* at 43.

As for other cumulative impacts, the Board also admitted that portion of the original Contention 5 that raised cumulative impacts more generally, rejecting the applicant and Staff's argument that cumulative impacts need not be considered. *Id.* at 40. In particular, the Board

[10] The resubmitted contention is the precise contention admitted by this board in LBP-12-3 on February 10, 2012. The only difference is resubmission with the regulatory cite of 10 CFR §§ 51.70 and 51.71 as it applies to the staff's NEPA responsibilities regarding the DSEIS.

admitted that portion of this Contention concerning the planned expansion of SEI's Lance District ISL program, noting that the ER indicates that "additional facilities would likely operate as satellites of the Ross facility and would utilize the same CCP that SEI proposes to construct for the Ross project." *Id.* at 42. As for the applicant's statement that the expansion poses no greater impacts because the "impacts will be distributed proportionately throughout the region of influence," *id.* at 42, even the Staff – as well as the Board – agreed that the contention was admissible "with regard to the lack of specificity about SEI's planned satellite facilities, and the potential impact resulting from the Ross facility's CPP being used for SEI's additional facilities and possible use of third parties." *Id.* The Board similarly admitted the Contention as to cumulative effects of groundwater quality. *Id.* at 43; *See also* 40 C.F.R. § 1502.22(a) ("If the incomplete information relevant to reasonably foreseeable significant adverse impacts is essential to a reasoned choice among alternatives and the overall costs of obtaining it are not exorbitant, the agency shall include the information in the environmental impact statement."); *see also*, 10 C.F.R. 51.71(d) ("The analysis for all draft environmental impact statements will, to the fullest extent practicable, quantify the various factors considered.").

B. The DSEIS's Failure to Resolve Contention 4/5A, Necessitating Contention 4/5A-

The DEIS does not adequately address cumulative impacts. Although the existence of a broader ISR program is recognized, DSEIS at 5-1-3-50, the impacts of this larger program are not analyzed in a manner that allows a consideration of the on-the-ground impacts associated with various impacted aspects of the environment.

For example, with respect to groundwater quantity – an issue the cumulative effects of which the Board has already admitted into this proceeding – the DSEIS contains *one paragraph* summarily stating that the cumulative impacts will be "SMALL," and that any such effects will

be "essentially restored within 24 years after the issuance of the NRC license to the Applicant." *Id.* at 5-25, line 31. However, there is no meaningful quantitative analysis of the projected cumulative consumptive uses of groundwater from uranium mining and other resources extraction activities that draw on the Lance and Fox Hills aquifers, and no *explanation* provided of how restoration will occur, or what it means to characterize the impacts as "small." 2d Abitz Decl. ¶¶ 38-43.

This is inadequate. An agency may not rely on "conclusory or unsupported suppositions," *McDonnell Douglas Corp. v. U.S. Dep't of the Air Force*, 375 F.3d 1182, 1186-87 (D.C. Cir. 2004), and it is insufficient to simply *assert* that an effect will be resolved at some point in the future. Moreover, courts have frequently rejected agency's use of conclusory labels like "small" and "moderate" to characterize impacts, where the agency does not explain the basis for these labels. *E.g. Greater Yellowstone Coal. v. Kempthorne*, 577 F. Supp. 2d 183, 201 (D.D.C. 2008); *Sierra Club. v. Mainella*, 459 F. Supp. 2d 76, 100-01 (D.D.C. 2006).

The cumulative impacts analysis associated with groundwater quality is similarly lacking. DSEIS at 5-25 to 5-26. For this and other impact areas, the cumulative impacts analysis, like the ER, fails to consider the cumulative impacts associated with the more extensive "Lance District Development" that the DSEIS acknowledges is "scheduled" for the area (*Id* Figure 2.6 at 2-8 and t 5-3 to 5-5.) surrounding the "Ross Project." Thus, while the DSEIS recognizes there are "four satellite areas within the Lance District that the NRC staff identifies as reasonably foreseeable," *id.* at 5-3-5, as in the ER the DSEIS fails to consider the cumulative impacts associated with this much larger project. *See* Declaration of Christopher Paine ("Paine Decl.") ¶¶ 23-56.

New Environmental Contention Number 6: NRC has failed to properly define the scope of the proposed major federal action here, which encompasses a much larger project in the same

geographic area, as revealed in the DSEIS and in documents drafted by Strata's Australian parent company, Peninsula Energy, Ltd.

CONTENTION: The DSEIS violates 10 C.F.R. §§ 51.70 and 71, NEPA, and the Council on Environmental Quality's (CEQ) implementing regulations for NEPA because it fails to consider the environmental impacts of, and appropriate alternatives to, the applicant's actual proposed project, and instead improperly segments the project by framing the Proposed Action under review as only a small part of the Applicant's planned and scheduled In Situ Recovery (ISR) activities in the Lance District.

Basis and Discussion:

NEPA requires that "[p]roposals or parts of proposals which are related to each other closely enough to be, in effect, a single course of action shall be evaluated *in a single impact statement*." 40 C.F.R. §1502.4(a). Proposals meet the standard for a single course of action where they "have similarities that provide a basis for evaluating their environmental consequences together, *such as common timing or geography*." 40 C.F.R. §1508.25(a) (emphasis added). Thus, as the Supreme Court has explained, "when several proposals for . . . actions that will have a cumulative or synergistic environmental impact upon a region are pending concurrently before an agency, their environmental consequences must be considered together" in a single NEPA document. *Kleppe v. Sierra Club*, 427 U.S. 390, 406 (1976).

Here, as has now become evident via a recent review of documents from the Applicant's Australian corporate parent (Peninsula Energy), the "proposed action" over which NRC is conducting this NEPA review is simply one part of a much larger project in the same geographic area. *See* Declaration of Christopher Paine ("Paine Decl.") ¶¶ 23-53. Accordingly, the applicant must prepare an ER, and NEPA review must be completed, on the *entire project*.

In particular, as detailed in the Paine Declaration, in preparing comments on the DSEIS over the past several weeks, Petitioners discovered a series of public statements by Peninsula Energy which reveal the actual scope of the project to be much larger than the scope considered in the DSEIS (and the ER). *Id.* ¶ 23. In these documents Peninsula Energy has repeatedly stated that, contrary to what is analyzed in the ER and DSEIS, it will develop the entire "Lance Project," not just the sub-component called the "Ross Project." *Id.* ¶¶ 23-53.

The declaration summarizes a large number of those documents, but to highlight just a few here, as recently as March, 2013, Peninsula Energy explained that it will develop "the Ross, Kendrick and Barber Production Units feeding a Central Processing Plant with a capacity of 750klbs per annum with the sequential inclusion of the Kendrick and Barber Production Units ramping up over several years to 2.2mlbs per annum steady-state production." Paine Decl. ¶ 34 (*citing* http://www.pel.net.au/images/peninsul---singaefehu.pdf). Indeed, the document makes it clear that the *reason* the applicant has proposed something considerably smaller than its entire proposed project is precisely to avoid a full and complete analysis of the environmental impacts associated with the project as a whole. Thus, the company states:

> All new project area permitting is designed so they are contiguous with the Ross permit area and are deemed amendments to the Ross SML (once issued) rather than standalone applications. *This strategy will significantly reduce the permitting process and timing*.

Id. at 4 (emphasis added). In other words, the company is telling the public, and its shareholders, that *the whole project will be developed*, while it is only analyzing a small portion in the DSEIS. Indeed, the Central Processing Plant (CPP) to be developed under the "Ross Project" may not even constitute an economically viable investment without the revenue assumptions based on exploiting these additional "production units."

This most recent announcement is consistent with a host of statements by Peninsula Energy referring to the development of the much broader "Lance Project." *Id.* ¶¶ 23-53; *see also, e.g., id.* ¶ 35 (discussing production "assumed to be permitted for development at Kendrick and Barber and to follow Ross into production at 12 month intervals feeding the CPP"); *id.* ¶ 23 ("the proposed Ross ISR site . . . forms *a part of the total project area* . . .") (emphasis added).

The DSEIS similarly acknowledges this explicit and broader scope, including:

* the "Ross Amendment," whereby the project is to be expanded to the north and west to increase the operating life of the project by supplying additional yellowcake. DSEIS at 5-3 ("As uranium production from early wellfields within the Ross Project area begins to diminish . . . additional wellfields in the Ross Amendment Area could be brought into production");

* the "Kendrick Satellite Area," which will be contiguous with the Ross Project, and by operating simultaneously will "allow the Applicant to increase its production of yellowcake to approximately 680,000 kg/yr." *Id.;*

* the "Richards Satellite Area," which is contiguous to the Kendrick area, will have "uranium-rich solutions . . . piped to the Rodd Projects' CPP for uranium recovery." *Id.* at 5-5; and

* the "remote IX-only plant" at the "Berber satellite area," whereby "the pregnant, uranium-rich solutions brought to the surface at the Berber satellite area would be treated by IX to yield uranium-loaded resins, which would then be trucked to the Ross Project's CPP for further processing." *Id.*

In light of the actual scope of the project, the applicant must prepare an ER – and then a DSEIS must be prepared – that considers the *entire* major federal action at issue. *E.g. Fund for Animals v. Clark*, 27 F. Supp. 2d 8, 13 (D.D.C. 1998) ("[i]f agency actions are similar in that they share common timing or geography, such actions should also be addressed in the *same environmental document* so as to assess adequately their combined impacts") (emphasis added).

That review must consider the environmental impacts of the entire project. It must also consider reasonable alternatives to that entire project – including, *e.g.*, alternatives whereby something *less* than the entire proposed Lance District ISL mining would occur.[11]

By failing to consider the overall project, the applicant and NRC are unlawfully segmenting the project into smaller parts. *E.g. Thomas v. Peterson*, 753 F.2d 754, 758 (9th Cir. 1985) ("close interdependence" between two aspects of a project warrant review in a single EIS); *Florida Wildlife v. U.S. Army Corps of Engrs.*, 401 F. Supp. 2d 1298, 1318 (S.D. Fla. 2005) (first phase of a project "that was never intended to stand alone" may not be artificially segmented from the larger project that is "conceptualized as an integrated whole, progressing in phases"). Accordingly, the Board should admit this new Contention that the Staff and Applicant have unlawfully segmented this project, and must consider preparing an ER – and then a DSEIS – that considers the *entire* major federal action it intends to undertake in this area.

The Contention Complies With 10 C.F.R. § 2.309

Contention No. 6 complies with 10 C.F.R. § 2.309, which requires Petitioners submitting a new contention to demonstrate that: (a) the information on "which the filing is based was not previously available," (b) the new information is "materially different from the information previously available," and (3) the filing is timely submitted based on "the availability of the subsequent information." 10 C.F.R. § 2.309(c).

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[11] The alternatives analysis that will be required for the entire project distinguishes Contention 6 from Contention 4/5A-A concerning cumulative impacts. Thus, even assuming *arguendo* that the full scope of the environmental impacts associated with the entire project can properly considered as part of a cumulative impacts analysis, restricting the scope of the proposed project would constrain the scope of alternatives to exclude*, inter alia*, developing something less than the entire project.

Here, the applicant and NRC Staff have presented the much smaller Ross Project as the proposed action. It was not until reviewing Peninsula Energy materials, and the DSEIS, in recent weeks that Petitioners came to appreciate that the connection between the Ross Project and the applicant's much broader plans for ISL mining in this same geographic area is sufficiently close to warrant consideration in a single EIS. Paine Decl. ¶¶ 22-56; *see also id.* ¶¶ 4-12 (discussing the smaller scope of the project at issue in this proceeding). Thus, since Contention No. 6 is based on materially different information that was not previously available, the Contention is timely.

CONCLUSION

For the foregoing reasons, the Petitioners have demonstrated that their updated contentions and new contention are admissible, and they are entitled to a hearing on these contentions.

Respectfully submitted,

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Date: May 6, 2013

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

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)

Dated: May 6, 2013

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)	)	

DECLARATION OF CHRISTOPHER E. PAINE ON BEHALF OF THE NATURAL RESOURCES DEFENSE COUNCIL & POWDER RIVER BASIN RESOURCE COUNCIL IN SUPPORT OF CONTENTIONS 4/5A AND 6

I. INTRODUCTION

I, Christopher Paine, declare that the following statements are true and correct to the best of my knowledge.

1. My qualifications and experience relevant to this proceeding are as follows: from August 2007 to March 2013, I held the position of Nuclear Program Director for Petitioner Natural Resources Defense Council (NRDC) and now hold the title of Senior Policy Adviser; from June 1991 to July 2007 I held the position of Senior Policy Analyst in the NRDC Nuclear Program; from February 1987 to May 1991 I was Legislative Assistant for Nuclear Energy and Arms Control to Senator Edward M. Kennedy of Massachusetts. In these positions I have gained a detailed knowledge of the statutory requirements and practical implementation of the Atomic Energy Act (AEA) and National Environmental Policy Act (NEPA). I have participated as a professional staff member in oversight investigations by Committees of the Congress concerning: the proliferative impacts of nuclear technology export licensing; the qualifications of a controversial former NRC Executive Director of Operations (EDO) to serve in a post subject to Senate confirmation; and the use of

fraudulent weld radiographs during construction to document regulatory compliance at a nuclear power plant. I have given declarations in prior and ongoing NRDC litigation challenging the adequacy of NEPA documents prepared by federal agencies, including the NRC, and I have been invited to appear before the Commission three times within the last two years to present NRDC's views on the Commission's regulatory response to the lessons of the Fukushima nuclear accident, and on the way NRC rules frequently function to suppress meaningful public participation in the nuclear licensing process. I am a 1974 graduate of Harvard College.

2. The observations and comments that follow in this declaration are based on my professional experience, on a review of relevant portions of the DSEIS for the Ross ISR Project in Crook County, Wyoming, and Strata's Environmental Report (ER), and on numerous other documents, for which URLs are provided in the text, that contain new and significant information concerning the scope and environmental consequences of the proposed NRC licensing action that was not properly considered in the Applicant's ER and the NRC Staff's DSEIS.

3. This declaration sets forth the historical and factual basis for Petitioners Contention Six that the DSEIS fails to consider the environmental impacts of, and appropriate alternatives to, the applicant's actual proposed project, and instead improperly segments environmental analysis of the project by framing the Proposed Action under review as a small part of the Applicant's planned and scheduled In Situ Recovery (ISR) activities in the Lance District. The declaration also supports the need for the expanded NEPA analysis called for in Petitioners' Contention 4/5A.

4. When the NRC Staff issued a Notice of Intent to prepare the SEIS for the "Ross Uranium Recovery Project" on Nov. 16, 2011, it did not describe a proposed scope for the environmental analysis, and in fact noted the "NRC's Part 51 regulations do not require scoping for SEISs." As a consequence of the Staff's decision not to voluntarily undertake a formal public scoping process for the DSEIS, the task of correctly divining the proper scope for the Proposed Action that would be subjected to detailed environmental analysis in the SEIS became the sole responsibility of the NRC Staff.
5. By the time of the Prehearing Conference on standing and admissible Contentions on December 20, 2011, or at any point in the ensuing months while it was preparing the SEIS, the NRC Staff could have and should have understood, from its own detailed regulatory knowledge of Strata's mining plans, that the scope of the Proposed Action delineated for detailed NEPA analysis in the SEIS no longer fairly reflected the widening scope of Strata's proposed mining scheme, advancing well-field deployment schedules, and stepped-up drilling activities in adjacent areas well beyond the proposed boundaries of the "Ross Project."
6. At any point between issuing the Notice of Intent in November, 2011 and filing the Draft SEIS in March 2012, the Staff could have exercised its inherent discretion and authority, stepped-back, and recognized that the scope of the Proposed Action subjected to detailed environmental analysis in the DSEIS had become too narrow and, with each advancing month, was becoming increasingly susceptible to the charge of being arbitrary and capricious, given the steady stream of ongoing disclosures to financial markets by the (wholly-owned) Applicant's Australian parent company, Peninsula Energy, Ltd., of its plans, schedules, advance preparations and financing to promptly begin ISL mining of

multiple "Lance Projects" – large areas outside the comparatively small "Ross Project" area that is the subject of environmental analysis in the DSEIS.

7. But NRC Staff chose not to notify the Applicant or the public, via a revised Notice of Intent to prepare a SEIS, that the Applicant's swiftly advancing plans for multiple "Lance Projects,"—adjacent to the small "Ross Project" area analyzed in the SEIS and spread over a much larger area with consequently wider environmental impacts—now necessitated a significantly revised scope for the Proposed Action and reasonable alternatives that NEPA requires be subjected to detailed environmental analysis. Instead, the Staff issued a Draft SEIS that fails to encompass the actual scope of ISL mining activities and environmental impacts that would be triggered by issuance of the pending draft license for the "Ross Project."
8. While Petitioners had previously expressed their strong concerns, via Admitted Contentions 4/5A, regarding future mining activities beyond the scope of the Ross Project that could properly be viewed as "reasonably foreseeable" for the purpose of assessing cumulative impacts, as Director of the NRDC Nuclear Program, I, and the other petitioners were not aware, as of the deadline for filing contentions based on the ER in October, 2011, of the immediacy and definitive extent of the Applicant's plans to mine expanded areas contiguous to the "Ross Project" area, attributes that remove them from the domain of "reasonably foreseeable" future actions that must be assessed for their "cumulative impacts," and place them squarely in the domain of the Applicant's "Proposed Action."
9. Based on its statements at hearing, the NRC Staff, as discussed further below, likewise appears to have been unaware at the time of the immediacy and full extent of the Applicant's plans that would be set in motion by the granting of a license for the "Ross

Project The ER as originally filed made oblique and even contradictory references to these future plans. At the Prehearing Conference on December 20, 2011, Attorney for the Petitioners, Geoffrey Fettus, noted their concern with the Applicant's position that "cumulative impacts associated with any potential future Strata satellites will be addressed in the environmental reports associated with each such satellite," and then continued as follows: "Strata's application carves up the potential impacts into pieces, preventing the public and regulators from realistically looking at the long term cumulative impacts." (Prehearing Transcript at 138).

10. However, statements made by NRC Staff during the Prehearing Conference on December 20, 2011 encouraged Petitioners to continue viewing these future plans, in legal terms, as appropriately belonging to the domain of contingent, uncertain, but nonetheless "reasonably foreseeable" future cumulative impacts in the vicinity of the Proposed Action, and not yet sufficiently defined to be part of the Proposed Action itself. In particular, at one point in the proceeding Judge G. Paul Bollwerk (for the Board) was inquiring of the Staff whether any follow-on cumulative impacts of the Ross Project could alone be sufficient to grant standing to Petitioner Pam Viviano, a rancher with two properties in the general vicinity of the Ross Project, but not immediately adjacent to its boundaries as then proposed in the License application:

JUDGE BOLLWERK: "..but just hypothetically, if the next project was going to be right next to her ranch, could she raise it then?....

MS. MARSH (for the NRC Staff): I would say she would need to wait until the opportunity for hearing for the new site came about. *If it were proposed as part of this action* …she could certainly get standing by arguing a harm for that (emphasis added).

JUDGE BOLLWERK: Well, when you say proposed, I mean, here – as the staff has pointed out, I believe, *the applicant has made it clear that they're looking to extend these additional sites on this corridor that they marked out*. All I'm saying is if that corridor went across from her property rather than down to the south, wouldn't she have, at least facially, a pretty good argument?

MS. MARSH: …But we don't – I mean, at this point, *we don't have the details of where any of these –if any of these proposed actions will in fact take place or what the details of those proposed sites might be. We'd be – I mean, we'd really be working at hypotheticals about where these sites might be or when or if they would actually be done.* The staff has said that we believe that the new – an expansion is reasonably foreseeable, but we haven't said that they are definitely going to happen, so we would just be hypothetically arguing about things that might not even happen. *And I don't have anything more*. (12/20/12 Prehearing Transcript, at 43-44) (emphasis added).

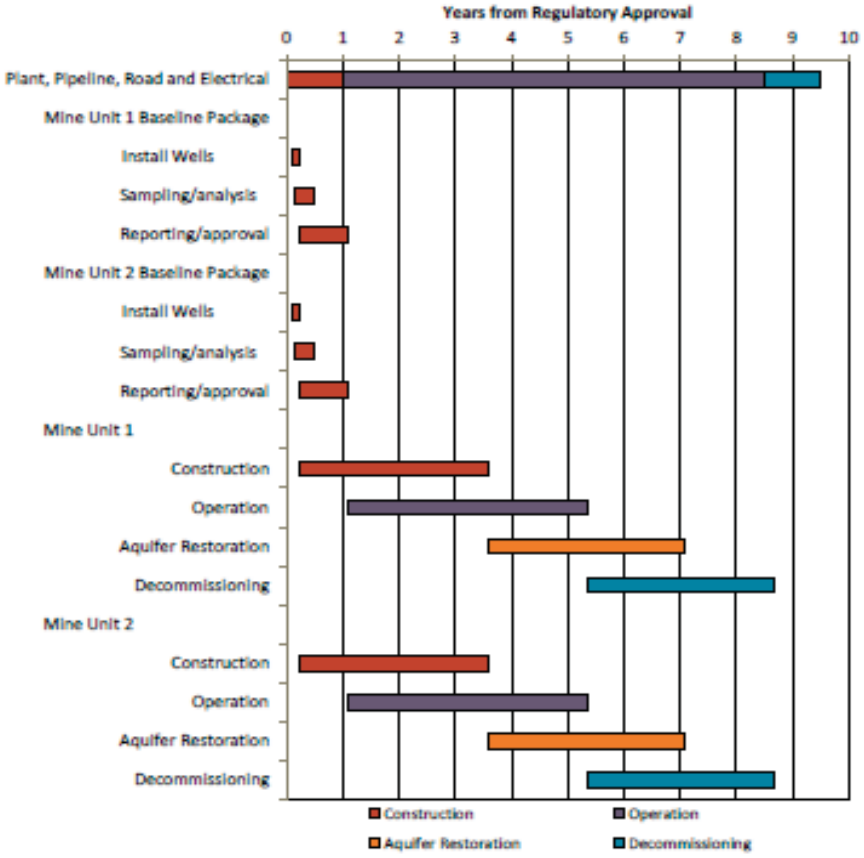
11. I and the other Petitioners likewise relied on the statement by Staff at hearing that "the cumulative impacts coming from future expansion of the ISR in the Lance District" was admissible because "the information doesn't exist in the [license] application…when it comes to the ISR expansion, that information is entirely lacking." Speaking for the Staff, Ms. Marsh stated, "The Staff will get the information from Strata, any other source it needs to, and then we'll do the analysis [in the] SEIS. At that point, if the Staff addresses the contention, that contention will be moot and the petitioners would have to raise another contention." (Prehearing transcript, at 147-48).

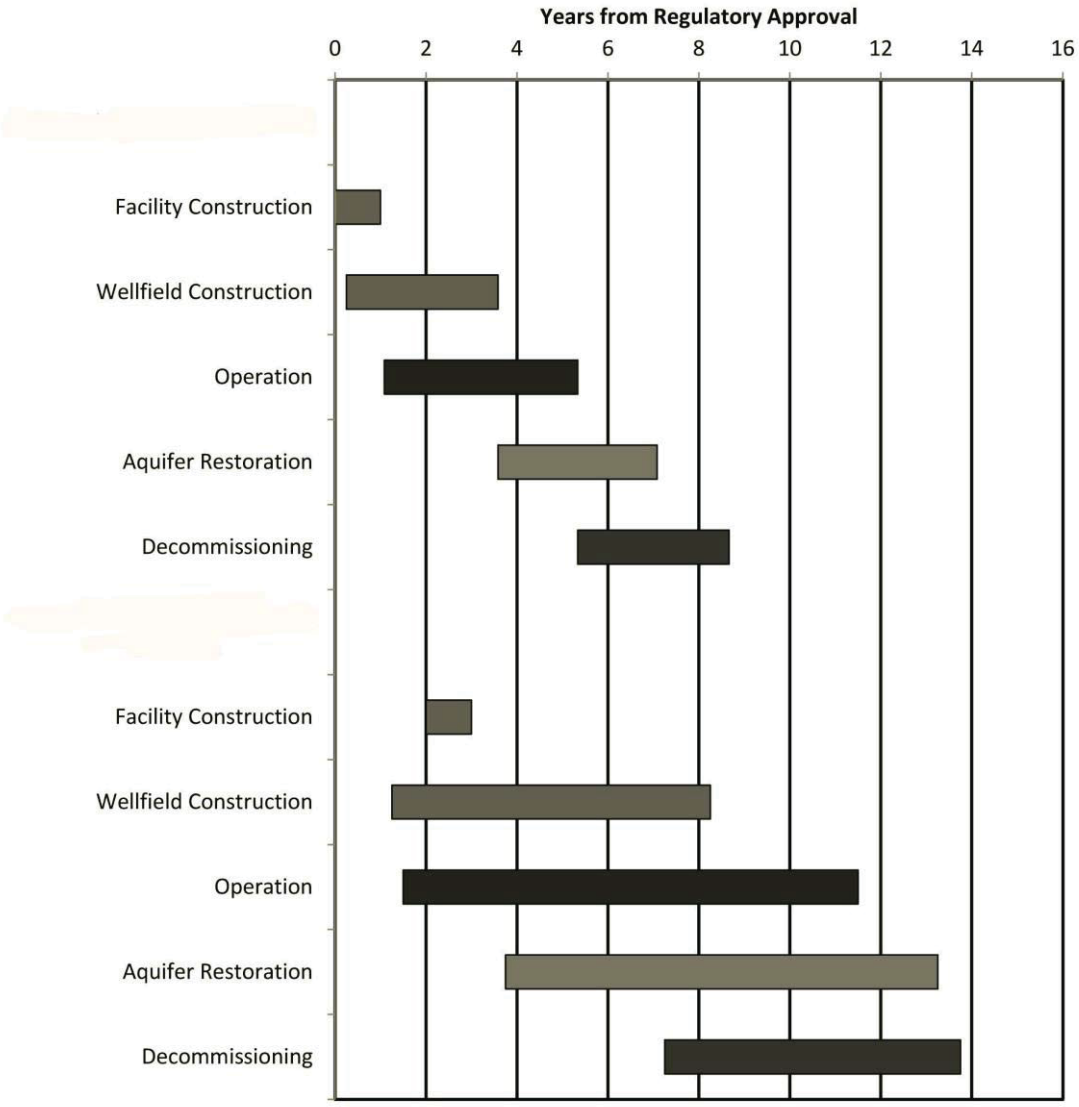
12. Petitioners have taken Ms. March's counsel to heart and have now "raised another contention," Contention 6, based on new information that was not available to them in the

ER, but has since come to light in the SEIS, and to a much greater extent, in other documents generated by the Applicant's Australian parent company, Peninsula Energy, Ltd. that are not referenced in the DSEIS.

13. Below are two Figures, from the ER and DSEIS, respectively, that suggest a significant evolution has occurred in the Applicant's and the NRC's strategy and timing for uranium recovery operations in the Lance District beyond the Ross Project. The first figure below is cited in ER Section 1.3.2 on the "*Ross ISR Project Schedule*," and shows a 9.5 year project. This exact figure is not repeated in the SEIS, but one resembling it appears on SEIS page 2-8, but now carries the title, "Figure 2.6: Schedule for *Potential Lance District Development*," and conveys a timeline of 14 years, 4.5 years longer than the schedule described in the ER (see next page for figure).

Figure 1.3-1. Ross ISR Project Schedule





Source: Strata, 2012a.

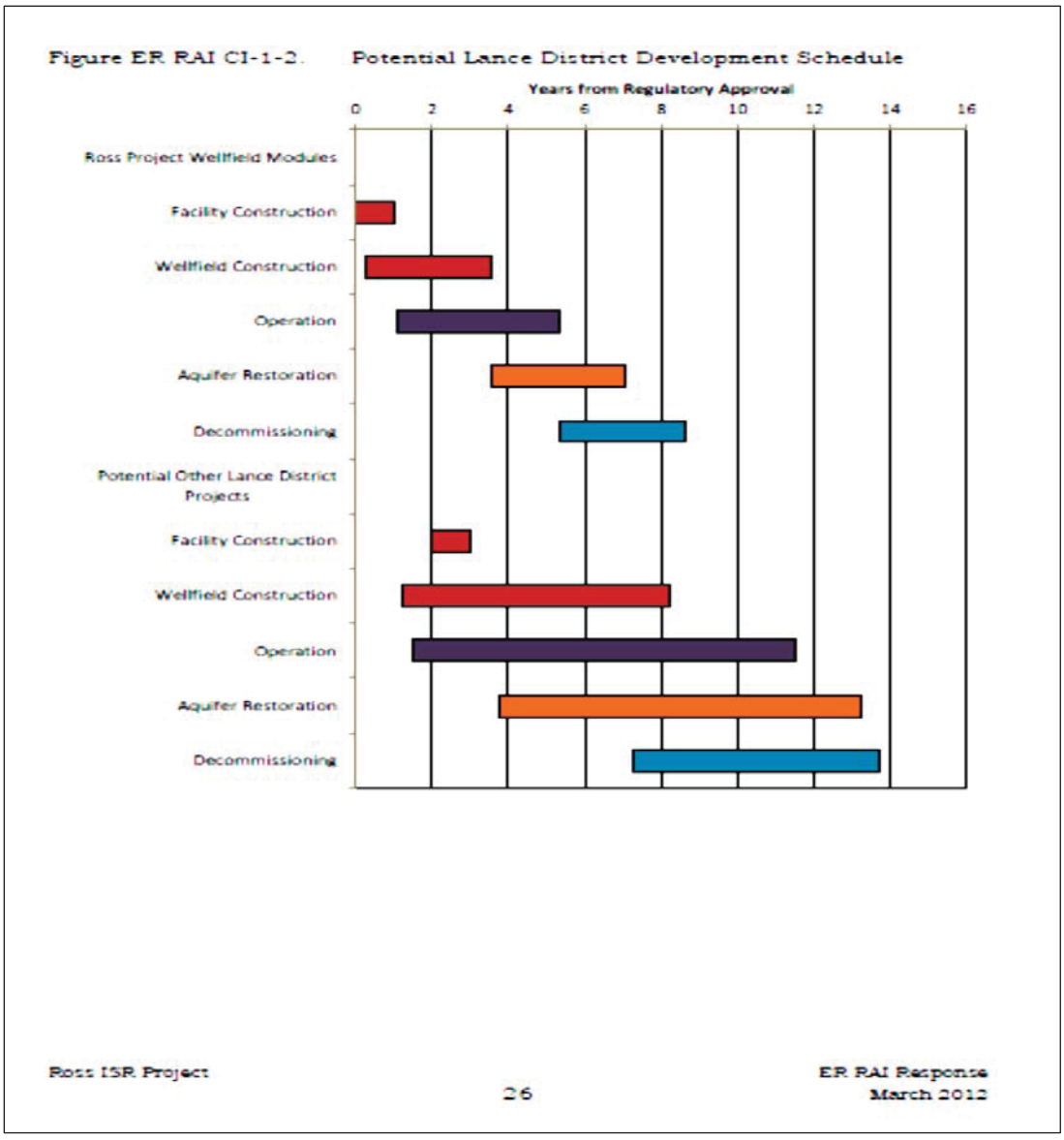
Figure 2.6 [from page 2-4 of SEIS]

Schedule for Potential Lance District Development

14. If one traces the above figure back to its source ("Strata, 2012a" RAI Response), one finds that the NRC Staff has deleted the subheadings "Ross Project Wellfield Modules" and "Potential Other Lance District Projects" that were present on the above chart in the RAI, subheadings that indicate that the Proposed Action *is really to license a single large ISR project via the Ross Project license and subsequent license conditions or amendments*

thereto, in which the various subsequent development "phases" clearly significantly overlap each other in time, and "satellite facility" construction *begins just a year after the first Ross Project well-field goes into operation*, and satellite well-field construction *begins less than a year* after construction of the Ross Project well-fields. Here is the March 2012 RAI Figure:

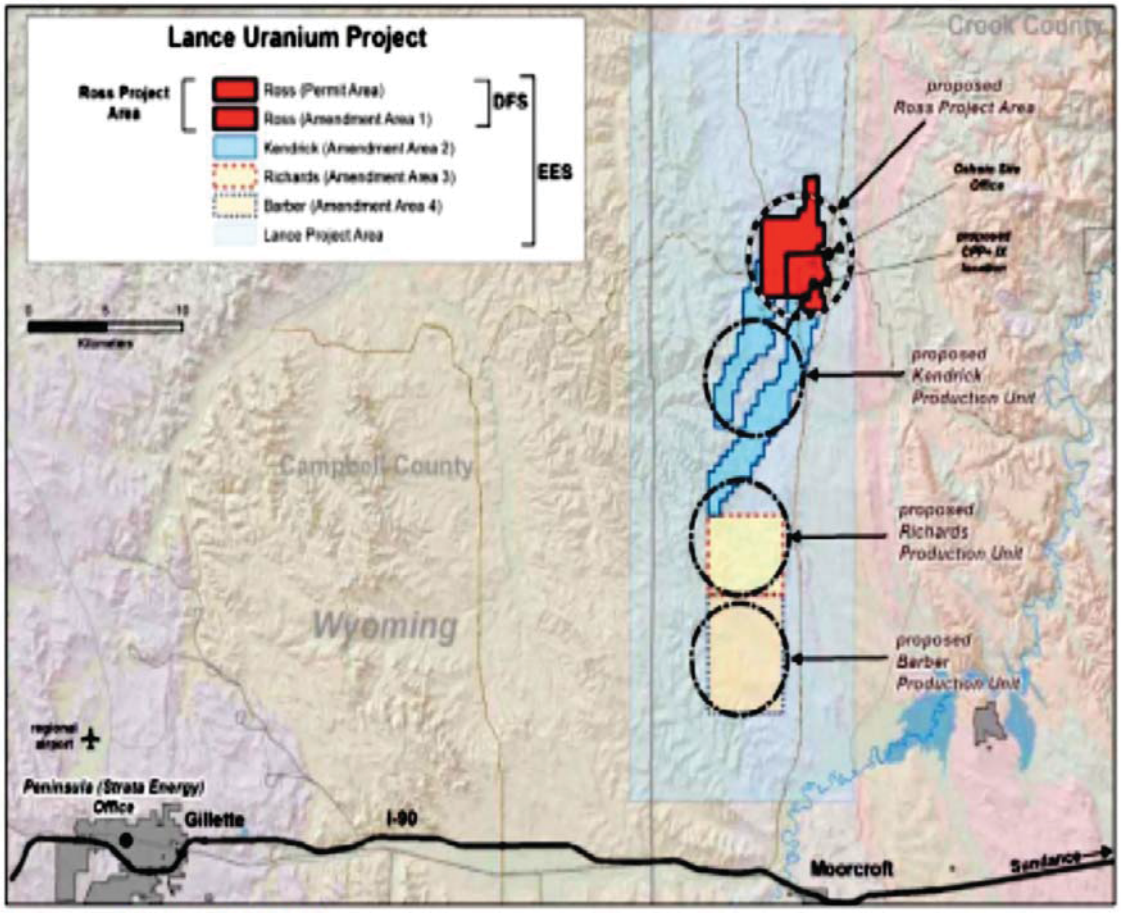
15.



16. Note the NRC Staff's deletions (from the previous chart) of the headings "Ross Project Wellfield Modules" and "Potential Other Lance District Projects" from the above chart provided by Strata. Otherwise it is the same chart.

17. Below is Strata's plan, provided to NRC in the RAI of March 2012, and now reproduced on page 2-4 of the DSEIS, to march through the entire Lance District uranium roll-front deposit over the 14 years following regulatory approval. It reveals that the proposed "Ross Permit Area" subjected to analysis in the ER and DSEIS is but a small fraction of the total area to be mined. It was the NRC Staff's NEPA obligation, not Petitioners', upon receipt of this information to modify the scope of the Proposed Action in the DSEIS to fairly reflect the reality that this expanded sequence of planned "production units" would have much wider environmental impacts, over a more defined timeframe, than previously described in the ER.

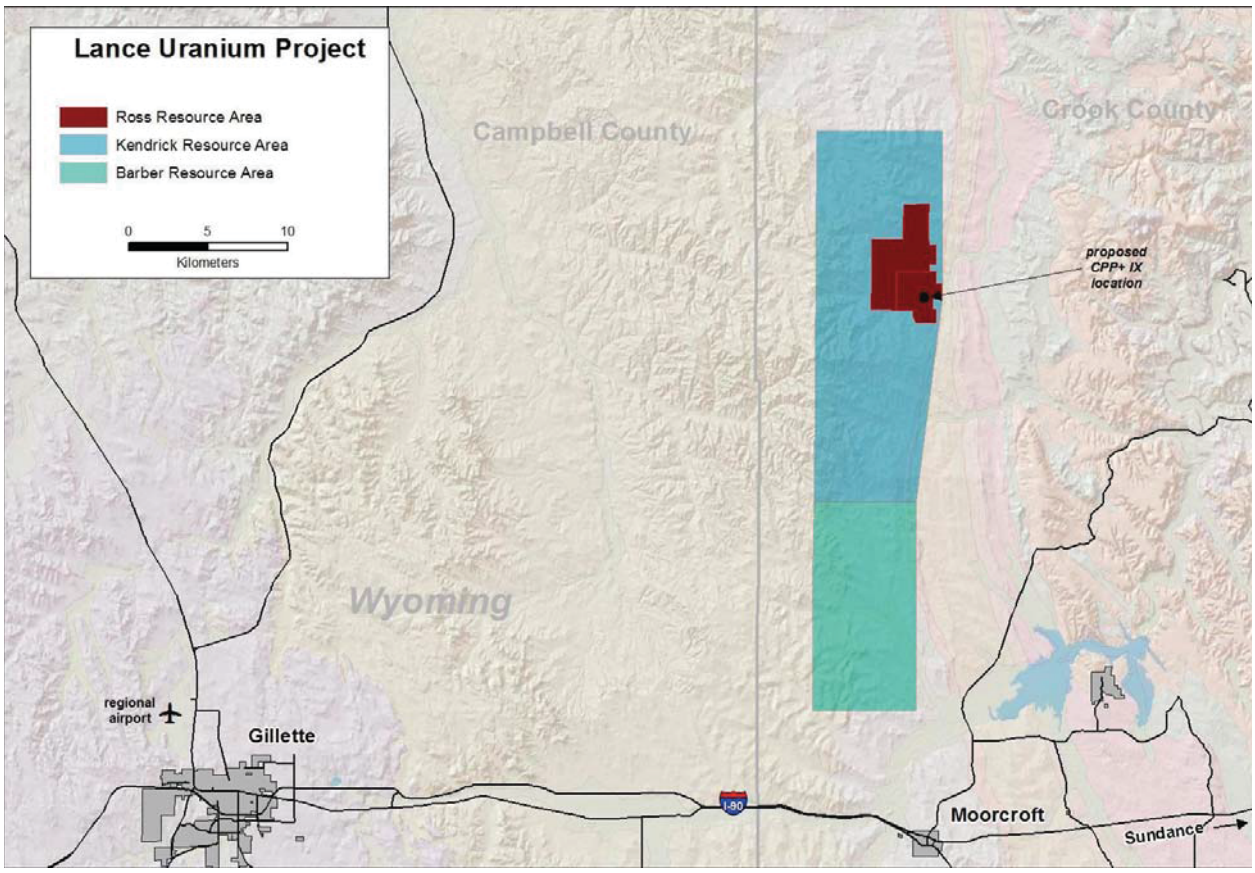
Figure ER RAI CI-1-1. Potential Future Lance District Projects



Source: Peninsula 2011

18.

19. Below is another map (dated 01/23/13) from the Australian corporate parent, Peninsula Energy, which differs from the previous maps in the ER, showing an expanded "Ross Resource Area" within an even larger "Kendrick Resource Area, which is in turn contiguous at its southern boundary with a "Barber Resource Area." This map is *prima facie* evidence that even the basic boundaries within which the environmental impacts of this proposed licensing action will be felt have not yet been defined, much less all the potential environmental impacts adequately considered as required under NEPA.



20. **Figure 1: Resource Area Location Map (Source: Peninsula Energy, January 23, 2013)**

21. Note that the NRC/Strata delineated "Ross Project" is merely a subset of a larger "Ross Resource Area" that is in turn included within an even larger "Kendrick Resource Area" that the company intends to mine more or less simultaneously with what it now calls the "Ross Production Unit," and a further "Berber Resource Area" now abuts the southern boundary of the Kendrick Resource Area and extends far to the south. In other words, *there is no discrete "Ross Project*," and it represents a tiny fraction of the total resource area that the Applicant is planning and preparing to mine. The proposed "Ross Project" license is merely a legal artifice to facilitate the deployment of a much larger ISL mining operation, now called "The Lance Projects," that extends over a much larger area.

22. This view is substantiated by a careful examination, which I conducted in April and early May of 2013, of a collection of company releases and presentations for the period October 2010 through March 2013 that I found via a web search on the website of Strata's Australian parent company, Peninsula Energy, Ltd. (Strata Energy is a 100%-owned U.S. subsidiary of Peninsula). In the paragraphs that follow, I will summarize the relevant highlights of that review:

23. In a release dated 4 January 2011, "Peninsula Completes Major Regulatory Milestone," [http://www.pel.net.au/images/peninsul-19--ayidiesieg.pdf] the company announced that it had submitted an application for an NRC Combined Source and 11e.(2) Byproduct Material License on December 31, 2010, requesting authorization to "construct and operate an in-situ uranium recovery (ISR) facility at Peninsula's Ross ISR Project, located near Oshoto, in north-eastern Wyoming (Ross Project). The proposed facility would consist of wellfields, pipelines, and a central plant to process extracted uranium into yellowcake for commercial use in nuclear power plants." The release noted that, "as previously announced, in October of 2010 the NRC conducted *an unprecedented on-site visit and pre-license application submission review* of Strata's proposed license application to identify any major acceptance or technical/environmental review issues. Feedback from that critical review was then incorporated into the final license application." This release noted that the "proposed Ross ISR site…forms *part of the total project area and the first to be permitted for production*."(emphasis added) This statement is significant as it suggests that NRC staff may have been made aware of the expansive nature of the overall project design even before the inception of the formal licensing process.

24. In a release dated 2 February 2011, "Peninsula Announces 33Mlbs U_3O_8 Resource at Lance," [http://www.pel.net.au/images/peninsul-19--zaayeikeis.pdf] the company stated, "The Directors...are pleased to announce a further upgrade of the JORC-complaint Resource Estimate for the Lance uranium projects in Wyoming, USA (**Lance Projects**)" [boldface in original]. (From this point forward, this is the nomenclature that the company uses to refer to its proposed ISR mining in Wyoming. The proposed "Ross ISR Project" mentioned in prior press release becomes the "Ross Permit Area.") The company also disclosed that "98% of [the] *Ross Permit Area* resource" had been defined to "Indicated or Measured Category," and that "resource conversion and exploration drilling will continue with two rotary mud rigs employed full time in the northern Ross area [i.e. outside the "Ross Permit Area"] and a third rig engaged at Barber to identify additional uranium mineralization in the area and increase the resource inventory at Barber." It also noted, "The Lance project covers an area of over 120km^2 within which there is a combined total of at least 305 line kilometers (190 mile) of known stacked roll fronts," and goes on to discuss the "upgrade" in the "mineralized potential of the *Lance Projects*" (emphasis added).
25. In a release dated 15 February 2011, "Peninsula Signs Uranium Sales Agreement," [http://www.pel.net.au/images/peninsul-19--cheojaozoo.pdf] the company announced, "Long term sale agreement secured for U308 from *Lance Projects*" (emphasis added).
26. In a release dated 24 Feb. 2011, "High Grade Drill Results Continue at Lance," [http://www.pel.net.au/images/peninsul---fooxeiquoo.pdf] the company disclosed that "one drilling rig is currently engaged within the Ross Permit area while a second drilling

rig is dedicated to areas immediately adjacent to the north-west. Within the next quarter, a third drilling rig will also commence drilling at Barber."

27. In a release dated 14 March 2011, "WDEQ Confirms Permit to Mine Application Complete and Adequate," [http://www.pel.net.au/images/peninsul---teewaimith.pdf] the company noted that this was "one of two primary permits necessary to conduct ISR operations at the *initial production center of the Lance Projects* in Wyoming, USA." (emphasis added)
28. In a release dated 4 May 2011, "Nuclear Regulatory Commission has Commenced Formal Safety and Environmental Acceptance Review," [http://www.pel.net.au/images/peninsul---eiyaoxaeko.pdf] Peninsula's Executive Chairman, Mr. Gus Simpson, stated, "The confirmation that the NRC expects to complete its acceptance review ahead of schedule is an example of the efficiencies being achieved *through the pro-active involvement of Strata and the regulatory bodies* during the new streamlined licensing process" (emphasis added). Such "pro-active involvement" of the company with NRC staff early in the licensing process suggests the possibility that the full-scope of the company's plan, pursuant to the proposed license, to swiftly mine expanded areas within the Lance District, may have been communicated to relevant officials within the agency early in the application process, in plenty of time to have informed an appropriate scope for NEPA analysis of the Proposed Action in the DSEIS.
29. In a release dated 16 May 2011, "Ross ISR Permitting Ahead of Schedule," [http://www.pel.net.au/images/peninsul---vaemoocohl.pdf] Peninsula Energy limited said it was "pleased to announce that recent feedback from key US regulatory agencies has confirmed that the Ross In-Situ recovery (ISR) license application continues to advance ahead of schedule." Again, such "feedback from key US regulatory agencies" presented an

opportunity to advise the Company regarding the necessary scope of the NEPA analysis that would be required to adequately consider the environmental impacts of its integrated plan to solution-mine large areas of the Lance District.

30. In release dated 17 June 2011, "Peninsula Announces Major Resource Upgrade and Definitive Feasibility Study Time Frame," [http://www.pel.net.au/images/peninsul---ugeoceotei.pdf]the company disclosed that "resource conversion" drilling – i.e. to convert "inferred resources" to "indicated and measured resources" suitably delineated for expanded ISR mining -- as well as "exploration drilling" would continue "outside the permit area" in the "northern Ross area" and "at Barber." The company included a table in the release showing "Lance Project U_30_8 Resource Estimate by Area and Category," which named three ISR areas targeted for development: "Ross Permit Area," "Ross," and "Barber," with the total resource estimates for "Ross" and "Barber" dwarfing the total for the "Ross Permit Area." The release further states, "one drilling rig is currently dedicated *to the Barber area in order to delineate sufficient mineralization to support the planned remote ion exchange (IX) plant that will provide additional feed to the central processing plant (CCP) [sic] to be located at Ross."* Note that there is nothing conditional or vaguely prospective about this scenario. It is described nearly two years ago as part of the Applicant's definite integrated plan, but this is not how it was presented in the ER.

31. In a release dated 29 June 2011, "Nuclear Regulatory Commission Accepts Application for Detailed Technical and Environmental Review, [http://www.pel.net.au/images/peninsul---iathuchuej.pdf] Peninsula Energy stated, "The Ross Project forms the core of *the greater Lance Project*, with primary mineral processing activities centered in *this initial production area*" (emphasis added). The release again took note of Strata's "strong lines of

communication with the various regulatory bodies," and announced, "The acceptance review was completed in 55 days, well short of the NRC internal guideline of 90 days for such reviews. With this prompt acceptance, the Ross Project continues to move forward on schedule."

32. In a release dated 12 Sept. 2011, "DFS Update and Lance Drilling Program Continues to Identify (sic) High Grade Mineralization," [http://www.pel.net.au/images/peninsul---jeemaefith.pdf] Peninsula Energy noted that its initial Definitive Feasibility Study (DFS) "was focused exclusively on the *Ross Project Area (Ross Permit Area and Ross Amendment Area)*," and that the "preliminary results of the Initial DFS are positive, which is particularly encouraging as *the Ross Project Area covers only a small area and resource base of the larger Lance project*" (emphasis added). In other words, the NRC staff knew, or certainly should have understood by September, 2011, that the "Ross Permit Area" described in the docketed License Application comprised only a part of a larger planned "Ross Project Area" *that already included* an additional "Ross Amendment Area," and that this expanded Ross Project Area in turn covered "only a small area and resource base of the larger Lance project."

33. In a release dated 20th December, 2011, "Resource Upgrade Drilling Intercepts High Grade Mineralization at Lance," [http://www.pel.net.au/images/peninsul---uivahtupie.pdf] Peninsula Energy announced that recent drilling in the wider "Ross Project Area" west of the "Ross Permit Boundary" had "produced thick higher grade intercepts, and the area is now recognized as *a key area for resource expansion given its close proximity to the proposed Central Processing Plant site*" (emphasis added).

34. In a release [http://www.pel.net.au/images/peninsul---singaefehu.pdf] dated 21 December 2011, "Definitive Feasibility and Expanded Economic Studies Confirm the Viability of the Lance ISR Projects," [note closeness in time with Dec. 20th Prehearing] Peninsula Energy disclosed "highlights" of these two studies, including a "planned steady state annual production rate of 2.19 mlbs $U_3 0_8$ per annum *from three production units within three years of start-up*'' (emphasis added). This amount was clearly vastly in excess of the forecast annual production from the "Ross production unit" (aka the "Ross Project") in Strata's license application. This release stated that the Ross Project requires only "the first production unit" with "a capacity of 750,000 lbs per annum," with "production *ramping up over three years* to 2.19 mlbs per annum steady-state production *with the inclusion of the Kendrick and Barber production units*" (emphasis added). The initial 750 klbs $U_3 0_8$ Ross production unit would produce "for a ten year minimum life from…measured and indicated resources contained within the *original Ross project permit application* <u>*and*</u> an area containing furthered measured and indicated [i.e. minable] resources that is *an extension of the Ross permit area*" (emphasis added). Just to make clear, even implementation of the small subset of the Proposed Action that is outlined in the ER and SEIS would require an "extension of the Ross permit area" to achieve the "10 year minimum life" outlined in the company's "Definitive Feasibility Study."

35. Further reinforcing the integrated nature of the actual full-scale ISR proposal under review in the Licensing process, Peninsula stated that its Definitive Feasibility Study was premised on spreading the capital, fixed-operating, and decommissioning costs of the CPP "across multiple production units within Lance…over an extended period of time," and cited the companion "Lance Expanded Economic Study" (EES) as "illustrating" this overall project

financial strategy. In the EES, further production units were "assumed to be *permitted for development at Kendrick and Barber and to follow Ross into production at 12 month intervals feeding the CPP*" (emphasis added). The company noted it was "continuing the drill program at Kendrick and Barber…*to provide the feedstock for the expanded project*…The CPP will house the initial ion exchange (IX) circuit and will see an additional IX circuit installed with the commissioning of *the second production unit planned for Kendrick* located in close proximity to the CPP. Additional IX circuits for remote satellite production units will not be housed at the CPP, but *at locations near the remote production units*. Loaded resins from these facilities will be transported to the CPP for further processing into yellow cake….Prior to the commissioning of the Barber production unit an additional US $8 million capital investment will be required to expand CPP capacity to 2.25 mlbs per annum.

36. Peninsula Energy's December 21, 2011 release [http://www.pel.net.au/images/peninsul---singaefehu.pdf] noted that the purpose of the Lance Expanded Economic Study (Lance EES) "was to demonstrate the Lance projects' continued economic vitality and robustness *over an extended life beyond the Ross production unit*, which is limited to measured and indicated resources of 6.2 mlbs [of] recovered U_3O_8 (emphasis added)." Strata's Australian parent further noted, under the heading "Permitting and Project Development Timeline," that swift WDEQ and NRC acceptance of the completeness of its applications attested to their "quality," and "provided the Company with the basis to submit amendments to bring on further production units in a timely and efficient manner." The following statement contained in the Dec. 21st release is of particular interest: "Following a recent review of the permitting strategy the Company is confident in finalizing permitting. In addition *all new*

project areas are being designed so they are contiguous with the Ross permit area and as such will be deemed to be amendments to the Ross permit (once issued) rather than standalone applications. This *strategy* will significantly reduce the permitting process and timing going forward" (emphasis added).

37. In a release dated 16th January 2012, "NRC Approves Earlier Deep Well Disposal Testing," [http://www.pel.net.au/images/peninsul---aelaoquuhu.pdf] Peninsula Energy announced that the "United States Nuclear Regulatory Commission (NRC) have advised Peninsula's wholly owned subsidiary Strata Energy, Inc. that the development of a deep disposal well [DDW] to test subsurface conditions would be considered exploration and Strata can begin drilling without any further approval. This decision allows the Company to proceed with DDW testing significantly ahead of original schedule and could see flow rates at the upper limits of expectation that would lead to significant capital expenditure reductions at the *Lance Projects* (emphasis added)….The NRC has confirmed that Strata can, upon the issue of the SML [Source Material License] apply to have the test deep disposal well converted for operations." Executive Chairman Gus Simpson added, "Proactive decision-making like this demonstrates the NRC's objective approach to the assessment of proposed ISR developments and its understanding of the value to the Companies of obtaining project development information early."

38. In a release dated 10 February 2012, "Peninsula Acquires Lance Projects Central Processing Site," [http://www.pel.net.au/images/peninsul---fochahoung.pdf] Peninsula Energy Limited announced that it "has acquired 240 acres covering the site of *the proposed Lance Projects Central Processing Plant (CPP)*," still referred to a year later in the DSEIS as the "Ross Project facility" (emphasis added). (DSEIS at 2-1). Again, the statements of

Peninsula Energy betray no uncertainty or ambivalence regarding the scope of its proposed actions.

39. In a release dated 13 February 2012, "NRC License Process," [http://www.pel.net.au/images/peninsul---eisaesheez.pdf] Executive Chairman Gus Simpson stated, "Based on previous license reviews, the grant of standing is a procedural matter and the Company does not anticipate delay to the review process or grant of the SML [Source Materials License]."

40. In a release dated 24 February, 2011 [year is a typo – release makes clear year is 2012], "High Grade Drill Results to Enhance Lance Resource," [http://www.pel.net.au/images/peninsul---fooxeiquoo.pdf] Peninsula Energy disclosed that its drilling along the Kendrick roll front system is consistently producing thick high grade intercepts which *has resulted in its prioritization due to its resource expansion potential and its proximity to the proposed site of the Lance Central Processing Plant*." In a statement with environmental implications, in terms of establishing "baseline" water quality in the "post-licensing" sequential manner described in the ER and the DSEIS, the company disclosed that the these Kendrick roll fronts (K4 and K5) "are located to the east of and adjacent to the K3 roll front trend which is down-gradient from the main roll front within the permit area."

41. In a release dated 27 February 2012, "Property Acquired for Lance Projects Operation," [http://www.pel.net.au/images/peninsul---aihohtheey.pdf] Peninsula Energy announced that it had purchased, through its wholly owned U.S. subsidiary Strata Energy, Inc., an additional 34.5 acres that would "facilitate the expanded exploration and the proposed development of the Lance projects."

42. In a release dated 5 April 2012, "Peninsula Advances Land and Mineral Rights at Lance," [http://www.pel.net.au/images/peninsul---wiwahgaepa.pdf] Peninsula Energy announced that it had "secured significant additional land and mineral rights for exploration and mining at its Lance Uranium Projects in north-eastern Wyoming. Executive Chairman Gus Simpson commented, "The increase in surface and mineral acreage highlights the success of *Strata's strategic land acquisition program*. What is currently held more than supports targeted exploration and production requirements at the Lance Projects." In a lengthy release date 3 May 2012, "Feasibility Study Upgrades Economics at Lance," [http://www.pel.net.au/images/peninsul---ietheichai.pdf] Peninsula Energy Ltd. reiterated many of the conclusions of its 21 December 2011 release (discussed previously above) and stated, "The *Lance ISR uranium projects* are ready to be transitioned to development stage following relevant permitting and project funding factors, which are all well advanced….The Company continues assembling a highly experienced team to successfully transition from explorer to producer and have the financial capacity to *fast track the project implementation* where possible" (emphasis added).

43. In a release dated 15 June 2012, "Spectacular Drill Results Continue at Lance Projects," [http://www.pel.net.au/images/peninsul---daiquoocei.pdf] Peninsula Energy Ltd. stated, "This drilling has been focused on converting inferred resources to the indicated category in *the planned Kendrick Production Unit* located to the west of the *Ross Production Unit*."

44. Dated 25 July 2012, "New Roll Front System Discovered at Lance Projects," [http://www.pel.net.au/images/peninsul---aineevooch.pdf] Peninsula Energy Ltd. graphically displayed the extent of its discoveries in the planned Kendrick Production Unit (see Figure 1 on page 3 of this release). The map shows a large area to the west and

southwest of the "Ross Production Unit" that was targeted because "success in this area could support a second ion exchange (IX) circuit within the central processing plant."

45. In a release dated 15th October 2012, "High Grade Drill Results Continue at Lance Projects," [http://www.pel.net.au/images/peninsul---epongiiphe.pdf] Peninsula announced, 'Strata has suspended resource drilling for several weeks as it complete multiple clusters of aquifer monitoring wells *as part of the Mine Permit extension process*. This process is being undertaken *to include the Kendrick Production unit in the mine planning schedule going forward*." (emphasis added)

46. In a release dated 7 November 2012, "$70 Million Industrial Revenue Bond for Lance Projects Wins Unanimous Crook County Commission Support," [http://www.pel.net.au/images/peninsul---aizuatheok.pdf] Peninsula Energy Ltd. announced that the "$70 million in requested Bonds represents 47% of the $148.1 million required to construct the *Lance Projects Central Processing Plant, CPP expansion, Satellite Ion Exchange Plant*, and *initial* well-field development" (emphasis added).

47. In a release dated 8 November 2012, "Peninsula Receives Draft Source Material License," [http://www.pel.net.au/images/peninsul---aimohgaeto.pdf] Peninsula announced that "issuance of the draft SML in less than two years after application submission reflects *a significantly accelerated schedule over the applications of others in the industry*, which have averaged 3 years or more in receiving draft licenses," and noted, "The draft SML also *confirms regulatory bounding conditions upon which the project economics have been based"* (emphasis added). Since the "project economics" appear to be based on the successful implementation of the wider "Lance Projects" rather than the singular "Ross Project" described in the ER and the DSEIS, this statement supports the view that the

Proposed Action includes a planned regulatory pathway for expansion of the Ross Project to the scale needed to realize the "project economics" of the Applicant's multiple planned "Lance Projects." For the purposes of defining the scope of the Proposed Action to be subjected to NEPA analysis and detailed consideration of reasonable alternatives, such economically-driven expansion along a defined regulatory pathway must be deemed highly likely to occur and therefore clearly within the scope of the Proposed Action.

48. In a release dated 22 November 2012, "Peninsula Receives Permit to Mine," [http://www.pel.net.au/images/peninsul---seraiquaef.pdf] Peninsula stated that "within the coming weeks, Strata will commence allowable construction (pre the SML license) at the Lance Projects, including the development of deep disposal wells, monitoring wells, and CPP site and civil works." Regarding this favorable development, Executive Chairman Gus Simpson stated, "With the issuance of the WDEQ Permit to Mine, the Lance Projects continue to gain momentum toward production. Yet again, the project team and regulatory authorities have achieved a significant project milestone on time and without issue."

49. Regarding the activities and sentiments expressed in the preceding paragraph, while the focus of this declaration is on the factual basis for Contention 6, I cannot help but note in passing that the onset of what appears to be in NEPA terms a premature and potentially irretrievable commitment of resources to not only the "Ross Project" but even multiple "Lance Projects," months before the appearance of even the draft SEIS for public comment, much less a Final EIS and Licensing decision, suggests that there is something seriously amiss with the timing of the NRC Staff's implementation of the NEPA process, resulting in at least the appearance and possibly the reality that the Staff is engaging in prohibited *ex-post facto* NEPA analysis to rationalize decisions already made.

50. In a release dated 23 January 2013, "Lance Projects Resource Estimate Adds 2.5 Million Measured and Indicated Pounds," [http://www.pel.net.au/images/peninsul---ehenoghaox.pdf] Peninsula noted, "The resource delineation and exploration drilling program was suspended at the Lance Projects in October 2012 and the rigs deployed to complete *multiple clusters of aquifer monitoring wells as part of the accelerated Mine Permit amendment process that incorporates the Kendrick Production Unit in the mine planning schedule." (emphasis added)* ….The drilling along the Kendrick roll front system has produced consistent thick high-grade intercepts and has been prioritized due to its resource expansion capacity and its proximity to the proposed site of the *Lance Central Processing Plant* [aka "The Ross Project CPP" in the SWEIS].

51. According to the DSEIS, "Strata's Proposed Action, the Ross Project, would occupy 697 ha [1,721 acres] in the north half of the approximately 90-km^2 Lance District, where the applicant is actively exploring for additional reserves." [DSEIS at xviii]. By contrast, Peninsula Energy, in its January 23rd release cited above, states, "The Lance Project, operated by Peninsula's US subsidiary, Strata Energy Inc., covers an area of over 120 km^2 within which there is a total of at least 305 line kilometers (190 miles) of known stacked [uranium] roll fronts. Of this total, only a small percentage has been explored, with over 90% of the drilling concentrated within the more advanced Ross, Kendrick, and Barber areas." It is regrettable that this far into the NRC's licensing and NEPA process, there remains such basic uncertainty in the public's and apparently even the NRC's knowledge regarding the scheduled, planned, and potential scope of uranium extraction activities that could occur in this region. This situation cries out for a comprehensive definition of the scope and scale of the activities and environmental impacts that could reasonably be

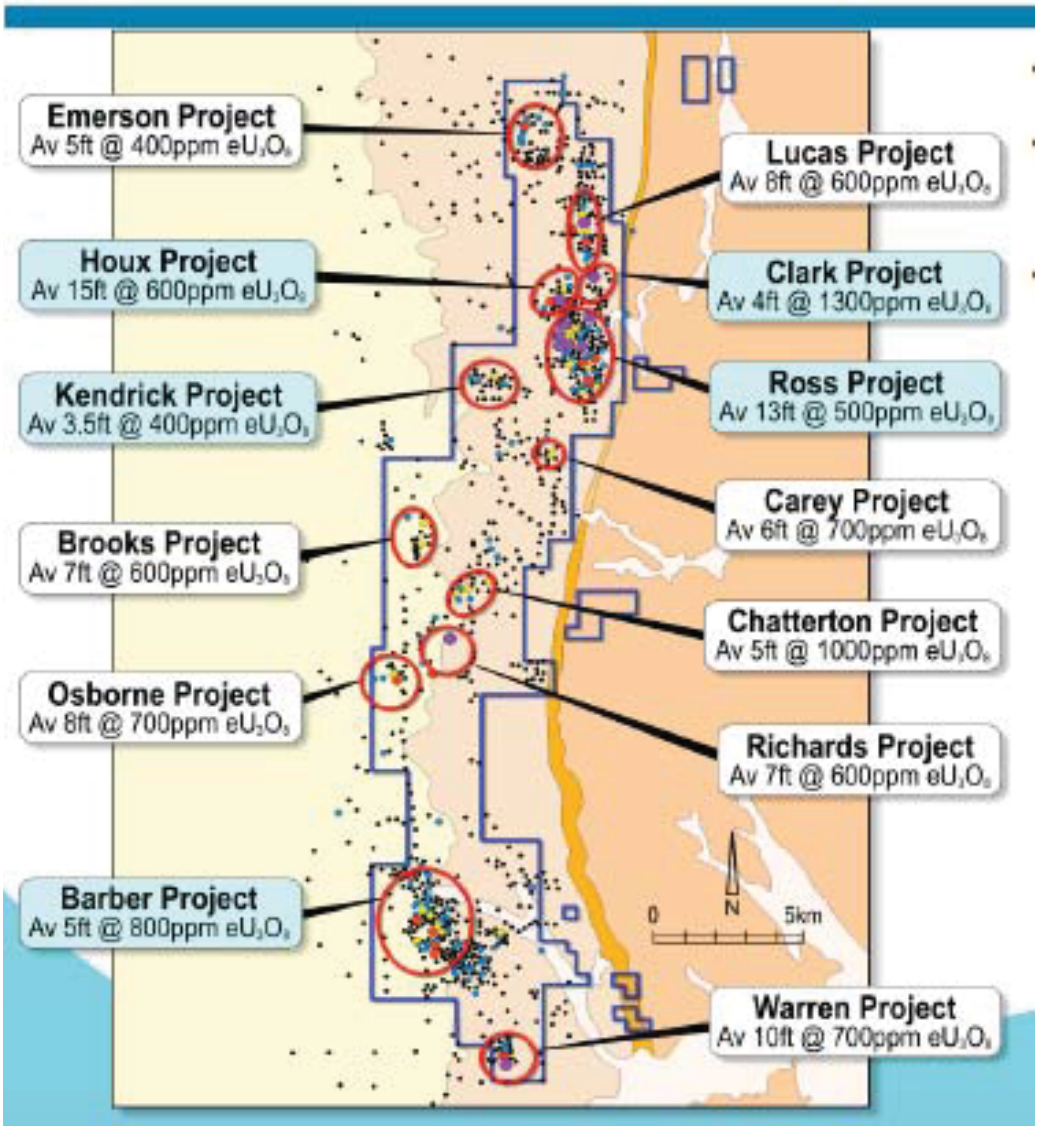
expected to ensue following an affirmative NRC decision to grant a license to Strata to pursue "The Lance Projects," as described in detail in the preceding paragraphs of this declaration.

52. Peninsula Energy Limited's most recent (2013) Company Presentation, [http://www.pel.net.au/images/peninsul---eineebeixe.pdf] states in a slide on its "Business Plan" that it intends to "Commence ISR production at Lance Projects, Wyoming in 2014 building to 2.2 mobs U308 per annum over 3.5 - 4 years (plant capacity 3 mlbs per annum." [It is simultaneously pursuing or seeking to acquire other uranium projects in South Africa and Australia, but intends to "Underpin Balance Sheet with Profit from Lance Projects." The Company sees a large resource potential at the Lance, and foresees "70 + years of mine life." By contrast, the DSEIS is vague on this issue, but the ER shows an operational mine life for the Ross Project of a little more than four years, and the DSEIS envisions a timeframe for cumulative impacts, including decommissioning of only 14 years for "Potential Lance District Development." I do not know where the correct answer lies, but I am quite certain that it is not in the current "Ross Project" DSEIS, which bears little resemblance to the business plans and schedules for expanded mining that Peninsula Energy Ltd., has been disclosing to investors and financial markets for the past 2.5 years.

53. The graphic below from the Peninsula Energy Ltd. March 21 "2013 Company Presentation: Emerging Producer" [http://www.pel.net.au/images/peninsul---eineebeixe.pdf] demonstrates that the "Ross Project" and its environmental impacts represent only a tiny fraction of the impacts that could be experienced as a result of the NRC decision to license a large and expandable "modular" ISR operation that can grow easily through the proliferation of nearby "amendment areas" and "satellite IX facilities." The "Ross Project" is only one of 13 prospective uranium ISR projects that

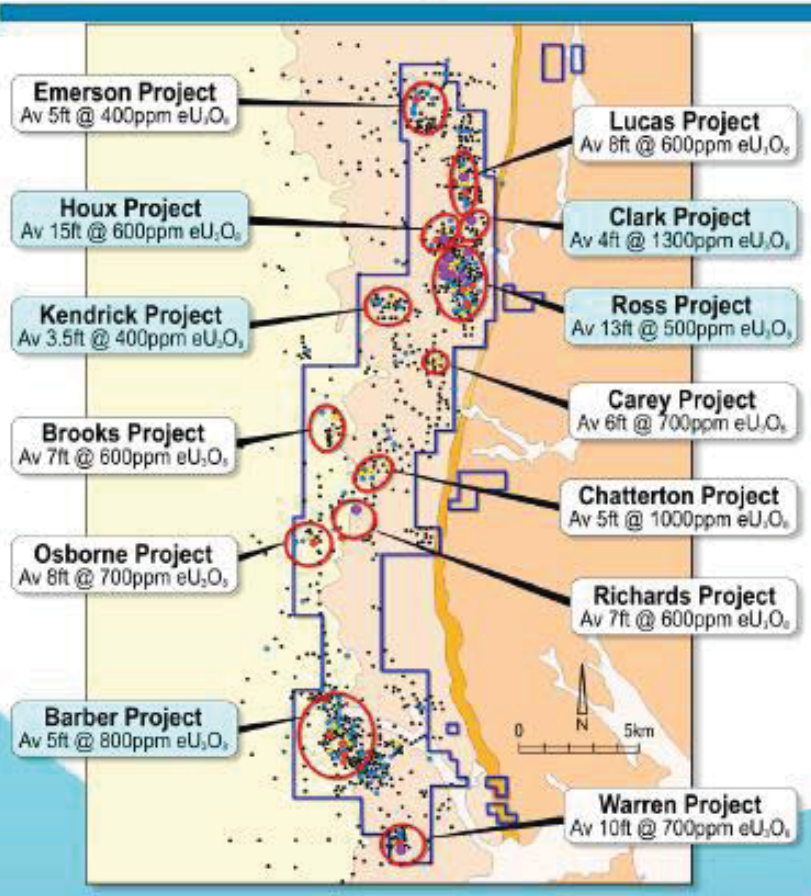
Peninsula Energy Ltd. is planning to develop in the Lance District in the years and decades ahead. This situation demands thoughtful and careful NEPA analysis, beginning with a full statement of the scope of the actions and environmental consequences that could ensue from the granting of the proposed license.

Detail from the March 21 Peninsula Presentation to the "2013 Mines and Money Conference"

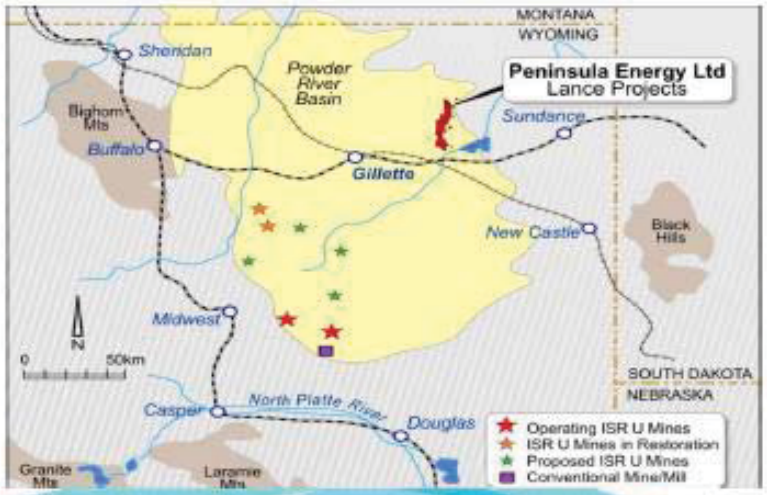


PENINSULA ENERGY LIMITED

Lance – Exploration Potential



- 13 historic resources
- 22 roll fronts extend for a combined linear strike length of 194 miles (312km)
- Exploration potential 158-217mlbs U_3O_8



LARGE RESOURCE POTENTIAL - 70+ YEARS MINE LIFE

23

54. As established by the preceding analysis in this declaration, almost from the beginning, the scope of the Applicant's planned activities has exceeded the public disclosure of them in the ER and now the DSEIS, although there has been greater candor, as I only recently discovered, with the investment community in Australia. At a minimum, the required rescoping of the Proposed Action must include all the additional mining projects in the additional resource areas – the "Ross Amendment Area," "Kendrick Resource Area," and the "Barber Resource Area" – that Peninsula has stated it is planning to exploit in the near term to amortize its investment in the CPP, utilize its full capacity, and make a profit for reinvestment in its uranium business elsewhere, and that could be put into production via an amendment to the initial license for the "Lance Projects Central Processing Plant" and "initial wellfields."

55. Another valid approach might be to assume that entire measured, indicated, and inferred uranium resources, under the control of the Applicant in the Lance District and susceptible to development via this proposed license and "amendments" thereto, *actually get mined*, and then assess the environmental impacts and reasonable alternatives to that level of uranium mining in the region over the predicted 70 year "mine life" projected in Peninsula's March 21st presentation to the "2013 Mines and Money Conference" in Hong Kong.

56. One could imagine an analysis that combined both these approaches, demanding a rigorous analytical approach for estimating the impacts of the planned and scheduled projects described by Peninsula in its numerous releases (and summarized in this declaration), and then flowing from that analysis, using reprensentative parameterized values to calculate the

environmental consequences of more distant future projects, until the resource under Peninsula's control is essentially mined-out.

/s/ (electronic signature)
Christopher E. Paine
Dated: May 6, 2013.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
1595 Wynkoop Street
DENVER, CO 80202-1129
Phone 800-227-8917
http://www.epa.gov/region08

MAY 15 2013

Ref: 8P-W-UIC

Mr. Kevin Frederick
Wyoming Department of Environmental Quality
Water Quality Division
Herschler Building
122 West 25th Street
Cheyenne, Wyoming 82002

Re: Aquifer Exemption Approval:
Strata Energy Corporation
Ross ISR Project
Upper Lance and Lower Fox Hills - Ore Zone Aquifer
Crook County, Wyoming

Dear Mr. Frederick:

The U.S. Environmental Protection Agency Region 8 Water Program office has reviewed your aquifer exemption request dated August 3, 2012, including the public notice and supporting information for the proposed Wyoming Department of Environmental Quality (WDEQ) designation of a limited portion of the Upper Lance and Lower Fox Hills, Crook County, Wyoming, as an exempted aquifer. We are also in receipt of the public comments submitted to the Land Quality Division (LQD) and LQD's response to objections as required by WDEQ's Noncoal In Situ Mining rules, Chapter 11, Section 21(c)(3).

This request is in connection with the Class III Ross In-Situ Recovery (ISR) Project proposed by Strata Energy Corporation (Strata) for their ISR mining activities.

APPROVAL OF PROPOSED AQUIFER EXEMPTION: Based on review of the supporting information provided by the WDEQ, the EPA hereby approves a non-substantial program revision to include exemption of a portion of the Lower Lance and Upper Fox Hills formations. (See 40 CFR §§ 144.7 & 145.32.) The depth and extent of the aquifer exemption is as follows:

> The portions of the Lower Lance and Upper Fox Hills formations identified as the ore zone or OZ aquifer located below the "LC" horizon aquitard and above the Basal Fox Hills lower aquitard, at an approximate depth of 250 to 650 feet below ground surface. It is horizontally described by the monitor well ring plus an additional 100 feet beyond the monitor well ring as shown in Map D12-1 accompanying WDEQ's aquifer exemption request.

Based on our review of the information provided, the EPA concurs with the WDEQ's conclusions concerning the aquifer exemption criteria listed below:

- it does not currently serve as a source of drinking water (40 CFR §146.4(a)), and
- it is mineral producing and can be demonstrated to contain minerals that, considering their quantity and location, are expected to be commercially producible (40 CFR §146.4(b)(1).)

This approval applies to the location and the injection activities described herein. Additional approvals may be required for additional injection activities.

OVERVIEW: The OZ aquifer contains uranium mineralization and is in the production zone at the Ross ISR Project. The OZ aquifer produces sufficient quantity of ground water to supply a public water system and the total dissolved solids ranges from 1,140 to 2,070 mg/L. Currently, there are no known domestic drinking water wells completed into the OZ aquifer within one-fourth (¼) mile of the proposed exemption area. Overlying and underlying confining aquitards have been identified to isolate the injection zone. The overlying "LC" horizon aquitard typically ranges from 20 to 89 feet and averages around 43 feet thick within the mine permit area. The underlying Basal Fox Hills lower aquitard is generally between 10 to 50 feet and averages around 32 feet thick within the mine permit area. During the public comment period which provided notice of the mining permit and exemption of the OZ aquifer, thirteen (13) public comments were received by WDEQ, including a request for a hearing. The requestor of the hearing and Strata negotiated an agreement prior to the hearing date. At the pre-hearing conference call with the Environmental Quality Council (EQC) held on October 8, 2012, all other objectors declined to proceed and provide testimony at the hearing and a hearing was never held. Additionally, the LQD has provided written responses to each individual who provided comments during the public comment period.

Should you have questions or concerns, please contact Wendy Cheung of my staff at (303) 312-6242.

Sincerely,

Derrith R. Watchman-Moore
Assistant Regional Administrator
Office of Partnerships and Regulatory Assistance

cc: Mark Rogaczewski, LQD
Robert Smith, OGWDW

April 14, 2014

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* Uranium Recovery Site)	)	ASLBP No. 12-915-01-MLA
	)	

NRC STAFF RESPONSE TO NATURAL RESOURCES DEFENSE COUNCIL'S AND POWDER RIVER BASIN RESOURCE COUNCIL'S JOINT MOTION TO MIGRATE OR AMEND CONTENTIONS, AND TO ADMIT NEW CONTENTIONS IN RESPONSE TO STAFF'S FINAL SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT STATEMENT

INTRODUCTION

The Staff of the U.S. Nuclear Regulatory Commission (NRC Staff) responds to the Natural Resources Defense Council's (NRDC) and Powder River Basin Resource Council's (PRBRC) (collectively Joint Intervenors or Intervenors) Joint Motion to Migrate or Amend Contentions, and to Admit New Contentions in Response to Staff's Final Supplemental Draft [sic] Environmental Impact Statement (FSEIS). For the reasons set forth below, the Board should dismiss two of the Joint Intervenors' previously admitted contentions and deny the two new contentions challenging the FSEIS.

BACKGROUND

I. The Application

On January 4, 2011, Strata Energy, Inc. (Strata or the Applicant) submitted an application for a combined NRC source and 11e.(2) byproduct material license.[1] As detailed in

[1] Letter from Strata Energy, Inc. Submitting Combined Source and 11e.(2) Byproduct Material License Application Requesting Authorization to Construct and Operate Proposed Ross In Situ Leach Uranium Recovery Project Site (Jan. 4, 2011) (Agencywide Documents Access and Management System

scope of this proceeding,[43] it is not based upon new and significant information that was not previously available to the Intervenors. As the Intervenors aver that Contention 1 is essentially identical to the previously admitted versions of Contention 1, and that the FSEIS is essentially identical to the ER and the DSEIS, *see* Motion at 8-9, 3d Abitz/Larson Decl. at ¶ 5, at these arguments should have been raised earlier in this proceeding.

II. Contention 2 Is Inadmissible as a Migrated or Amended Contention

Environmental Contention 2:

> The FSEIS fails to analyze the environmental impacts that will occur if the applicant cannot restore groundwater to primary or secondary limits. The FSEIS fails to meet the requirements of 10 C.F.R. §§ 51.90-95 and NEPA because it fails to evaluate the virtual certainty that the applicant will be unable to restore groundwater to primary or secondary limits in that the FSEIS does not provide and evaluate information regarding the reasonable range of hazardous constituent concentration values that are likely to be applicable if the applicant is required to implement an Alternative Concentration Limit (ACL) in accordance with 10 C.F.R. Part 40, App. A, Criterion 5B(5)(c).[44]

The Intervenors argue that the Staff has not substantiated its claim in the FSEIS that impacts on ground water quality will ultimately be small, nor has the Staff provided an analysis that demonstrates how it arrives at or quantifies that determination. Motion at 10. The Intervenors claim that the FSEIS fails in the same respect as the DSEIS by neglecting to provide and evaluate information regarding the "reasonable range" of hazardous constituent concentration values referred to in the Board's formulation of the admitted contention. *Id.* at 12. Finally, while acknowledging that "the FSEIS contains some added analysis of other projects," Joint Intervenors argue that this information does not address "the fundamental flaw of the EIS

[43] 10 C.F.R. § 2.335(a); *see also Exelon Gen. Co.* (Limerick Generating Station), LBP-13-1, 75 NRC 57, 63 (2013) ("Generally, NRC regulations may not be challenged in any NRC adjudicatory proceeding.")

[44] As with Contention 1, Joint Intervenors note that the resubmitted contention is the same as Contention 2 as admitted by the Board in its July 26, 2013 order, except with respect to the substitution of a reference to 10 C.F.R. §§ 51.90-95 in place of references to 51.70 and 71. Motion at 10 n.6. The Intervenors rely upon the previously filed declarations of Drs. Moran and the newly filed declaration of Drs. Abitz and Larson. *Id.*

[. . .] that no ISL uranium project has restored *all* constituents to pre-mining baseline conditions and that Strata is likely to repeat that fate here." *Id.* (emphasis in original).

The Board initially admitted Contention 2 on the basis of an underlying assumption that Strata might not be able to restore groundwater to pre-mining baseline quality or to drinking water quality standards, necessitating that the Applicant obtain an alternate concentration limit (ACL). Motion at 10-11.[45] The Board determined that NEPA required "a public explanation of the impacts of being unable to restore the mined aquifer to primary or secondary baseline and, instead, having to use an ACL, as that alternate limitation might be implemented per a reasonable bounding analysis."[46] When the Board migrated Contention 2 to the DSEIS, it found that although the DSEIS did address the environmental impacts that might result should an ACL be necessary for the Ross Project, it did not address the crux of the contention, i.e., since an ACL may realistically be necessary, "within a reasonable range," what is the potential ACL likely to look like and might be the associated impacts.[47] Therefore, the remaining issue admitted as to Contention 2 is the narrow question of whether the Staff provided and evaluated information "regarding the reasonable range of hazardous constituent concentration values that are likely to be applicable if the applicant is required to implement an ACL." Because the FSEIS provides this information and accounts for it in its conclusions regarding the environmental impacts that may occur as a result of the proposed Ross Project, Contention 2 is not eligible for migration to the FSEIS.

In its description of the potential environmental impacts on groundwater resulting from the proposed Ross Project, the FSEIS includes a new discussion of historic approvals of aquifer

[45] *See Strata Energy, Inc.*, LBP-12-3, 75 NRC at 197-98.

[46] *Id.* at 197.

[47] *Strata Energy, Inc.*, LBP-13-10, 75 NRC at 138.

restoration activities by the NRC. Section 4.5.1.3 of the FSEIS describes three facilities[48] that received NRC's approval for aquifer restoration activities and the groundwater quality parameters in those wellfields for which the NRC approved restoration. FSEIS at 4-46. These descriptions are intended to provide examples of hazardous constituent concentration values that the NRC found to be protective of human health and the environment.

In each case, the FSEIS notes that the facility was able to restore the majority of groundwater constituents to either post-licensing, pre-operational baseline values or to an approved secondary value consisting of levels equivalent to either Wyoming's Class I Domestic Use standards or the Environmental Protection Agency's (EPA's) drinking water maximum contaminant levels (MCLs). *Id.* at 4-48. For constituents exceeding the post-licensing, pre-operational baseline values, the FSEIS describes exceedances ranging from 6 to 680 percent above those values. *Id.* at 4-46. As the Joint Intervenors point out, the FSEIS inaccurately characterizes Crow Butte Wellfield 1's final concentration value for uranium as "18 percent above post-licensing, pre-operational concentrations." Motion at 24-25; 3d Abitz/Larson Decl. at ¶ 35. In fact, the final concentration value for uranium was *18 times* the baseline value. *See* Affidavit of Dr. Kathryn Johnson at ¶ 4 ("Johnson Decl.")[49]; Motion at 24-25; 3d Abitz/Larson Decl. at ¶ 35. (Had the drafting error not been committed, the FSEIS would have documented exceedances ranging from approximately 6 to 1800 percent above post-licensing, pre-operational values.) Nevertheless, as the FSEIS notes, the essential matter is that the NRC approved wellfield restoration for all of these facilities based on this range of reported values, including the values corrected by Dr. Johnson in her affidavit, and in so doing found these values to be protective of human health and the environment. *See* FSEIS at 4-46 ("NRC has

[48] The FSEIS notes that a fourth, Cogema Mining Company's Christensen Ranch Mine Units 2-6, has requested approval of restoration from the NRC. FSEIS at 4-46.

[49] The Staff submits Dr. Kathryn Johnson's affidavit as an attachment hereto to respond to the drafting error in the FSEIS and its implications. Dr. Johnson concludes in her affidavit that the error identified by the Intervenors does not affect the Staff's analysis or conclusions in the FSEIS. Johnson Decl. at ¶ 10.

approved aquifer restoration in Crow Butte Wellfield 1 (NRC, 2003c), Smith Ranch-Highland A-Wellfield (NRC, 2004a), and Irigaray Mine Units 1-9 (NRC, 2006).”). Therefore, the historical ranges of concentration values described in the FSEIS, as corrected by Dr. Johnson’s affidavit, provide an idea of what a range of possible ACLs for the Ross Project might look like, and accordingly are representative of the impacts that might result should Strata be unable to restore the Ross wellfields to post-licensing, pre-operational values.[50]

Arguing in the alternative that Contention 2 should be admitted as an amended contention, Joint Intervenors address the new information provided in the FSEIS and conclude that the historical information concerning ISR restoration efforts are not indicative of successful restoration. 3d Abitz/Larson Decl. at ¶ 34. The Intervenors contend that the NRC Staff’s conclusions at the time of restoration approval for these facilities was flawed, arguing, for example, that the NRC did not provide risk or dose calculations to support their conclusion, in 2003, that restoration values in Crow Butte Wellfield 1 were protective of human health and the environment. *Id.* at ¶ 35. They assert that the Staff’s FSEIS should have gone further, by discussing post-restoration constituent concentrations for Smith Ranch-Highland Wellfield-A and an analysis of pore volume numbers for Irigaray Mine Units 1-9. *Id.* at ¶ 36, ¶ 45. They also appear to argue that the methodology used to establish the restoration values for Irigaray Mine Units 1-9 was deceptive or flawed. *Id.* at ¶¶ 37-40. The Intervenors state that these circumstances support their contention that the Staff has not “addressed the almost certain impact to groundwater resources when alternative concentration limits are set after restoration fails.” 3d Abitz/Larson Decl. at ¶ 41.

[50] *See Strata Energy, Inc.*, LBP-12-3, 75 NRC at 197 (“Joint Petitioners . . . suggest that the magnitude of the endeavor could be narrowed to a range of possible ACLs based on the historical experience of other ISL/ISR sites.”).

As the Commission has stated, "NEPA does not call for certainty or precision, but an *estimate* of anticipated (not unduly speculative) impacts;"[51] "while there will always be more data that could be gathered, agencies must have some discretion to draw the line and move forward with decisionmaking."[52] To attempt to satisfy the Intervenors' demands for even more analysis, even to the point of questioning the NRC's prior technical assessments supporting the agency's approval of restoration for these sites, would go far beyond what NEPA and the Board has required. As requested by the Intervenors, the Staff provided and analyzed information on a range of hazardous constituent concentration values presented by historic ISR projects at the time of restoration approval. As a result of the Staff's review of this information, the FSEIS is able to conclude that most of those constituents were returned to concentrations below either post-licensing, pre-operational concentrations or Class I Domestic Use standards. For the few constituents that exceeded these standards, the concentrations did not change the class of use and did not represent a potential impact to the groundwater outside the aquifer-exemption boundary. FSEIS at 4-48.

The FSEIS analyzes the potential impacts to groundwater quality in the ore zone and surrounding aquifers from ISR operations. FSEIS at 4-37. The FSEIS states that a licensee would be required by its WDEQ Permit to Mine and by its source and byproduct materials license to conduct aquifer-restoration activities to restore the ore zone aquifer to post-licensing, pre-operational conditions, if possible. If the aquifer could not be returned to that condition, the NRC would require that the aquifer meet EPA MCLs as provided in 10 C.F.R. Part 40, Appendix A, *or ACLs as approved by the NRC*. The FSEIS concludes that, *for these reasons*, the potential impacts to water quality of the exempted aquifer as a result of ISR operations is expected to be "SMALL" and temporary. *Id.* Once again, for the purposes of determining the

[51] *Louisiana Energy Services*, CLI-05-20, 62 NRC at 536 (emphasis in original).

[52] *Entergy Nuclear Generation Co. and Entergy Nuclear Operations, Inc.* (Pilgrim Nuclear Power Station), CLI-10-11, 71 NRC 287, 315 (2010).

potential effects of the Ross Project, the Staff *assumed* that Strata will be unable to restore groundwater to primary or secondary limits, and concluded that such impacts would nevertheless be "SMALL." *Id.* Therefore, because the FSEIS accounts for this possibility and in addition describes, based upon historical experience, what the range of hazardous constituent values for a Ross Project ACL may look like, the Staff's FSEIS resolves the matter that the Board considered to be the crux of the concern engendered in Contention 2.

The remainder of the arguments made by Joint Intervenors are not material to, or within the scope of, the issues presented by Contention 2. As noted above, the Intervenors' contention is *premised on the assumption that an ACL would be required*.[53] Furthermore, as noted previously, the Board has limited the scope of Contention 2 to the narrow question of whether the Staff has described and analyzed a reasonable range of hazards constituent concentration values that are likely to be applicable should the Applicant require an ACL.[54] Therefore, the arguments in the Motion and the 3d Abitz/Larson Declaration concerning the Applicant's proposed restoration process, restoration timeframe, aquifer restoration criteria, aquifer restoration techniques, and the likelihood that Strata will fail to restore ISL-contaminated groundwater to baseline values and will instead require an ACL, do not amount to support for a genuine dispute with the FSEIS's finding that water quality impacts would be SMALL even with an ACL.

In addition, Joint Intervenors' claim that "[n]either Strata nor the NRC Staff have provided any evidence suggesting that the Ross Project will not cause significant aquifer degradation, even if Strata complies with an NRC-provided ACL," Motion at 25, is not properly within the scope of the admitted contention. In admitting Contention 2 against the ER, the Board expressly stated that "[Contention 2] is not a vehicle for Joint Petitioners to seek to establish that

[53] *See Strata Energy, Inc.*, LBP-12-3, 75 NRC at 197.

[54] *See Strata Energy, Inc.*, LBP-13-10, 75 NRC at 137-38.

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)	)	

Pre-Filed Testimony of Dr. Lance Larson on
Contentions 2 and 3

Table of Contents

Expert Witness Background Information

Q. 1. Please state your name, position and employer, including duration of employment.

A. 1. Dr. Lance Larson, Science Fellow, Natural Resources Defense Council. I started with the NRDC Science Center in January 2014 and am located in the Washington D.C. office. I work with the Land and Wildlife, Energy, and Water programs to protect U.S. groundwater resources.

Q. 2. Please state your education, professional registration and memberships.

A. 2. I earned a dual doctorate in environmental engineering and biogeochemistry from the Pennsylvania State University (2013). My graduate research focused on modeling acid mine drainage, arsenic and uranium fate and transport, and biogeochemical interactions between surface and groundwater. I've presented research at scientific conferences in the United States and internationally, and published multiple peer-reviewed research articles regarding interactions of redox-sensitive elements, such as iron, arsenic, and uranium. For example, in 2012 I published a peer-reviewed article on surface and pore-water interactions associated with arsenic and uranium transport in northwestern South Dakota, and in 2011 I published another peer-reviewed article on sediment-bound arsenic and uranium within reservoir sediments in North Dakota. My full resume is attached at JTI004.

Q. 3. Have you worked on *in-situ* Leach (ISL) matters prior to arriving at NRDC?

A. 3. Yes. While finishing my undergraduate degree, I worked a summer internship with RESPEC consulting in Rapid City, SD, which supported surface water hydrology and well log characterization of various geological units associated with Powertech/Azarga's proposed ISL mine near Dewey-Burdock, SD.

Q. 4. What, briefly, have you worked on since you have been at NRDC? How many of these projects have involved groundwater characterization and analysis?

A. 4. My time at the NRDC has been spent working on analyzing historical environmental impacts of ISL mines across the United States, examining the current scientific literature concerning uranium transport and sequestration mechanisms, and reviewing the NEPA documents associated with the Ross ISL project. My other projects with the NRDC are associated with researching the current state of regional groundwater supplies in the United States.

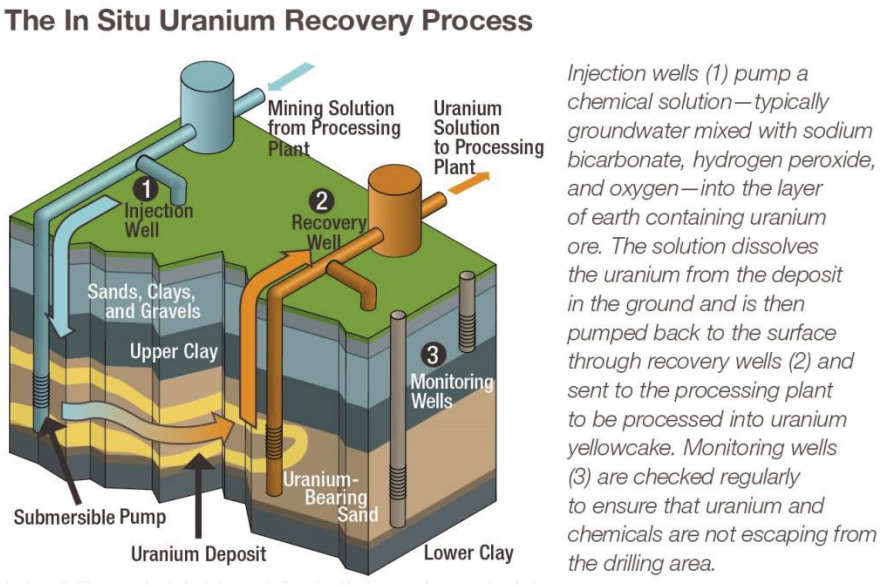
General Background Information Regarding ISL Extraction

Q. 5. Dr. Larson – please describe the ISL uranium recovery process in basic terms.

A. 5. A uranium recovery process has emerged within the last 40 years, termed *in-situ* ("in place") leach (ISL) or *in-situ* recovery (ISR) uranium extraction. This process involves injecting an oxidizing solution into a groundwater aquifer containing naturally occurring uranium ore. The solution dissolves the uranium minerals and the 'pregnant' solution is pumped to the surface, where the uranium is subsequently processed and shipped offsite. The process exploits the redox (oxidation-reduction) characteristics of uranium. This "redox" characteristic matters for the following reason. In the ore body, uranium exists as U^{4+} is a solid, as the mineral uraninite ($UO_2(s)$), formed by natural conditions over geologic time frames. The injection of a lixiviant solution oxidizes the naturally occurring uraninite ore, creating the U^{6+} oxidation state, which is substantially more soluble.

Q. 6. Dr. Larson I would like to draw your attention to the following figure. What is this?

A. 6. This is a figure taken from the NRC's website on ISL recovery provides a basic graphical representation of the ISL recovery process (http://www.nrc.gov/materials/uranium-recovery/extraction-methods/isl-recovery-facilities.html).



SCHEMATIC FIGURE OF GENERAL IN SITU RECOVERY PROCESS.

Q. 7. Please explain the basics of an underground aquifer.

A. 7. An aquifer is a geological unit which is capable of storing and transmitting significant amounts of water. Aquifers are divided into two broad categories, unconfined and confined. An

unconfined aquifer is a shallow aquifer that is 'open' to atmospheric conditions. That is, it is not vertically constrained by an overlying confining unit. An unconfined aquifer's water-level is termed the *water table,* which represents the boundary between the saturated and unsaturated zone. A confined aquifer is overlain by an impervious confining geological unit, *aquiclude* or *aquitard*, which limits vertical transmission of water.

The *potentiometric surface* is the water-level surface for a confined aquifer that is due to the both the elevation and pressure head. When the potentiometric surface exceeds the land elevation, an artesian well or spring will be observed. Internal solid matrix stress and expansion of groundwater in the pore spaces account for the pressure head. Groundwater flows from high-to-low head potential similar to surface water flowing from high to low elevation, due to friction losses within the geological units and reflected with relatively lower potentiometric surfaces.

Q. 8. Have you reviewed the applicant's Environmental Report, DSEIS, FSEIS, and all the associated documentation with the Ross Project?

A. 8. Yes, I have extensively reviewed the applicant's Environmental Report (ER), the Draft Supplemental Environmental Impact Statement (DSEIS) for the Ross Project, the Final Supplemental EIS (FSEIS), and a host of other associated and relevant documents (SEI009A, SEI016A-E). All documents I reviewed are noted and referenced in this Direct Testimony. A complete list can be found at the conclusion of this Direct Testimony and in our referenced exhibits. My conclusions are my own professional opinions and are based upon my review of the relevant documents and my education and experience in such matters.

Contention 2 – The FSEIS fails to analyze the environmental impacts that will occur if the applicant cannot restore groundwater to primary of secondary limits

Q. 9. In your expert opinion, has Strata or NRC Staff analyzed the environmental impacts to groundwater that are likely to exist post-restoration, including what will occur if the applicant cannot restore groundwater to primary of secondary limits, either in the ER, the DSEIS or the FSEIS?

A. 9. No, and I will explain in detail in the pages that follow.

Proposed Aquifer Restoration

Q. 10. Dr. Larson, please explain what it means to "restore" an ISL mining site.

A. 10. According to the FSEIS (SEI009A at p. 2-35), the groundwater restoration at the site will follow the progression

1) Groundwater sweep
2) Reverse osmosis (RO) permeate injection
3) Recirculation
4) Chemical treatment
5) Stability monitoring

Groundwater sweep (1) involves collective recovery pumping in the wellfield to capture elevated constituents in ISL impacted water. Following groundwater sweep, RO permeate injection (2) occurs as a 'pump-and-treat' method where recovered groundwater is treated using RO and the permeate is re-injected into the wellfield. After RO permeate injection, 'hot spots' (where uranium concentrations remain elevated) are focused using recirculation (3), which aims to homogenize elevated groundwater concentrations through dilution. Recirculation is similar RO permeate injection, except the recovered groundwater is not

treated with RO. In certain instances, chemical injection treatment (4), typically hydrogen sulfide gas or NaS, is injected in an attempt to reduce groundwater concentrations further. Upon completion of the restoration phase, 12 months of stability monitoring (5) is required to confirm that wellfield water quality concentrations are stable and water quality parameters of concern are not migrating beyond the permit boundary. The costs of groundwater restoration at ISL sites are significant, typically 40% of the entire project budget (JTI029; p 55 in pdf, p 48 in document).

Q. 11. Now that we have established the concept of what restoration is and how it's supposed to work, how well have restoration efforts worked in the ISL uranium mining industry?

A.11. I have reviewed extensive empirical data and results, published by industry, academia, or regulators on this issue, and these data uniformly suggest groundwater restoration to pre-mining baseline levels for uranium concentrations has been overwhelmingly unsuccessful (JTI030; p.16). I will address the issue of what specific instances of ISL restoration look like several times in the testimony that follows.

NRC Staff/FSEIS Characterization of Aquifer Restorations

Q. 12. NRC Staff included in the FSEIS (SEI009A at 4-46) a discussion of three historical aquifer restoration activities that received NRC approval, including examples of hazardous constituent concentration values that the agency found protective of human health and the environment. The FSEIS relies on these examples to conclude that the impacts of the Ross Project on groundwater quality will be "small," FSEIS at 4-45 to 4-48, and Staff, in their April 14, 2014 Answer to Intervenors' FSEIS Contentions, defended against Joint Intervenors' FSEIS contention on this issue by asserting these examples provide "an idea of what a range of possible ACLs for the Ross Project might look like, and accordingly are representative of the impacts that might result should Strata be unable to restore the Ross

wellfields to post-licensing, pre-operational values." Dr. Larson, can you address the adequacy of Staff's presentation in the FSEIS in this regard?

A.12. Yes I can address Staff's presentation and I will do so in the following paragraphs. But in summary, in the FSEIS (SEI009A at pages 4-45 to 4-48) Staff presented a short discussion and limited data from NRC approved restorations at three sites – a) Crow Butte mine unit 1, b) Smith Highland Ranch ISL mine unit A, and c) the Irigaray ISL site (mine units 1-9). The FSEIS also purports to disclose what happened with d) the Nubeth Project, a 1970s ISL project conducted in the same proposed permit area as the Ross site. Staff's discussion of each of these four sites is inadequate and fails to present any meaningful understanding of what is certain to occur at as a result of the Ross Project: irretrievable and irreversible environmental degradation of groundwater quality, which the FSEIS does not acknowledge or discuss. And it certainly does not constitute a bounding analysis that could inform a decision maker of the likely environmental impacts. I will review in turn each of the three examples listed in the FSEIS sites, as well as issues associated with the Nubeth ISL groundwater restorations.

Q.13. Even though it was the last you mentioned, as it's contained within the Ross Project boundary, let's start with the Nubeth Project. What happened here?

A.13. According to the FSEIS (SEI009A at p. 3-39), the Nubeth project had two separate ISL leach operations which were conducted within the current Ross permit boundary. Project A was a single push-pull (the injection and recovery processes were used with one well) which was located "*1000 ft north of Oshoto Reservoir*" and occurred in 1976. Project B was a research and development project located "*3,000 feet south of Oshoto Reservoir*" which occurred began in 1978.

Q. 14. Can you show the results of the Nubeth project?

A. 14. I created the table below to display the complete results from project B of the Nubeth restoration (SEI009A at p. 5-28). Samples for individual wells associated with the Nubeth ore zone operation (3x, 4x, 5x, 6x, 11x, 12x, 19x, and 20x) are shown for 'baseline' (NRC017; p.66 in pdf) and Restoration/Post-Restoration. The NRC Staff presented the highlighted data in Table 5.4 of the FSEIS, and omitted four other 1981 samples taken post-restoration (NRC018; p 47-53 in pdf and JTI031; p. 8-11 pdf). When the average restoration/post-restoration values are compared to the average 'baseline', the percent increase for post-restoration, average uranium values (range from 109 – 2640 %) are greater than the values the NRC Staff provided in Table 5.4. Well 4x, 6x, and 12x were near or below uranium concentrations reported by the NRC Staff, yet all post-restoration sample averages exceeded average 'baseline' uranium concentrations. These data are critical to assessing the potential environmental impacts to water quality from previous ISL restorations near the applicant's proposed mining activities, yet the FSEIS did not provide a complete analysis with the available data.

	Baseline - (Nuclear Dynamics 1978 - ML12135A358) Nubeth Well - Uranium Concentration (mg/L)									Restoration and Post-Restoration Nubeth Well - Uranium Concentration (mg/L)							
Date	3x	4x	5x	6x	11x	12x	19x	20x		3x*	4x*	5x ^	6x ^	11x ^	12x ^	19x*	20x*
	0.071	0.08	0.1	0.075	0.079	0.073	0.3	0.006		0.12	0.21	0.1	0.09	0.1	0.09	8	0.094
	0.059	0.067	0.077	0.08	0.065	0.049	0.069	0.002		0.18	0.12	0.09	0.1	0.1	0.09	1.1	0.081
6/1978	0.068	0.086	0.068	0.1	0.079	0.064	0.069	0.003		0.64	0.16	0.09	0.1	0.1	0.09	1.4	0.088
	0.089	0.12	0.057	0.098	0.088	0.059	0.077	0.002		0.51	0.16		0.1	0.1	0.09	0.84	0.065
	0.068	0.09	0.11	0.095	0.082	0.067	0.078	0.002		0.24	0.22	0.08	0.1	0.08	0.11	0.48	0.068
Average =	0.071	0.089	0.082	0.090	0.079	0.062	0.119	0.003	Average =	0.338	0.174	0.090	0.098	0.096	0.094	2.36	0.079
Max =	0.089	0.12	0.11	0.1	0.088	0.073	0.3	0.006	Max =	0.64	0.22	0.1	0.1	0.1	0.11	8	0.094
									Percent Change (Averages) =	**476**	**196**	**109**	**109**	**122**	**151**	**1993**	**2640**

Highlighted values presented by the NRC staff in Table 5-4, p. 5-28, FEIS
^ - May - September 1979 (Nuclear Dynamics 1980 - ML13274A287)
* - March - October 1981 (ND Resources 1982 - ML13274A178)

URANIUM CONCENTRATIONS FROM NUBETH ISL OPERATIONS. "BASELINE" URANIUM CONCENTRATIONS ARE ON THE LEFT AND POST-RESTORATION VALUES ARE ON THE RIGHT

(MG/L). THE HIGHLIGHTED VALUES SHOW THE DATA PRESENTED IN THE SEI009A, P.5-28. PERCENT CHANGE WAS CALCULATED AS (POST-RESTORATION/BASELINE) * 100.

Along with inadequately presenting the restoration data from Nubeth project B, no data or discussion is presented from groundwater restorations from Nubeth project A, which was located within the proposed permit boundary, except for Table 3.7 (SEI009A, p. 3-41) which displays a pre-test sample that does not aid in understanding what happened with the restoration of the aquifer after leaching occurred. However, groundwater restorations at the Nubeth project A were unsuccessful as well (JTI032 p. 14-15; and p. 87).

Q.15. So what do these results from the Nubeth Project mean?

A. 15. In my expert opinion, failure to restore the groundwater after a short six-month pilot-scale single well leaching project should have clearly communicated to the NRC Staff that it will not be possible to restore a full-scale commercial ISL operations in 8 months as the FSEIS claims (SEI009A; p.2-35). I believe the FSEIS seriously underestimates the time necessary to restore groundwater after full-scale ISL operations, such as the Ross Project. Additionally, and perhaps more importantly, the Nubeth Project indicates that at this particular site, Strata will be unlikely to restore groundwater to primary or secondary standards. This conclusion is confounded by the fact that either Nubeth Project used only a single injection well, whereas commercial operations of ISL, like the Ross Project, use hundreds of wells, which means that groundwater restoration at the commercial scale will be even more difficult to obtain. In this regard, I also examined the results from commercial ISL operations in the United States, such as Crow Butte ISL, Smith Highland Mine Units A, and Willow Creek ISL, which serve as additional evidence of the

expected groundwater impacts at the Ross ISL project. The details of groundwater restoration activities at those sites, and subsequent groundwater contamination, will be discussed in depth in the following section.

Q. 16. Let's move to the Crow Butte Wellfield 1. In its FSEIS, what did the NRC allege happened and then what actually happened?

A. 16. With respect to Crow Butte Wellfield 1: briefly, the NRC approved the restoration of Wellfield 1 after 30 of 37 water-quality parameters were returned to 'baseline' or Wyoming Class I Domestic Use Standards. Similar to other ISL groundwater restoration results, radium-226 and uranium concentrations were not restored. In the FSEIS, NRC Staff justified this failure with this statement:

"*The NRC determined that the radium-226 and uranium concentrations at 31 percent and 18 percent above post-licensing, pre-operational concentrations were protective of human health and the environment (Crow Butte Resources, 2001; NRC023 p. 10). The applicable condition in Crow Butte's NRC license was changed to require stability monitoring beyond the six-month period, as necessary to ensure no increasing concentration trends were exhibited*." (SEI009A; p. 4-46).

NRC Staff's justification is flawed. First, there is no risk or dose calculation to support the contention that the elevated radium-226 and uranium concentrations pose no threat to human health and the environment. The NRC staff incorrectly analyzed the groundwater restoration data from Crow Butte mine unit 1 and stated that uranium concentrations increase by only 18% post-restoration, whereas concentrations actually increased 18.8 times baseline concentrations (NRC036; p. 2), as is seen in the chart immediately below this paragraph. I demonstrated this

error in a March 31, 2014 declaration on behalf of the Joint Intervenors (at ¶35). The difference is great, yet even after the NRC acknowledged its error after issuance of the FSEIS, (NRC036; p. 2) the NRC staff asserted the error made no impact on the qualitative aquifer impacts being "SMALL and temporary" (JTI033; p. 18 and p. 19). To the contrary, groundwater concentrations observed at 1.73 mg/L (shown in the figure below) suggest very high contamination relative to the 0.03 mg/L drinking water standards and there is no discussion or demonstration from Staff that the effects on the aquifer are temporary, reversible, or retrievable, yet NRC staff state these levels are "SMALL" (JTI033; p. 18 and p. 19). In sum, this NRC staff example of ISL restoration demonstrates a failure to accurately and thoroughly analyze the significant environmental impacts that arise when ISL operators fail to restore contaminated groundwater at ISL sites.

Table 3: Parameters Below UIC Permit Standards

Parameter	Baseline Average (Primary Goal)	UIC Permit Standard	Stabilization Average Water Quality
Arsenic (mg/l)	<0.002	0.05	0.017
Calcium (mg/l)	12.5	125	19.9
Total Carbonate (mg/l)	351	609	421
Iron (mg/l)	<0.044	0.30	<0.09
Potassium (mg/l)	12.5	125	13.2
Magnesium (mg/l)	3.2	32	5.3
Molybdenum (mg/l)	<0.069	1.00	0.10
Vanadium (mg/l)	<0.066	0.2	0.11
Radium-226 (pCi/l)	229.7	584	303
Uranium (mg/l)	0.092	5.0	1.73

It should be noted that, of the ten parameters that meet the UIC permit standards but were not returned to baseline concentrations, when standard statistical methods are applied to the baseline data, the concentrations of five of these parameters are statistically the same as baseline. The NRC states in NUREG-1569[2] that "...the baseline average plus three standard deviations is another method for establishing primary restoration targets that has been found acceptable by the NRC." CBR recognizes that this method of determining baseline concentrations is not the method approved in CBR's License. CBR is required to restore the affected groundwater on a mine unit average to the average baseline concentration with no statistical analysis of the data. However, CBR believes that NRC should consider statistical methods when determining whether acceptable efforts have been made to return Mine Unit 1 to baseline condition. Using NRC-accepted methods, five of the ten parameters are statistically at baseline concentration on a mine unit average.

[2] USNRC, NUREG-1569, *DRAFT STANDARD REVIEW PLAN for In Situ Leach Uranium Extraction License Applications*, October 1997.

RESTORATION RESULTS AT CROW BUTTE MINE UNIT 1 COMPARED TO AVERAGE BASELINE CONCENTRATIONS. URANIUM SPECIFICALLY IS HIGHLIGHTED.

Q. 17. Let's turn to the Smith Ranch Highland Wellfield A. In the FSEIS what did the NRC allege happen and what really happened?

A. 17. The NRC next discussed groundwater restoration at Smith Ranch-Highland Wellfield A (SEI009A; p. 4-46). There, the NRC stated 31 of 35 water-quality parameters were restored to 'baseline' concentrations; but again, little analysis was provided with respect to constituents not restored to 'baseline' values. Specifically, the NRC Staff did not discuss the post-restoration concentrations of uranium and heavy metals in the ore field. The Smith Ranch-Highland facility observed elevated post-restoration contaminant concentrations, relative to 'baseline', for arsenic (3000%), selenium (7000%), and uranium (7060%)(NRC037; p.8 in pdf). Specific spatial and temporal uranium groundwater concentrations from Smith Highland Wellfield A and B will be presented later in this document.

Q. 18. And turning to the third example of "restoration" provided by the NRC in its FSEIS, what happened with Irigaray Mine Units 1-9?

A. 18. Next, the FSEIS referenced the restoration approval at Irigaray Mine Units 1-9 (SEI009A; p.4-46) and stated that even though several water quality parameters were not restored, concentrations in excess of post-licensing, pre-operational levels would not exceed EPA MCLs for groundwater outside the aquifer exemption boundary (SEI009A; p.4-46). In fact, results from the Irigaray Mine Units reflect similar failures as those described above to restore uranium to baseline concentrations. I created the table below to show the restoration results for average baseline and average stability uranium concentrations for each mine unit. This data is not discussed in any detail in the FSEIS (JTI005A-R; p.259-346).

Irigaray Mine Unit	Average Baseline	Average Stability Rounds 1-4	% Change Average Stability 1-4
Mine Unit 1	3.042	0.988	32%
Mine Unit 2	0.130	3.782	2908%
Mine Unit 3	0.023	2.878	12515%
Mine Unit 4	0.046	2.420	5292%
Mine Unit 5	0.020	1.493	7467%
Mine Unit 6	0.112	1.854	1663%
Mine Unit 7	0.119	1.456	1226.8%
Mine Unit 8	0.041	1.591	3923%
Mine Unit 9	0.066	1.825	2751%

Uranium Concentrations (mg/L)

In industry's restoration summary report, industry describes the results as acceptable, saying: "*COGEMA has expended significant effort to restore the groundwater quality within the Irigaray wellfield to baseline conditions. At the completion of the Irigaray groundwater restoration program, the ore zone aquifer has been restored to standards consistent with Best Practicable Technology (BPT) and NRC's ALARA (As Low As Reasonably Achievable) principle. In this regard, over 840 million gallons of water were processed over an 11.5-year period, and an average of 13.7 pore volumes were treated for the entire wellfield. Treatment volumes exceeded the amounts included in the approved treatment plan.*" (NRC030; p.86 in pdf, p. 4-18).

In summary, the Irigary site was not restored to baseline concentrations despite an 11.5 year groundwater restoration period and 13.7 pore volumes recirculated in the aquifer

Q. 19. Does this site raise concerns regarding how baseline and restoration efforts are related?

A. 19. Yes it does. Here, 'baseline' values from Irigaray (Mine Unit 1) were significantly elevated from research and development mining activities prior to 1976 (NRC020; p. A-6, 4th paragraph and subsequent pages). Baseline uranium groundwater concentrations for Irigaray mine unit 1 were collected between 11/9/1976 – 2/24/1977 (JTI034; p.256 in pdf or p. B-4). Therefore, baseline uranium groundwater samples were biased towards high concentrations. These 'baseline' data from Irigaray were presented as the minimum, maximum, and averaged for all wellfields (wellfields 1-9) (NRC032; p. 3). The entire Irigaray restoration results for all wellfields were presented as a single combined wellfield (NRC030; p.71 in pdf, p. 4-3 in document), a COGEMA Mining Report from 2005 that stated as follows:

"*In May 2003, COGEMA Mining, Inc. met with WDEQ personnel to discuss the restoration status of the Irigaray and Christensen Ranch projects. At that time, it was proposed and agreed that one restoration report package (this report [referring to the original document]) would be submitted for the Irigaray project. This would entail combining all baseline data from Units 1 through 9 together for a larger database. It was recognized that the data from Units 1 through 9 are more meaningful when combined as a whole than if presented as several individual packages. Thus, a combined baseline data set was compiled from the ore zone baseline wells located in Production Units 1 through 9 and is included in Table 4-2 [original document].*"

All wellfields (1-9) were combined for a composite average 'baseline' and compared to restoration composite concentrations, as determined by COGEMA and WDEQ. However, 8 of the 9 wellfields (Wellfields 2 through 9) have significantly lower average 'baseline' uranium concentrations (range 0.023 – 0.13 mg/L) relative to the composite average 'baseline' value of 0.52 mg/L. Again, see the table I created above for the specific values for each mine unit. Thus, the elevated 'baseline' samples collected after research and development activities at Wellfield 1 skewed the composite wellfield average uranium concentration to a higher average value of 0.52 mg/L.

Consequently, the new restoration table gives the illusion that the overall post-restoration average uranium concentrations increased from only 0.52 to 1.83 mg/L (~3.52x increase). However, when compared to the initial average 'baseline' uranium concentrations for each wellfield, the average post-restoration uranium increases for Wellfields 1 through 9 are substantially higher. This post-operations and post-restoration manipulation of data essentially masks the reality of the groundwater impacts of the mining operations.

In brief, WDEQ approved a restoration and concluded further attenuation monitoring was not required and wells within the wellfield could be abandoned (NRC035; p. 4). The NRC Staff agreed with WDEQ's assessment of the restoration on September 20, 2006 (NRC034; p. 1).

Q. 20. So what's your conclusion from reviewing this example provided by the NRC?

A. 20. With respect to baseline, the examples demonstrate that previous mining activities and operations bias 'baseline' values to high concentrations, and pre-industrial baseline does not exist at these ISL mining sites. These examples and observations support the related nature of

Intervenor's Contentions 1 and 2: in that, the NRC Staff and the applicant have neither established an adequate baseline nor addressed the certain and degrading impact to groundwater resources when alternative concentration limits are set after restoration fails.

Disclosure Of Impacts of the Ross ISL Project

Q. 21. Since the Ross Project has yet to take place, we can't precisely know end results. But in contrast to Staff's presentation, can we look with more detail at sites where similar restoration plans have been approved and what might transpire?

A. 21. Yes. Commercial ISL sites in the United States have used the same restoration techniques as what's being proposed for the Ross ISL groundwater restoration. For example, at Christensen ranch, mine unit 4, the same restoration process was followed as proposed in the Ross FSEIS.

For example: The NRC staff states (JTI035; p. 33):

"*As reported by the licensee, production at MU-4 was initiated in June 1994 at MOD42, August 1994 at MOD43, and December 1994 at MOD41. Operations continued until August 1997. Groundwater sweep phase of the restoration was initiated at all three modules in August 1997 and completed at all modules in July 1998. The volume of water associated with the groundwater sweep activities was 1.93 PVs. After a three year hiatus, the next phase of restoration consisted of the groundwater treatment with RO permeate injection. This phase was initiated at MOD43 in April 2001, and at the other two modules in February-March 2002. The groundwater treatment phase was completed by March 2003. A total of 9.84 PVs is associated with the groundwater treatment phase. Injection of hydrogen sulfide gas as a reductant was initiated during the final stages of the groundwater treatment phase for MOD42 from January 2003 to March 2003. The final phase of restoration consisted of groundwater recirculation to spread the hydrogen sulfide*

reductant to modules MOD41 and MOD43. This phase of restoration was initiated in March 2003 and concluded in April 2004. The total volume of water associated with the groundwater recirculation phase is 1.0 PVs." (*Cf.* SEI009A at p.2-35 and 2-36).

The results from Christensen ranch show severe contamination of uranium occurred while following the standard NRC groundwater restoration plan, which is also being proposed for the Ross ISL operation. Average groundwater uranium concentrations increased from 0.044 mg/L to 3.83 mg/L during the last stability round sampling event, an increase of roughly 87x, as summarized below. I created the table below based solely on the data provided by the NRC at: JTI005A-R; p.65-84). Further, concentrations as high as 16 mg/L were observed in one well, which is 533x the drinking water standard (0.03 mg/L). If this is any indication, similar groundwater degradation at the Ross project is inevitable.

Baseline			Post-restoration, Stability Round 4 Sampling		
Average	0.044	mg/L	Average	3.83	mg/L
Max	0.37	mg/L	Max	16.0	mg/L
Min	0.005	mg/L	Min	0.009	mg/L
n	49		n	15	

COMPARISON OF AVERAGER BASELINE URANIUM GROUNDWATER CONCENTRATIONS AND POST-RESTORATION STABILITY ROUND 4 URANIUM CONCENTRATIONS FOR CHRISTENSEN RANCH ISL, MINE UNIT 4.

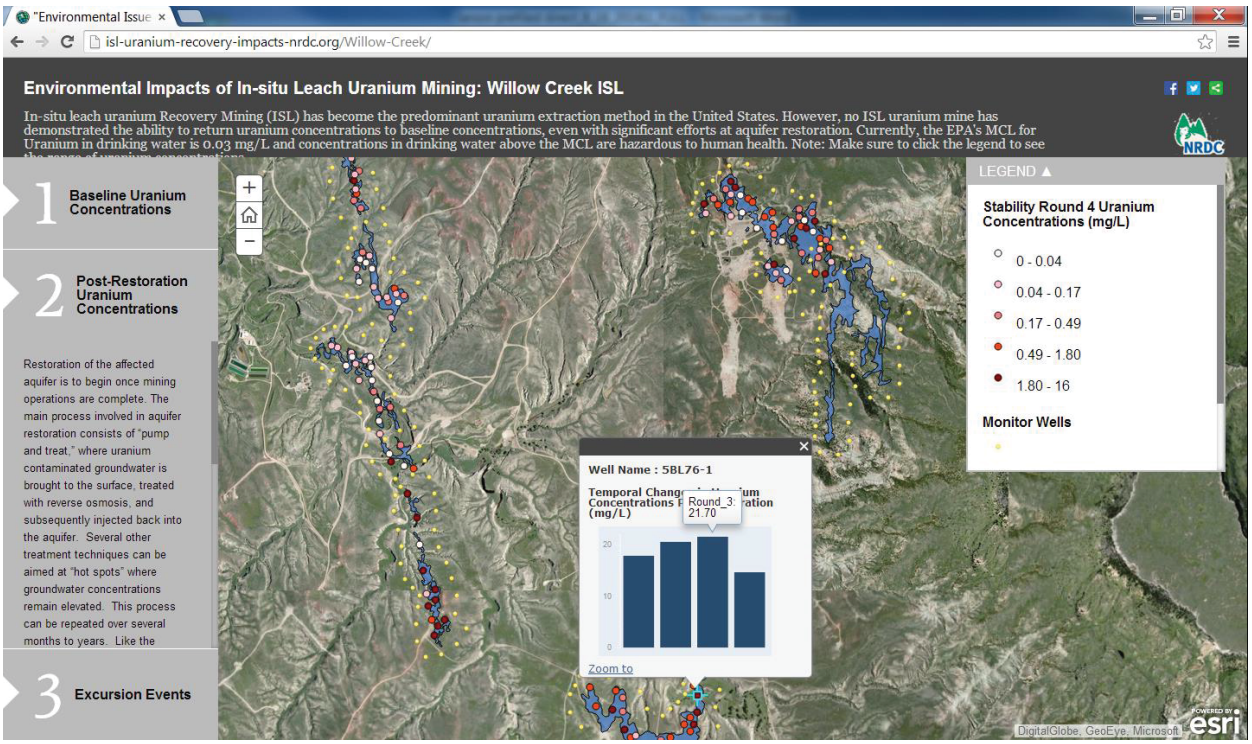
Q.22. In light of these examples, what is your professional opinion regarding the likely impact of the Ross Project on groundwater quality?

A.22. Relying on the examples the NRC cites in the FSEIS, the Christensen Ranch results shown above, and the examples I will discuss later in my testimony, it is my professional opinion

that it is inconceivable that the Ross Project will have a "SMALL and Temporary" impact on groundwater quality, as the FSEIS concludes (SEI009A; p. xxx). There is no discussion of the irretrievable and seemingly irreversible impacts of this process. To the contrary, if the FSEIS were to consider the actual baseline conditions on the site and compare those values to the reasonably anticipated conditions post-restoration, the FSEIS would disclose that the Ross Project will have significant environmental impacts. The public, and the agency, should confront this reality before allowing this project to proceed.

Q.23. We have discussed your concerns with the other sites relied upon. In your professional opinion, is there more the FSEIS could have, and should have, disclosed regarding the likely outcome at the Ross Project, other than referring to other sites?

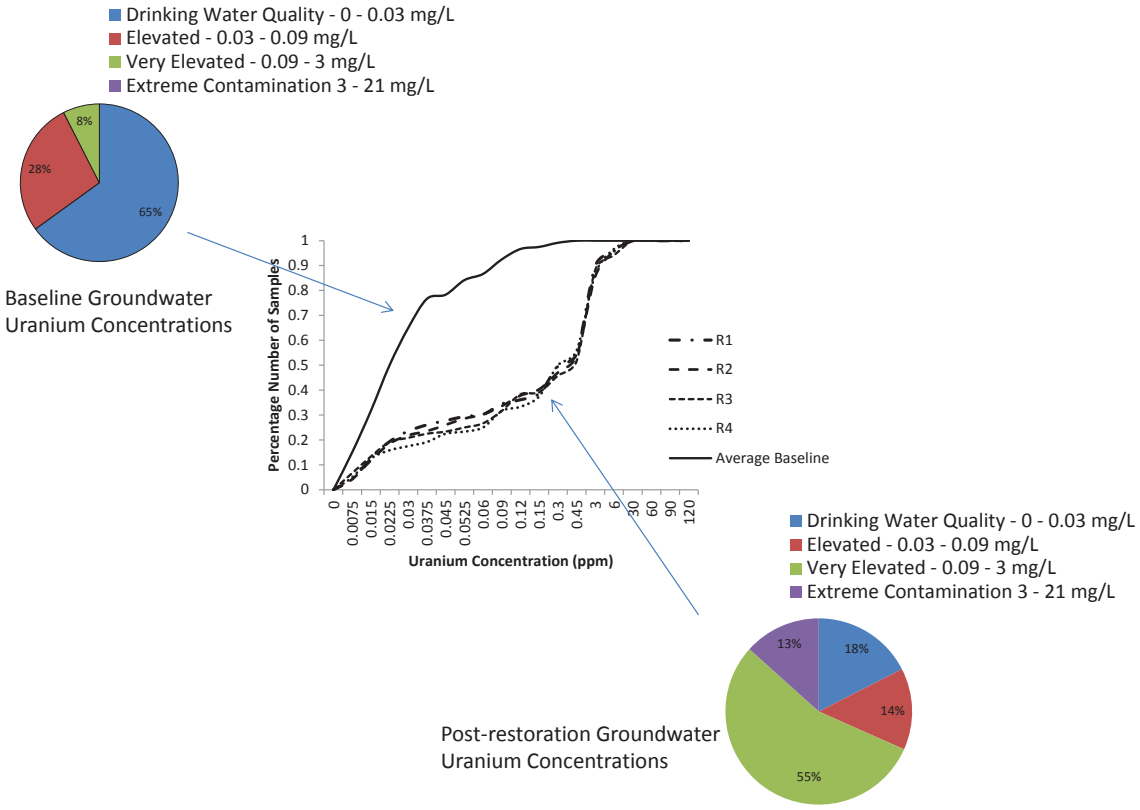
A.23. Absolutely. While it is of course impossible to predict precisely what the post-restoration values are going to be at the site, the experience at these other sites allow the Staff to, at the very least, prepare a bounding analysis disclosing the boundaries of the likely outcomes. Such a meaningful bounding analysis would show quantitatively – derived from a representative number of sites – what the actual groundwater impacts would be rather than a few anecdotal and qualitative conclusions such as Staff presents in the FSEIS. Further, Staff certainly has the resources to visually present and analyze the restoration results for a number of sites. As will be discussed later in my testimony, I have done just such a visual presentation for two sites. By failing to confront the degradation of water quality that is, in my professional opinion, certain to be the result of this project, or to disclose a detailed analysis of what I consider to be the likely outcomes, the FSEIS has fundamentally masked serious and irretrievable degradation of environmental resources.



Q. 58. Is there a way to look at this data set holistically? That is, can we see the entirety of the impact to the aquifer? For example, what is the difference for all samples, between average baseline and post-restoration uranium concentrations?

A. 58. Yes we can look at the data as a whole and I have analyzed the sample well distributions between average baseline and post-restoration uranium concentrations due to ISL and groundwater restorations. Using the entire wellfield data set from Christensen Ranch MU2-6, I created a cumulative histogram for average baseline and each post restoration phase sampling round concentrations (denoted as "R1, R2, R3, R4"). The figure below shows the results of the analysis, displaying the distribution of data, in this case, cumulative distribution of data. The y-axis shows the percent number of samples which observe uranium concentrations at various magnitudes. To interpret the figure, choose a concentration of uranium (for example: 0.03 mg/L), and read the corresponding value on the y-axis. For pre-mining baseline conditions, the

percentage of samples with concentrations of 0.03 mg/L or less is approximately 65%, while post-restoration samples show the percentage of samples at or below 0.03 mg/L was approximately 18%. The pie charts summarize these distributions, for average baseline conditions (top left) and post-restoration conditions (bottom right).



Q. 59. In light of what this chart show us, how do ISL activities change the groundwater quality distribution of uranium concentrations?

A. 59. Elevated uranium concentrations (0.03-0.09 mg/L) were observed in 28% of the baseline samples and very elevated (0.09 – 3.0 mg/L) represented 8% of the baseline samples, however the majority of the average baseline groundwater samples were below the MCL for uranium of 0.03 mg/L (~65%, n = 120).

Upon mining and restoration activities, the groundwater quality sample distribution shows significant changes to these observed percentages. For example, a new category termed 'extreme contamination' was created to describe samples >3.0 mg/L (>100x safe drinking water standards). These 'extreme contamination' samples represented roughly 13% of all observed post-restoration groundwater wells. Further, the 'very elevated' uranium concentrations increased from 8% (Baseline) to 59% (Post-restoration). Finally the drinking water quality samples decreased from approximately 2/3 of all samples, to roughly 18% of the observed samples. This analysis demonstrates, quantitatively, the severe water quality degradation which occurs as a result of ISL mining, which is not disclosed or discussed in the FSEIS.

The total amount of groundwater affected from ISL mining at Christensen Ranch mine unit 2-6 was estimated by industry as 1.04 billion gallons of groundwater (JTI038, p.21).

Q. 60. What do these results tell us about the potential impacts to the groundwater from the Ross project and the need to evaluate information regarding the reasonable range of hazardous constituent concentration values that are likely to be applicable if the applicant is required to implement an Alternative Concentration Limit (ACL)?

A. 60. As discussed previously, Willow Creek/Christensen ranch, mine unit 4 (located in the bottom left of the Storymap, wells start with the number 4), the same restoration process was followed as proposed in the Ross FSEIS.

For example: The NRC staff states (JTI035; p. 33):

"*As reported by the licensee, production at MU-4 was initiated in June 1994 at MOD42, August 1994 at MOD43, and December 1994 at MOD41. Operations continued until August 1997. Groundwater sweep phase of the restoration was initiated at all three modules in August 1997 and completed at all modules in July 1998. The volume of water associated with the groundwater*

sweep activities was 1.93 PVs. After a three year hiatus, the next phase of restoration consisted of the groundwater treatment with RO permeate injection. This phase was initiated at MOD43 in April 2001, and at the other two modules in February-March 2002. The groundwater treatment phase was completed by March 2003. A total of 9.84 PVs is associated with the groundwater treatment phase. Injection of hydrogen sulfide gas as a reductant was initiated during the final stages of the groundwater treatment phase for MOD42 from January 2003 to March 2003. The final phase of restoration consisted of groundwater recirculation to spread the hydrogen sulfide reductant to modules MOD41 and MOD43. This phase of restoration was initiated in March 2003 and concluded in April 2004. The total volume of water associated with the groundwater recirculation phase is 1.0 PVs."

It's also important to note that the complete active restoration for this mine unit only, was roughly 11 months for groundwater sweep, 1-2 years for RO permeate injection, and roughly 13 months for groundwater recirculation.

Groundwater restoration techniques and pore volume requirements at this mine unit followed the same progression as described by the NRC staff for Ross (SEI009A; p.2-35 – p. 2-37) with a far shorter active groundwater restoration time frame of 8 months (SEI009A; p.2-35). Similar or worse, groundwater degradation at the Ross project is virtually inevitable and such impacts have not been meaningfully analyzed in the FSEIS.

Smith Highland Mine Units A and B - Baseline/Post-restoration

Q. 61. Let's now turn to the second Storymap – Smith Ranch. We don't need to walk through all the steps we did before as it basically works the same –

Contention 3: The FSEIS fails to include adequate hydrological information to demonstrate Strata's ability to contain groundwater fluid migration.

Q. 67. In your expert opinion, have Strata or NRC Staff in the ER, the DSEIS, or the FSEIS presented adequate hydrological information to demonstrate Strata's ability to contain groundwater fluid migration?

A. 67. No. I have several areas of significant concern. First, I have fundamental disagreements with the NRC over how they either interpret basic geochemical interactions that will take place in the subsurface when efforts to establish baseline are commenced and, more important, when mining commences. Second, the FSEIS fails to account for the potential for contaminant excursions in light of an inadequate assessment of aquifer confinement. Specifically, the FSEIS has failed to sufficiently analyze the potential for and impacts associated with vertical fluid migration, and unidentified or unsealed drillholes between aquifer units. This is directly relevant to the FSEIS's failure to analyze sufficiently the potential for and impacts associated with fluid migration associated with unplugged exploratory boreholes, including the adequacy of applicant's plans to mitigate possible borehole-related migration impacts by monitoring wellfields surrounding the boreholes and/or plugging the boreholes. Further, the early detection systems will be inadequate to capture potential for fluid migration and there is a failure to understand the aquifer geochemistry. I explain in detail below.

Q. 68. Let's start with your first point so I can understand your concerns about the failure to analyze sufficiently the potential for and impacts associated with fluid migration associated with unplugged exploratory boreholes. What is your dispute with the FSEIS's presentation of basic geochemical interactions that will take place in the subsurface when efforts to establish baseline are commenced and, more important, when mining commences?

A. 68. The fact that Strata will be unable to restore wellfields to pre-mining, scientifically and statistically defensible baseline concentrations is associated with the NRC Staff and Strata's failure to acknowledge the reaction kinetics and thermodynamics of uranium ore geochemistry. Strata and NRC staff understand that ore deposits form over the period of hundreds of thousands to millions of years. During these immense time intervals, the fluvial deposits accumulate uranium where reducing conditions are favorable for precipitation of uranium. Strata and the NRC staff also understand that injection of an oxidizing-bicarbonate lixiviant destroys the natural balance in the ore-zone geochemical conditions over a period of a few years by pumping very high levels of oxidants and complexing agents through the ore zone. Under these anthropogenic induced changes, materials along the lixiviant flow path are oxidized and the reducing capacity built up in the sediments over hundreds of thousands to millions of years is substantially altered in a matter of months.

Thus, while the FSEIS assumes that the restoration phase will simply involve efforts to remove the contamination that remained in the groundwater as a result of the operations phase, NRC Staff ignores that uranium and other materials disrupted by the ISL process will continue to remain obstinately elevated into the groundwater long after operations have been completed. Several hypotheses have been proposed to explain these severely elevated uranium concentrations, post-restoration. Researchers have suggested that lixiviant is stored in confining units, or at least geological units of relatively lower hydraulic conductivity, and provides a continual source of oxidizing capacity to the ore (JTI040; p. 8 in pdf, p. 36 in document). The USGS has suggested that the continual re-introduction of dissolved oxygen in the RO permeate injection process may be further degrading the aquifer's reducing capacity (JTI041; p.2 in pdf). Finally, our understanding of uranyl-carbonate complexes has greatly increased over the past

decade, which reveals that uranyl-carbonate complexes are relatively unreactive, and hence stubbornly mobile compared to uranyl-hydroxide complexes (JTI042; Figures 3 and Figure 4, p. 4. JTI043; Abstract).

Regardless, empirical data show the ISL process will create substantial contamination into the groundwater that will continue to degrade water quality, and a significant component for the post-restoration efforts will be remediating the ongoing contamination that will occur long after operations are over. None of this is disclosed or discussed in the FSEIS. And further, the failure to analyze all of the above sufficiently in conjunction with the potential for and impacts associated with fluid migration associated with unplugged exploratory boreholes exacerbates the likely results and makes this oversight more troubling.

Q. 69. Let's turn to the next issue – aquifer confinement. First explain what it is and why it matters for the conclusions related to fluid migration and the failure to analyze sufficiently the potential for and impacts associated with unplugged exploratory boreholes made in the FSEIS.

A.69. Aquifer confinement occurs when an aquifer is bounded by an overlying and underlying geologic unit of relatively lower permeability. If an aquifer used for ISL is confined, then the lixiviant solution and associated contaminants of concern are prevented from moving vertically.

Q. 70. Have previous ISL sites proven aquifer confinement? Have vertical fluid excursions occurred under confined aquifer conditions?

A. 70. There are several examples of vertical excursions in aquifers that were allegedly confined. The NRC staff has determined previous ISL sites were confined aquifers and therefore would not allow for vertical fluid excursions. For example, the NRC stated in 1988, in the Environmental Assessment (EA) for Malapai Resources, Christensen Ranch In Situ Leach Satellite operation:

"*This data [aquifer testing characterizations] would theoretically indicate that ground-water flow would be contained by the aquitards and concentrated within the production zone. Further evidence of the confining characteristics associated with the units bounding the production zone has been evidence by the successful operation of the Christensen Ranch Research and Development operation*. (JTI044; p. 26)"

However analysis of the Christensen Ranch Restoration Technical Evaluation Report (TER), in 2008, shows that vertical excursions were an environmental issue. To quote (JTI035; p. 11), "*First, excursions in the shallow aquifer in the vicinity of the southern area of MU-2 and the northern area of MU-3 indicate an impact greater than a single well.*" At this same site, NRC Staff included a comment about how the groundwater monitoring parameter values, called upper control limits (UCLs), in an overlying aquifer were set extremely high, not allowing them to detect a fluid migration:

"*The staff evaluated the setting and found spatial nexus between the wells that were, or have been reported, on excursion. The relations are: (1) well 2MW-89 is located between MU-2 South and MU-3, (2) three (2MW-68S, 3MW-46S, and 3MW-48S) of five wells in the shallow aquifer overlying the southernmost portion of MU-2 South and northernmost of MU-3 have been on excursion either during operations (3MW-48S and 3MW-46S), or during or subsequent to restoration (2MW-68S and 3MW-48S); and (3), established UCLs for two other wells in the shallow aquifer in that area (2MW-70S and 2MW-72S) are extremely high, limiting their potential to detect an excursion*." (JTI035; p. 22)

Like many reported excursion events, the precise source of the vertical excursions was unclear. The NRC confirmed this uncertainty with the following statement:

"*Furthermore, the staff notes that the documentation by the licensee on the source of the excursions for wells in the overlying aquifer is inconclusive. For example, for the 1991 excursion at well 3MW-48S, the licensee noted that the excursion in the overlying aquifer could be through well completions, exploration boreholes or hydraulic communication between aquifers*." (JTI035; p. 23)

Q. 71. Have the NRC staff or other regulators made the same erroneous assumption about confined aquifers at other sites?

A. 71. Yes, it was found that "*aquifer testing procedures have had more limited success in determining the potential for vertical excursions*" (*citing* Staub et al., NRC020, p.32). Staub further supported this statement with an analysis of vertical excursions at Irigaray in the late 1970s:

"*WMC investigated possible reasons for the excursions in wells SM-1, SM-6, and SM-7 beginning in April, 1979. Geologic and hydrologic data were studied, including geophysical logs, core data, geologic cross sections, and pump test data. WMC (1980) [original document] could find no evidence of natural hydraulic connection between the Upper Irigaray Sandstone and the Coal Unit* (Staub et al. 1986, NRC020, p.A-28, 2nd paragraph)*." As a result of these diagnostic tests, WMC (1980) concluded that the most likely pathways for lixiviant migration to the Coal Unit in Production Units 4 and 5 during 1980 were unplugged exploration boreholes* (NRC020; p.29, 4th paragraph)*."*

In other words, the standard methods for proving aquifer confinement could not predict nor explain vertical excursions.

Q. 72. Could unidentified, unsealed abandoned boreholes affect aquifer confinement?

A. 72. Absolutely, the consensus for vertical excursions appears to be directly related to the number of abandoned, unidentified exploration drillholes, or failed well casings (NRC020; p.29, last paragraph; p.30, 2nd paragraph). In other words, "*vertical excursions are directly related to the intensity of drilling activity*" (NRC020; p.48 in pdf., p. 30 in doc, 1st paragraph). Even where an aquifer was naturally confined, a drillhole or abandoned well creates preferential vertical flow paths. And many such drillholes create many pathways for those contaminants.

Q. 73. What is your concern with the FSEIS's discussion of abandoned boreholes at the Ross project site?

A. 73. The principal issue is that in order to justify its conclusion of a confined OZ aquifer, the FSEIS assumed that the more than 1,682 abandoned Nubeth drillholes in the project area would all be plugged prior to Strata's operations, thereby removing these holes as a source of contaminant migration (SEI009A; p. 3-37). However, the FSEIS disclosed that only 759 of those drillholes – or less than 50% – had even been identified, FSEIS at 2-28, and the FSEIS did not explain the basis for assuming that the remaining more than 800 holes would be located. Further troubling, the FSEIS stated that of the 759 drillholes, only 55 of them had been sealed (FSEIS; p. 2-48, 3rd paragraph). However, as of May 9, 2013 625 Nubeth exploratory drillholes have been located and 86 have been plugged by Strata (SEI009A, p.85, response to RP032-060).

These drillhole numbers, while inconsistent, demonstrate an alarming potential for uranium bearing lixiviant to migrate to overlying or underlying aquifers. According to the most recent well abandonment numbers, Strata has yet to find 1,057 Nubeth wells (1,682 – 625) and has yet to plug and abandon 1,596 Nubeth drillholes (1,682 – 86). Further, these numbers do not

include the proposed wellfield development proposed for ISL activities in the Ross permit boundary, ranging from "*1,400-2,200 recovery and injection wells in addition to 34 to 140-250 monitoring wells*" (SEI009A; p.5-54, 5th paragraph).

Q. 74. In light of these experiences at previous ISL sites, what is your professional opinion regarding the likelihood of vertical excursions of contaminants at the Ross site?

A. 74. Vertical excursions are likely given experience at other sites. As is evident from the examples above, it is difficult to assess whether an aquifer is truly confined. The lack of well plugging and not identifying hundreds of abandoned wells show that Strata and the NRC staff have not adequately demonstrated ability to maintain vertical fluid migrations from the ore zone aquifers.

Q.75. What, in your view, should the FSEIS have included to address this issue?

A.75. The FSEIS should have disclosed that excursions are likely, and then addresses the steps that will be taken to address them when detected. Instead, based on the assumption that the aquifer is confined the FSEIS presumes excursions are unlikely.

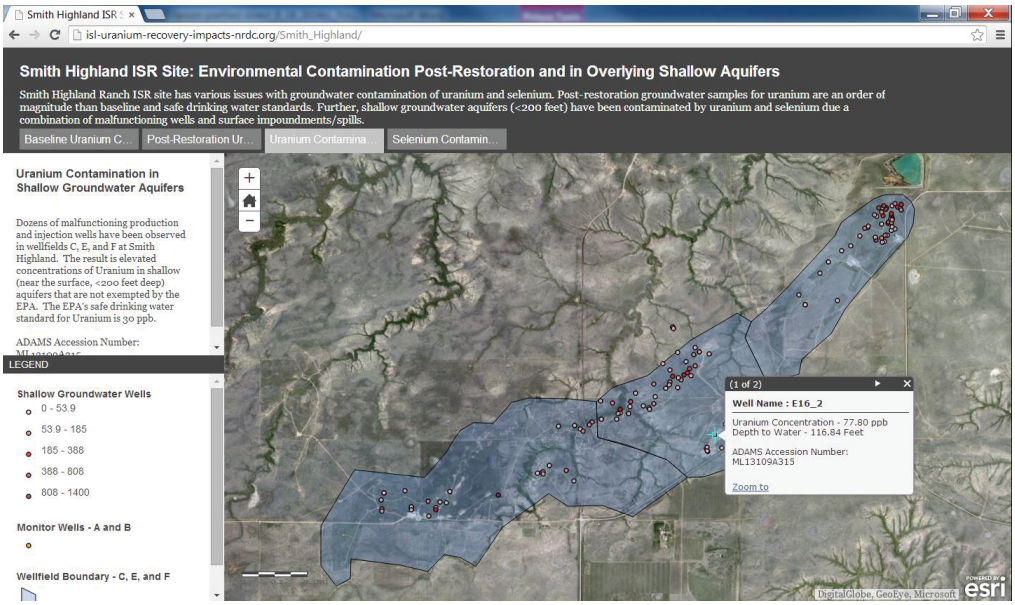
A Storymap visual representation of data which support Contention 3 – Fluid Migration

Horizontal and Vertical Excursions at Willow Creek/Christensen Ranch ISL

Q. 76. Dr. Larson, we've focused on the FSEIS's failure to sufficiently explore the potential for and impacts associated with fluid migration associated with unplugged exploratory boreholes, including the adequacy of applicant's plans to mitigate possible borehole-related migration impacts by monitoring wellfields surrounding the boreholes and/or plugging the boreholes. What can excursion events tell us about problems related to fluid migration and how might those problems be exacerbated by the failure thus far at the proposed Ross Site

Q. 85. What information does selecting a well present?

A. 85. When a well is selected, the 'pop-up' window displays the well name, groundwater uranium concentration (ppb), the measured depth to water (feet), and the ADAMS accession number. I've selected well E16_2 as an example (JTI005B-R; p.36). The groundwater uranium concentration was 77.80 ppb and the depth to water was 116.84 feet deep. The total depth for well E16_2 was 130 feet (JTI036, p.54).



The impacts from Selenium contamination in the shallow groundwater can be observed in a similar fashion by selecting the fourth tab "Selenium Contamination in Shallow Groundwater Aquifers". The EPA MCL for selenium is 50 ppb (or 0.05 mg/L). As is apparent, the environmental impacts are significant. None of this sort of analysis of irretrievable and irreversible impacts are present in SEI009A.

Conclusion

Q. 86. Dr. Larson, you've explained and demonstrated extensively how the FSEIS fails to analyze the environmental impacts that will occur if the applicant cannot restore groundwater to primary or secondary limits and how the FSEIS fails to include adequate

hydrological information to demonstrate SEI's ability to contain groundwater fluid migration. Can you please briefly summarize why it is so important the FSEIS addresses these issues in the context of groundwater protection in the American West?

A. 86. Groundwater is a significant source of drinking water supply for municipalities and also a source for agricultural irrigation in this part of the country. Groundwater is an attractive water source to meet these demands because it is accessible in areas without substantial surface water availability, requires relatively less treatment compared to surface water, and is less susceptible to drought conditions. According to the USGS, groundwater is the source of drinking water for half the United States. Furthermore, groundwater contributes the largest percentage of source water for agriculture irrigation, which consumes roughly 80% of all US water consumption (JTI047).

Water demands in the future will increase (JTI048), therefore groundwater resources will be increasingly relied upon as a consistent, reliable, source of fresh water. However due to overreliance on groundwater, significant groundwater depletion has been observed by the United States Geological Survey over the past decade. The Central Valley Aquifer, Ca and High Plains Aquifer (Ogallala), have already observed shocking groundwater volume losses from 1960-2008 (JTI027).

The current drought crises in these regions are causing many communities to scrounge and save for water. For example, a community in Texas (Wichita Falls) recently began using treated, recycled wastewater (sewage water), for municipal drinking water, as few available options for water sources could be used to meet demands (http://www.npr.org/2014/05/06/309101579/drought-stricken-texas-town-turns-to-toilets-for-water). California communities are currently enacting strict water usage fines for community

members to deal with a record drought. Future water issues will be compounded significantly, suggesting water supplies will be increasingly scarce and using fresh water sources wastefully, for any means, is shortsighted.

Q. 87. Turning toward the issue before the Board, why does groundwater matter so much in this regional area of the West? In this particular area of Wyoming?

A. 87. Population increases over the last decade in northeastern Wyoming have put increasing stress on the available water supplies. The city of Gillette, Wyoming depends on drinking water from the Fort Union Aquifer and other local aquifers, to provide municipal water supplies. However, water availability in these aquifers are dwindling and the population is projected to substantially increase from 37,000 to 57,000 by 2030. To meet increasing water demands, the city is enacting the Gillette Madison Pipeline Project, a 217.6 million dollar project, which will route water from the Madison aquifer, north of Keyhole Reservoir to Gillette via pipeline (http://www.gillettewy.gov/index.aspx?page=902). The project is intended to meet growing water demands for the next 20 years. This example demonstrates the specific vulnerability of this region to increased water demands and the scarce options to meet those demands.

Q. 88. Would significant groundwater contamination or long-term degradation of a groundwater aquifer really matter, even if no one has is currently accessing that groundwater for water right now?

A. 88. If the groundwater which has contaminant levels above the US EPA's drinking water standards is used directly as a primary source of drinking water it carries a risk of detrimental

health impacts. Groundwater that does not meet drinking water standards would require "at the end of the pipe" treatment to return water to acceptable drinking water standards, which is costly and carries numerous logistical issues (waste disposal, energy requirements, O&M costs, etc.).

In general, financial limitations prompt municipalities to utilize the highest quality source water which requires the least amount of treatment. When relatively high quality (low treatment) source water is unavailable, the next economically available source of water is used. This general trend explains why desalination of sea water is used as a last resort, due to significantly high economical treatment costs. Therefore, preventing water contamination in the first place is regarded by many water resources and environmental engineers as the 'best treatment option'.

Q. 89. And what about the groundwater affected by the Lance District projects? Are there specific impacts in the near or long term?

A. 89. In the FSEIS and license for the Ross ISL project the NRC Staff has approved the same groundwater restoration methods which have failed to meet baseline and/or safe drinking water standards at every previous ISL site, and for technical and scientific reasons, will not result in groundwater quality meeting primary or secondary standards. As demonstrated throughout this document, it's common for 'restored' post-mining groundwater at ISL operations to exceed that value, and in some wells by an order of magnitude or more.

The volume of contaminated water within the ore zone is not trivial, and the impacted water volumes can be (depending on the site specific geology and aquifer properties) in the hundreds of millions of gallons groundwater per mine unit. For example, industry estimated the

total affected volume for Christensen Mine Units 2-6 was approximately 1.04 billion gallons of groundwater (JTI038, p.21).

For all the reasons above and based on review of the relevant data, it is my professional opinion that no ISL mine site has ever fully restored the groundwater to pre-mining 'baseline' conditions. And equally important, the FSEIS fails to consider and acknowledge this likelihood and any subsequent environmental impacts of permanently contaminated groundwater.

Q.90. Does this conclude your testimony.

A. 90. Yes.

I, Dr. Lance N. Larson, do hereby declare under penalty of perjury that my statements in the foregoing testimony and my statement of professional qualifications are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 C.F.R. § 2.304(d).

/(electronic signature approved)/
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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)	)	

Pre-Filed Direct Testimony of Dr. Richard Abitz
Supporting Joint Intervenors' Contentions 1 and 3

Q.1. Please state your name, current position and employer, including duration of employment.

A.1. My name is Dr. Richard Abitz. For the past eight years I have been the principal geochemist and owner of Geochemical Consulting Services, LLC. Among other tasks, I provide analysis of chemical and radiological data, modeling of soil and water systems, and risk assessments associated with numerous projects involving hazardous and radiological materials. I have been hired by numerous federal agencies for this work over my career, including the Department of Energy and its national laboratories, and the U.S. Environmental Protection Agency. I also am retained by environmental organizations to provide consultation and expert testimony associated with such projects. I have worked with the NRDC on this matter since the fall of 2011.

Q.2. How is your testimony organized?

A.2. My testimony is organized as follows:

1) Background information on my qualifications as an expert witness in these proceedings;

2) Summary of my testimony;

3) Background information on establishing baseline groundwater quality;

4) Testimony supporting Contention 1 – The FSEIS fails to adequately characterize baseline (i.e., original or pre-mining) groundwater quality;

5) Testimony supporting Contention 3 – The FSEIS fails to include adequate hydrological information to demonstrate SEI's ability to contain groundwater fluid migration; and

6) Conclusion.

I. Background Information on Qualifications to be an Expert Witness

Q.3. Please state your educational background, professional experience, and organizational memberships that qualify you to provide testimony in these proceedings.

A.3. I am a geologist and geochemist with more than 25 years of domestic and international experience in conducting and managing environmental work associated with the restoration of groundwater and soil contaminated by uranium and other radionuclides. I received my Ph.D. in Geology from the University of New Mexico in 1989. Among other prior work, from 2003-2006 I served as the Manager for Environmental Services Group, where I oversaw the work of over 50 scientists and technicians who performed water, soil and air sampling; laboratory analyses associated with radionuclide, metals and organic compounds; and other related work. I also worked on remediation strategies for the Great Miami aquifer, which involved uranium contamination. In the 1990s, I worked on geology and geochemical issues associated with groundwater, soil and waste-disposal issues associated with the Fernald Environmental Management Program and the Waste Isolation Pilot Project. I am a member of the Geological Society of America and the International Association of Geochemistry and Cosmochemistry.

My full Curriculum Vitae (CV) is attached at Joint Intervernors' Exhibit 002 (hereinafter "JTI002").

Q.4. Has your work been published in peer-reviewed publications?

A.4. Over my career, I have published more than 20 such papers, on numerous topics. My published works include papers on the need for valid statistical protocols to establish baseline water quality at Uranium ISL facilities, the geochemistry of natural and contaminated groundwater and brines, and the decommissioning of highly contaminated nuclear facilities. A complete list of my publications is at the end of my CV.

Q.5. Have you been admitted to testify in federal or state court, or in prior administrative proceedings?

A.5. Yes. On November 8, 2001, I testified before the NRC on water quality issues related to the Hydro Resources, Inc. application for a license for an ISL facility at Crownpoint, New Mexico. On Februrary 17, 2009, I testified before the New Mexico Mining Commission on revisions to state regulations to protect water quality. On May 10, 2010, I testified before the State of Texas, Goliad County Groundwater Conservation District on the invalid baseline data developed by Uranium Energy Corporation for their permit to perform uranium ISL mining in Goliad, Texas. I have also prepared numerous declarations on water quality issues related to improper well installation and development and invalid aquifer baseline values for proposed and developed uranium ISL facilities in New Mexico, Texas, Colorado, Nebraska and Wyoming.

Q.6. Please summarize your work on ISL matters prior to working for NRDC on this project?

A. 6. I have been evaluating ISL permits and licenses for nearly 20 years. My experience includes work at the proposed Churchrock and Crownpoint sites in New Mexico; the Kingsville Dome and Goliad Projects in Texas; the proposed Centennial Project in Colorado; and the Crow Butte Project in Nebraska. Work executed for the Goliad Project in Goliad, Texas was performed under contract with the Goliad County Groundwater Conservation District and was focused on baseline water quality in the uranium ore zones in the Goliad Formation. Additionally, in the performance of the above work, I have spent a considerable amount of time reviewing records and data from the Smith Ranch- Highland Project and Irigaray and Christensen Ranch Project (the Willow Creek facility) in Wyoming.

Q.7. How many of your projects, ISL uranium mining related or otherwise, have involved groundwater characterization and analysis?

A.7. All of them.

Q.8. Have you been responsible for conducting or overseeing the collection of baseline water quality data at any of these sites, and if so please describe.

A.8. Under a contract between the Goliad County Groundwater Conservation District and Geochemical Consulting Services, LLC, I was responsible for evaluating all the groundwater data collected by Uranium Energy Corporation (UEC) for their Goliad Project.

Q. 9. Have you reviewed the applicant's Environmental Report, DSEIS, FSEIS, and all the associated documentation with the Ross Project?

A. 9. Yes, I have extensively reviewed applicant SEI's Environmental Report (ER), Technical Report (TR), the Draft Supplemental Environmental Impact Statement (DSEIS) for the Ross Project prepared by NRC staff, the Final Supplemental EIS (FSEIS) prepared by NRC staff, and

a host of other associated and relevant documents. During the course of these proceedings, I have submitted three declarations detailing concerns with the ER and TR, then the DSEIS, then the FSEIS. All the documents I reviewed in preparing those declarations and in preparing this testimony are noted and referenced in this Direct Testimony. A complete list can be found in at the conclusion of this testimony and in the Joint Intervenors' list of exhibits. My conclusions are my own and based upon the review of the relevant documents and my decades of experience in such matters.

II. Summary of Testimony

Q.10. Please provide a brief summary of your testimony.

A.10. I am providing expert testimony in support of Joint Intervenors' admitted Contentions 1 and 3. I will discuss the foundation behind Contention 1, specifically the FSEIS fails to adequately assess and disclose baseline groundwater. Before addressing specific flaws, I will provide some technical background information on how to properly establish baseline groundwater quality and why it matters in the case of an ISL facility. Then, I will turn to Contention 3 and provide testimony that the FSEIS fails to include adequate hydrological information to demonstrate SEI's ability to contain groundwater fluid migration. I will discuss the numerous unidentified and unplugged abandoned exploration wells in the area and how they can be pathways for fluid migration during the project. I will also discuss SEI's monitoring data and how it was insufficient for the NRC staff to make an informed fluid migration impact assessment given that the applicant's six monitor-well clusters and the 24-hour pump tests at four of these clusters provided insufficient hydrological information to demonstrate satisfactory groundwater control during planned high-yield industrial well operations.

needed detailed analysis on the hydrological properties in the exempted aquifer, redox conditions in the aquifer, the availability of various complexing anions, microbial community structure, and structural heterogeneity of the fluvial deposits.

I am left to conclude that the NRC Staff's assertion that uranium is a poor indicator of transport during ISL operations demonstrates a failure to understand the changing geochemical subsurface environment when lixiviant is injected and a less than careful manner toward both the historic record of ISL excursions and recent research on geochemical and hydrological data one can assess to establish a sound scientific basis to predict contaminant transport. The result is that by not utilizing uranium as an excursion parameter the FSEIS skews the environmental impact analysis, failing to disclose information vital to the agency and the public that must be disclosed and confronted before the licensing decision is made.

Fluid Migration And Communication Between Aquifer Units Resulting from Improperly Abandoned Exploration Wells

Q. 41. Has the NRC, in its FSEIS, sufficiently analyzed the potential for and impacts associated with fluid migration and communication between aquifer units?

A. 41. No. The FSEIS notes that there are thousands of abandoned wells, but it does not disclose any total amount beyond information SEI has relayed to the agency. Indeed, the FSEIS 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; FSEIS at 4-34. SEI009A).

Additionally, the FSEIS 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." (NRC006,A DSEIS at 4-36; FSEIS at 4-30, SEI009A).

In short, both the DSEIS and now the FSEIS simply assume 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, NRC006A).[2] "*…the applicant will attempt to locate and properly abandon all historical drillholes located within the ring of perimeter-monitoring wells in each wellfield…*" (FSEIS at 3-37, SEI009A).

The NRC Staff states in the FSEIS (p. 2-48, SEI009A) that, of the 1682 abandoned holes from Nubeth operations, the applicant had located 759 and plugged 55 wells. This was the exact number of wells presented in the DSEIS (p. 2-44, NRC006A); indicating from October 2010 to the FSEIS publication (February 2014), the applicant had not properly plugged a single abandoned exploratory wellhole. As the NRC is asking only for an 'attempt' by the applicant to locate and plug the holes, there is absolutely no assurance that any further boreholes will be plugged and abandoned. Old exploratory wells are very difficult to locate, let alone properly plug and abandon, because records of their precise location may be missing and the uncased holes tend to collapse and fill in overtime. It is highly unlikely that SEI's commitment will be little more than a promise left unfulfilled.

[2] 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. These numbers were the same in the FSEIS (p. 2-48).

The fact that the applicant has plugged roughly 3.3% (55/1682) of what they now report to be the known historical exploration boreholes in the permit boundary (96.7% of the known boreholes in the permit boundary have not been properly sealed), indicates that they may never be filled because unconsolidated sediments on the surface tend to collapse and fill in the old boreholes and there may be no accurate records available to locate the original borehole. This type of event has been a recurrent problem for ISL sites, regardless of whether or not there have been license conditions requiring the proper filling of old boreholes or proper treatment of boreholes from the current operation. As an example, in March 2007, the Texas Railroad Commission described its Notice of Violation to Uranium Energy Corporation: "[t]he Permittee failed to complete surface plugging and drill site reclamation as specific in Section IV of as specified in Section IV of Uranium Exploration Permit No. 123. Specifically, the permittee failed to segregate and replace topsoil, and/or properly install a cement surface plug, and/or allow pits to dry before backfilling and/or compact backfilled materials and topsoil above grade in the reclaimed mud pits to compensate for settling, and/or mark the exact location of each borehole." (JTI026 at p. 8). Note also in the same Notice of Violoation (NOV) the comments of the Texas regulator, citing difficulty with locating the majority of the boreholes even though significant efforts were taken to identify them. *Id*. at 3.

Indeed, the scope of the problem could actually be much worse than is disclosed in the FSEIS. The 1,682 figure in the FSEIS contrasts with the over 2,000 exploration boreholes drilled in the area identified at the ER stage of this proceeding (SEI005B at 5-35). Whether the figure is more than 2,000 or 1,682 there should be a full accounting of all improperly abandoned

boreholes in the FSEIS; and the FSEIS must also present a clear discussion of the time table and requirements to locate, plug and abandon the boreholes before any wellfield is developed.

Alternatively, the FSEIS could have (and should have, given its discussion of plans for these abandoned boreholes) disclosed that in light of the likelihood that these wells will not all be located and filled, there are significant risks of excursions, and disclosed the environmental impacts posed therefrom. What Staff cannot do – but did in the FSEIS – is discount those environmental impacts altogether by inappropriately *assuming* these wellholes will be filled.

Q. 42. Why is failure to fully account for all of the improperly abandoned boreholes a problem?

A. 42. It's a problem that the NRC acknowledges, even though they have yet to analyze the potential impacts in any meaningful way. The historical records at ISL sites indicate nearly all vertical excursions in the overlying aquifer were "*directly related to the intensity of drilling activities*" (NRC020 at p. 30, Staub et al. 1986). That is, thinning of the fluvial confining unit, unidentified malfunctioning of equipment, or unsealed bore-holes into the ore zone aquifer have largely been responsible for vertical excursion into overlying ore bodies. The NRC Staff agrees and states, "*Vertical excursions tend to be more difficult to recover than horizontal excursions, and in a few cases, remained on excursion status for as long as eight years. The vertical excursions were traced to thinning of the confining geologic unit below the ore zone and improperly abandoned drillholes from earlier exploration activities*." (SEI009A, FSEIS, p. 4-37, emphasis supplied). Control, prevention, and remediation of vertical excursions were largely unsuccessful at previous ISL sites in the United States (NRC020 at p. 29, Staub et al. 1986). In

other words, when a vertical excursion occurs in the SM aquifer, the applicant will have limited options to correct the excursion.

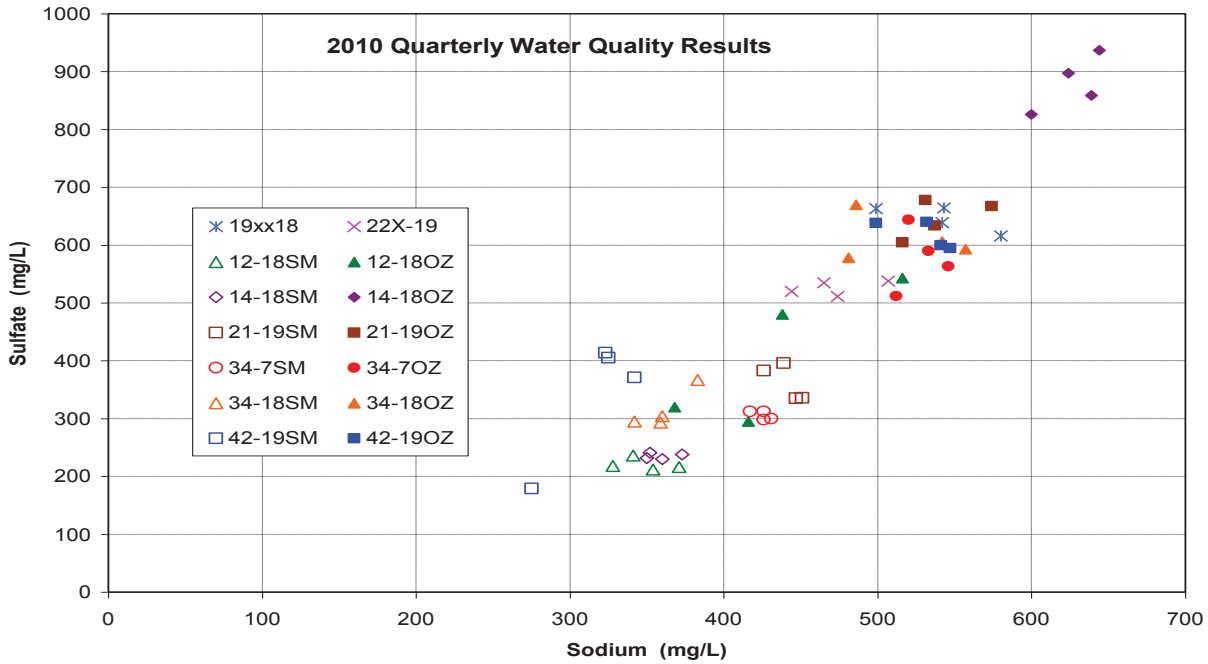
Q. 43. Could you explain why you think the pump tests performed by SEI, and relied upon by NRC in the FSEIS, provided insufficient hydrological information to demonstrate satisfactory groundwater control during planned high-yield industrial well operations?

A. 43. In my expert opinion, neither the number of wells tested for hydrological parameters nor the short duration of the pump tests run to date establish adequate hydrological information to demonstrate control of groundwater over 1,866 acres of complex fluvial stratigraphy, as depicted in the geological cross sections in Addendum 2.6-C of the Strata Technical Report. 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; Strata 2011b, Addendum 2.7-J, SEI006D). The FSEIS 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 inappropriate because the FSEIS 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 (SEI009A, FSEIS; p. 4-37).

Q. 44. What are the consequences of NRC's failure to properly assess hydrologic control in the FSEIS?

A. 44. 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 (see my figure below,

constructed from data in Appendix C of the FSEIS (SEI009A). 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 (SEI006A, 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.



Q. 45. **In addition to showing mixing between the OZ and SM aquifers, what does the above figure indicate with respect to vertical excursions when lixiviant is injected in the OZ aquifer?**

A. 45. The above figure illustrates that the closer 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 major-ion chemistry of the horizons prior to the drilling of thousands of exploration boreholes).

Additionally, it is also known that 22x-19 is screened through the SM and OZ zones, and the FSEIS presents no detailed engineering analysis to show the effect of the industrial well operation on the ISR operations. The complexity of the stratigraphy coupled with thousands of unplugged boreholes, established mixing between the SM and OZ zones, and the operation of the high-yield industrial wells requires 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 FSEIS 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.

Q. 46. Is this type of analysis supported by information in the historical record?

A. 46. Yes. The above analysis is supported by the discussion and figure from (Staub et al.1986; NRC020 at p. 24), which provides evidence for alternative interpretations to aquifer tests and the complexities in adequately defining aquifer confinement:

> "*Conventional exploration methods as describe above seldom provide enough detail to determine whether an ore zone aquifer is sufficiently isolated from other aquifers. The complex stratigraphy of alluvial sediments is a serious obstacle to projection of lithologic units between boreholes even at short distances. Figure 2.8 [original document; see below] presents several interpretations of the same data. In the absence of proof of the contrary, stratigraphic units are often projected as continuous layers between boreholes which may lead to a false sense of security with respect to aquifer isolation. Furthermore, two-dimensional cross-sections do not necessarily portray accurate relationships between aquifers in three dimensions. Thus, an aquitard may be continuous in one direction and discontinuous in another.*" (Staub et al. 1986) (page 24).

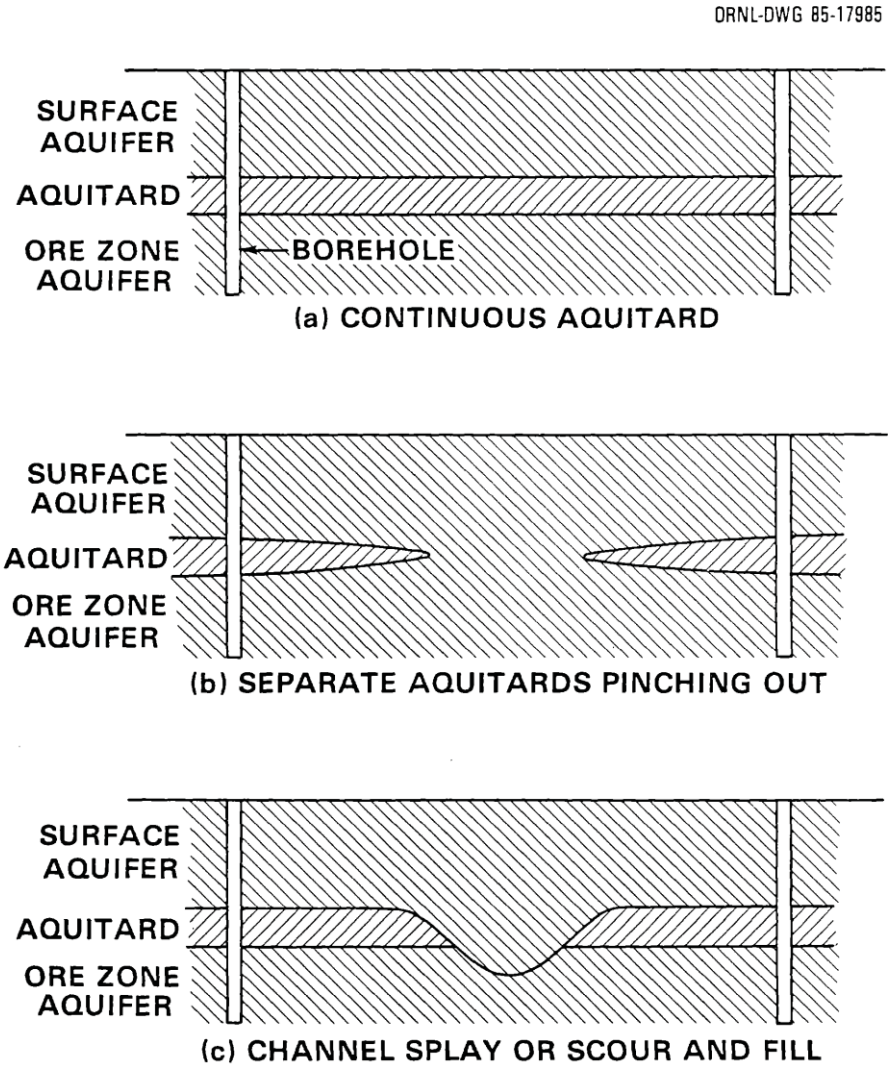


Fig. 2.8. Alternate interpretations of the same borehole data.

1

2 **Conclusion**

3 **Q. 47. Given your concerns with this specific project, why does properly establishing**

4 **baseline groundwater quality and including adequate hydrological information to**

demonstrate SEI's ability to contain groundwater fluid migration matter so much in the American West?

A. 47. The United States Geological Survey's (USGS) publication *Groundwater Depletion in the United States (1900 – 2008)* (JTI027, http://pubs.usgs.gov/sir/2013/5079/SIR2013-5079.pdf) brings attention to the importance of groundwater as drinking water to western communities and, to a lesser extent, the support of agriculture and industry. The conclusions reached in this report are worth noting:

> "This large volume of depletion represents a serious problem in the United States because much of this storage loss cannot be easily or quickly recovered and affects the sustainability of some critical water supplies and base flow to streams, among other effects……In addition to widely recognized adverse environmental effects of groundwater depletion, the depletion also impacts communities dependent on groundwater resources in that the continuation of depletion at observed rates makes the water supply unsustainable in the long term." *Id*. at 50.

In a response to a request from the U.S House of Representatives Subcommittee on Interior Appropriations, the USGS (1998) issued their report to Congress on *Strategic Directions for the U.S Geological Survey Ground-Water Resources Program* (*http://water.usgs.gov/ogw/gwrp/stratdir/,*. JTI028). This report identifies groundwater as one of most important resources in the United States and indicates 57 percent of Wyoming residents rely on groundwater for their drinking supply. *Id*. at 1.

Use of groundwater for drinking water is the highest priority for western states and its protection must be part of any credible sustainability policy. Agriculture and industry interests

must be minimized and set aside to ensure adequate drinking water for future generations. The proper scientific analyses must be made to determine those groundwater resources that are unfit for human consumption and industry markets should be carefully scrutinized to determine if the use of groundwater by the industry truly benefits the State and Nation. In the case of the uranium ISL industry and with respect to the environmental analysis of this project in particular, there has yet to be transparent examination of the purported benefits to the State of Wyoming and the United States by the extraction of uranium when that extraction inevitably degrades that scarce source of Western groundwater. Such benefits and harms would also need to be analyzed with a firm understanding of whether uranium produced in the United States would have an appreciable difference on the world uranium market. I am not persuaded domestic sources would make any difference, but that analysis is missing from the review of this project entirely.

Q.48. Does this conclude your testimony.

A. 48. Yes.

I, Dr. Richard J. Abitz, do hereby declare under penalty of perjury that my statements in the foregoing testimony and my statement of professional qualifications are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 C.F.R. § 2.304(d).

/(electronic signature approved)/
Richard J. Abitz
CEO & Principal Geochemist
Geochemical Consulting Services, LLC
3767 Fallentree Ln
Cincinnati, Ohio 45236

RAILROAD COMMISSION OF TEXAS

SURFACE MINING AND RECLAMATION DIVISION

March 27, 2007

Mr. James B. Blackburn, Jr.
Blackburn Carter
4709 Austin
Houston, Texas 77004

RE: Uranium Energy Corporation (UEC)
Weesatche Project, Goliad County
Uranium Exploration Permit No. 123
Inspection Report

Dear Mr. Blackburn:

Enclosed is a copy of the report for the inspection completed on March 7-9, 2007 at UEC's Weesatche Project, Goliad County. The inspection focused on assessing the borehole site reclamation in accordance with the performance standards defined in the permit application, permit issuance letter and the Uranium Act and Regulations. Deficiencies with the borehole and mud pit reclamation were identified and a Notice of Violation was issued as a result of the inspection.

Additionally, a gamma radiation survey of the area was conducted for comparison of the pit area radiation levels with the normal background level. The soil samples collected as part of this survey are still being analyzed and will be included in a subsequent report.

If you have any questions, please contact me at (512) 463-6901.

Sincerely,

Melvin B. Hodgkiss, Director
Surface Mining and Reclamation Division

MBH/ms
Enclosure

Mine Name: Weesatch Project
Permit Number: 123
Inspection Date: March 7-9, 2007

III. Comments – Inspection Narrative

- *Document the area of the permit inspected*
- *Discuss observations made during the inspection*
- *Document the results of any field tests taken*
- *Provide a summary of any discussions with industry representatives, along with results, and expectations from those discussions*
- *Describe any enforcement action taken during the inspection, along with facts or evidence supporting the enforcement action*

This inspection focused on reclamation of the drilling activities associated with UEC's Weesatch Project, Permit No. 123. The examination was in response to a complaint and request for on-site investigation by James B. Blackburn, Jr. representing Goliad County. The complaint, received February 6, 2007, alleged that UEC was not disposing drill fluids and potentially harmful cuttings in accordance with the approved Uranium Exploration Permit No. 123 and that UEC's activities were adversely impacting the area groundwater resources. We met with Mr. Mike O'Leary at the site on March 7, 2007 at the beginning of the inspection.

Goliad County Commissioner Jim Krenek, Mr. Art Dohmann, Ms. Margret Rutherford and Dr. H. C. Clark, representing the Goliad County group, were also present on March 7, 2007. At the groups' request, we met them at the property of Mr. Elder Abrameit where they discussed the site conditions that prompted their complaint (see photograph 1).

UEC was contacted regarding the complaint and in response provided, by email on February 9, 2007, the location coordinates, plugging dates, and land ownership for each borehole drilled under the permit. UEC reported to the Commission that it had thus far plugged 202 holes.

The inspection focused on the surface impacts of the drilling program to verify if the reclamation procedures were being met. Site reclamation was assessed based on the performance standards defined in the permit application, permit issuance letter and the Uranium Act and Regulations. A total of 117 of the 202 boreholes reported as plugged were checked. A table listing the 117 drill locations checked during this inspection and the evaluation of reclamation associated with each borehole and mud pit is attached. During this inspection UEC had four drilling rigs active (see photograph 2). Only the older boreholes, on which UEC had provided identification information and reported as plugged, were inspected for reclamation compliance.

In Section IV A of the application, UEC states that, during drill site preparations, topsoil will be segregated from other soils and saved and later re-distributed. Topsoil was not re-distributed on the top of the majority of the drill sites inspected. In the 117 borehole sites inspected 74 were not fully re-topsoiled. Site 32892-84 (see photograph 3) exemplifies this drill site reclamation failure. Site 32892-84 is covered with a gray subsoil with little or no topsoil evident.

Mine Name:	Weesatch Project
Permit Number:	123
Inspection Date:	March 7-9, 2007

III. Comments – Cont.

In Section IV A of the application, UEC states that mud pits will be allowed to dry before being backfilled with subsoil and cuttings. This drying aids in preventing excursions semi-solid drilling fluids. I observed at the active sites that drilling pits were being backfilled very quickly after the hole was logged with no drying period (see photograph 4). This process caused lighter drilling liquids to be crowded out of the pit and flow on to the surface. Evidence of this reclamation failure was also evident in the several older drill holes including Borehole 32892-84 where drilling fluids or cuttings were found on the surface (see photograph 5).

In Section IV A of the application, UEC states that mud pit areas will be backfilled to above grade to allow for settling. This precaution is designed to prevent the formation of depressions in the pasturelands drilled. Eleven of the 117 boreholes inspected had depression areas forming over the mud pits. Borehole 32201-N40 is an example of this backfilling failure (see photograph 6).

UEC committed in Section IV B of the application to mark each borehole location in such a way that the Commission could verify the presence of a surface plug. UEC provided the Commission with State Plane Coordinates for each borehole. We attempted to locate the boreholes with the coordinates using three separate GPS systems, one with sub-meter accuracy. The Commission inspectors were only able to tag the surface plug in six holes of the 117 inspected using the GPS and a four foot steel rod probe. The holes that were located were found because there was some surface indication of the borehole location not because they were at the exact coordinates provided. Evidence was present in the field that a number of boreholes may have been marked over the hole with a wooden stake at one time but most of the sites had been regraded or otherwise re-disturbed.

As required by the Commission's permit issuance letter, each borehole drilled in this project is required to have a ten-foot surface plug located three feet below the surface. The majority of the borehole locations were unable to be located for verification. Of the fourteen boreholes located, five were found to be open to the surface with the cement plug estimated to be greater than 20 feet below the surface and the remainder of the plugs found were between 0 and 18 inches below the surface. Borehole 32201-N38 (see photograph 7) is an example of this plugging failure.

Several sites were inspected where the surface reclamation had been done in accordance with the performance standards contained in UEC's Permit No. 123 (see photographs 8 and 9).

In addition to the site reclamation inspection, a gamma radiation survey of the area was made to determine if the radiation levels from the pit areas was higher than background levels. As part of this survey, soil samples were secured for analysis. The results of this part of the inspection are still being analyzed and will be included in a subsequent report.

Mine Name:	Weesatch Project
Permit Number:	123
Inspection Date:	March 7-9, 2007

III. Comments – Cont.

Based on observations made during this field inspection I believed that UEC was not in compliance with their Exploration Permit and the Regulations and issued Notice of Violation 080A. The Notice of Violation requires that UEC install a concrete surface plug at all sites, mark the exact location of each borehole for verification by the Commission, and remove all drilling mud, cuttings, cement and other debris burying it with no less than one foot of topsoil. UEC is directed to complete the remedial action by April 12, 2007.

A closeout meeting was conducted on March 12 via telephone conference with Mr. O'leary wherein the items included in this report were discussed.

Uranium Exploration Corporation (UEC) - Weesatch Project Inspection

March 7-9, 2007

Site #	Mud Pit Reclamation Surface Attributes					Borehole		
	Borehole Cuttings [1]	Drilling Mud [1]	Cement [1]	Settling	% of Disturbed Area Topsoiled [2]	Located	Surface Plug	Plug Depth [3]
30892-103	N	N	N	N	0-59	N	-	-
30892-104	N	N	N	N	60-100	N	-	-
30892-101	N	Y	N	N	0-59	N	-	-
30892-102	N	Y	N	N	0-59	N	-	-
30892-102C	N	Y	N	N	0-59	N	-	-
30892-105	N	Y	N	N	0-59	N	-	-
30892-113	N	N	N	N	0-59	N	-	-
30892-114	N	N	N	N	0-59	N	-	-
30892-115	N	N	N	N	0-59	N	-	-
30892-116	N	N	N	N	0-59	N	-	-
30892-117	N	N	N	N	0-59	N	-	-
30892-118	N	N	N	N	0-59	N	-	-
30892-118AC	N	N	N	N	0-59	N	-	-
30892-118C	N	N	N	N	0-59	N	-	-
30892-119	N	N	N	N	0-59	N	-	-
30892-120	N	N	N	N	0-59	N	-	-
30892-120BC	N	N	N	N	0-59	N	-	-
30892-120C	N	N	N	N	0-59	N	-	-
30892-121	N	N	N	N	0-59	N	-	-
30892-83	N	N	N	N	0-59	N	-	-
30892-85	N	N	N	Y	0-59	N	-	-
30892-85AC	N	N	N	N	0-59	N	-	-
30892-85C	N	N	N	N	0-59	N	-	-
30892-86	N	N	N	N	60-100	N	-	-
30892-86C	N	N	N	N	0-59	N	-	-
30892-90	N	N	N	N	60-100	N	-	-
30892-91	N	N	N	N	60-100	N	-	-
30892-92	N	N	N	N	60-100	Y	Y	14"
30892-94	N	N	N	N	60-100	N	-	-
30892-95	N	N	N	N	0-59	Y	Y	8"
30892-97	N	N	Y	N	60-100	Y	Y	18"
30892-98	N	N	N	N	60-100	N	-	-
32201-N37	N	N	Y	Y	0-59	Y	Y	0'
32201-N39	N	N	N	N	50	N	-	-
32201-N52	N	N	N	N	0	N	-	-
32201-N58	N	N	N	N	0	N	-	-
32201-N62	N	N	N	N	0	N	-	-
32202-101	N	N	N	N	60-100	N	-	-
32202-102	N	N	N	N	60-100	N	-	-

Site #	Mud Pit Reclamation Surface Attributes					Borehole		
	Borehole Cuttings [1]	Driling Mud [1]	Cement [1]	Settling	% of Disturbed Area Topsoiled [2]	Located	Surface Plug	Plug Depth [3]
32202-106	N	N	N	N	60-100	N	-	-
32202-107	N	N	N	N	60-100	N	-	-
32202-108	N	N	N	N	60-100	N	-	-
32202-112	N	N	N	N	50	N	-	-
32202-113	N	N	N	N	60-100	Y	Y	12"
32202-114	N	N	N	N	60-100	N	-	-
32202-115	N	N	N	N	60-100	N	-	-
32202-116	N	N	N	N	0-59	N	-	-
32202-117	N	N	N	Y	0-59	N	-	-
32202-118	N	N	N	N	60-100	Y	Y	12"
32202-120	N	N	N	N	60-100	Y	Y	18"
32202-121	N	N	N	N	60-100	Y	Y	10"
32202-123	N	N	N	N	60-100	N	-	-
32202-124	N	N	N	N	60-100	N	-	-
32202-125	N	N	N	Y	60-100	N	-	-
32202-127	N	N	N	N	60-100	N	-	-
32202-94	N	N	N	N	60-100	N	-	-
32202-95	N	N	N	N	60-100	N	-	-
32202-96	N	N	N	N	60-100	N	-	-
32202-97	N	N	N	N	60-100	N	-	-
32202-98	N	N	N	N	60-100	N	-	-
32202-99	N	N	N	N	0-59	N	-	-
32206-01	N	N	N	N	80	N	-	-
32206-02	N	N	N	Y	0	N	-	-
32206-06	N	N	N	Y	0	N	-	-
32206-07	N	N	N	Y	0	N	-	-
32206-08	N	N	N	N	0	N	-	-
32206-12	N	N	N	N	0	N	-	-
32206-12A	N	N	N	N	60-100	N	-	-
32206-12N	N	N	N	N	0	N	-	-
32206-12S	N	N	N	N	0	N	-	-
32206-18	N	N	N	N	0	N	-	-
32208-30	N	N	N	Y	0	N	-	-
32208-31	N	N	N	N	0	N	-	-
32208-32	N	N	N	N	100	N	-	-
32208-42	N	N	N	N	60-100	N	-	-
32208-43	N	N	N	N	85	N	-	-
32208-46	N	N	N	N	0	N	-	-
JACOBS WW	N	N	N	N	60-100	Y	-	-
P1-07-1 8	N	N	N	N	60-100	N	-	-
P-1-07-3-4	N	N	N	N	60-100	N	-	-
P1-07-4	N	N	N	N	60-100	N	-	-
P1-07-6	N	N	N	N	60-100	N	-	-

Site #	Surface Attributes					Borehole		
	Borehole Cuttings [1]	Drilling Mud [1]	Cement [1]	Settling	% of Disturbed Area Topsoiled [2]	Located	Surface Plug	Plug Depth [3]
P1-07-7	N	N	N	N	60-100	N	-	-
30892-84	N	N	N	N	0-59	N	-	-
30892-88	N	Y	N	N	0-59	N	-	-
30892-99	N	Y	Y	N	0-59	N	-	-
30898-21	Y	N	N	N	60	N	-	-
30898-22	Y	N	N	N	90	N	-	-
30898-23	N	N	Y	N	60	N	-	-
30898-24	Y	N	N	N	90	N	-	-
30898-31	Y	N	Y	N	85	N	-	-
30898-32	N	N	Y	Y	95	Y	Y	18"
30898-35	N	Y	Y	N	60	N	-	-
32201-N1	N	Y	N	N	0-59	N	-	-
32201-N10	N	N	N	N	0	N	-	-
32201-N12	N	Y	Y	Y	0	Y	N	-
32201-N2	N	Y	N	N	0-59	Y	N	-
32201-N3	N	Y	N	N	20	Y	N	-
32201-N38	N	Y	N	Y	80	Y	N	-
32201-N40	N	N	N	Y	80	N	-	-
32201-N41	N	N	N	N	80	N	-	-
32201-N5	N	N	N	N	100	N	-	-
32201-N6	N	N	N	N	60	N	-	-
32201-N7	N	Y	N	N	50	N	-	-
32206-03	N	N	N	N	0	N	-	-
32206-09	N	N	Y	N	0	N	-	-
32206-11	N	N	Y	N	60-100	N	-	-
32206-15	N	N	N	N	0	N	-	-
32206-19	Y	N	N	N	0	N	-	-
32206-20	N	N	Y	N	60-100	N	-	-
32206-21	N	N	Y	N	60-100	N	-	-
32208-41	N	Y	N	N	90	N	-	-
32208-44	Y	Y	Y	N	0	N	-	-
32208-45	N	Y	Y	N	0	Y	N	-
P1-07-1-4	Y	N	N	N	0-59	N	-	-
P1-07-2-4	N	N	N	N	60-100	N	-	-
P1-07-8-8	Y	N	Y	N	0-59	N	-	-

Notes:

[1] Material found on surface

[2] % estimates made on first day of inspection were made as a range

[3] Measurement from ground surface to top of plug

N = No; Y = Yes

MRD-24
(02/07)

RAILROAD COMMISSION OF TEXAS
SURFACE MINING AND RECLAMATION DIVISION

Notice of Violation No.
080A

NOTICE OF VIOLATION

Company: Uranium Energy Corporation (UEC)

Mine Name: Weesatch Project Permit No. Exploration Permit No. 123

Type of Mine: ☐ Coal ☒ Uranium ☐ Other

Mailing Address: Suite 230-9801 Anderson Mill Road City Austin Zip 78750

County Goliad Telephone Number: (512) 828-6980

Date of Inspection: March 7-9, 2007

Time of Inspection: FROM: 8:00 A.M. TO: 12:00 A.M.
P.M. P.M.

Description of Violation(s) The permittee failed to complete surface plugging and drill site reclamation as specified in Section IV of Uranium Exploration Permit No. 123. Specifically, the permittee failed to segregate and replace topsoil, and/or properly install a cement surface plug, and/or allow pits to dry before backfilling and/or backfill or compact backfilled materials and topsoil above grade in the reclaimed mud pits to compensate for settling, and/or mark the exact location of each borehole.

Provisions of Regulations, Act or Permit Violated Uranium Exploration Permit No. 123, Section IV, and § 11. 137 and §11.138 of the Texas Uranium Surface Mining Regulations

Area of Operation Affected Uranium Exploration Permit No. 123 Permit Area

Remedial Action Required The permittee shall: 1) Install a concrete surface plug as required in the permit, 2) Mark the exact location of each borehole for verification by the Commission, 3) Remove all drilling mud, cuttings, cement and other debris burying it with no less than one foot of topsoil.

Time for Abatement Thirty Days (April 12, 2007)

NOTICE Issued by _____ Date March 13, 2007

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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)	)	

Pre-Filed Rebuttal Testimony of Dr. Lance Larson on
Contentions 2 and 3

Q. 1. Dr. Larson, you've testified in this proceeding before today?

A. 1. Yes, my name is Dr. Lance Larson and I provided pre-filed direct testimony in this proceeding on August 25, 2014. *See* JTI003. My credentials were provided at that time. *See* JTI004.

Q.2. How is your rebuttal testimony filed this day organized?

A. 2. My testimony is organized as follows:

1) Response to Staff and SEI Testimony regarding Contention 2 and the matter of whether the FSEIS analyzes the environmental impacts that will occur if the applicant cannot restore groundwater to primary or secondary limits; and

2) Response to Staff and SEI Testimony regarding Contention 3 and the matter of whether the FSEIS fails to include adequate hydrological information to demonstrate SEI's ability to contain groundwater fluid migration.

I. Response to Staff and SEI Testimony regarding Contention 2

Q. 3. Staff asserts (at 31) ***"Consistent with the Commission's generic determination in the GEIS (Ex. NRC007 at 4.2-27), the Staff determined in the FSEIS (Ex. SEI009A at 4-40 and 4-48) that the potential impacts to water quality of the exempted aquifer as a result of Ross Project operations would be expected to be SMALL and temporary because Strata is required by Condition 10.6 of its license (Ex. SEI015) to comply with 10 C.F.R. Part 40, Appendix A, Criterion 5B. In other words, the Staff concluded in the FSEIS that the potential impacts to water quality of the exempted aquifer as a result of ISR operations would be SMALL and temporary regardless of which of the three options defined in 10 C.F.R. Part 40, Appendix A, Criterion 5B, is used."*** **How do you respond?**

A. 3. I do not agree that the environmental impact of an ACL is "small and temporary" regardless of the extent of contamination, which is what Staff seems to imply with its reliance on the yet to be determined ACL. Rather, the FSEIS, and now the Staff in its testimony, fail to present a clear picture of the extent of groundwater impacts at previous ISL sites, as what they purport to call a "bounding analysis" fails to accurately present the data and further, fails to accurately and precisely display the irreversible degradation of the natural resource. As documented in my August 25, 2014, prefiled direct testimony, the likelihood of meeting either the original baseline or the EPA Maximum Contamination Limit for uranium, is vanishingly small. Relying on the examples NRC cites in the FSEIS or in their August testimony (JTI003; p.22), and the underlying data from NRC sources on which the Storymaps are based, it is my professional opinion that the Ross Project will not have "SMALL and Temporary" impacts on groundwater quality, but rather that those impacts will be large and long-term. As I will discuss

below, Staff's "bounding analysis" fails to accurately provide a meaningful discussion of the irretrievable and irreversible impacts of ISL operations.

Q.4. Staff asserts (at 33) "*the Commission approved restoration of uranium to values ranging from 4 to 71 times post-licensing, pre-operational background values. Specifically, the average concentration of uranium in the wellfield(s) for which the Commission issued restoration approval were as follows: (1) Crow Butte Wellfield 1: 1.73 mg/L, or 18 times background levels; (2) Smith Ranch- Highland A-Wellfield: 3.53 mg/L, or 71 times background levels; and (3) Irigaray Mine Units 1-9: 1.83 mg/L, or 4 times background levels (Crow Butte Resources, 2001; PRI, 2004; Cogema, 2006b). In other words, based upon the available historical record of uranium concentrations at the close of active restoration, if an ACL is requested by Strata for the Ross Project, it is likely to range between 1.7 mg/L and 3.5 mg/L, or 4 to 71 times the post-licensing, preoperational background values for uranium that ranged from 0.05 to 0.52 mg/L*." How do you respond to this?

A.4. The figures above are what Staff purports, post hoc, to call its "bounding analysis." This data was not presented as a bounding analysis in the FSEIS and for the reasons I explain below, it should not be understood or presented as a meaningful or accurate bounding analysis. I will discuss the reasons for this in turn.

Crow Butte

First, as noted in my August testimony, in neither the FSEIS or in Staff's August testimony is there a risk or dose calculation to support the contention that the elevated radium-226 and uranium concentrations pose no threat to human health and the environment.

Second, Staff further asserts (at 37) "*the FSEIS documented the systematic approach taken by the Commission in 2003, in which it: (1) assessed concentrations in groundwater after aquifer restoration; (2) ensured the stability of concentrations over time; (3) compared the groundwater concentrations to primary and secondary standards; and (4) applied those standards to arrive at a determination that the groundwater concentrations presented by Crow Butte for Wellfield 1 were protective of human health and the environment*."

The FSEIS did no such thing. The FSEIS (SEI009A at 4-46) briefly describes the Crow Butte history, states that restoration levels were approved, citing a 2001 Crowe Butte restoration report. Such a treatment leaves out important details. On March 29, 2002, obliquely referenced in the FSEIS as "stability monitoring," the NRC Staff denied the Crow Butte restoration report referenced and discussed in the FSEIS as being not protective of human health and the environment. (JTI053; p. 99). In that document, Staff concluded "*the data in your Restoration Report, submitted by letter dated January 14, 2000, and the additional information submitted by letter dated August 24, 2001, do not demonstrate that the restoration activities in Unit 1, have resulted in constituent levels that will remain below levels protective of human health and the environment, in accordance with 10 CFR 40.31(h) and Criterion 5F, 10 CFR Part 40, Appendix A.*"

Further, upon collection of additional groundwater samples between June and September 2002, the groundwater samples observed uranium concentrations of similar magnitudes (1.6 – 1.8 mg/L) (JTI053: p. 125 – 126), thus, precisely the same as what was described above as below levels deemed to be protective of human health and the environment. However, while there was no decrease in the uranium, but seemingly not approaching an arbitrarily set secondary standard of 5 mg/L, after this second round of stability sampling, NRC approved the restoration. To

reiterate, despite roughly equivalent uranium concentrations observed previously which were deemed not protective, the NRC approved restoration as adequately protective. The basis for finding similar concentrations protective in one instance and not in another is not discussed at all in the FSEIS. Indeed, approval of the Crow Butte mine unit 1 concentration levels -- 1.73 mg/L, or 18 times background levels -- as "protective of human health and the environmental" was determined by an arbitrary standard chosen out of expedience for that site and has little meaning for assessing a future ACL at the Ross project. It also demonstrates the subjective statement "protective of human health and the environment" is only condition dependent, and lacks scientific or empirical basis for assessing restoration performance.

Smith Ranch

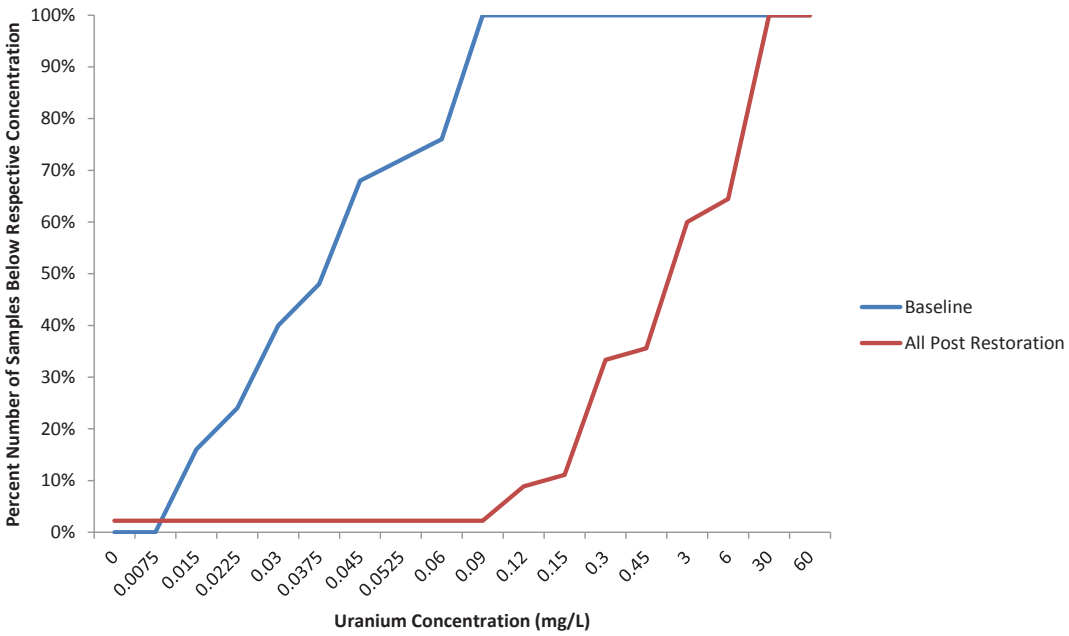
For Smith Ranch wellfield A, Staff acknowledges the averaging of uranium concentrations at 71 times the background as a purported high end of what could happen at Ross. However, Staff has not performed analysis on the entire distribution of data available from the Staff's own data at Smith Ranch, which could justify why that concentration is applicable and not something potentially much higher. As evidenced by the underlying NRC spreadsheet groundwater data,[1] groundwater contamination at ISL sites widely varies spatially and temporally, and these need to be factored into the data analysis. In neither its FSEIS or subsequent testimony has the Staff done such analysis.

As a measure of contrast, compare Staff's anecdotal and conclusory statements regarding restoration at Smith Ranch with the substantially more complete picture presented in my August testimony for Smith Ranch. There, I provide examples of various wells and a comparison of

[1] Per the Board's September 10, 2014 Order, Joint Intervenors will file the spreadsheets in .pdf form on September 16, 2014.

post-restoration and baseline uranium concentrations in the groundwater. For example, samples at well MP-4 observed extremely elevated uranium concentrations (5.5 – 11.5 mg/L) compared to average baseline (0.03 mg/L), exceeding the average baseline uranium concentration by ~183x - 383x, with no evidence that natural attenuation was decreasing elevated uranium concentrations. Well MP-5 observed a similar trend, where uranium concentrations range from 5.9 – 11.00 mg/L, where 11.00 mg/L was the last sample available suggesting an progressively increasing trend. The average baseline was 0.04 mg/L, indicating concentrations had increased between 148x – 275x baseline concentrations, well above the 71x proposed by Staff. Further, according to the NRC Staff's spreadsheets, these samples were all collected between February 1999 and November 1999, implying they should be relevant to the bounding analysis. None of these complexities and none of this granular data or analysis are presented by Staff in the FSEIS or in their testimony.

For this rebuttal, I've prepared a cumulative histogram from the NRC's own data used in the August Testimony at Smith Ranch wellfield A (MP1 – MP5) that demonstrates that extreme contamination levels (defined as >3 mg/L or 100x safe drinking water standards) were approximately 40% of the post restoration samples. All baseline samples were used (n=25) and all post-restoration samples were used (n = 45) in creation of the cumulative histogram.



Q.5. Staff (at 39, 40) asserts that in your March declaration you and Dr. Abitz failed to fully present the analysis of Borch *et al*. as it related to declining uranium concentrations. Specifically, Staff asserts *"[Drs. Abitz and Larson note, the 2005–2012 data from well MP-4 demonstrate that the production zone continues to contain elevated levels of uranium. The authors of the study cited by Drs. Abitz and Larson determined that the uranium level in that well increased 4.4 percent over the monitoring period (see Ex. NRC037 at PDF 6, Table 3). However, Drs. Abitz and Larson do not discuss the full analysis and conclusion reached in the study. In their independent review of the post-restoration data at A-Wellfield, the study identifies the 30 percent decline in uranium concentrations in well I-21 between 2005 and 2012 (Ex. NRC037 at PDF 6, Table 3), and the low levels of uranium reported in the surrounding monitoring wells and concludes that the natural attenuation process is occurring as predicted by Power Resources Inc.'s analysis (see Exs. NRC037; NRC028 at 64, 94). Based*

on our review of the post-restoration groundwater presented in the study by Borch et al (2012), we believe that it is consistent with the conclusion reached by the Commission when it approved restoration of A-Wellfield, which is that the level of uranium at the time of restoration approval was protective of human health and the environment. (Ex. NRC027)."

How do you respond?

A.5. It is Staff that inaccurately presents the Borch *et al.* conclusions and improperly concludes without qualification that natural attenuation is responsible for the decrease in uranium. Specifically, in the analysis of the Borch *et al*. 2012 paper from Smith Highland, the NRC Staff conclude that natural attenuation was responsible for the decrease in uranium concentrations at well I-21. However, NRC Staff's conclusion is taken out of context, as Borch *et al*. fully state: (NRC037 at p.7):

"The trend at I-21 could be due to more uranium being attenuated by natural processes or leaving with groundwater than the influx of uranium. It is very difficult to speculate or model the most likely natural attenuation processes controlling the fate and transport of U at this site due to the general lack of hydrological and biogeochemical data." (emphasis added).

In others words, the authors attempted to explain that decreased uranium concentrations observed at well I-21 could be due to *either* natural attenuation *or* because the net uranium flux was migrating from well. The difference between the two is stark, and important for assessing the potential for uranium transport. The authors further conclude that there is insufficient data to attempt to model these complex hydro-biogeochemical reactions that influence the transport of uranium in an aquifer. The incomplete hydrological and biogeochemical dataset issue has been raised previously (JTI003; p. 50-52) and will also be discussed in depth in contention 3.

Further, not discussed by Staff in either the FSEIS or their testimony, a crucial matter for any meaningful attempt at bounding analysis of potential restoration results, is the trend toward

increasing uranium concentrations within the ore zone. An example of this that should have been analyzed in the FSEIS is the results and data from Smith Highland mine unit A. The uranium concentration trends within the mine unit, suggest that concentrations are *either* increasing or staying stable, and elevated. Samples taken at this site after the Borch *et al*. 2012 demonstrate this trend. The 2012 sample from I-21 actually increased to 2.13 mg/L from 2011, which observed 0.663 mg/L (NRC029; p. 52). The 2012 sample from MP-4 observed a uranium concentration of 17.3 mg/L, the highest concentration measured at this well. Note, that the uranium concentration observed at MP-4 at the beginning of 1999 was 5.50 mg/L (See JTI005B-R; p. 28-29), suggesting that between 1999 and 2012 uranium concentrations at well MP-4 more than tripled (from 5.5 mg/L to 17.3 mg/L). These results indicate that the effects on groundwater in the ore zone are not SMALL nor temporary as continually asserted throughout the FSEIS.

Increasing uranium trends are also confirmed in wells from 'restored groundwater' at Christensen mine unit 5-2. This is clearly a trend across sites that has received no attention from the Staff, either in the FSEIS or the in their testimony. For example, Monitor Wells 5AH57-1, 5AG-70, and 5AV46-1 were former injection wells used in the 'first' operation of Christensen Ranch mine unit 5, which all had been converted to monitoring wells upon the operation of mine unit 5-2 (NRC041; p.2 and 4-6). Within a year of sampling, these wells observed alarmingly increasing trends of uranium concentrations. For example well 5AV46-1 observed a significant increase in uranium concentrations in less than a year (from 11/28/2011 to 7/2/2012), from ~5.4 mg/L to 31.2 mg/L (180x to 1,040x safe drinking water standards). The last sample observed at 5AV46-1 observed the maximum concentration measured (31.2 mg/L), indicating an upward trend in groundwater that had been "restored" (JTI054; p. 8). It's important to note that the 'first' post-restoration stability measurements in mine unit 5 ended in 8/1/2004, suggesting

concentrations were increasing, and are still rising, within the well field to extremely high concentrations roughly a decade after stability monitoring ended. Again, these data suggest there's very little empirical evidence that the environmental impacts will be either "small" or temporary. In fact, the publically available groundwater data suggest the impacts to groundwater are and will be large and permanent.

Q.6. Staff (at 40-41) criticizes your analysis of the Irigaray baseline and restoration results. Specifically, Staff asserts, *"Furthermore, to attempt to recalculate the uranium concentrations using the initial average "baseline" concentrations as proposed by Drs. Abitz and Larson is neither practicable nor useful for the purposes of the discussion of historic restoration approvals in the FSEIS. First, a recalculation of these values using the alternate approach proposed by Drs. Abitz and Larson would require the Staff to essentially re-do the technical evaluation previously performed by the Commission for this wellfield using a different assumption regarding averaging baseline of wellfields. Such an exercise would be predicated on the availability of all the necessary raw data and an outlay of time and resources disproportionate to the value of the exercise, in that it would not serve the purpose of the discussion in the FSEIS – to record what actually occurred when the Commission approved alternate restoration values at Irigaray in the past. Second, the result of such an effort would likely not impact the range of concentration values for uranium recorded in the FSEIS as approved secondary restoration standards at the Irigaray wellfields. For the hypothetical situation in which the uranium baseline concentrations for Irigaray Mine Units 1-9 excluded data from Mine Unit 1, following the approach suggested by Drs. Abitz and Larson, it is almost certain that the restoration uranium concentrations in Mine Units 1 and Mine Units 2-*

9 would fall below the high end of the range for uranium established by the three facilities presented in the FSEIS – that is, 3.5 mg/L, or approximately 71 times the background value for uranium, as approved by the Commission for Smith Ranch-Highland AWellfield. Therefore, we do not believe that the Intervenors' concerns regarding the Commission's approach for approving alternate restoration values at Irigaray Mine Units 1-9 meaningfully affect the Staff's evaluations or conclusions in the Ross Project FSEIS." **How do you respond?**

A.6. Staff's assertion that the "post-licensing, pre-operational background values for uranium that ranged from 0.05 to 0.52 mg/L", is flawed and unjustified. First, by examining the actual cumulative distribution for baseline data from a representative site, such as Willow Creek - Christensen Ranch, the value of 0.05 mg/L would be higher than roughly 85% of the baseline samples measured (JTI003; p. 41, figure). For the Smith Highland Samples, 0.05 mg/L baseline would have exceeded approximately 70% of the observed baseline samples (See histogram figure above). There is no justification to assume a concentration at such a high baseline concentration (0.05 mg/L), when that value is unrepresentative of the actual concentrations observed in the groundwater representative of baseline groundwater at ISL sites.

Next, I've explained, in my initial testimony (JTI003; p.16), that pre-mining leach activities which were not restored in Irigaray mine unit 1 had a profound impact on the 'average baseline' concentrations (See table in JTI003; p.15). This extremely high value, which was an artifact of injection of lixiviant prior to collection of 'baseline' samples, was used in order to skew the baseline dataset for mine units 2-9 to the substantially higher value ~0.52 mg/L. Therefore, the upper bound baseline concentration is also unjustified.

By determining that the range of uranium concentration increases at Irigaray mine units 1-9 showed only an increase of 4x displays the pitfalls of how not to perform a meaningful data analysis. While the Staff acknowledges that Irigaray mine unit 1 data was skewed from research and development activities (NRC001, p.22), they assert that the results of mine units 2-9, data which I presented in my initial testimony (JTI003; p.15), would "*fall below the high end of the range for uranium established by the three facilities presented in the FSEIS – that is 3.5 mg/L, or approximately 71 times the background value for uranium*".

However, the approach to claim that these values are within the "bounding analysis" does not compare how those values changed from respective baseline values for each individual mine unit. To only consider the 'final' concentrations and not compare them to an actual and representative sample of initial average baseline concentrations shows the fallacy of the proverbial 'one-armed fisherman' (imagine a one-armed fisherman gesturing to describe the size of a fish he had caught: "It was this big"). To put it plainly, while the average stability concentrations of Irigaray mine units 2-9 ranged from approximately 1.46 – 3.8 mg/L; the actual range of increase from average baseline increased between 16x – 125x (See table in JTI003; p.15), exceeding both the upper and lower bounding limits proposed by Staff (4x – 71x). Again, this example presents how the "bounding analysis" suggested by Staff, using the available data of approved restoration ISL sites, does not provide a meaningful range of baseline values nor potential ACLs.

Q.7. But didn't Staff (at 41) assert that Intervenors' approach for approving alternate restoration values at Irigaray Mine Units 1-9 would not meaningfully affect the Staff's evaluations or conclusions in the Ross Project FSEIS?

A.7. Staff asserts that what transpired at the Irigaray site has no relevance on the Ross operation (NRC001, p.22), but Staff is incorrect. This situation directly parallels the two failed groundwater restorations from Nubeth's research and development activities within the Ross project boundaries. In other words, localized previous mining activities at Nubeth would result in high 'background' or 'baseline' values, and mask the actual impacts to the groundwater, which would be used to absolve groundwater restoration responsibilities. This is true, regardless of the type of lixiviant used (NRC001, p.22), whereas ISL sites using sodium carbonate lixiviants have also failed to restoration baseline values at all ISL operations in the US after ending ammonia based lixiviants in the early 1980s.

Of note, Staff cites Cogema's Christensen Ranch mine units 2-6 has requested approval for restoration in 2008. Uranium One acquired the license from Cogema in 2009 (~5 years prior to the FSEIS) and has restarted ISL operations in parts of mine unit 5, and began operations in several new mine units without prior approval of the restoration report for mine units 2-6. JTI055. I discussed and presented data for specific groundwater contamination from the 'first baseline' and 'first post-restoration' at Christensen Ranch (JTI005B-R; p.1-20). It's unclear from the FSEIS, how the agency would proceed to handle a pending groundwater restoration approval of several mine units (MU2-MU6), while concurrent ISL operations are occurring at adjacent (MU7, MU8, MU9, MU10-A, MU10-B: JTI055) and within former mine units (MU 5-2: JTI056; p.2), and the potential environmental impacts to groundwater which would ensue in such a process.

II. Response to Staff and SEI Testimony regarding Contention 3

Q.8. Staff (at 71, 72) mounts a defense of its presentation of subsurface geochemistry and geochemical mechanisms of uranium transport in the FSEIS. Specifically, Staff challenges your claim that the FSEIS (SEI009A at 4-41) is "inaccurate and an oversimplification of the dominant geochemical mechanisms which dictate subsurface transport of soluble uranium." Staff asserts its position in the FSEIS is fact, and Staff's approval of chloride, conductivity, and total alkalinity as described in the SER (SEI014 at 280) and in License Condition 11.4 is consistent with analysis of excursion and recommendations for excursion monitoring parameters in Staub et al. (1986) (NRC020 at 37-39). They go on to note that geochemical reactions involving uranium that are described by Drs. Abitz and Larson in their paragraphs 48–50 are the very reasons why uranium is not monitored as an indicator parameter for excursions. Further, Staff asserts the point is not whether uranium may increase in the groundwater from an excursion. The point is which parameter should be monitored as a leading indicator to identify the excursion most quickly. Staff concludes, "[*i*]*n response to the geochemical reactions involving uranium described by Abitz and Larson (paragraphs 48-50), the rate of uranium transport in the aquifer could be slowed by adsorption and precipitation; and therefore, uranium is not a leading indicator of an excursion into the groundwater outside the production zone. There is nothing vague or contradictory about the information and impact analysis in the FSEIS."* How do you respond to Staff's defense of its treatment of the potential for fluid migration in the aquifer?

A.8. Respectfully, the NRC Staff's understanding and associated presentation of uranium subsurface geochemistry contaminant fate and transport is dated and thus, the FSEIS is lacking

in its treatment of the matter. This is an area of significant concern and in my August testimony I expressed fundamental disagreements with the NRC over how they interpret geochemical interactions that will take place in the subsurface when efforts to establish baseline are commenced and, more important, when mining commences. This is especially important as the FSEIS fails to account for the potential for contaminant excursions in light of an inadequate assessment of aquifer confinement. Specifically, by failing to accurately understand and assess uranium fate and transport in the subsurface combined with a failure to sufficiently analyze the potential for and impacts associated with vertical fluid migration, through unidentified or unsealed drillholes between aquifer units, Staff essentially dilutes the significant and irreversible environmental impact. A clear understanding of these pathways is directly relevant to the FSEIS's failure to analyze sufficiently the potential for and impacts associated with fluid migration associated with unplugged exploratory boreholes, including the adequacy of applicant's plans to mitigate possible borehole-related migration impacts by monitoring wellfields surrounding the boreholes and/or plugging the boreholes.

Q.9. Dr. Larson, let's unpack this one piece at a time, so let's start with the geochemistry and whether the FSEIS presented adequate hydrological information to demonstrate SEI's ability to contain groundwater fluid migration?

A.9. In defending its presentation of subsurface geochemistry and why it doesn't use uranium as an excursion indicator, the NRC Staff claims that the assertion in the FSEIS (SEI009A at 4-41) and in its direct testimony (p. 71, 72, note 5) that "*These constituents move through the aquifer faster than other water-quality parameters, and therefore levels above these would indicate excursions before radionuclides and other elements move outside the production (i.e., uranium-*

recovery) zone" is a statement of fact. This purported statement of fact is made without any citation or supporting evidence, only a professional opinion.

However, the scientific literature over the last decade contradicts NRC's assertion and its simplistic assumptions regarding conventional uranium transport mechanisms, especially concerning geochemical conditions which arise due to ISL operations. A factual statement regarding uranium transport is that uranium mobility in groundwater is dependent on a host of site specific hydro-biogeochemical conditions, which can be mutually agreed upon by SEI, Staff, and Intervenors'. This is articulated by a current quote from the homepage of Gary Curtis, an environmental engineer with the USGS:

> "Groundwater contamination from hexavalent uranium U(VI) is a problem at many federal sites because of its importance in the nuclear fuel cycle. The adsorption and therefore mobility of U(VI) in groundwater is controlled by the local geochemical conditions such as pH and especially the alkalinity which is usually composed primarily of bicarbonate and carbonate ions. Understanding the mobility of U(VI) in groundwater is a key prerequisite to estimating the discharge to receiving water bodies, quantifying risks from the use of contaminated groundwater and evaluating site management alternatives." JTI057.

Now that we've established uranium mobility in groundwater is dependent on a host of site specific hydro-biogeochemical conditions, and not qualitative conjectures of speed, I will present a review of the updated science on the issue of fluid migration and potential uranium transport that is entirely missing from the FSEIS and staff's post hoc defense in its August testimony. In short, I conclude NRC Staff's model of uranium transport is poor and does not adequately support the control of unwarranted fluid migration off-site.

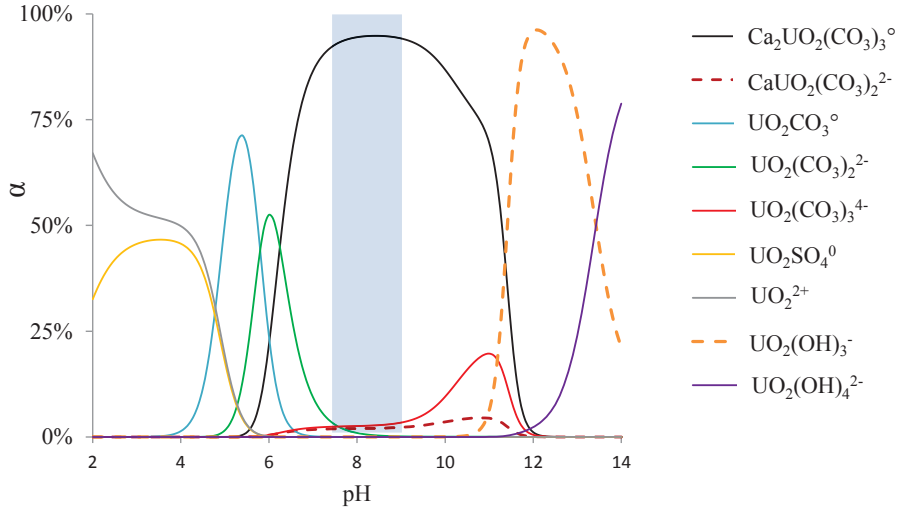
Q.10. Why do you say this?

A.10. I will start with some basic technical data that informs the development of the science of uranium's potential for fluid migration in the last decade.

In natural environments, uranium forms complexes with various anions, termed ligands, in solution. Complexes are species which form when the central atom interacts with a ligand. Uranium can conceivably exist as several species given the specific conditions of the solution (See figure below).

Fox et al. (JTI058 at p. 8, paragraph 2, (2006)) demonstrated that the presence of calcium and carbonates have significant impact on uranium adsorption to reactive mineral surfaces. This is due to the formation of calcium-uranyl-carbonate complexes (Ca-UO2-CO3) which are thermodynamically stable under those conditions. Kelly et al. (JTI059 (2007)) observed evidence of the existence of these species with spectroscopy and thermodynamic speciation calculations predicted geochemical stability ranges. These measurements provide direct evidence for the existence of these complexes and consistency was established with thermodynamic speciation calculation predictions, which were used in my geochemical model below.

I've created the figure below using a geochemical modeling software (PHREEQC v.3.1.2) using an updated thermodynamic database which includes the formation of the Ca-UO2-CO3 complexes and representative average stability data from Christensen Ranch ISL mine unit 5. The pH was the master independent variable and average post-restoration constituent concentrations were held constant. The shaded grey region shows the range of measured pH values from the stability samples at Christensen Ranch. The table below the figure shows the input data into the thermodynamic database and model. This figure shows, unequivocally, that the representative geochemical conditions in the aquifer post-restoration are largely dominated by Ca-UO2-CO3 complexes predicted by the updated thermodynamic database. This geochemical evidence has significant implications towards uranium adsorption and reductive precipitation which will be discussed below.



Relevant aqueous species and PHREEQC input data

Aqueous Species	Reaction				log K
$Ca_2UO_2(CO_3)_3°$	$2Ca^{2+} + UO_2^{2+} + 3CO_3^{-2}$		=	$Ca_2UO_2(CO_3)_3°$	30.6
$CaUO_2(CO_3)_2^{2-}$	$Ca^{2+} + UO_2^{2+} + 3CO_3^{-2}$		=	$CaUO_2(CO_3)_2^{2-}$	25.4
$UO_2CO_3°$	$UO_2^{2+} + CO_3^{-2}$		=	$UO_2CO_3°$	9.63
$UO_2(CO_3)_2^{2-}$	$UO_2^{2+} + 2CO_3^{-2}$		=	$UO_2(CO_3)_2^{2-}$	17.0
$UO_2(CO_3)_3^{4-}$	$UO_2^{2+} + 3CO_3^{-2}$		=	$UO_2(CO_3)_3^{4-}$	21.63
$UO_2SO_4^0$	$UO_2^{2+} + SO_4^{-2}$		=	$UO_2SO_4^0$	3.15
$UO_2(OH)_3^-$	$UO_2^{2+} + 3H_2O$		=	$UO_2(OH)_3^- + 3H^+$	-19.2
$UO_2(OH)_4^{2-}$	$UO_2^{2+} + 3H_2O$		=	$UO_2(OH)_4^{2-} + 4H^+$	-33.0

	Baseline Ore					**Stability Ore**				
	mean	n	std	min	max	mean	n	std	min	max
Ca	10.4	100	4.1	2.5	32.6	33.4	100	29.9	4	138
Mg	1.4	100	0.6	0.2	3.2	6.7	100	6.1	1	30.8
Na	146.4	100	11.5	115	180	154.1	100	86.8	51	420
SO_4^{2-}	215.5	100	33.5	185	330	150.0	100	107.2	21	408
Cl	7.4	200	0.9	5.6	13.1	11.0	100	10.0	2	37.9
CO_{3T}	113.3	200	20.6	79.4	217.4	275.9	100	182.6	86	864
pH	8.8	200	0.4	8.03	10.86	8.1	100	0.3	7.4	8.9
U(VI)	0.026	100	0.0	0.0060	0.22	2.26	100	3.7	0.0069	21.7

Concentrations in mg/L

Q.11. So you've explained that geochemical conditions in the aquifer post-restoration are largely dominated by Ca-UO2-CO3 complexes, and that calcium and carbonates have significant impact on uranium adsorption to reactive mineral surfaces. Please explain adsorption and why this matters to Staff's defense (at 71, 72) of its presentation of subsurface geochemistry and geochemical mechanisms of uranium transport in the FSEIS?

A.11. Adsorption describes the phenomenon where certain ions attract to a reactive surface. When the predominant uranium species are Ca-UO2-CO3 complexes, uranium adsorption observed decreases with respect to various reactive surfaces (JTI058; p. 8, paragraph 2). When this finding was input into geochemical transport models, the authors found that under certain ISL relevant conditions there was substantial uncertainty with respect to uranium mobility (See figure below).

For example, the USGS used an updated geochemical model to simulate uranium transport from conditions similar to the proposed Dewey-Burdock ISL operation, SD (figure from JTI042, p. 5). The authors demonstrated the recently updated thermodynamic database, based on the addition of Ca-UO2-CO3 and U(VI)-CO3 complexes, display the nonreactive transport of uranium in confined aquifers. The red line indicates the modeled uranium concentration using outdated thermodynamic database (WATEQ4F) without considering CA-UO2-CO3 complexes. The uranium concentrations predicted by the red line are substantially lower due to the assumption that Ca-UO2-CO3 complexes are not present in solution and adsorptive processes are removing uranium from solution.

The blue line shows the modeled uranium concentration using (WATEQ4F) which includes the updated thermodynamic database. The uranium concentrations predicted by the blue line are substantially higher, because of the stability of updated uranium complexes and

their inability to react with iron oxides. Thus, under these geochemical conditions, uranium is highly mobile and does not adhere to conventional adsorptive mechanisms and remains elevated in the groundwater downgradient. The green line displays the concentration of uranium when adsorption was removed from the model (nonreactive transport).

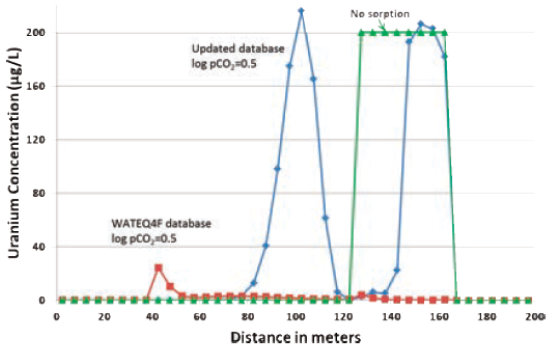


Fig. 9 *Uranium concentrations in groundwater at 25 years with 500 ppm Fe and CO2 in recovery zone of log pCO2 equal to 0.5 and downgradient calcite equal to 0.15 weight percent. Green line is with no sorption, blue line is with updated database and red line is with WATEQ4F database.*

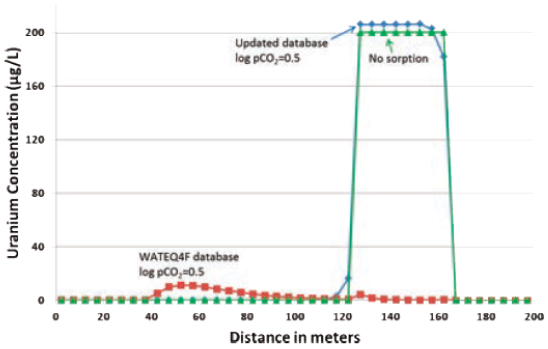


Fig. 10 *Uranium concentrations in groundwater at 25 years with 500 ppm Fe and CO2 in recovery zone of log pCO2 equal to 0.5 and infinite calcite. Green line is with no sorption, blue line is with updated database and red line is with WATEQ4F database.*

Q.12 So older models presumed problematic concentrations of uranium wouldn't migrate, but newer models demonstrate fluid migration occurs at an increased rate over what was previously expected?

A.12. Essentially, yes. Under the geochemical conditions modeled, within 25 years the front edge of the uranium plume was predicted to migrate roughly 165 m (See figure above). More importantly is the vast difference between model results for the updated thermodynamic database (Blue) and the outdated thermodynamic database (Red) suggesting that uranium transport from ISL sites is grossly underestimated and transport of high levels of uranium concentrations

beyond the well field could reasonably occur within the span of a human life time or a matter of decades once hydraulic control is lost or absent.

Further, there is empirical evidence that the presence of reducing conditions is a poor assumption that will impede uranium transport through spontaneous precipitation. This is supported by groundwater samples taken from Kingsville Dome in Texas which observed very elevated uranium concentrations under reducing conditions. In brief, all groundwater samples observed indicators that reducing conditions were present: low dissolved oxygen (<1 – 0.24 mg/L), occurrence of ferrous iron (Fe^{2+}) in solution, and the detection of sulfide (JTI060; p.60). All of these factors indicate evidence for reducing conditions present in the groundwater affected by ISL.

Indeed, the measured geochemical evidence from Kingsville Dome ISL groundwater samples strongly suggests ISL influenced uranium concentrations remain extremely elevated under reducing conditions. While all geochemical parameters mentioned previously indicate reducing conditions were present in the aquifer samples, uranium concentrations ranged between 4.7 – 12.5 mg/L (JTI060; p.59), which range 157x – 417x above safe drinking water standards and consistent with many of the elevated samples observed at Willow Creek and Smith Highland. This observation (very high dissolved uranium concentrations under reducing conditions) is consistent with scientific literature which has found decreased abiotic reduction of uranium due to the presence of bicarbonate (JTI060; p.46) and the kinetics of sulfide promoted uranyl-carbonate complexes are substantially lower than uranyl-hydroxide complexes (JTI061). Moreover, biotic reduction of uranium in the presence of calcium has observed decreased uranium reduction rates compared to conditions where no Ca was present (JTI043; p.2, paragraph 2). This suggests that biotic reduction of uranium in the form of Ca-UO2-CO3

complexes is less bioavailable than other forms. In plain terms, certain microorganisms have difficulty 'eating' (reducing U(VI) to U(IV)) uranium when it's mixed with Calcium and carbonate, then they would without those ions present.

Therefore, Staff's qualitative statement that "*These constituents move through the aquifer faster than other water-quality parameters, and therefore levels above these would indicate excursions before radionuclides and other elements move outside the production (i.e., uranium-recovery) zone"* is neither a statement of fact nor consistent with the current scientific knowledge concerning geochemical process which dictate the migration of uranium in ISL aquifers. The subsurface geochemistry at these sites are highly complex and none of the biogeochemical data required to adequately predict uranium fluid migration is collected, analyzed, nor acknowledged by the NRC Staff. Without a thorough understanding of subsurface hydro-biogeochemical mechanisms, it is impossible to adequately address the risks to adjacent aquifers and private well locations by uranium migration.

Q.13. The NRC Staff assert that they have adequately described how mining activities will disturb reducing geochemical conditions (NRC001; p.70-71) and proceed to explain the ISL mining process. Does this adequately explain how the reducing conditions will be affected?

A.13. No. A recent explanation from scientific research provides a more thorough and appropriate discussion of ISL recovery's disruption to the naturally established geochemical conditions. None of this was provided in the FSEIS:

"This reversal of the ISR process does not naturally occur under regulatory time frames for the bulk of the leached ore zone. In fact, the persistence of uranium and other contaminants elevated

during ISR operations, in spite of years of restoration effort, is a strong motivation for investigating more efficient and effective restoration approaches." (JTI060; p.44)

In other words, the authors explain that ISR process will have, for all practical purposes, permanent impacts to the geochemical conditions within the ore zone. Further, the authors provide incentive to study obstinately elevated uranium concentrations in groundwater due to ISL activities and following ISL groundwater restorations. This is consistent with much of the groundwater data and trends presented throughout my initial testimony (JTI003), and reported in this document. In other words, the geochemical conditions, and thus groundwater quality, within the ore zone will be permanently altered, and subsequently degraded upon ISL operations. Yet, with this overwhelming evidence, Staff continues to assert to the environmental impacts to groundwater will be "small and temporary".

Q.15. Let's turn to the matter of understanding these issues as they relate to excursions. Could you explain further?

A.15. There's little dispute that horizontal excursions can be recovered during mining operations by iteratively adjusting the net hydraulic head gradient. Yet, the unforeseen circumstances when horizontal excursions cannot be recovered, or a loss of hydraulic control, are troublesome. NRC Staff's discussion (NRC001; p. 73) of well 5MW66 as a successful example horizontal excursion recovery is questionable. This well has been on excursion status on-and-off for almost a decade and there is little explanation for the source plume in NRC's own data (JTI062). Further, uranium concentrations were observed at 1.1 and 0.5 mg/L (4/23/2012 and 5/1/2012) while all

three excursion parameters were below respective detection limits (NRC041; p.9), which supports the notion uranium can be very elevated even while excursion parameters are below detection. It is unclear why 0.4 mg/L is used (13.3x safe drinking water standard) as the detection limit for uranium. Modern techniques to measure uranium, such as ICP-MS, can detect uranium as low as 0.0003 mg/L. The inclusion of hydro-geochemical data would provide the necessary information to assess and correct potential horizontal excursions; however none of this data is collected, assessed, or acknowledged by the NRC Staff.

Q.16.NRC dismisses (NRC001 at 59 and SEI009A; p.4-42) the possibility of fluid migration and associated excursions via the boreholes at the Ross site as follows: "*[b]reaches to the integrity of the confining unit from historical exploration and delineation drillholes will be minimized by the applicant's locating and abandoning the drillholes within the wellfields (citing License Condition 10.12 .)*" *Id.* How do you respond?

A.16. As discussed in my August Testimony, there are a sizable number of unfilled and unlocated boreholes and with the difficulty of locating and properly plugging them, the potential for problematic vertical migration is significant, notwithstanding a license condition that assures us the holes will be filled. The Texas example cited by Dr. Abitz in his direct testimony (JTI001 at ¶ 41) illustrates this point precisely. There, the Texas regulator issued a "Notice of Violation" that detailed losing track of the boreholes and failing to properly manage them (JTI026; p. 3-8) – all in direct violation of express license conditions. None of this actual evidence is analyzed or discussed in the FSEIS or staff's or SEI's testimony.

Q.17. Does this conclude your testimony.

A. 17. Yes.

I, Dr. Lance N. Larson, do hereby declare under penalty of perjury that my statements in the foregoing testimony and my statement of professional qualifications are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 C.F.R. § 2.304(d).

/(electronic signature approved)/
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EDUCATION

Ph.D.	Fall 2013	Environmental Engineering and Biogeochemistry, Pennsylvania State University
M.Sc.	2010	Civil and Environmental Engineering, South Dakota School of Mines and Technology
B.Eng.	2008	Environmental Engineering, California Polytechnic State University, SLO

POSITIONS

2014-present	Postdoctoral Science Fellow, Natural Resources Defense Council (NRDC), Washington, DC.
2010-2013	Graduate Research Assistant, Pennsylvania State University, University Park, Pa
2008-2010	Graduate Research Assistant, South Dakota School of Mines and Technology

PUBLICATIONS

*Jones D.J., Kolesar C., Grettenberger C., **Larson L.N.**, Burgos W.D., Macaladay J.L. (2014). Ecological niches of Fe-oxidizing acidophiles in an acidic coal mine drainage.

***Larson L.N.,** Miller C., Macalady J.L., Borch T., Gorski C., Burgos W.D. (2014). Biogeochemical transformation of schwertmannite to goethite under a coal mine drainage impacted stream.

Larson L.N., Sánchez-España J., Kaley B., Sheng, Y., Bibby, K., Burgos W.D. (2014). Thermodynamic controls on the kinetics of microbial low-pH Fe(II) oxidation. *Environmental Science and Technology*, *48* (16), pp 9246–9254

Larson L.N., Burgos W.D.**,** Sánchez-España J. (2014). Rates of Low-pH biological Fe(II) oxidation in the Appalachian Bituminous Coal Basin and the Iberian Pyrite Belt. *Applied Geochemistry, 47, 85-98.*

Larson L. N., Fitzgerald M., Singha K., Gooseff M. N., Macalady J. L. and Burgos W. (2013). Hydrogeochemical niches associated with hyporheic exchange beneath an acid mine drainage-contaminated stream. *Journal of Hydrology*, 501, 163-174.

Larson L. N., Kipp G. G., Mott H. V. and Stone J. J. (2012). Sediment pore-water interactions associated with arsenic and uranium transport from the North Cave Hills mining region, South Dakota, USA. *Applied Geochemistry,* 27, 879-891.

Burgos W. D., Borch T., Troyer L. D., Luan F., **Larson L. N.**, Brown J. F., Lambson J. and Shimizu M. (2012). Schwertmannite and Fe oxides formed by biological low-pH Fe(II) oxidation versus

abiotic neutralization: Impact on trace metal sequestration. *Geochimica et Cosmochimica Acta,* 76, 29-44.

Larson L. N., Stone J. J. (2011). Sediment-bound arsenic and uranium within the Bowman–Haley Reservoir, North Dakota. *Water, Air, Soil Pollution,* 219, 27-42.

* *In Preparation*

PUBLICATION ACKNOWLEDGEMENTS

Luan, F., Li Xie, Jie Sheng, Jun Li, Qi Zhou, Guiming Zhai, Reduction of nitrobenzene by steel convert slag with Fe(II) system: The role of calcium in steel slag, Journal of Hazardous Materials, Volumes 217–218, 30 May 2012, Pages 416-421, ISSN 0304-3894, 10.1016/j.jhazmat.2012.03.047.

Lupo C. Stone J.J. Bulk Atmospheric Mercury Fluxes for the Northern Great Plains, USA. Water, Air, Soil Pollution. 224, 1-12, 2013

TEACHING EXPERIENCE

2012, spring	Guest Lecturer, Pennsylvania State University. Water Quality Chemistry, CE 475.
2012, fall	Teaching Assistant, Pennsylvania State University. Environmental Engineering Capstone Design, CE 472W
2010, fall	Teaching Assistant, Pennsylvania State University. Introduction to Environmental Engineering, CE 370
2010, spring	Teaching Assistant, South Dakota School of Mines and Technology. Physical/Chemical Process Design and Laboratory, ENVE 426.
2006-2008	Multicultural Engineering Program Tutor, Cal Poly, San Luis Obispo, Ca.

CONFERENCE PRESENTATIONS AND ABSTRACTS

Larson, L.N., Comparison of field and laboratory low-pH Fe(II) oxidation rates. Presented at 14th annual Abandoned Mine Reclamation Conference, State College, Pa, August 2012

Borch, T., Troyer, L., **Larson, L.N.**, Stone, J.J., Impact of biogeochemical redox processes on U and As dynamics within a U mining impacted watershed. Presented at the International Workshop on Uranium Biogeochemistry: transformations and applications, Ascona Switzerland, March 2012.

Burgos, W., Fitzgerald, M., **Larson, L.N.**, Herwehe, L., Singha, K., Gooseff, M., Electrical resistivity imaging of a deep coal mine discharge. Presented at the 21st Annual Goldschmidt Geochemistry Conference, Prague, Czech Republic, August 2011.

Jones, D., Brown, J., **Larson, L.N.**, Mills, D., Burgos, W., Macalady, J., Ecological niches of Fe-oxidizing acidophiles in a coal mine discharge. Presented at the 21st Annual Goldschmidt Geochemistry Conference, Prague, Czech Republic, August 2011.

Larson, L.N., Luan, F., Troyer, L., Borch, T., Burgos, W., Schwertmannite and Fe oxides formed by biological low-pH Fe(II) oxidation versus abiotic neutralization. Presented at the 21st Annual Goldschmidt Geochemistry Conference, Prague, Czech Republic, August 2011.

Stone, J.J., **Larson, L.N.**, Kipp, G., Sediment pore-water equilibria interactions associated with arsenic and uranium transport within a historical uranium mining-impacted watershed in South Dakota. Proceedings from the 28th Annual Meeting of American Society of Mining and Reclamation, Bismarck, ND, 2011.

Kipp, G., Stone, J.J., **Larson, L.N.**. Arsenic and uranium transport in sediments near abandoned uranium mines in Harding County, South Dakota. Presented at the 2010 Geologic Society of American Denver Annual Meeting, Denver, CO, November 2010.

Troyer, L., Borch, T., **Larson, L.N.**, Stone, J.J. Impact of redox chemistry on the fate and transport of arsenic and uranium at an abandoned uranium mine. Presented at the 20th Annual Goldschmidt Geochemistry Conference, Knoxville, TN, June 2010.

Larson, L.N., Stone, J.J., Stetler, L., Troyer, L., Borch, T., Sediment pore-water equilibrium interactions associated with arsenic and uranium transport within a historical uranium mining impacted watershed, Harding County, SD. Presented at the joint meeting of the Rocky Mountain Section, Geologic Society of America 62nd Annual Meeting and the 2010 Western South Dakota Hydrology Conference, Rapid City, SD, April 2010.

Larson, L.N., Stone, J.J., Stetler, L., Arsenic and uranium impacted sediment behavior within the Bowman-Haley Reservoir, Bowman County, North Dakota. Presented at the joint meeting of the Rocky Mountain Section, Geologic Society of America 62nd Annual Meeting and the 2010 Western South Dakota Hydrology Conference, Rapid City, SD, April 2010.

Larson, L.N., Stone, J.J., Stetler, L.D., Development of an arsenic and uranium fate and transport model for historical uranium mining impacts from Custer National Forest, Harding County, South Dakota. Presented at 2009 Western South Dakota Hydrology Conference, Rapid City, SD, April 2009.

Education and Training

B.A., Geology, Humboldt State University, Arcata, California; 1981
M.S., Geology, University of New Mexico, Albuquerque; 1984
Ph.D., Geology, University of New Mexico, Albuquerque; 1989
Environmental Risk Assessment Communication and Application Workshop, INEL Oversight Program, Boise, Idaho; 1992
OSHA HAZWOP Training, 29 CFR 1910.120 (40 hours, IT Corporation, 1994)
Practical Models Supporting Remediation of Chlorinated Solvents, Aiken, SC 2010

Experience and Background

2009 - present

Program Manager, Savannah River National Laboratory, Aiken, SC

- Dr. Abitz leads the DOE EM-44 site-wide program to investigate and develop technologies for the *in situ* decommissioning of highly contaminated nuclear facilities. He also supports EM-32 technology development for the remediation of contaminated groundwater and soil across the DOE complex. His knowledge in these areas has been extended into international nuclear clean-up programs in the United Kingdom and Japan, where he interfaces and collaborates with international scientists and engineers on innovative technologies for the safe and effective decommissioning of highly contaminated nuclear facilities and the removal or immobilization of radionuclides in the environment.

2006 - present

Principal Geochemist/Owner, Geochemical Consulting Services, Blue Ash, Ohio

Geochemical Expert on ISL Uranium Mining for the Navajo & Sioux Nations, Coloradoans Against Resource Destruction (CARD), the Goliad County Groundwater Conservation District (GCGCD), and the National Resources Defense Council, Inc.(NRDC)

- Dr. Abitz provides legal testimony, technical review, geochemical modeling, and geological analysis for work associated with the proposed *in situ* uranium leach mines in the vicinity of Church Rock and Crownpoint, New Mexico (Navajo Nation), the expansion of the Crow Butte mine in Nebraska (Sioux Nation), the Centennial Project in Weld County, Colorado (CARD), the Goliad Project near Goliad, Texas (GCGCD), and the Ross Project in Crook County, Wyoming (NRDC).

Technical Support to the Savannah River Site

- Dr. Abitz supported the contract transition team for Savannah River Nuclear Solutions (SRNS). He reviewed RCRA and CERCLA groundwater remedial systems (electrical resistivity heating with soil vapor extraction, chemical reactive barrier, and tritium phytoremediation), project controls and management systems used to status the remediation work, and regulatory milestones to assess the status of the Area Closure Projects and SRNS readiness to perform the work scope. He

also supported SRNS in the preparation of the ARRA baseline estimate for the Solid Waste Management and Area Closure Projects.

NESHAP Report for the Fernald Preserve, Cincinnati, Ohio

- For the Fernald Annual Sitewide Environmental Report, Dr. Abitz prepares the chapters on air emissions (particulate with uranium, thorium and radium isotopes, and radon), population dose, and the NESHAP annual report.

Risk Assessment for the Fernald Closure Project (FCP), Cincinnati, Ohio

- Tasked with the responsibility to develop and author the Interim Residual Risk Assessment for the Fernald site, Dr. Abitz evaluated the risk to visitors and workers exposed to residual contaminants in air, soil and surface-water pathways. Risk scenarios showed the incremental lifetime cancer risk to the receptors was below the recommended EPA maximum of 0.0001.

2003 – 2006 ***Manager of the Environmental Services Group and Senior Consultant, Fluor Fernald, Inc., Cincinnati Ohio***

- As the manager for the Environmental Services Group (ESG), Dr. Abitz oversaw the work of over 50 scientists and technicians. Personnel in the ESG performed water, soil and air sampling and monitoring; analytical services for radionuclides, metals and organic compounds; data verification, validation, reduction and reporting; and *in situ* soil activity measurements for ^{226}Ra, ^{232}Th, and ^{238}U via the site's real-time instrument measurement program (RTIMP).

- As the site geochemist, he prepared an estimate of the curie inventory for the OSDF to provide a baseline value to DOE legacy management. The scope of this task was to develop the estimate using information from the Ohio Field Office Recycled Uranium Project Report, OU3 and OU5 RI/FS documents, the Fernald Dosimetry Reconstruction Project, remedial operation records, historic records, active monitoring data, interviews with technical personnel who supervised plant operations from the early 1960's through production shut down in 1989, and analytical results on soil placed in the OSDF.

- Dr. Abitz also served as senior consultant to the FCP on the long-term remediation strategy for the Great Miami aquifer. In this capacity, he coordinated laboratory and microscopy studies on the form of uranium present on aquifer sediments. The laboratory and microscopy studies examined the amount of uranium that is fixed to the sediments via chemical adsorption and overgrowth rims versus the mobile fraction that is readily desorbed from the aquifer matrix. These key studies identified and addressed the kinetics of uranium reactions to determine the time constraints associated with achieving the EPA's drinking water standard for uranium.

Environmental Science Manager/Project Manager/Senior Consultant, Fluor Fernald,

1998 - 2003 ***Inc., Cincinnati, Ohio.***

- In his role as environmental science manager, Dr. Abitz directed the RTIMP, which provided *in situ* soil activity measurements for ^{226}Ra, ^{232}Th, and ^{238}U in live time. This program supports excavation and D&D work by scanning soil to confirm U contamination is below the waste acceptance criteria for Fernald's on-site disposal facility (OSDF). Prior to the release of remediated land, the RTIMP performs *in situ* activity measurements to demonstrate that the soil is below the final remediation levels established for ^{226}Ra, ^{232}Th, and ^{238}U.

- As a project manager, Dr. Abitz managed a remediation budget of six million dollars for Title I/II design work for D&D of structures and removal of all contaminated soil and subgrade structures within the former Production Area. Dr. Abitz lead a team of engineers and scientists who integrated the remedial design with regulatory issues, sampling and analysis plans, waste management operations, demolition and construction activities, health and safety issues, radiological controls, and quality assurance protocols.

- Dr. Abitz served as a senior consultant to the DOE Technology Development Program, where he performed technical oversight of several university studies dealing with the mobilization of uranium and its removal from groundwater. He was active with laboratory investigations that examine the distribution of uranium phases in soil and aquifer sediment, the leaching behavior of the uranium phases, the treatment of contaminated soil with phosphate, and the geochemical properties of aggregate materials used to construct liners in the OSDF. The research established important baseline information on the distribution of uranium in the aquifer and in OSDF construction materials, while treatment studies evaluated the effectiveness of phosphate in reducing the solubility and mobility of uranium in the disposal cell.

- As a participant in research that evaluated the natural attenuation of uranium using a combination of passive inorganic and organic systems, Dr. Abitz was involved with work groups from industry, academia and DOE laboratories. The inorganic systems that were investigated include rip-rap channels constructed with rock containing iron oxyhydroxide phases (e.g., goethite and hematite) or phosphate minerals (e.g., apatite) and flow-through cells using zero-valent iron. Organic systems that showed potential promise include sulfate-reducing bacteria, microbial mats, lichen, and phytoextraction. A combination of these systems may prove to be practical and cost effective in the treatment of low leachate volumes.

President/Owner, Geochemical Consulting Services, Albuquerque, New Mexico.
Dr. Abitz served as a geochemical consultant to the Fernald Environmental Management
1997 - 1998 Program (FEMP) and the WIPP Project.

- Dr. Abitz performed confidential work for the Navajo Nation on the proposed *in*

situ uranium leach mines in the vicinity of Church Rock and Crownpoint, New Mexico.

- At FEMP, he evaluated the efficiency of selected alternatives for soil and groundwater remediation, including soil washing and *in situ* uranium leaching methods. This effort involved supervising the technical team, assisting in the negotiation of clean-up levels with DOE and EPA, developing soil-treatment protocols, and interacting with public-interest groups.

- At the WIPP site, Dr. Abitz provided the operating contractor with expertise in the area of brine geochemistry. He was responsible for oversight of laboratory analyses and QA/QC, data analysis, and geochemical interpretation of the composition and origin of fluids in the vicinity of underground operations. Dr. Abitz also evaluated the solubility of transuranic elements in sodium-chloride brine and in brine containing organic-complexing agents such as citric acid, oxalic acid, and EDTA.

Project Manager/Senior Staff Consultant, IT Corporation, Albuquerque, New Mexico. Dr. Abitz served as project scientist/manager on geochemical tasks associated with the WIPP Project, Norton AFB Groundwater Study, FEMP Operable Units 5 and 3 RI/FS, and Navajo EPA. Specific activities include:

1994 - 1997

- Conducted a rerun of the chemical compatibility analysis of TRU waste forms and container materials for Appendix C1 of the WIPP RCRA Part B permit. The chemical compatibility analysis was carried out with all defense generated, contact-handled (CH) and remote-handled (RH) transuranic-mixed waste streams reported in the 1995 WIPP Transuranic Waste Baseline Inventory Report (WTWBIR). Chemicals reported by the generator sites were classified into reaction groups as defined by the U.S. Environmental Protection Agency (EPA) document "A Method for Determining the Compatibility of Hazardous Wastes." The list of potential chemical incompatibilities reported by the program was hand checked using the EPA document as a reference to assure proper functioning of the program. All potential chemical incompatibilities were then evaluated on a case-by-case basis to identify which of the reactions could occur, given the nature of the waste, its chemical constituents, and final waste form.

- Assisted in evaluating the geochemical performance of backfill configurations proposed in the WIPP Compliance Certification Application. Modeled the interaction of Salado Formation brine with MgO placed in the backfill to estimate the quantity of MgO required to buffer the pH of the indigenous brine between 8 and 9. This pH range is desirable for minimizing the solubility of plutonium and neptunium contained within the waste forms, and lowers the solubility of uranium and americium relative to lower pH values found in Salado Formation brine.

- Project scientist responsible for developing the background groundwater report for Norton AFB This report established background radionuclide concentrations in

local and regional groundwater and provided a robust scientific model to explain the presence of elevated levels of naturally-occurring uranium. The task required coordination of scientific and support staff to produce a principal milestone document that was delivered to the client one week ahead of schedule.

- Project manager and scientist on the FEMP OU5 FS task to evaluate aqueous reactions of metal and radionuclide complexes in proposed injection zones of the Great Miami Aquifer. Responsible for oversight of technical tasks, budget, schedule, and final technical report.

- Project scientist tasked with supporting the Navajo EPA on the evaluation of groundwater contamination from the mill tailings at the UNC Church Rock, New Mexico site. Radionuclide, sulfate and nitrate concentrations were evaluated to discriminate between contamination originating from the mill tailings and natural salts present in the valley alluvium.

- Project manager and scientist on the FEMP OU3 RI/FS task to evaluate the release of radionuclides and metals from the proposed on-site disposal facility. Responsible for oversight of technical tasks, budget, schedule, and final technical report.

1989 - 1994 ***Senior Geochemist, IT Corporation, Albuquerque, New Mexico*** Dr. Abitz evaluated the radiochemistry of transuranic elements in sodium-chloride brine for the WIPP Project and served as the project geochemist for four operable units on the FEMP RI/FS. He was also active setting up the LANL RMMA concept and provided radiochemistry support to INEL in developing a No Migration Variance Petition (NMVP) for the INEL calcine facility.

- Developed solubility database for the WIPP EATF. Evaluated the solubility of thorium, uranium, neptunium, plutonium, and americium in sodium-chloride brine and in the presence of organic complexing agents, such as EDTA and citric acid. Prepared solubility charts of the radionuclides over the pH range of 2 to 12.

- Authored white paper on geochemistry of FEMP site for OU 5 RI/FS. This paper discusses leaching, dissolution, and desorption processes that release uranium and its progeny from surface sources, adsorption and aqueous complexation of the solubilized uranium and progeny with subsurface soils and groundwater, and predicts secondary uranium phases that may form in the soils.

- Conducted site-surveys and interviewed LANL personnel on radiation practices associated with the handling, packaging, labeling, storage, transport, and disposal of transuranic materials. Information was used to develop LANL RMMA concept, where each RMMA is held accountable for all radiaoactive materials that enter and exit the area.

- Developed waste analysis plans for transuranic and low-level mixed wastes present

at LANL. This activity was conducted to complete RCRA Part B permits and ensure regulatory compliance to DOE orders for all LANL facilities that generate, store, or dispose of mixed waste.

- Managed and had technical oversight on geochemical program associated with FEMP RI/FS. Program tasks include the characterization of soil mineralogy by polarized light microscopy and x-ray diffraction studies, design and implementation of laboratory tests to characterize the composition of leachate derived from cemented and vitrified waste samples, evaluation of contaminant adsorption ratios, data validation, and tracking of labor and material costs.

- Designed laboratory experiments for FEMP RI/FS to measure adsorption ratios of radionuclides and metals and implemented ANSI/ANS-16.1 leach tests to evaluate the performance of cemented waste forms. Results were used to evaluate the most effective alternative for immobilizing radionuclides and metals from a near surface disposal cell.

- Led INEL waste characterization program on calcined solid waste. Responsible for evaluating radiochemistry data on uranium fission products and transuranic elements in aqueous and calcined waste forms. Provided assistance in the development of EPA approved sampling and analytical plans to support a draft no migration variance petition for the radioactive calcined waste stored at the ICPP.

Professional Affiliations

Geological Society of America
International Association of Geochemistry and Cosmochemistry

Presentations & Publications

Abitz, R.J., Farfan, E., and Coleman, R., 2011, Gamma-Ray Mapping and Waste Segregation, invited presentation to the Japan/USDOE October 26 & 27 workshop on clean-up of the Fukushima Nuclear Power Stations, Tokyo, Japan.

Szilagyi, A., P. Kirk, R. Abitz, and J. Gladden, 2011, The Office of Deactivation and Decommissioning Research and Development Program for Fiscal Year 2011, Paper 11533, Waste Management Symposia, Phoenix, AZ.

Abitz, R.J., 2010, Decommissioning Highly Contaminated Nuclear Facilities at the Department of Energy Sites, *Proceedings of the United Kingdom Decommissioning and Waste Management Conference*, Penrith, Cumbria, UK.

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ATOMIC SAFETY AND LICENSING BOARD PANEL

HEARING

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In the Matter of: : Docket No. 40-9091-MLA

STRATA ENERGY, INC. :

: ASLBP No.

(Ross In Situ Recovery : 12-915-01-MLA-BD01

Uranium Project) :

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Tuesday, September 30, 2014

Wyoming Meeting Room

Energy Hall

CAMP-PLEX Multi-Event

Facilities

1635 Reata Drive

Gillette, Wyoming

BEFORE:

G. PAUL BOLLWERK, III, Chairman

DR. RICHARD F. COLE, Administrative Judge*

DR. CRAIG M. WHITE, Administrative Judge

*present via teleconference

resumed at 10:20 a.m.)

CHAIRMAN BOLLWERK: Could we go on the record briefly.

We have received a proposed question, and so the Board is going to take a brief recess to consult about the question and we should be right back in about ten minutes or less, I would hope. Thank you.

(Whereupon, the above-entitled matter went off the record at 10:20 a.m. and resumed at 10:31 a.m.)

CHAIRMAN BOLLWERK: All right. Let's go back on the record, please.

We have returned from a break for Board consideration of a question that was posed relative to Contention 2, to the staff panel, and we are going to ask the following question, and this is for, at least, initially for Dr. Johnson.

You testified that, in evaluating the size and level of the environmental impacts on groundwater, the focus is on the nonexempt aquifer, and that, therefore, the impacts to the exempted aquifer, itself, are immaterial.

Does this mean that if the NRC were to approve an ACL thousands of times above EPA Safe Drinking Water Act Standards for uranium, the impacts would still be small.

DR. JOHNSON: Judge Bollwerk, the -- I certainly did not imply that the concentrations of any constituent -- let's use uranium as an example -- inside the exempted aquifer is immaterial.

The concentrations that are within the exempt aquifer at the -- at the time, let's say, a restoration is approved, first of all, there are for two reasons, I would say.

One is because the way that the approved restorations were done that are discussed in the SEIS were average concentrations over all the wells within the -- the production area.

So, that average, of course, would be -- would be higher if there were some wells that were, you know, very, very high concentrations. So, the overall average has to be to, you know, some level that would -- would be approved.

And so, of course, those levels

are important in any given well in terms of making sure that your average meets the -- the ACL that is ultimately approved.

Now, the ACL can't just be any number. It has to be a number that -- a value, a concentration, that, upon evaluation shows that, once you reach the boundary of the exempted aquifer, you are at drinking water standards for constituents, including uranium.

So, if the ACL were, you know, let's say, you know, at a ridiculously large number then, in all likelihood, it would not -- you could not demonstrate that it would be protective of the human health and the environment at that boundary of the exempted aquifer.

So, the -- you know, the ACL can't just be any number. It has to be a number that meets that, you know, very important criteria that is protective of -- at the -- at the boundary of the exempted aquifer.

CHAIRMAN BOLLWERK: All right. Judge White, do you have any --

JUDGE WHITE: So, you are -- am I correct that you are saying that -- that the

-- that the aquifer outside the exempt aquifer, at that boundary of the exempt aquifer, is still the standard for deciding whether the impact is small, medium or large and that -- and that you are saying that this -- this example, this hypothetical here with some extremely high value would be reflected in the water quality outside the exempt aquifer, and that is what -- that is still what is -- is what is important?

It isn't really what concentration in the exempt aquifer is, it is how the concentration in the exempt aquifer will effect water just outside the boundaries, is that correct, that you are saying that?

DR. JOHNSON: Yes. That is correct.

CHAIRMAN BOLLWERK: All right. Judge Cole, do you have anything with regard to this question?

JUDGE COLE: No.

CHAIRMAN BOLLWERK: All right. I will look to the parties briefly. Any -- any other --

MR. PUGSLEY No questions.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY & LICENSING BOARD

In the Matter of	)	Docket No. 40-9091-MLA
	)	
STRATA ENERGY, INC.,	)	ASLBP No. 12-915-01-MLA
	)	
(Ross In Situ Recovery Uranium Project)	)	November 3, 2014

NATURAL RESOURCES DEFENSE COUNCIL'S & POWDER RIVER BASIN RESOURCE COUNCIL'S PROPOSED FINDINGS OF FACT & CONCLUSIONS OF LAW FOR ENVIRONMENTAL CONTENTIONS 1, 2 AND 3

I. INTRODUCTION

1. In accordance with 10 C.F.R. §§ 2.1204(b) and 2.1207 and this Atomic Safety and Licensing Board's ("ASLB" or "Board") Orders of July 25, 2014, August 7, 2014, and directions at the close of the evidentiary hearing held in Gillette, Wyoming on September 30, 2014 and October 1, 2014 ("Hearing"), Intervenors Natural Resources Defense Council and Powder River Basin Resource Council ("Joint Intervenors") hereby submit proposed findings of fact and conclusions of law on Environmental Contentions 1, 2 and 3 for the Ross In Situ Recovery Project in Crook County, Wyoming ("Ross Project"). For the reasons set forth, Joint Intervenors urge the Board to find the Supplemental Environmental Impact Statement ("SEIS") and associated environmental review for the Ross Project fails to comply with the National Environmental Policy Act ("NEPA"), 42 U.S.C. 4321, *et seq.*, and applicable regulations, and on that basis find in favor of Joint Intervenors on all three contentions, vacate the Ross Project Record of Decision ("ROD") and license, and remand the matter to the NRC Staff.

19. SEI submitted written direct testimonies for hydrologists Hal Demuth and Errol Lawrence (SEI026); geologist Ben Schiffer (SEI005); civil engineer Ray Moores (SEI042); Strata CEO Ralph Knode (SEI001); and Strata Vice-President Michael Griffin (SEI039).

20. On September 12, 2014, the parties submitted their prefiled Rebuttal Testimonies. Joint Intervenors submitted the rebuttal testimonies of Drs. Abitz and Larson. JTI051-R (Abitz); JTI052-R (Larson). Each of the Staff and SEI witnesses submitting written direct also submitted Rebuttal Testimonies. NRC044 (NRC Staff); SEI045 (Schiffer); SEI046 (Demuth and Lawrence); SEI047 (Knode); SEI048 (Moores); SEI049 (Griffin).

21. The Board conducted an evidentiary hearing on Contentions 1, 2 and 3 from September 30, 2014 through October 1, 2014. At the hearing the prefiled testimonies of the witnesses and supporting exhibits were admitted, and the witnesses were asked additional questions. *See generally* Transcr..

22. The Board admitted the following exhibits of Joint Intervenors: JTI001-R, JTI002; JTI003-R; JTI004; JTI005A-R2; JTI005B-R2; JTI006 through JTI024; JTI025R; JTI026 through JTI050; JTI051-R; JTI052-R; JTI053; JTI054; JTI055-R; and JTI056 through JTI062. *See* Transcr. at 409, 587, and 742, and 747.

III. LEGAL STANDARDS

A. Burden of Proof

22. "It is well established that the Applicant carries the burden of proof . . . ." *Duke Power Co.*, (Catawba Nuclear Station, Units 1 and 2), CLI-83-19, 17 N.R.C. 1041 (1983); 10 C.F.R. § 2.325 (2011). SEI and NRC Staff must demonstrate the environmental analysis took the required "hard look" at the environmental impacts associated with the issuance

of a materials license for the Ross Project ISL uranium recovery site. *Marsh v. Oregon Natural Resources Council*, 490 U.S. 360, 374 (1989). NRC has described the burden of proof in a NRC license proceeding as follows:

> [t]he ultimate burden of proof on the question of whether the permit or the license should be issued is . . . upon the applicant. But where . . . one of the other parties contends that, for a specific reason . . . the permit or license should be denied, that party has the burden of going forward with evidence to buttress that contention. Once he has introduced sufficient evidence to establish a prima facie case, the burden then shifts to the applicant who, as part of his overall burden of proof, must provide sufficient rebuttal to satisfy the Board that it should reject the contention as a basis for denial of the permit or license.

In re Amergen Energy Co., LLC (Oyster Creek Nuclear Generating Station), CLI-09-7, 69 N.R.C. 235, 269 (2009); *see also*, ASLB July 25, 2014 Order at 2-3 (describing SEI "as the party with the ultimate burden of proof").

23. Parties challenging a license must establish a prima facie case on their contentions. At that point, the burden of proof shifts back to the applicant to rebut the specific contentions. The applicant must demonstrate compliance with the applicable regulations by meeting a "reasonable assurance" standard, which is equated to a "preponderance of the evidence." *Amergen Energy Co.* 69 N.R.C.at 263. To establish a prima facie case for a NEPA contention, it is only necessary to show that the NRC has failed to take a "hard look" at the issues raised. *Marsh*, 490 U.S. at 374.

24. Particularly since the SEI license has already been issued, SEI and Staff may not defend the NEPA analysis by relying on new evidence, information, or analysis not considered by Staff in connection with the preparation of the FSEIS. *See, e.g., Fla. Power & Light v. Lorion*, 470 U.S. 729, 744 (1985); *Ctr. for Biological Diversity v. BLM*,

698 F.3d 1101, 1124 (9th Cir. 2012). The defense of the FSEIS must be confined to materials before the agency at the time the FSEIS was issued. *See, e.g., Grand Canyon Air Tour Coal. v. FAA*, 154 F.3d 455, 469 (D.C. Cir. 1998); *Izaak Walton League of Am. v. Marsh*, 655 F.2d 346, 369 (D.C. Cir. 1981) (emphasis added) (citing *Citizens to Preserve Overton Park, Inc. v. Volpe*, 401 U.S. 402, 420, (1971)); *Envtl. Def. Fund, Inc. v. Costle*, 657 F.2d 275, 284 (D.C. Cir. 1981) ("[t]he focal point for judicial review should be the administrative record already in existence, *not some new record completed initially in the reviewing court*") (emphasis added).

B. The National Environmental Policy Act

25. The National Environmental Policy Act ("NEPA"). 42 U.S.C. § 4321, *et seq.*, is our "basic national charter for protection of the environment." 40 C.F.R. § 1500.1; *Dept. of Transp. v. Pub Citizen*, 541 U.S. 752, 756 (2004). NEPA requires an Environmental Impact Statement ("EIS"), or, where applicable a Supplemental EIS ("SEIS"), for any major federal action with significant environmental impacts. 42 U.S.C. § 4332; 40 C.F.R. §1502.9. NEPA's fundamental purpose is two-fold. First, it ensures the agency, in reaching its decision, will have available, and will carefully consider, detailed information concerning significant environmental impacts. Second, it guarantees the relevant information will be made available to the larger audience that may also play a role in both the decision-making process and the implementation of that decision. *Entergy Nuclear Generation Co. and Entergy Nuclear Operations, Inc.* (Pilgrim Nuclear Power

159. Further, the FSEIS contains no data or discussion regarding the groundwater restorations from Nubeth project A, which was located within the proposed permit boundary, except for Table 3.7 (SEI009A at 3-41 (at .pdf p. 185)) which displays a pre-test sample that does not aid in understanding what happened with the restoration of the aquifer after leaching occurred. However, groundwater restorations at the Nubeth project A were unsuccessful as well (JTI032 at 14-15 and 87). JTI003-R at 10.

160. The lesson and finding to be drawn from the Nubeth example is that failure to restore the groundwater after a short six-month pilot-scale single well leaching project should have clearly communicated to the NRC Staff that it will not be possible to restore a full-scale commercial ISL operations in 8 months as the FSEIS claims (see SEI009A at 2-35 (at .pdf p. 119)). The FSEIS seriously underestimates the time necessary to restore groundwater after full-scale ISL operations, such as the Ross Project. JTI003-R at 10, 11.

161. Additionally, the Nubeth Project used only a single injection well, whereas commercial operations of ISL, like the Ross Project, use hundreds of wells, which means that groundwater restoration at the commercial scale will be even more difficult. *Id*.

d. These Other Sites Demonstrate There Will Be Substantial Degradation Of The Mined Aquifer At The Ross Project Site

162. As demonstrated below, the record of this proceeding presents uncontroverted factual comparisons of baseline and post-restoration uranium concentrations in the affected groundwater that demonstrate substantial degradation of that groundwater, clearly noticeable and sufficient to destabilize important attributes of the resource considered.

163. No ISL mine has ever returned groundwater concentrations to primary or secondary standards. JTI003-R at 68. As confirmed at the Hearing:

> CHAIRMAN BOLLWERK: All right. So, it sounds like, in terms of license amendments, all roads lead to ACL's?
>
> MR. SAXTON: That is correct.
>
> CHAIRMAN BOLLWERK: All right. And so, I guess -- well, the question would be relative to number one and number two, have any applicant -- I am sorry. Have any licensees ever come and requested approval under one or two?
>
> MR. SAXTON: No, Your Honor.

Transcr. at 552-553.

164. Groundwater data from other representative ISL sites, such as Christensen Ranch Mine Units 2 – 6 and Smith-Highland Ranch Mine Units A and B, is relevant because those operators used restoration methods and circulation volumes similar to those proposed for the Ross project. SEI009A at 2-35 (at .pdf p. 119) ("The aquifer-restoration activities proposed for the Ross Project are the same as those methods described in GEIS Section 2.5: 1) ground-water transfer, 2) ground-water sweep, 3) RO treatment with permeate injection, 4) ground-water recirculation, and 5) stabilization monitoring."). These sites show that after those restoration methods were employed, uranium concentrations in the groundwater within the ore zone have still increased substantially, and in some cases, by several magnitudes or more. JTI003-R at 22-48; JTI052-R at 3-7.[9] The actual results from the NRC's own database follow in findings ¶¶s 165-182.

[9] This data (JTI005A-R2) was presented as screenshots from a dynamic interactive web based application in order to visualized, interpret, and assimilate the data, rather than presenting the data in a static spreadsheet or figure. Screen capture images were created from the application (JTI005B-R2) which were presented and explained progressively

i. Christensen Ranch Analysis

165. Christensen Ranch mine unit 2, well 2AI30-1 baseline uranium concentrations were measured on 8/28/1992, 9/9/1992, 9/18/1992, and 10/8/1992. JTI005A-R2 at 2-7. The respective uranium concentrations in groundwater at this well prior to mining were 0.026, 0.037, 0.022, and 0.004 mg/L, for respective sampling dates. The average uranium concentration was 0.022 mg/L. JTI005B-R2 at 6; *see also*, discussion at JTI003-R at 36-38.

166. Next, at the same well, Christensen Ranch mine unit 2, well 2AI30-1, post-restoration stability uranium concentrations were measured on 4/8/2004, 7/15/2004, 10/12/2004, and 1/4/2005. JTI005A-R2 at10-15. The respective uranium concentrations in groundwater at this well were 0.207, 0.113, 0.263, and 0.25 mg/L, for respective sampling dates. Thus, compared to the average baseline concentrations at this well, these values observed increases of 9.4x, 5.1x, 11.9x, and 11.4x, respectively. These values exceed EPA's safe drinking water standard for uranium (*see* U.S. ENVTL. PROT. AGENCY, NATIONAL PRIMARY DRINKING WATER REGULATIONS, EPA 816-F-09-004 (2009), available at http://water.epa.gov/drink/contaminants/upload/mcl-2.pdf., 0.03 mg/L) by 6.9 times (or "x"), 3.8x, 8.8x, and 8.3x, respectively. JTI005B-R2 at 8.

167. Christensen Ranch mine unit 5, well 5BL76-1 baseline uranium concentrations were measured on 9/1/1994, 9/15/1994, 9/28/1994, and 10/12/1994. JTI005A-R2 at 90-102. The respective uranium concentrations in groundwater at this well prior to mining were

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throughout JTI003-R. The well(s) shown in each screen capture (JTI005B-R2 1-36) can be sourced to the original spreadsheet data page location, along with other information, such as the date of sampling. *See* JTI005A-R2, 1-356 (NRC ISL Database Spreadsheets).

0.027, 0.031, 0.021, and 0.024 mg/L, for respective sampling dates. The average uranium concentration was 0.026 mg/L. JTI005B-R2 at 9; *see* also JTI003-R at 39-40.

168. At the same well, Christensen Ranch mine unit 5, well 5BL76-1 post-restoration stability uranium concentrations were measured on 11/12/2003, 2/11/2004, 5/11/2004, and 8/12/2004. JTI005A-R2 at 112-118. The respective uranium concentrations in groundwater at this well were 18, 20.7, 21.7, and 14.8 mg/L, for respective sampling dates. Again, compared to the average baseline concentrations at this well, these values observed increases of 692x, 796x, 835x, and 569x, respectively. These values exceed EPA's safe drinking water standard for uranium (0.03 mg/L) by 600x, 690x, 723x, and 493x respectively. JTI005B-R2 at 10.

169. Next, Christensen Ranch mine unit 5, well 5BN162-2 baseline uranium concentrations were measured on 10/26/1994, 11/8/1994, 11/22/1994, and 12/5/1994. JTI005A-R2 at 90-102. The respective uranium concentrations in groundwater at this well prior to mining were 0.047, 0.034, 0.035, and 0.025 mg/L, for respective sampling dates. The average uranium concentration was 0.035 mg/L. JTI005B-R2 at 11.

170. And at the same well, Christensen Ranch mine unit 5, well 5BN162-2 post-restoration stability uranium concentrations were measured on 11/12/2003, 2/10/2004, 5/11/2004, and 8/12/2004. JTI005A-R2 at 112-118. The respective uranium concentrations in groundwater at this well were 0.359, 0.44, 1.01, and 2.08 mg/L, for respective sampling dates. Compared to the average baseline concentrations at this well, these values observed increases of 10.3x, 12.6x, 28.9x, and 59.4x, respectively. These

values exceeded EPA's safe drinking water standard for uranium (0.03 mg/L) by 11.9x, 14.7x, 33.7x, and 69.3x. JTI005B-R2 at 12.

171. At Christensen Ranch mine unit 4, well 4T114-1, baseline uranium concentrations were measured on 1/19/1994, 2/2/1994, 2/16/1994, and 3/7/1994. JTI005A-R2 at 66-72. The respective uranium concentrations in groundwater at this well prior to mining were 0.009, 0.008, 0.005, and 0.009 mg/L, for respective sampling dates. The average uranium concentration was 0.008 mg/L. JTI005B-R2 at 13.

172. At the same well, Christensen Ranch mine unit 4, well 4T114-1, post-restoration stability uranium concentrations were measured on 4/1/2004, 6/29/2004, 9/28/2004, and 1/3/2005. JTI005A-R2 at 78-82. The respective uranium concentrations in groundwater at this well were 17.1, 12, 15.6, and 16 mg/L, for respective sampling dates. Compared to the average baseline concentrations at this well, these values observed increases of 2138x, 1500x, 1950x, and 2000x, respectively. These values exceeded EPA's safe drinking water standard for uranium (0.03 mg/L) by 570x, 400x, 520x, and 533x. JTI005B-R2 at 14.

173. Christensen Ranch mine unit 5, well MW-07 baseline uranium concentrations were measured on 8/30/1994, 9/13/1994, 9/27/1994, and 10/11/1994. JTI005A-R2 at 91-104. The respective uranium concentrations in groundwater at this well prior to mining were 0.028, 0.008, 0.012, and 0.09 mg/L, for respective sampling dates. The average uranium concentration was 0.035 mg/L. JTI005B-R2 at 17.

174. Christensen Ranch mine unit 5, well MW-07 post-restoration stability uranium concentrations were measured on 11/11/2003, 2/9/2004, 5/10/2004, and 8/11/2004.

JTI005A-R2 at 113-119. The respective uranium concentrations in groundwater at this well were 1.17, 2.85, 3.90, and 3.83 mg/L, for respective sampling dates. Compared to the average baseline concentrations at this well, these values observed increases of 33x, 81x, 111x, and 109x, respectively. These values exceed EPA's safe drinking water standard for uranium (0.03 mg/L) by 39x, 95x, 130x, and 128x. JTI005B-R2 at 18.

ii. Smith Highland Ranch Analysis

175. Smith-Highland Ranch mine unit A, well MP5 baseline uranium concentrations were measured on 8/18/1987, 8/19/1987, 8/26/1987, 8/28/1987, and 9/9/1987. JTI005A-R2 at 223-225. The respective uranium concentrations in groundwater at this well prior to mining were 0.0282, 0.0564, 0.0185, 0.0399, and 0.042 mg/L, for respective sampling dates. The average uranium concentration was 0.037 mg/L. JTI005B-R2 at 26.

176. Smith-Highland Ranch mine unit A, well MP5 post-restoration stability uranium concentrations were measured on 2/5/1999, 2/23/1999, 4/1/1999, 5/27/1999, 7/21/1999, 8/18/1999, 9/17/1999, 10/20/1999, 11/11/1999. JTI005A-R2 at 228-232. The respective uranium concentrations in groundwater at this well were 5.9, 8.35, 7.9, 6.6, 6.7, 9.17, 10.1, 9.3, and 11 mg/L, for respective sampling dates. Compared to the average baseline concentrations at this well, these values observed increases of 159x, 226x, 214x, 178x, 181x, 248x, 273x, 251x, and 297x, respectively. These values exceed EPA's safe drinking water standard for uranium (0.03 mg/L) by 197x, 278x, 263x, 220x, 223x, 306x, 337x, 310x, and 367x. JTI005B-R2 at 27.

177. Smith-Highland Ranch mine unit A, well MP4 baseline uranium concentrations were measured on 8/24/1987, 8/25/1987, 8/28/1987, 8/31/1987, and 9/9/1987. JTI005A-

R2 at 223-225. The respective uranium concentrations in groundwater at this well prior to mining were 0.0307, 0.0447, 0.034, 0.039, and 0.026 mg/L, for respective sampling dates. The average uranium concentration was 0.028 mg/L. JTI005B-R2 at 28.

178. Smith-Highland Ranch mine unit A, well MP4 post-restoration stability uranium concentrations were measured on 2/5/1999, 2/23/1999, 4/1/1999, 5/27/1999, 7/21/1999, 8/18/1999, 9/17/1999, 10/20/1999, 11/11/1999. JTI005A-R2 at 227-232. The respective uranium concentrations in groundwater at this well were 5.5, 8.2, 10.8, 11.5, 10.8, 8.75, 10.4, 9.9, and 10.6 mg/L, for respective sampling dates. . Compared to the average baseline concentrations at this well, these values observed increases of 196x, 293x, 386x, 411x, 386x, 313x, 371x, 354x, and 379x, respectively. These values exceed EPA's safe drinking water standard for uranium (0.03 mg/L) by 183x, 273x, 360x, 383x, 360x, 292x, 347x, 330x, and 353x. JTI005B-R2 at 29.

179. This well (MP4) was sampled again in 2012. The uranium concentration was observed as 17.3 mg/L. NRC029 at 53.

180. Smith-Highland Ranch mine unit B, well MP30 baseline uranium concentrations were measured on 8/12/1988, 8/13/1988, and 8/14/1988. JTI005A-R2 at 236-240. The respective uranium concentrations in groundwater at this well prior to mining were 0.0263, 0.0282, and 0.0194 mg/L, for respective sampling dates. The average uranium concentration was 0.024 mg/L. JTI005B-R2 at 30.

181. Smith-Highland Ranch mine unit B, well MP30 post-restoration stability uranium concentrations were measured on 8/30/2004, 9/27/2004, 10/25/2004, 12/28/2004, 1/26/2007. JTI005A-R2 at 246-254. The respective uranium concentrations in

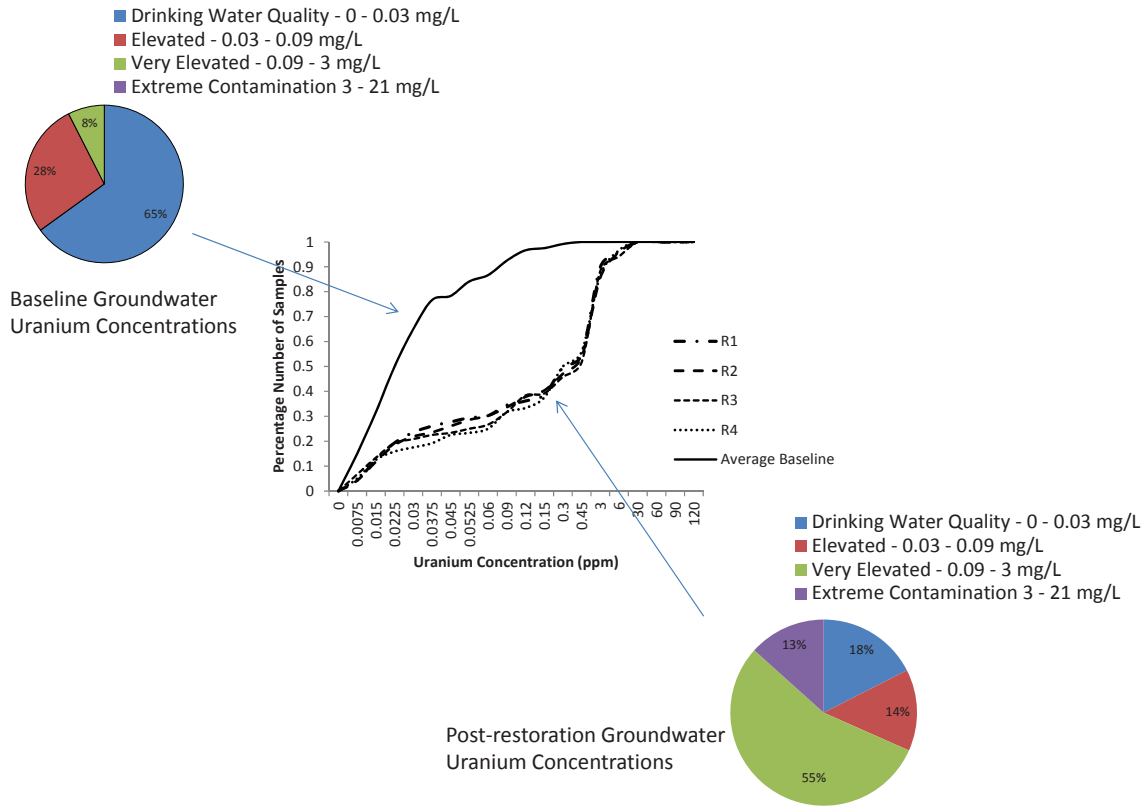
groundwater at this well were 4.36, 3.06, 3.13, 5.02, and 5.68 mg/L, for respective sampling dates. Compared to the average baseline concentrations at this well, these values observed increases of 182x, 128x, 130x, 209x, and 237x, respectively. These values exceed EPA's safe drinking water standard for uranium (0.03 mg/L) by 145x, 102x, 104x, 167x, and 189x. JTI005B-R2 at 31.

182. Finally, samples at well MP-4 observed extremely elevated uranium concentrations (5.5 – 11.5 mg/L) compared to average baseline (0.03 mg/L), exceeding the average baseline uranium concentration by ~183x - 383x, with no evidence that natural attenuation was decreasing elevated uranium concentrations. JTI052-R at 6. Well MP-5 observed a similar trend, where uranium concentrations range from 5.9 – 11.00 mg/L, where 11.00 mg/L was the last sample available suggesting an progressively increasing trend. The average baseline was 0.04 mg/L, indicating concentrations had increased between 148x – 275x baseline concentrations, well above the 71x proposed by Staff. *Id*. Further, according to the NRC Staff's spreadsheets, these samples were all collected between February 1999 and November 1999, implying they should be relevant to the bounding analysis. *Id*. None of these complexities and none of this granular data or analysis are presented by Staff in the FSEIS or in their testimony. *Id*.

iii. Cumulative Aquifer Restoration Data Analysis For Christensen Ranch MU2-6

183. Next, using the entire wellfield data set from Christensen Ranch MU2-6, a histogram for average baseline and each post restoration phase sampling round concentrations (denoted as "R1, R2, R3, R4") presents that entire data set. The figure presents a visual display of the cumulative distribution of the NRC's own data at

JTI005A-R2 at 1-188 (at .pdf pp. 2-187). The y-axis shows the percent number of samples which observe uranium concentrations at various magnitudes. To interpret the figure, choose a concentration of uranium (for example: 0.03 mg/L), and read the corresponding value on the y-axis. For pre-mining baseline conditions, the histogram demonstrates the percentage of samples with concentrations of 0.03 mg/L or less is approximately 65%, while post-restoration samples show the percentage of samples at or below 0.03 mg/L was approximately 18%. The distributions for average baseline conditions (top left) and post-restoration conditions (bottom right) are included in the histogram. JTI003-R at 40.

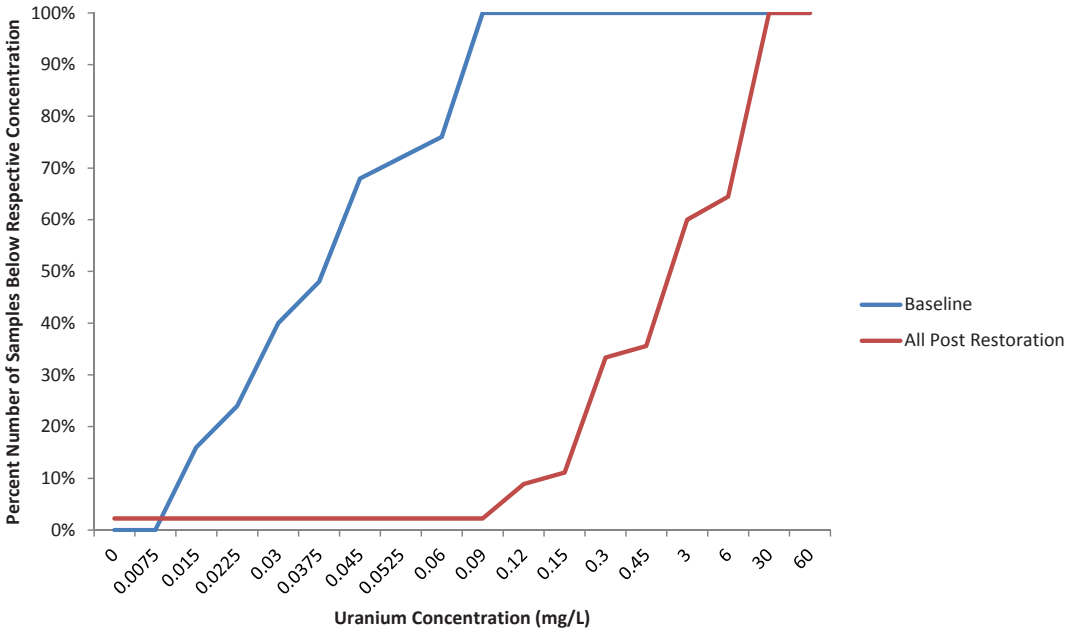


184. The histogram shows that elevated uranium concentrations (0.03-0.09 mg/L) were observed in 28% of the baseline samples and very elevated (0.09 – 3.0 mg/L) in 8% of the baseline samples, however the majority of the average baseline groundwater samples were below the MCL for uranium of 0.03 mg/L (~65%, n = 120). *Id*.

185. This histogram shows that upon conclusion of mining and restoration activities, the groundwater quality sample distribution shows significant changes to these observed percentages. For example, "extreme contamination" (>3.0 mg/L, or >100x safe drinking water standards) samples represent roughly 13% of all observed post-restoration groundwater wells. Further, "very elevated" uranium concentrations increased from 8% (Baseline) to 59% (Post-restoration). Finally the drinking water quality samples decreased from approximately 2/3 of all samples, to roughly 18% of the observed samples. This uncontroverted analysis demonstrates, quantitatively, the severe water quality degradation which occurs as a result of ISL licensed activities, which is not disclosed or discussed in the FSEIS.

iv. Cumulative Aquifer Restoration Data Analysis For Smith Ranch Well MP-4

186. Joint Intervenors prepared a cumulative histogram from the NRC's own data for Smith Ranch wellfield A (MP1 – MP5) that demonstrates that extreme contamination levels (defined as >3 mg/L or 100x safe drinking water standards) were approximately 40% of the post restoration samples. All baseline samples were used (n=25) and all post-restoration samples were used (n = 45) in creation of the cumulative histogram. *Id*.



Id. at 7.

187. Staff's assertion that the "post-licensing, pre-operational background values for uranium that ranged from 0.05 to 0.52 mg/L", is flawed and without merit. *Id*. at 11. By presenting the actual cumulative distribution for baseline data from a representative site, such as Willow Creek - Christensen Ranch, the value of 0.05 mg/L would be higher than roughly 85% of the baseline samples measured. *Id*.; *see* Figure at JTI003 at 41. For the Smith Highland Samples, 0.05 mg/L baseline would have exceeded approximately 705% of the observed baseline samples. *Id*.; s*ee* histogram figure above. Staff had no basis to assume a concentration at such a high baseline concentration (0.05 mg/L), when that value is unrepresentative of the actual concentrations observed in the groundwater representative of baseline groundwater at ISL sites. *Id*.

CERTIFICATE OF SERVICE

I hereby certify that on February 15, 2017, undersigned counsel for Petitioners filed the foregoing Joint Appendix with the U.S. Court of Appeals for the District of Columbia Circuit by filing the same with the Court's CM/ECF filing system. The following counsel will be served through this filing:

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