SEI001

August 25, 2014

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:

G. Paul Bollwerk, III, Chairman
Dr. Richard F. Cole,
Dr. Craig M. White

In the Matter of:	)	
	)	
Strata Energy, Inc.	)	Docket No. 40-9091-MLA
	)	ASLBP No. 12-915-01-MLA-BD01
	)	
(Ross In Situ Recovery	)	
Uranium Project)	)	

<u>INITIAL WRITTEN TESTIMONY OF RALPH KNODE</u>

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1.0 WITNESS BACKGROUND INFORMATION

Q.1. Please state your name, position and employer, including duration of employment.
A.1. Ralph Knode. I am the Chief Executive Officer (CEO) of Strata Energy Inc. I have been the CEO since April 2012. My *curriculum vitae* is included as Exhibit SEI002.

Q.2. Please state your education and professional memberships.
A.2. I hold a Bachelor's Degree in Geology from Amherst College. I am a member of the Society of Mining Engineers.

Q.3. Please describe your involvement in the ISR Industry over your career.
A.3. I have worked exclusively in the uranium ISR industry since 1979. I have worked on seven uranium ISR projects in the U.S as well as seven ISR projects in Kazakhstan, one ISR project in Australia and one potential ISR project in Tanzania. I have directly overseen the construction and operation of two ISR pilot plant demonstrations (one in the US and one in Kazakhstan). I have directly overseen the construction of three commercial ISR operations (one each in the U.S., Kazakhstan and Australia). I have also been directly in charge of three operating ISR facilities in the U.S. and one operating facility in Kazakhstan. During this time I have been involved directly and indirectly with drilling of tens of thousands of exploration holes and tens of thousands of ISR mining and monitoring wells

Q.4. Please describe your role in these projects.
A.4. Over my career in the ISR industry I have had various roles with each successive role generally increasing my responsibility. I started out as a field geologist working very closely with drilling rigs and have advanced to various supervisory roles since beginning my career in the industry in 1979. Some of the positions I have held include drilling supervisor, general manager of uranium operations, director of operations and construction, vice president of technical, senior vice president of projects, and my now current role as CEO of Strata Energy. In nearly all of the projects I have been involved with there was extensive drilling of exploration and development boreholes for collection of geologic information. In five of these projects (Crow Butte, Smith Ranch/Highland, JV Inkai, Honeymoon and Ross) I was directly involved in the design, installation and operation of mining and monitoring wells. In many of these projects I was involved in technical reviews and operational assessment of active ISR mining activities.

Q.5. What has been your role in the Ross ISR Uranium Project?
A.5. As CEO of Strata Energy I have the responsibility to oversee all aspects of day to day operations of Strata. This would include oversight of all licensing actions, oversight of design, engineering and construction of both the wellfields and the recovery facilities, oversight of the financial planning and budgetary considerations, oversight of all land and mineral acquisition,

oversight of the development and implementation of health and safety programs and face to face interaction with land owners and other stakeholders.

2.0 CONTENTION 1 - ALLEGED FAILURE OF THE FSEIS TO ADEQUATELY CHARACTERIZE BASELINE (I.E. ORIGINAL OR PRE-MINING) GROUNDWATER QUALITY

2.1 Exploration Drilling, ISR Test Operations, and Associated Well Construction Have Not Altered Baseline Conditions

Q.6. Based on your extensive experience from exploration through restoration at ISR facilities, can you briefly describe the types of drilling activities that occur during the different phases of a project?

A.6. Yes. There are typically two types of drilling activities at an ISR operation: 1) exploration and/or development drilling and 2) well installation. Both entail use of a mud rotary drilling system, which is to say the drill rig uses a rotating drill bit attached to a rotating string of drilling pipe and the fluid or drilling mud is continuously circulated from a drilling pit through the drill pipe and drill bit and returns to the drill pit. The drilling fluid is typically a simple mixture of water and high grade bentonite. Small amounts of polymers are typically added to the water/bentonite mix. The purpose of the drilling fluid is to: a) cool and clean the drill bit, b) continually remove the ground up rock from the bottom of the drillhole to the surface, c) produce a thin, impermeable layer of material that coats the outside diameter of the drillhole to stop the horizontal movement of fluids into or out of the drillhole, and d) minimize the swelling of shales and clays encountered in the drilling process.

The drilling proceeds until the hole reaches the desired depth. At that time the procedures going forward are different depending on whether the hole is abandoned in the case of an exploration hole or a well is constructed.

In the case of an exploration hole, approved abandonment material is mixed into the existing drilling fluid creating a very viscous fluid (abandonment mud) that is pumped through the drill pipe while it is still at total depth and displaces the lighter and less viscous drilling fluid. The drillhole is filled from bottom to top with the abandonment mud. The drill pipe is removed and a geophysical instrument is lowered to the bottom of the hole to collect geologic and radiometric information. It takes time for the abandonment mud to reach its final gel-like state and this allows the geophysical tool to be lowered and removed from the drillhole before the mud sets up and becomes a permanent impermeable seal. An appropriate surface plug is then installed and the location surveyed.

In the case of a well installation, the same geophysical instrument is lowered down the drillhole and readings are taken. The drillhole, which is typically 5 ¼″ diameter, is enlarged by using a larger diameter drill bit, usually 8″ in diameter. The process of enlarging the drillhole is referred to as reaming the drillhole. This entails the exact same process as the original drillhole. Drilling fluid is used for the same reasons: cooling the bit, removing ground up bedrock and sealing the drillhole to stop movement of fluids into or out of the drill bore horizontally. Once the drillhole is reamed, well casing is lowered into the open hole to the desired depth. The next step is to seal the annular space between the outside of the well casing and the wall of the surrounding bedrock. In ISR wells this is typically done by pumping a neat cement slurry or other approved grouting material down the inside of the well casing, and back up through the annular opening until it reaches the surface. A small amount of cement slurry is left inside the well casing and the cement slurry is allowed to cure or harden for several days.

The final step is to run a small drill bit down the inside of the well casing and drill out the cement slurry left inside the casing. With the cement slurry removed from inside the casing, a well screen can be lowered and placed at the desired elevation. Once this is done, the well needs to be "developed." This is a process of removing the bentonite drilling fluid from the open screen interval. This can be accomplished by several methods or combination of methods. The most common development methods in ISR well installation are air lifting, swabbing or a combination of both.

At Ross, the wells are developed by air lifting; Exhibit SEI003 depicts how a well is developed using air. This involves lowering a pipe below the static water level, usually a few tens of feet. A burst of air from an air compressor travels down the pipe and lifts those few tens of feet of water above the pipe out of the well casing. With the water removed from the top of the water column, a vacuum is created below and fresh water rushes into the bottom of the well through the screened interval. This rushing of the water into the casing through the screen removes any residual drilling fluid and fines in the interval that is screened. This is done repeatedly over several hours until the water coming out of the well is clean and representative of the native water in the screened interval.

Q.7. It has been alleged that fluids and gases introduced during drilling of exploration boreholes affect the chemistry of the aquifer (Moran 2011 ¶32, 33; Abitz 2011 ¶20, 21; Abitz and Larson 2014 ¶13). Please describe how typical mud rotary drilling methods limit interactions between the borehole and the surrounding materials including aquifers.

A.7. As described in ¶A.6, drilling fluids in mud rotary drilling systems are specifically designed to form a thin, impermeable layer referred to in the drilling industry as filter cake. The purpose of the filter cake is to impede the movement of drilling fluids into the surrounding materials. Drilling fluids can be tailored to specific conditions and are very effective in minimizing or eliminating drilling fluids from entering the bedrock, or in this case the aquifer, to be monitored or mined. Driscoll (1986) describes the process on page 288 as follows:

> "As drilling progresses, a film of small particles builds up on the wall of the borehole. This flexible lining, which may consist of clay, silt, or colloids, forms when the pressure of the drilling fluid forces small volumes of water into the formation, leaving the fine, suspended material on the borehole wall. In time, the lining completely covers the wall and holds loose particles or crumbly materials in place. It protects the wall from being eroded by the upward-flowing stream of drilling fluid, and acts to seal the wall and reduce the loss of fluids into surrounding permeable formations."

Q.8. Does exploration drilling typically involve injection of atmospheric gases into the aquifer?

A.8. No. During mud rotary drilling only drilling fluid is introduced into the borehole. It is possible that there could be some small amount of air entrained within the drilling fluid; however, the filter cake would effectively limit how much air would enter the aquifer. Additionally, the pressure of the aquifer, that is the level the water rises in the well above the top of the aquifer would also serve to limit the introduction of air. At Ross this is demonstrated by the fact the water level in an OZ sandstone monitor well is approximately 200' above the top of the OZ sand itself. One can then simply calculate the upward pressure of the aquifer (200 feet x 0.42psi/ft). In the case of the OZ sandstone at Ross, there would be approximately 84 pounds per square inch of pressure working in conjunction with the filter cake to limit the introduction of drilling fluid into the aquifer. Otherwise no air is injected during exploration borehole drilling with a mud rotary system.

Q.9. Do you think it would be possible to contaminate an entire aquifer by drilling exploration boreholes?

A.9. In my opinion, it is unrealistic to think that an entire aquifer could be contaminated by exploration drilling. As I have described above, there is a very tough and impermeable filter cake that prevents drilling fluids from leaving the borehole and entering the surrounding materials. Any small amounts of atmospheric air that might have been in the drilling fluid would have a very limited impact on the aquifer, both spatially and in time.

Another good example of not affecting water quality by exploration drilling or well development can be seen with the phased manner in which mine units are installed. Typically the monitor network of a particular mine unit is installed first. These wells are then sampled over the specified period and Commission-approved background is determined. At a later date, the remaining mining wells are installed in very close proximity to the aforementioned monitor wells. At that time one can clearly see, as the monitor wells are routinely sampled, there is no effect on the water quality by the drilling of development wells and installation of the associated mining wells.

In the ISR uranium industry we inject oxygen-rich solutions into the aquifer to alter its chemistry to mobilize the uranium so it can be extracted. It has been my experience that it takes a lot of oxygen-rich solutions to make a difference in the aquifer and even then the effects are relatively localized to the injection wells. If we could significantly alter the chemistry of the aquifer by drilling a few exploration boreholes, ISR mining would require a lot less circulation of oxygen-rich solutions and would be much less expensive.

Q.10. Please describe how construction of wells differs from exploration borehole drilling.

A.10. As described in ¶A.6, drilling of the initial pilot hole for a well is very similar to the method used to drill an exploration borehole. To construct a well the hole is then reamed or enlarged with a bigger bit. The driller then sets casing to the desired depth. The annular space between the casing and the drillhole is then cemented to prevent water in the target aquifer from mixing with other aquifers. Once the well screen is in place, the well is then developed to remove the remaining drilling fluid and fines from the screened intervals. Standard practice in the ISR industry and a license condition at all U.S. ISR facilities is to conduct mechanical integrity testing on the wells once they are completed. This is to ensure that there are no places where mining fluids can escape the well casing and enter upper aquifers.

Q.11. You explained that the biggest difference between constructing boreholes and wells is that construction of wells includes casing, an annular seal and well development. Please describe in your experience how ISR wells are typically developed.

A.11. Well development by air lifting and/or swabbing are standard well development methods in the ISR industry. During air lifting well development air is injected into the wellbore which forces the water up out of the wellbore. Some operations use swabbing in addition to or in place of air lifting. With swabbing, a tight fitting tool with a check valve is lowered down the well casing until it is a few tens of feet below the static water level. When the swabbing tool is pulled upwards rapidly, the check valve closes and the water above the swab tool is quickly removed from the well casing. This causes the same reaction as air lifting, which creates a vacuum in the screened interval and causes water from the aquifer to rush into the well casing, removing drilling fluids and fines from the screened interval. This rushing of water into the casing through the screen removes any residual drilling fluid and fines in the screened interval. This is done repeatedly over several hours until the water coming out of the well is clean and representative of the native water in the screened interval.

Typically, after air lifting is complete, monitor wells are also pumped to continue well development. During the pumping phase of development a submersible pump is installed in the wellbore and water is removed from the wellbore using the pump. Typically field parameters such as pH, EC, temperature, and turbidity are measured during the development to determine geochemical stability. Typically, well development continues until three or more water samples collected from the well demonstrate less than 10% change in measured field parameters. This indicates that formation water that has not been impacted by drilling activities is being collected.

Q.12. You mentioned that at the Ross ISR Project and at most others at which you have worked that the wells are typically developed using air lift techniques. It has been alleged that air lifting introduces oxygen and alters the chemistry of the aquifer (Abitz 2011 ¶20, 21, Moran 2011 ¶33). During air lifting is the air injected directly into the aquifer?

A.12. No. No air is injected into the aquifer. At Ross and most other ISR projects, the wells are developed by air lifting as noted above in A.11 and on Exhibit SEI003. This involves lowering a pipe 50-100 feet below the static water level. A burst of air from an air compressor travels down the pipe and quickly lifts that 50-100 feet of water out of the well casing. As described in ¶¶A.6 and A.11, when the water is removed from the top of the water column, a vacuum is created and fresh water rushes into the bottom of the well through the screened interval.

At the Ross ISR Project, during air lifting operations the air is actually injected into the well bore below the static water table but significantly above the screened portion of the aquifer. The SM, OZ and DM aquifers at the site are all confined, which means that the water level in the aquifer is above the top of the aquifer. For example, in the Ross project area well development of OZ monitor wells consists of injecting air approximately 200 feet above the top of the screened aquifer. Exhibit SEI003 depicts typical air lift well development in the OZ. Since typical air lift development operations do not actually inject air anywhere near the screened interval of the aquifer, no air is ever injected directly into the aquifer. Based on my experience, I believe there is no merit in the claim that well development through air lifting significantly alters the chemistry of the aquifer around the well in question much less the aquifer as a whole.

Q.13. Is it possible that well development using submersible pumps could introduce air into the aquifer?
A.13. No. Within the Ross area our submersible pumps in the monitor wells are typically set in the wellbore at an elevation approximately 200 feet above the screened aquifer. Therefore, it is impossible to pump the water level down below the screened aquifer which essentially eliminates the potential to introduce air into the aquifer.

Q.14. In your experience, both at the Ross ISR Project and others, have you ever observed or been made aware of instances where drilling or constructing wells has impacted water quality in an aquifer?
A.14. No. In fact, every effort is made to minimize impacts to all aquifers encountered during the drilling, well construction, and development process. This includes the use of drilling fluids designed to coat the borehole wall with filter cake which effectively eliminates the movement of drilling fluids into the aquifer. It also includes use of well casing materials that have no effect on the groundwater and water quality. In addition, cementing the annular space serves to isolate only the uranium host aquifer or monitoring interval, etc.

Q.15. In your experience at multiple ISR projects dating back to the 1980s, how common has it been to evaluate a project using a Research and Development (R&D) project similar to Nubeth?
A.15. In the late 1970s and early 1980s, it was common, if not required, to run a pilot demonstration similar to the Nubeth project. This was done to assess the ability to mine the ore body as well as determine if the aquifer could be reasonably restored. I am aware of and personally visited the pilot demonstration plants at Nubeth, Crow Butte, Highland, Smith Ranch, Nine Mile, North Platte, Luenberger, Ruth and Reno Creek.

Q.16. To your knowledge, were there any long-term impacts to groundwater resources associated with these R&D projects?
A.16. No. To my knowledge there have not been any long-term impacts to the groundwater resources at any of these sites. There are good reasons for this. First and foremost, groundwater

quality will naturally attenuate over time. That means with no restoration effort at all, groundwater will eventually return to its prior undisturbed state. Typically at Ross and other ISR sites in Wyoming and Nebraska, groundwater moves at very slow rates in the impacted aquifers. So if natural attenuation returns the groundwater to baseline or near baseline quality over 20-30 years, that same groundwater has only moved 100-200 feet. With those facts in mind, I do not believe that long-term impacts from ISR R&D projects to the groundwater are possible.

Q.17. Are you aware whether the NRC has documented any long-term impacts to a water supply well attributable to an ISR facility?

A.17. To my knowledge NRC has not documented any long-term impacts to a water supply well attributable to an ISR facility. In fact, a 2009 report from the NRC staff to the NRC Commissioners (Exhibit SEI004B) states at 5 that:

> "Based on a review of historical licensing documentation, data from the regional monitoring at all existing ISR facilities indicate that no impacts attributable to an ISR facility were observed at the regional monitoring locations. In addition, the staff is unaware of any situation indicating that: (1) the quality of groundwater at a nearby water supply well has been degraded; (2) the use of a water supply well has been discontinued; or, (3) a well has been relocated because of environmental impacts attributed to an ISR facility."

3.0 CONTENTION 2 - ALLEGED FAILURE OF THE FSEIS TO ANALYZE THE ENVIRONMENTAL IMPACTS THAT WILL OCCUR IF THE APPLICANT CANNOT RESTORE GROUNDWATER TO PRIMARY OR SECONDARY LIMITS

3.1 Restoration at Other ISR Facilities Has Been Successful and the Methods Used at Other Facilities Will Work at the Ross ISR Project.

Q.18. Please explain how restoration techniques have advanced over your career.

A.18. The ISR uranium industry has matured significantly since I started working in it. During the early stages of ISR, groundwater restoration largely consisted of groundwater sweep, which essentially required massive amounts of groundwater to be removed from the aquifer to pull freshwater into the targeted portion of the aquifer. This is a standard pump and treat method which is used in many other groundwater remediation projects even today.

The industry has significantly reduced the unnecessary consumption of groundwater in restoration through the use of reverse-osmosis (RO) water treatment. Today, RO units are more efficient than ever at removing contaminants. Recycling of affected groundwater through modern RO units has proven to be an effective way to accelerate restoration at ISR sites.

Other methods such as addition of reductants to help consume oxygen have been demonstrated to be successful as well. More recently, the development of bioremediation to reduce trace metals from the affected groundwater are proving to be effective. There is a body of evidence, both in the field and with modern groundwater modeling programs, that demonstrates natural attenuation may be an effective and efficient groundwater restoration technique.

Industry understanding of the geochemistry has significantly advanced since the pilot projects of the 1970s and 1980s and we have learned how to adjust the timing, the vertical extent, and the chemistry of our leach solutions to improve restoration efficiency.

Q.19. Given the technological advances developed over the last 30+ years in the ISR industry, do you believe that the efficiency of groundwater restoration at the Ross ISR Project will be improved over the historical restoration of the Nubeth R&D in the early 1980s?

A.19. Yes. When Nubeth R&D was operated, recovery of uranium through ISR methods was a relatively new industry. Strata has evaluated the Nubeth pilot project and there are a number of things that could be done to increase the efficiency not only during uranium recovery but also during restoration as well. For example, we believe that better control of the pH and the injection solution chemistry as well as improved filtration would have helped improve both uranium recovery and aquifer restoration.

We anticipate that the use of modern RO treatment will also help us maintain better control of leach chemistry during mining and improve the effectiveness of restoration. We also have the advantage of new technologies that were not available in the 1980s to help us monitor the wellfields.

For example, computers and modern groundwater modeling programs allow us to evaluate the geohydrology and understand groundwater movement in the aquifer in much more detail than were available in first generation ISR operations. We can also use transducers to track real time changes in water levels and groundwater chemistry. Strata plans to take advantage of the large body of research and development that has occurred since the early 1980s as well as technological advancements to operate the Ross ISR Project to significantly improve restoration efficiency over the historic pilot project.

If needed, Strata could propose alternative restoration methods other than straight RO treatment. This may include bioremediation in conjunction with RO treatment that has shown to be quite effective in laboratory and field tests. Strata would assess the viability of any alternative restoration methods and apply for an amendment to its license if an alternative method is desired.

Q.20. With advancements in restoration over the last 30 years do you believe there is a risk that the Ross ISR Project will have significant negative impacts on the Fox Hills and Lance host aquifer?

A.20. Absolutely not. I have been involved with aquifer restoration at a number of uranium ISR facilities and I believe that the conditions at the Ross ISR Project are similar to other projects I have seen successfully restored. I have no doubt restoration will be successful at the Ross ISR Project. As detailed in the SER (Exhibit SEI010 at 318), NRC staff also support this conclusion.

Furthermore, I believe that even though we are committed and bound by the NRC license to restore the groundwater at the Ross ISR Project, it can be demonstrated with modern groundwater modeling programs and recent research that if we did nothing to restore the affected groundwater at Ross, natural attenuation would prevent any significant negative groundwater impacts in the Fox Hills and Lance host aquifer.

4.0 CONTENTION 3 - ALLEGED FAILURE TO INCLUDE ADEQUATE HYDROLOGICAL INFORMATION TO DEMONSTRATE SEI'S ABILITY TO CONTAIN GROUNDWATER FLUID MIGRATION

4.1 Sufficient Controls Will Be in Place to Prevent Lack of Confinement Due to Unplugged or Improperly Plugged Exploration Holes

Q.21. You have worked at a number of uranium ISR projects. In your experience have exploration drillholes been a significant issue to successful ISR and containment of unplanned fluid migration at these sites?

A.21. No. Every uranium ISR project with which I have been involved has had a large number of exploration drillholes on it. We have been able to successfully operate at all of the facilities because the boreholes within the wellfields were successfully plugged or they sealed up naturally. One feature of geologically young sedimentary formations is the presence of swelling clay and shale zones. In most if not all projects I have worked on, the tendency of clay and shale horizons to swell is common. It has been my experience that even when historical drillholes are not plugged to today's strict standards, the swelling action of clay and shale horizons encountered in the drillhole will provide a natural seal between the mining zone and other aquifers.

Both Highland and Smith Ranch in Wyoming and JV Inkai in Kazakhstan had large numbers of historical exploration drillholes that were drilled in the 1970s. These holes were likely not plugged to today's strict standards. However, in my experience, the presence of these historical drillholes was never a significant issue in successful ISR.

Strata has devoted and will continue to devote significant time and resources to verifying that historical exploration drillholes within the proposed wellfields are plugged. We believe that these efforts will successfully prevent vertical excursions.

Q.22. What commitments has Strata made with regard to boreholes to reduce or eliminate the potential for migration of fluids?

A.22. As described in the license application (e.g., Exhibit SEI016B at 402), Strata has committed that prior to ISR uranium recovery, all historic exploration and delineation drillholes that can be located within the perimeter monitor well ring and beneath the central plant area will be plugged and abandoned to today's standards. In fact, the current plugging commitment by Strata to use neat cement or high density bentonite grout is above and beyond the current State of Wyoming plugging requirement.

Q.23. Please describe Strata's technique for finding and plugging historical exploration holes.
A.23. Strata has largely been successful in locating historical exploration holes within the Ross project area. The historical Nubeth exploration drillholes within the project area were capped with a cement plug containing a metal cap that identified the hole via a unique number. We have been able to successfully locate these holes using a metal detector. The hole locations are then surveyed so we can easily find them when it is time to plug them. To date we have located 92% of all historical exploration holes within the currently proposed wellfields at Ross (see ¶A.25).

The procedure for plugging and abandoning the historical exploration holes is: 1) remove the cement cap and set up the drill rig over the old hole, 2) lower the drill pipe to the bottom of the old hole, verifying the depth using the old geophysical logs, 3) calculate the required amount of abandonment material and mix that amount of either neat cement slurry or high solids bentonite grout in a portable mixing unit, 4) fill the drillhole from bottom to top with the abandonment fluid, 5) allow the hole to sit for 1-2 days, allowing the abandonment fluid to settle, then top off the hole with bentonite chips and place a cement cap approximately 4 feet below the ground surface, mark with a metal tag and fill the remaining 4 feet with topsoil.

Q.24. To your knowledge, were the methods to locate historical drillholes and the proposed abandonment procedures provided in the license application?
A.24. Yes. The method to plug and abandon historical exploration drillholes was discussed in the license application including ER Section 5.4.2 (Exhibit SEI016B at 402), TR Section 3.1.6 (Exhibit SEI014C at 41-42), and TR Addendum 2.6-E (Exhibit SEI014F).

Q.25. Please describe Strata's plugging and abandonment efforts since the application was submitted.
A.25. Since the permit application was submitted, Strata has made significant progress in locating historical Nubeth exploration drillholes. As of August 1, 2014, Strata has located and surveyed 1,354 historical Nubeth exploration drillholes. More importantly, within the Ross project area estimated mine unit boundaries, 92% of the historical exploration drillholes have been located. As of August 1, 2014, 108 historical exploration holes have been re-entered, plugged and abandoned according to today's strict plugging requirements. Strata has clearly demonstrated that these holes can be located and properly plugged as committed to in the approved license application.

In our experience at Ross, when entering the historical exploration drillholes, the drill pipe does not fall freely to the bottom of the drillhole. Even with the significant weight of the drill pipe, drilling fluid must be circulated through the drill pipe to get to the bottom of the drillhole.

Q.26. Strata has invested a significant amount of time and resources toward finding and abandoning boreholes. Please explain why Strata takes borehole abandonment so seriously.
A.26. First of all, Strata has made commitments in the approved license application and it fully intends to honor those commitments. Further, license condition 10.12 (Exhibit SEI015 at 9)

requires Strata to attempt to locate and abandon all drillholes located within the perimeter monitor well ring of each wellfield. As described in Ray Moores' initial testimony (Exhibit SEI 043 at A.8.), once we have located and properly abandoned all the drillholes within each perimeter monitor well ring we will then conduct additional wellfield scale aquifer tests to demonstrate that the abandoned drillholes do not compromise the integrity of the upper and lower confining units. Strata has a strong economic incentive to ensure isolation of the uranium recovery activities to select portions of the mineralized and exempt aquifer.

4.2 The FSEIS Adequately Addresses Excursion Recovery Methods

Q.27. It has been alleged that there is no credible scientific basis demonstrating that adjustments in pumping rates can recapture a lixiviant plume if a well goes on excursion status (Abitz and Larson 2014 ¶51). Over the course of your career have you seen this method used to recover a lixiviant plume after a perimeter monitor well goes on excursion status?

A.27. In the majority of horizontal excursions that I am aware of, unless there are unusual geologic or man-made circumstances, the plume of lixiviant that has moved away from the mining wells can be recovered or drawn back into the pattern area. This is done by adjusting the pumping and injection rates of mining wells in the immediate vicinity of the excursion. Commonly, injection of mining solutions is limited or stopped completely in the mining unit closest to the excursion. Then pumping from those mining wells closest to the excursion will draw the mining solutions away from the monitor well and back into the mine unit. This effectively ends the excursion.

5.0 REFERENCES

Abitz, R., 2011, Declaration of Dr. Richard Abitz on Behalf of the Natural Resources Defense Council and Powder River Basin Resource Council, ADAMS Accession No. ML11300A191, October 23, 2011, Attachment to the Petition to Intervene and Request for Hearing by the Natural Resources Defense Council and Powder River Basin Resource Council, PDF pages 106 to 132.

Abitz, R. and L. Larson, 2014, Joint Third Declaration of Dr. Richard Abitz and First Declaration of Dr. Lance Larson on Behalf of the Natural Resources Defense Council and Powder River Basin Resource Council, ADAMS Accession No. ML14091A004, March 31, 2014, Exhibit 1 to Natural Resources Defense Council's and Powder River Basin Resource Council's Joint Motion to Migrate or Amend Contentions, and to Admit Contentions in Response to Staff's Final Supplemental Environmental Impact Statement.

Driscoll, F.G., 1986, Groundwater and Wells, Second Edition, Johnson Division, St. Paul, Minnesota.

Moran, R.E., 2011, Declaration of Robert E. Moran on Behalf of the Natural Resources Defense Council and Powder River Basin Resource Council, ADAMS Accession No. ML11300A191, October 24, 2011, Attachment to the Petition to Intervene and Request for Hearing by the Natural Resources Defense Council and Powder River Basin Resource Council, PDF pages 12 to 69.

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NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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(Ross In Situ Recovery	)		
Uranium Project)	)		

AFFIDAVIT OF RALPH KNODE

I declare under penalty of perjury that my statements in prefiled Exhibits SEI001 (Ralph Knode Initial Written Testimony) and SEI002 (Ralph Knode CV) are true and correct to the best of my knowledge and belief.

Ralph Knode

Ralph Knode

Executed in Gillette, WY
this 23rd day of August, 2014