August 25, 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'S INITIAL TESTIMONY

INTRODUCTION

Q.1 **Please state your name, position, and employer, and briefly describe your role in reviewing Strata's application for a license related to the Ross Project.**

A.1a My name is Johari Moore. I am an Environmental Project Manager in the NRC's Office of Federal and State Materials and Environmental Management Programs, Division of Waste Management and Environmental Protection, Environmental Review Branch. Exhibit (Ex.) NRC002 provides a statement of my professional qualifications. I served as the Lead Project Manager for the NRC Staff's environmental review of the Ross Project application. In this capacity, I was responsible for overseeing the development of the Draft (DSEIS) and Final (FSEIS) Supplemental Environmental Impact Statement for the Ross Project.

A.1b My name is John Saxton. I am a Hydrogeologist with the Uranium Recovery Licensing Branch in the NRC's Office of Federal, State and Materials and Environmental Management Programs. Ex. NRC003 provides a statement of my professional qualifications. I was the Project Manager and technical

reviewer in the area of hydrogeology for Staff's safety review of the Ross ISR Project license application. In my role as Project Manager, I reviewed the Ross Project FSEIS to ensure consistency with the Staff's technical findings in its Safety Evaluation Report. I am therefore familiar with the FSEIS, particularly with the FSEIS sections addressing groundwater quality and hydrogeology.

A.1c My name is Kathryn Johnson. I am a geochemist employed by Attenuation Environmental Company (AEC). I also own and operate Johnson Environmental Concepts. Ex. NRC004 provides a statement of my professional qualifications. For the Ross Project DSEIS and FSEIS, I served as the subject matter expert for matters related to water quality and as the principal editor of all sections on geology, soils, and hydrology.

A.1d My name is Anthony Burgess. I am employed by AEC as principal hydrogeologist. I also own and operate my own company, Anthony Burgess Consulting Inc. Ex. NRC005 provides a statement of my professional qualifications. I prepared the sections of the DSEIS and FSEIS that address groundwater issues.

Q.2 Are you familiar with the admitted contentions in this proceeding?

A.2 (H. Moore, J. Saxton, K. Johnson, A. Burgess) Yes. We have reviewed the Joint Intervenors' admitted contentions challenging both the FSEIS and the DSEIS issued by the NRC Staff for the Ross Project. We have reviewed the declarations filed by the Joint Intervenors in this proceeding, including the Joint Third Declaration of Dr. Richard Abitz and First Declaration of Dr. Lance Larson ("Joint Third Declaration"), the Second Declaration of Dr. Richard Abitz ("Second Abitz Declaration"), the First Declaration of Dr. Richard Abitz, and the original declarations of Dr. Robert E. Moran, Dr. Ronald L. Sass, and Dr. Richard Abitz. In addition, we have reviewed documents cited by the Joint

Intervenors and their experts that pertain to the contentions on which we will be testifying.

Q.3 What are the contentions on which you will be testifying?

A.3a (J. Moore) I will be testifying on Contentions 1 (Baseline Groundwater Quality), 2 (ACL Bounding Analysis), and 3 (Fluid Migration).

A.3b (J. Saxton) I will be testifying on Contentions 1 (Baseline Groundwater Quality), 2 (ACL Bounding Analysis), and 3 (Fluid Migration).

A.3c (K. Johnson) I will be testifying on Contentions 1 (Baseline Groundwater Quality), 2 (ACL Bounding Analysis), and 3 (Fluid Migration).

A.4d A. Burgess) I will be testifying on Contention 3 (Fluid Migration).

CONTENTION 1

Q.1.1 In Contention 1, the Intervenors argue that the FSEIS is inadequate because it fails to include information needed to determine baseline groundwater quality. In support of their arguments, the Intervenors refer to paragraphs 8-30 in the Joint Third Declaration of Dr. Richard Abitz and Dr. Lance Larson. The Intervenors also refer to paragraphs 36-56 of the Moran Declaration, paragraphs 8-15 and 22-23 of the Sass Declaration, paragraphs 15-27 of the First Abitz Declaration, and generally to the Second Abitz Declaration. Are you familiar with the arguments raised in these declarations?

A.1.1 (K. Johnson, J. Moore, J. Saxton) Yes, we have reviewed the declarations of Drs. Abitz, Larson, Moran, and Sass, and are familiar with the specific arguments raised in those declarations.

Q.1.2 Where in the FSEIS does the Staff address baseline groundwater quality?

A.1.2 (K. Johnson, J. Moore, J. Saxton) The Intervenors' term "baseline groundwater quality" broadly encompasses two different sets of information, which should be

clarified at the outset. The first type of "baseline" information is pre-licensing, site-characterization groundwater quality information that describes the existing state of groundwater quality in the vicinity of the Ross facility. This information is required to be included in an SEIS by 10 C.F.R. Part 51, Subpart A, Appendix A, "Affected environment," and is used by the Staff as the basis for its evaluation in the FSEIS of the current quality of the groundwater that may be impacted by the Ross Project's operation and to qualitatively assess how ISR activities at the site might reasonably affect that groundwater quality. The Staff describes this pre-licensing, site-characterization groundwater quality information in Sections 2.1.1.1 and 3.5.3.3 of the FSEIS (Ex. SEI009A). Appendix C of the FSEIS (Ex. SEI009B) provides the dataset for the description of the groundwater quality information in these sections.

The Intervenors state that the FSEIS fails to include information on "baseline" water quality that must be established pursuant to 10 C.F.R. Part 40, Appendix A, Criterion 5B(5). This information, which we refer to as "post-licensing, pre-operational" water quality information in the FSEIS to distinguish it from the site-characterization water quality information required by NEPA and 10 C.F.R. Part 51, is used by the Staff to establish standards for a regulatory groundwater detection monitoring program in order to detect a release, and to establish standards for aquifer restoration after uranium recovery operations are complete. While the FSEIS cannot provide the empirical values for the concentrations of hazardous constituents collected pursuant to Criterion 5B(5) because they are not developed until after the license is issued, as explained further in A.1.4 of our testimony, the FSEIS describes the process, schedule, and purpose of collecting and defining post-licensing, pre-operational groundwater quality information in FSEIS Sections 2.1.1.1, 2.1.1.2, 2.1.1.3,

4.5.1.2, 4.5.1.3, 5.7.2, 6.3.2, in response to comments in Appendix B, and in Appendix B1.

Q.1.3 In paragraphs 8 and 9 of the Intervenors' Joint Third Declaration, Drs. Abitz and Larson argue that the FSEIS introduces regulatory confusion by replacing the term "baseline" with the phrase "post-licensing, pre-operational," referring to the DSEIS at page 2-24 and the FSEIS at page 2-25. Can you address their concern?

A.1.3 (K. Johnson, J. Moore, J. Saxton) As we discuss in A.1.2 of our testimony, it is important to differentiate the two types of "baseline" groundwater quality data that are gathered for an ISR project. When the terms "baseline groundwater quality data" or "background groundwater quality data" are used with respect to ISR facilities, it may not always be apparent whether the terms are referring to the pre-licensing, site-characterization groundwater quality data developed to satisfy 10 C.F.R. Part 51 and Part 40, Appendix A, Criterion 7, or to post-licensing, pre-operational groundwater quality data developed pursuant to Part 40, Appendix A, Criterion 5B(5). Therefore, the FSEIS was revised throughout to clearly distinguish the two types of data, and the Staff revised a text box in Section 2.1.1.1 of the FSEIS (Ex. SEI009A at 2-25) to describe the change in terminology. This was not done to introduce regulatory confusion but to clarify and differentiate between the two types of information.

Q.1.4 In paragraph 7 of the Joint Third Declaration, Drs. Abitz and Larson argue that the FSEIS fails to present any empirical characterization of the pre-mining baseline water quality values that will be used to assess the impacts of the Ross Project on the exempted aquifer, to detect horizontal and vertical migration of lixiviant outside the exempted aquifer, and to

establish binding and achievable water quality values for aquifer restoration. Do you agree?

A.1.4 (K. Johnson, J. Moore, J. Saxton) We agree that the FSEIS does not present empirical values for the Commission-approved post-licensing, pre-operational concentrations of groundwater constituents at the Ross Project site that will be used to detect excursions and to set restoration target values for the exempted aquifer, because those data will not be gathered until Strata has established the monitoring well network required by Condition 11.3 of its source and byproduct materials license (Ex. SEI015). As the Staff explains in the FSEIS, most extensively in Section 2.1.1.1, the Commission-approved background water quality values will be established in accordance with Criterion 5B(5) in 10 C.F.R. Part 40, Appendix A, before Strata begins uranium production in a wellfield. This is the data that is used to establish standards for aquifer restoration after uranium recovery is complete. The methods for assessing Commission-approved background concentrations are memorialized in License Condition 11.3 of the license (Ex. SEI015).

That said, we strongly disagree with their claim that "pre-mining baseline water quality" is not characterized in the FSEIS. The FSEIS presents and describes pre-licensing, site-characterization groundwater-quality data for the Ross Project area. The Staff summarizes Strata's site-characterization baseline groundwater sampling methodology and results in FSEIS Section 3.5.3.3, and refers to this information in FSEIS Section 2.1.1.1 (Ex. SEI009A at 2-25). As the Staff explains in Section 3.5.3.3, Strata developed the site characterization water quality data from samples gathered from its own pre-licensing, site-characterization monitoring well network at the Ross Project site,

from sampling and analysis of existing water supply wells, and from historical data from the former Nubeth operation.

The Staff shows the monitoring well clusters used by Strata to develop site-characterization groundwater quality data in FSEIS Figure 3.15 (Ex. SEI009A at 3-36). As the FSEIS notes, Strata collected the groundwater quality samples from the wells identified in Figure 3.15 between 2010 and 2011 (Ex. SEI009A at 3-38). The FSEIS describes 29 currently operable water supply wells within a 2-mile radius of the Ross Project identified and sampled by Strata and presents the location of these wells in corrected Figure 3.16 (Exs. NRC011 at 3-43) (Figure 3.44-33 of Strata's environmental report (SEI016A at 3-231)). The water supply wells were sampled in 10 consecutive quarters in 2009, 2010, and 2011, using the same methods established for sampling monitoring wells. The Staff summarizes the water quality data collected by Nubeth in 1976 and 1978 before operations in Table 3.7 of the FSEIS (Ex. SEI009A at 3-41), and provides additional information regarding water quality data after restoration of the Nubeth project in FSEIS Section 5.7.2.

The resulting data from the monitoring well network and the 29 water supply wells are provided in full in FSEIS Appendix C, characterized in Section 3.5.3.3, and compared to the Wyoming Department of Environmental Quality's (WDEQ's) and the U.S. Environmental Protection Agency's (EPA's) water-quality standards for constituents, which are presented in Table 3.8 of the FSEIS. The results of the comparison are described for each aquifer unit associated with the Ross Project area. The Staff provided a qualitative comparison between the pre-licensing, site-characterization water quality data

collected by Nubeth (Table 3.7) with Strata's data from the monitoring wells completed in the ore zone (Table 3.6).

Based on the information provided, the Staff determined that Strata's approach for defining pre-licensing, site-characterization water quality meets Criterion 7 in 10 C.F.R. Part 40, Appendix A. Under Criterion 7, at least one full year prior to any major site construction, the applicant or licensee must conduct a monitoring program to provide complete baseline data on a milling site and its environs. The Staff determined that Strata's sampling and analysis efforts adhered to both the WDEQ/LQD's *Hydrology*, *"*Coal and Noncoal," Guideline No. 8 (Ex. SEI013), and the NRC's Regulatory Guide 4.14, Revision 1 (Ex. SEI008). WDEQ's Guideline No. 8 establishes the constituents that should be included in water quality sampling, how the samples should be collected and handled, and the appropriate analytical methods to be used. Regulatory Guide 4.14 recommends that groundwater samples be collected quarterly from wells placed in the area potentially impacted by the project and from each well within two kilometers of the tailings area that is or could be used for drinking water, water for livestock, or crop irrigation. The water quality datasets that are generated from following Criterion 7 and Reg. Guide 4.14 are sufficient to meet the requirements of NEPA, which requires a description of the water that could be affected by the proposed action, specifically providing the mean, range, and temporal and spatial variations in water quality (Ex. NRC013 at 5-8, 6-7). In summary, the baseline groundwater quality data presented in FSEIS Section 3.5.3.3 is sufficient to permit the Staff to characterize the environment that may be affected by the Ross Project and to support the assessment of the project's reasonably foreseeable impacts to groundwater quality at the site.

Q.1.5 **In paragraph 10 of their Joint Third Declaration, Drs. Abitz and Larson state that the FSEIS "simply presents a range of values for water quality and lacks a thorough technical discussion on how a valid scientific and statistical representation of 'baseline' will be developed for the project." A similar argument is made in paragraph 13, in which Drs. Abitz and Larson state that the FSEIS's conclusion regarding impacts on groundwater resources is without basis because the FSEIS lacks "a discussion of the proper scientific and statistical methods that must be executed to establish valid baseline values." Can you respond to these statements?**

A.1.5 (K. Johnson, J. Moore, J. Saxton) The FSEIS discusses groundwater quality at the Ross Project site and its environs in order to characterize the environment that may be affected by the Project. The Staff prepares a SEIS for an ISR project in accordance with the requirements set forth in 10 C.F.R. Part 51. Part 51 requires a SEIS to succinctly describe the environment to be affected by the proposed action, with data and analyses in the statement to be described at a level of detail commensurate with the importance of the impact – less important material is to be summarized, consolidated, or simply referenced. The Staff also follows guidance set forth in NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs" (Ex. NRC013). NUREG-1748 states that the SEIS should include a description of site-specific and regional data on the characteristics of surface- and groundwater quality in sufficient detail to provide the necessary data for other reviews dealing with water resources.

Based on these factors, the baseline groundwater quality data presented in FSEIS Section 3.5.3.3 is sufficient to permit the Staff to

characterize the environment that may be affected by the Ross Project and support the assessment of the project's reasonably foreseeable impacts to groundwater quality at the site. Further empirical analysis of the groundwater data described in the FSEIS is not necessary to characterize the groundwater conditions at the site or to support the Staff's assessment of potential impacts from the project. For the same reason, the gathering of more detailed information to establish a "scientific and statistical, pre-license baseline," as called for by Drs. Abitz and Larson in paragraph 10 of their Joint Third Declaration, is unnecessary to characterize groundwater conditions at the site. Such data would be superfluous, as the existing data is sufficient to serve the purposes of the Staff's NEPA review.

Moreover, even if the Staff were to include this Criterion 5B(5) data in the FSEIS, it would not likely alter the FSEIS's conclusions regarding the potential impacts of the project on groundwater quality. In Section 4.5.1.2 of the FSEIS, the Staff concludes, tiering from the GEIS (Exs. NRC007 and NRC008), that the potential impacts to the quality of the uranium-bearing production zone aquifer as a result of the Ross Project's operations are be expected to be SMALL and temporary. As explained in Section 2.1.1.1 of the FSEIS, this is because when uranium recovery in a wellfield is complete, the licensee is required to conduct aquifer restoration activities to restore the production aquifer to pre-operational class-of-use conditions to meet WDEQ regulations and the groundwater protection standards in Criterion 5B(5)(a) or (b) of NRC regulations.

As stated in Criterion 5B(6), conceptually, restoration of groundwater to background concentrations (the option presented in Criterion 5B(5)(a)) is deemed to present no incremental hazards, and the restoration of water quality

to drinking water limits enumerated in Table 5C (the option presented in Criterion 5B(5)(b)) is deemed to pose an acceptable hazard level at the point of compliance. If the aquifer cannot be returned to Commission-approved background or to the maximum contaminant levels provided in Table 5C, the NRC requires that the production aquifer be returned to alternate concentration limits (ACL) approved by the NRC. The Commission will approve a site-specific ACL if it finds that the proposed limit is as low as reasonably achievable and that the ACL will not pose a substantial present or potential hazard. The Staff's conclusion in the FSEIS, as in the GEIS, is based upon a qualitative assessment of the potential impacts to groundwater of the ISR project's operations and assumes Strata's compliance with Condition 10.6 in its license (Ex. SEI015), which prescribes the process and standards for aquifer restoration. Therefore, while the Criterion 5B(5) values must be established prior to commencement of ISR operations, they are not necessary to the Staff's assessment of the potential impacts of the Ross Project and do not alter the Staff's conclusions regarding potential groundwater impacts in the FSEIS. The description and characterization of groundwater quality in the FSEIS is sufficient to assess the environmental impacts of the Ross Project on the groundwater quality of the exempted aquifer.

Finally, the Staff did provide in the FSEIS a thorough technical discussion of how the Criterion 5B(5) values will be established. In Section 2.1.1.1, the FSEIS describes the requirement, established by Condition 11.3 of license, that Strata install a monitoring-well ring around the perimeter of each wellfield and monitoring wells in the underlying and overlying aquifers. The monitoring-well ring would be used to detect horizontal and vertical excursions of uranium-recovery solutions during uranium-recovery operation and, prior to

commencing ISR operations, these wells would allow sampling and analysis of groundwater (see Ex. SEI015). The resulting post-licensing, pre-operational concentration-based levels would be used to calculate groundwater protection standards called the Ross Project's upper control limits (UCLs). These post-licensing, pre-operational values and the calculated UCLs would be established for each separate uranium-recovery unit. During uranium-recovery wellfield operations, the licensee would then sample groundwater from the monitoring wells and compare the analytical values to the NRC-specified UCLs to determine whether an excursion of any solution (such as lixiviant) into the surrounding aquifers has occurred.

Q.1.6 **In Contention 1, Joint Intervenors allege that the FSEIS departs from NRC guidance regarding baseline groundwater quality, stating that the Standard Review Plan for In Situ Leach Uranium Extraction License Applications (NUREG-1569) "discusses in several sections the need for 'reasonably comprehensive' data shown to have been 'collected by acceptable sampling procedures.'" Can you address this claim?**

A.1.6 (K. Johnson, J. Moore, J. Saxton) The NRC Staff reviewed the groundwater sampling methods and groundwater quality analytical results presented in Strata's application and supporting documents. Based on its review, the Staff found that the sampling and analytical methods used by Strata to determine baseline groundwater quality were consistent applicable NRC guidance (Ex. NRC012 at 3).

Section 2.7.3 of NUREG-1569 provides guidance that is relevant to an ISR applicant's submittal of both its Technical Report and Environmental Report. In particular, Section 2.7.3 explains how an applicant can comply with 10 C.F.R. § 51.45(b), which requires that the applicant submit an

Environmental Report that provides, among other information, a description of the environment affected. The Staff expects applicants to characterize the "baseline" of the proposed license area groundwater data in accordance with guidance in NUREG-1569, Section 2.7; characterize or have procedures to characterize nearby water supply users prior to major site construction in accordance with Criterion 7 and Regulatory Guide 4.14; and have procedures to develop the Commission-approved background concentrations under Criterion 5B(5) for the groundwater detection monitoring program for the various regulated units that may be proposed in accordance with Criterion 7A. The regulated units consist of lined retention ponds (surface impoundments) and subsurface wellfields (Ex. NRC012 at 2-3).

Strata's groundwater data was collected over a two-year period from 27 monitoring and industrial wells (3 were routinely dry) located throughout the proposed Ross license area. The data provide information on both temporal and spatial (i.e., vertical and horizontal) variations in the groundwater quality. The water quality information was obtained using established sampling and analytical methods and includes parameters listed in Table 2.7.3-1 of NUREG-1569. Strata also provided water quality data from 29 existing water supply wells within 2 miles of the Ross ISR Project. For those wells, the reported sampling and analytical methods are acceptable as industry standard practices and the parameters analyzed are consistent with recommendations in Regulatory Guide 4.14. The information provided by Strata included summary statistical and graphical analyses of the groundwater quality data (Ex. NRC012 at 3).

In its review of Strata's application for compliance with the Atomic Energy Act and NRC safety regulations, the Staff found that the empirical data

on groundwater quality collected by Strata met the requirements of Criterion 7 and was consistent with guidance in Section 2.7 of NUREG-1569 (Ex. NRC012 at 3). Because the location and placement of Strata's wells and the sampling and analytical methods used were consistent with those described in Section 2.7, the Staff found that the quality of the baseline groundwater data presented in the FSEIS was adequate for use in assessing the Ross Project's potential environmental impacts on groundwater resources.

Q.1.7 **In paragraphs 11 and 12 of the Joint Third Declaration, Drs. Abitz and Larson state that post-licensing, pre-operational background values are only viable if those values are established with samples collected from wells hydraulically upgradient of the disturbed area, and draw a comparison with RCRA and CERCLA sites. They further state that the NRC has no basis to suggest that post-licensing, pre-operational baseline in a disturbed area meets the intent of regulations directed at establishing proper baseline. Can you address these arguments?**

A.1.7 (K. Johnson, J. Moore, J. Saxton) The FSEIS's discussion of the process for establishing post-licensing, pre-operational background values is descriptive and relies on the Staff's safety analysis in the SER (Ex. SEI010) and the conditions of Strata's license (Ex. SEI015). The SER and Strata's license follow 10 C.F.R. Part 40 requirements for the establishment of background values in the wellfield area. Because the FSEIS relies upon the Staff's safety review and the conditions in Strata's license in order to define these aspects of the proposed action, the FSEIS describes what is permitted by NRC regulations with respect to the methodology for establishing Criterion 5B(5) background values.

In addition, we disagree with Drs. Abitz and Larson that the establishment of background values is only viable if those values are established with samples collected from wells hydraulically upgradient of the disturbed area. The EPA's regulations implementing RCRA, specifically 40 C.F.R. § 264.97(a)(1)(i), allow that a determination of background groundwater quality may include sampling of wells that are not hydraulically upgradient of the waste management area where sampling at non-upgradient wells will provide an indication of background groundwater quality that is representative or more representative than that provided by upgradient wells. Upgradient wells are not always necessary, nor do they necessarily provide valid background values for ISR projects. Because of the way uranium roll-fronts are formed, the groundwater upgradient of the ore body contains oxygen and is geochemically distinct from the groundwater in the same horizon through the production zone, which is generally oxygen deficient (Ex. NRC007 at 3.1-6; Ex. NRC009A at 3-8 and B-80). Therefore, upgradient water quality is not necessarily representative of the background water quality in the ISR production zone. With respect to Drs. Abitz and Larson's reference to CERCLA, we do not know what point they wish to make with that reference other than that the provisions of CERCLA apply to federal facilities, so we are not able at this time to provide testimony as to that provision's applicability to the siting of monitoring wells for a privately owned and operated ISR project.

In sum, the Staff determined that the groundwater quality data from monitoring wells located in the area that would be developed as wellfields was adequate for the characterization of the Ross Project site in Section 3.5.3.3 of the FSEIS. The data provide information on water quality of the ore-zone and surrounding aquifers prior to the occurrence of any impacts from the ISR

operation. Upgradient water quality data are not necessary for Ross Project site characterization purposes because the upgradient data would not likely be representative of the background water quality in the ISR production zone.

Q.1.8 In paragraph 13 of the Joint Third Declaration, Drs. Abitz and Larson claim that the FSEIS's conclusions regarding impacts on groundwater resources are without basis in part because the pre-licensing water quality information reported in Tables 3.6 and 3.7 of the FSEIS are biased to high values. Can you respond to this argument?

A.1.8 (K. Johnson, J. Moore, J. Saxton) Drs. Abitz and Larson raise several different claims in this and subsequent paragraphs of their Joint Third Declaration regarding the data in Tables 3.6 and 3.7 of the FSEIS (Ex. SEI009A at 3-40 and 3-41). As stated in A.1.5, the Staff's conclusion in the FSEIS regarding the potential impacts to groundwater due to the ISR project's operations is the result of a qualitative assessment based on the expectation that Strata will comply with Condition 10.6 in its license (Ex. SEI015), which prescribes the process and standards for aquifer restoration. Nevertheless, notwithstanding the fact that the Staff's assessment of the potential impacts to groundwater did not require more statistical analysis of the data in Tables 3.6 and 3.7, we attempt to identify and address these claims in turn.

(1) Improper Well Installation and Development

Drs. Abitz and Larson claim that the values reported in Tables 3.6 and 3.7 of the FSEIS are biased to high values because of improper well installation and development. Drs. Abitz and Larson do not elaborate on this claim. However, in a parallel claim in paragraph 15 of the Joint Third Declaration directed at the Staff's alleged failure to explain how Strata or the terms of its license will prevent post-licensing, pre-operational background values from

becoming contaminated by improper well installation, they state that the use of oxidizing fluids during drilling operations, and the impact of air-lifting during well development, can cause uranium ore to be oxidized during the drilling, casing, and development of monitoring wells and thereby "alter true baseline water quality values."

FSEIS Section 2.1.1.1 (Ex. SEI009A at 2-19–2-23) describes the well installation and completion methods proposed by the licensee. The methods are those typically used to drill conventional monitoring wells and water supply wells using mud-rotary drilling techniques. Well-development techniques by pumping, air lifting or swabbing are conventional techniques used to develop both monitoring wells and water supply wells. Such procedures for well installation and development are common practice (see Exs. SEI012B at 18; NRC014; NRC015), which the Staff has found acceptable. Also, because the objective for the site characterization wells is to obtain water quality of the aquifer as it would be used as a resource (i.e., as if a typical water supply well were completed in the aquifer), the use of standard well drilling techniques is appropriate.

Drs. Abitz and Larson's arguments that the well construction and development techniques may have affected water quality may be true to the extent that the impacts are short-term and localized to the vicinity of the well. In fact, Strata observed that the samples collected at the time of well-development (between December 2009 and January 2010) using the air-lift technique did contain higher concentrations of some constituents compared to the samples that were collected in March 2010 (Ex. SEI016A at 3-116). Therefore, Strata did not include the water quality analysis from the sampling at the time of well development in its pre-operational, site-characterization

groundwater quality data reported in the ER. The analytical data from the sampling at the time of well development is included in Addendum 2.7-J of the TR (Ex. SEI014I at PDF 16).

As described in A.1.4 and in paragraph 2 of this answer, the range of constituent concentrations (i.e. minimum and maximum values) is the parameter used in the FSEIS to characterize the quality of water that could be impacted by the proposed action. Uranium concentrations in the first quarter of sampling from the monitoring wells in the ore-zone aquifer (March 2011) ranged from 0.011 mg/L to 0.096 mg/L (Ex. SEI009B at Appendix C). The comparable range in the last quarter reported in the FSEIS (October 2011) was 0.006 mg/L to 0.104 mg/L (Ex. SEI009B at Appendix C). The ranges of concentrations are essentially equivalent from March 2010 to October 2011 (the minimum is slightly lower and the maximum is slightly higher in October 2011 compared to March 2010). There is no systematic decline in the range of uranium concentrations during 2010 and 2011. Therefore, the Staff determined that the data summarized in Table 3.6 are representative of the characteristics of the site and adequate to inform the public and decision-makers for the Ross Project.

Drs. Abitz and Larson also argue that the water quality data from the ore zone that was collected by Strata and reported in Table 3.6 of the FSEIS are biased towards elevated concentrations because the samples are selectively obtained from the ore-rich interval. For the pre-licensing baseline wells, this statement is incorrect. The wells are screened over the entire ore-zone aquifer, as shown by the well-completion information in Table 3.4-20 and Figures 3.4-15 through 3.47-20 of Strata's ER and incorporated by reference in the FSEIS (Ex. SEI009A at 3-38). For the post-licensing, pre-operational

background information, the wells will be screened only over the ore interval. However, the intent of those wells is to establish control samples in order to measure restoration effectiveness and, as a result, fully penetrating wells that include both the ore interval and the other intervals within the ore-zone aquifer would diminish their effectiveness. In addition, having fully penetrating wells would allow the migration of fluids to the entire aquifer horizon, rather than limiting it to the ore body.

(2) Previous ISR Operations at Nubeth

Drs. Abitz and Larson also claim that the values reported in Tables 3.6 of the FSEIS are biased to high values due to previous ISR operations at Nubeth. Albeit without further reference to the data in these tables, in paragraphs 22 through 24 of the Joint Third Declaration, Drs. Abitz and Larson claim more generally that the FSEIS fails to account for the lack of a "pre-industrial baseline" at the Ross Project site, the implication being that the FSEIS is deficient for failing to present and analyze such pre-industrial baseline values. Drs. Abitz and Larson state in paragraph 23 of the Joint Third Declaration that pre-industrial baseline values "can only be determined if statistically valid, random groundwater samples are collected from wells that are constructed and developed without the addition of oxidizing fluids and air; and collected before the well field is developed." They do not reference any supporting authorities that would indicate that this is the only recognized methodology for establishing pre-industrial baseline values.

First, the Staff used the groundwater quality data collected by Nubeth in 1976 prior to Nubeth's single well push/pull in-situ test and in 1978 prior to the five-spot R&D test (Exs. NRC016, NRC017) for its environmental review. Based upon the description of sample collection contained in the historical

documents pertaining to the Nubeth projects, the Staff determined that the collection of the pre-industrial groundwater quality was performed according to industry standards. Those data are compiled in Table 3.7 of the FSEIS as the only available estimate of pre-industrial water quality (Ex.SEI009A at 3-41). The Staff compared the 1976 and 1978 groundwater quality data with Strata's groundwater monitoring data in Section 3.5.3.3 in the FSEIS to assess differences in water quality from the late 1970s to 2010-2011.

Second, the important point is that the purpose of the FSEIS is to characterize the *existing* groundwater quality conditions in and adjacent to the Ross Project site and to assess the potential impacts to groundwater quality that may occur as the result of ISR operations. If the groundwater quality data in Tables 3.6 are biased to high values as a result of impacts from the former Nubeth operation, these "high values" are what are representative of the existing groundwater conditions at the site. The same consideration applies to the relevance of this information to the establishment of post-licensing, pre-operational background values for the Ross Project. The purpose of defining these values is not to evaluate the impacts of past uranium mining activities on water quality. Post-licensing, pre-operational background values are defined in order to establish standards for a regulatory groundwater monitoring program in order to detect a release, and to establish standards for aquifer restoration after uranium recovery operations are complete.

Finally, while historical data developed from the former Nubeth operation was considered as part of a thorough characterization of the existing conditions at the Ross Project site, the Staff also accounted for the impacts of the Nubeth site in the FSEIS in the context of cumulative impacts. Under regulations issued by the Council on Environmental Quality (CEQ), the

environmental impacts that result from past actions are assessed as cumulative impacts as defined in 40 C.F.R. § 1508.7. The Staff evaluates past actions, including past uranium mining activities and their potential environmental impacts, in Section 5 of the FSEIS. In addition to the extensive discussion of the Nubeth project in Sections 2 and 3 of the FSEIS, the Staff reviews the groundwater restoration at Nubeth and appropriately accounts for the impacts of the Nubeth site (Exs. NRC018 and NRC019) as part of its discussion of cumulative impacts in Section 5.7.2 of the FSEIS. The Staff documents in the FSEIS that the concentrations of the constituents in the pre-operational groundwater quality from the OZ in 1978 are comparable to concentrations in the pre-licensing, site characterization data collected by Strata in 2010–2011. In other words, the Staff found that 2010–2011 pre-license site characterization groundwater quality is comparable with the 1978 pre-operational Nubeth R&D project groundwater quality. No evidence of the Nubeth R&D project can be observed in the pre-license site characterization groundwater quality collected for the Ross Project.

(3) Statistical Analysis

The Staff disagrees with the claim by Drs. Abitz and Larson that the data from Strata's monitoring program, compiled in Table 3.6 (Ex. SEI009A at 3-40), is lacking necessary statistical analysis. The purpose and use of the data in the FSEIS is to characterize the Ross Project's water quality and to support the Staff's assessment of the project's potential impacts. The purpose of this data is not to establish a value of central tendency (such as mean or median) with a specific confidence level that could be used to determine whether the constituents meet or do not meet established regulatory limits. The limited statistical data (i.e. the mean, ranges, and number of samples)

presented in the FSEIS is sufficient for the Staff to conduct the qualitative and descriptive evaluation required for the FSEIS's characterization of groundwater at the site and evaluation of the project's potential impacts.

Q.1.9 **In paragraphs 15 through 21 of the Joint Third Affidavit, Drs. Abitz and Larson allege that the FSEIS fails to explain how post-licensing, pre-operational measurements will provide unbiased data for assessing post-licensing impacts in light of concerns about well installation and development activities in and around the Ross Project area. Please respond to their concerns.**

A.1.9 (K. Johnson, J. Moore, J. Saxton) As we explain in A.1.7 of our testimony, the FSEIS's discussion of the process for establishing post-licensing, pre-operational background values is descriptive and relies on the Staff's safety analysis in the SER (Ex. SEI010 at 266) and the conditions of Strata's license (Ex. SEI015). Because the FSEIS relies upon the Staff's safety review and the conditions in Strata's license in order to define these aspects of the proposed action, the FSEIS describes what is permitted by NRC regulations with respect to the process for establishing Criterion 5B(5) background values.

The process for detecting excursions and evaluating restoration progress described in Sections 2.1.1.2 and 2.1.1.3 of the FSEIS is a comparative analysis between the post-licensing, pre-operational values and operational and restoration monitoring data. Although the Staff does not agree that perturbations from well installation and development or from previous and ongoing drilling have any effect on water quality except in localized areas around a well during a short period of time after the well is installed, any long-term effects from well installation and sampling would be equal in both the

post-licensing, pre-operational values and in the monitoring wells during operations and would not impair the comparative analysis.

We do not agree with the concern raised by Drs. Abitz and Larson that operational wellfields possibly would degrade post-licensing, pre-operational water quality measurements in subsequent adjacent monitoring wells targeting the same aquifers. Excursion of lixiviant is the only process by which an operating wellfield could impact post-licensing, pre-operational concentrations in subsequent adjacent wellfields. The requirements to prevent, detect, and correct excursions if they occur are described in Sections 2.1.12 and 4.5.1.2 of the FSEIS. Condition 10.7 of Strata's license requires that a net inward hydrologic gradient be maintained within a wellfield. The inward gradient would serve to reduce the potential of an excursion's occurring. In other words, during operation and restoration, the flow gradient within a wellfield is inwards; in comparison, a flow gradient out of the wellfield would be necessary to allow an operating wellfield to degrade the water quality in a subsequent wellfield. Each wellfield is surrounded by perimeter monitoring wells to detect excursions when they occur. Upon detection, the licensee would comply with License Condition 11.5, which establishes the requirements of the excursion-monitoring program and acceptable corrective actions. (The effectiveness of the excursion-monitoring program and acceptable corrective actions are discussed further in **A.3.2.6 and A.3.2.11** of our testimony.) Excursion monitoring and corrective actions, if necessary, continue through final decommissioning of a wellfield.

Drs. Abitz and Larson discuss the history of one wellfield at Irigaray developed in the late 1970s and generalize the problem with the post-licensing, pre-operational baseline at this one wellfield to the Ross Project. However, the

post-licensing, pre-operational baseline for several wells was established for the Irigaray wellfield in 1976-1977 after the pilot project had been conducted in 1975 within the area of the wellfield (See Exs. NRC020; NRC043). This timing, without any subsequent restoration report in the record, suggests that the baseline for Wellfield 1 was likely impacted by the prior pilot project operations. This isolated historic occurrence is not comparable to the Ross Project. The Irigaray facility was one of the first commercial wellfields developed over a recent pilot project facility, and the evaluation of wells for collection of post-licensing, pre-operational data were likely not as rigorous as required by Condition 10.13 of Strata's license for the Ross Project. In addition, the ISR projects at Irigaray used ammonium-based lixiviant until May 1980, at which time the operator was required by the NRC to halt the use of ammonium-based lixiviant because that type of lixiviant led to excursion and restoration problems at the site (Ex. NRC020). This type of lixiviant will not be used at the Ross Project.

Q.1.10 **In paragraphs 19 and 20 of the Joint Third Declaration, Drs. Abitz and Larson claim that the 2011 groundwater monitoring data collected by Strata from its monitoring well clusters and discussed in Section 3.5.3.3 of the FSEIS support their hypothesis that the ore zone is disturbed by well installation and development activities. As a result, this data raises questions about whether the baseline data will be representative for the purpose of assessing post-licensing impacts after numerous wellfield wells are drilled. Can you respond to this argument?**

A.1.10 (K. Johnson, J. Moore, J. Saxton) The FSEIS describes the site characterization groundwater quality data from Strata's monitoring wells in Section 3.5.3.3. The data set included (1) the analysis of four sets of quarterly

groundwater samples from the 3-month periods spaced over 12 months, March 2010–October 2010, as called for by NUREG-1569 (Ex. SEI007 at 2-26), as well as (2) the data from the next four quarters of groundwater samples, February 2010–November 2011, that the Staff received from Strata in response to a Request for Additional Information (Ex. SEI017).

The Staff used the monitoring well data summarized in Table 3.6 and presented in Appendix C to perform the following steps for the FSEIS: (1) compare the data with EPA and WDEQ water quality standards to confirm the Wyoming Class of Use; (2) confirm that the groundwater characterization data was consistent with the aquifer exemption approved by WDEQ and EPA (Ex. SEI034); (3) describe the nature of the potential impacts, such as noting that the higher total dissolved solids, uranium, vanadium, and radium-226 in the lixiviant compared to the water quality in the surrounding aquifers would cause temporary increases in total dissolved solids and the potential for increases in uranium, vanadium, and radium-226 in the surrounding aquifers if an excursion were to occur; and (4) compare with the Nubeth background data to assess cumulative impacts from past actions. The range of values for each constituent from each aquifer in the 2010 data was compared to the range of values in the 2011 data. As we discuss in A.1.8(2) of our testimony, the range of uranium concentrations showed no systematic decline in the sampling of 2010 and 2011. As stated in the FSEIS, the Staff determined that the 2011 data was generally consistent with the 2010 data, which indicated that the data sufficed for a representative characterization of groundwater quality at the Ross site and environs (Ex. SEI009A at 3-38).

Q.1.11 Drs. Abitz and Larson claim in paragraph 30 of their Joint Third Declaration that the FSEIS fails to provide sufficient information to

conclude that the regional water quality in the ore zone exceeds the EPA's drinking water maximum concentration limits (MCLs) for uranium and radium-226. Can you address their claim?

A.1.11 (K. Johnson, J. Moore, J. Saxton) In this paragraph, Drs. Abitz and Larson state that groundwater data collected and analyzed using their recommend additional or alternative methods (i.e. the methods described in paragraphs 25 through 29 of their Joint Third Declaration) will improve the quality of the groundwater data described in Section 3.5.3.3 and will demonstrate that the regional water quality in the ore zone does not exceed the EPA's drinking water MCLs for uranium and radium-226.

First, we note that the Staff's discussion of groundwater quality in the FSEIS is not intended to make the formal determination that that the regional water quality in the ore zone exceeds the EPA's drinking water MCLs for uranium and radium-226 such that the ore zone aquifer should or should not be exempted as an underground source of drinking water (USDW). The FSEIS compares the site characterization data developed for the Ross Project to the EPA's standards and finds as a factual matter that "Uranium and Ra-226 were present in the [ore zone] at concentrations greater than the standards" (Ex. SEI009A at 3-42) and "Wyoming's Class II Use standard and the EPA MCL's were exceeded in Well 19XX18 for radiological parameters: uranium, Ra-226 + Ra-228, and gross alpha" (Ex. SEI009A at 3-44). The Staff included this comparison in Section 3.5.3.3 of the FSEIS in order to demonstrate that the characteristics of the water quality in the ore zone are consistent with the characteristics of an aquifer that would be exempted as a USDW by the WDEQ and the EPA. This comparison is important because the Staff's analysis of the potential impacts to groundwater from the Ross Project relies, in large part, on

the fact that the production aquifer must be exempted as a USDW in order for operations to commence.

Second, the information gathered and assessed by the Staff in the FSEIS was sufficient to find that some levels of uranium and radium-226 in the ore zone exceeded the EPA's MCLs for these constituents. The site characterization information for groundwater used for the FSEIS was developed by Strata consistent with NRC guidelines as provided in NUREG-1569 (Ex. SEI007) and Regulatory Guide 4.14 (Ex. SEI008). In addition, the Staff's finding in the FSEIS regarding the levels of uranium and radium-226 in the ore zone aquifer are supported by the WDEQ's and EPA's conclusions that the ore zone aquifer is an exempt USDW. In a May 15, 2013 letter to WDEQ (Ex. SEI034), EPA concurred with WDEQ's conclusions that the ore zone aquifer (1) does not currently serve as a source of drinking water, and (2) is mineral-producing and can be demonstrated to contain minerals that, considering their quantity and location, are expected to be commercially producible. Therefore, for the purposes of the qualitative characterization of groundwater at the Ross Project site, the FSEIS provides sufficient information to conclude that the water quality at some locations in the ore zone exceeds the EPA's drinking water MCLs for uranium and radium-226.

CONTENTION 2

Q.2.1 In Contention 2, the Intervenors argue that the FSEIS fails to include information needed to determine the environmental impacts to groundwater quality of the Ross Project. In support of their arguments, the Intervenors refer to paragraphs 31-47 of the Joint Third Declaration of Dr. Richard Abitz and Dr. Lance Larson. The Intervenors also refer to paragraphs 66-67 and 70-75 of the Moran Declaration, paragraphs 28-29

of the First Abitz Declaration, and paragraphs 24-29 of the Second Abitz Declaration. Are you familiar with the arguments raised in these declarations?

A.2.1 (K. Johnson, J. Moore, J. Saxton) Yes, we have reviewed the declarations of Drs. Abitz, Larson, and Moran, and are familiar with the specific arguments raised in those declarations.

Q.2.2 Where in the FSEIS does the Staff address groundwater quality impacts?

A.2.2 (K. Johnson, J. Moore, J. Saxton) Section 4.5 of the FSEIS (Ex. SEI009A) provides an analysis of the potential environmental impacts to groundwater quality due to excursions and an analysis of the impacts following the aquifer-restoration phase of the Ross Project. The Staff's analysis of the potential environmental impacts to groundwater quality in the ore zone and surrounding aquifers due to the operations phase of the Ross Project is provided in FSEIS Section 4.5.1.2, "Ross Project Operation." The Staff's evaluation of the potential environmental impacts to groundwater quality stemming from the restoration phase of the Ross Project is provided in FSEIS Section 4.5.1.3, "Ross Project Aquifer Restoration."

Q.2.3 In paragraph 42 of the Joint Third Declaration, Drs. Abitz and Larson state that the FSEIS fails to adequately define the specific criteria or standards for aquifer restoration during the NEPA process and prior to licensing. Do you agree?

A.2.3 (K. Johnson, J. Moore, J. Saxton) We do not agree that the FSEIS fails to adequately define the criteria for aquifer restoration. We first note that Drs. Abitz and Larson appear in paragraph 42 of their declaration to confuse the "criteria/standards" for aquifer restoration with "numerical values" for the eventual restoration of the Ross Project's aquifer. The FSEIS cannot identify

the specific values for hazardous constituent concentrations that are expected to apply to the Ross Project because the Staff will not have the data to evaluate whether the licensee will meet primary or numerical values in Paragraph 5C of Criterion 5B(5), or require an ACL, until the late stages of aquifer restoration. Therefore, it is not possible to include a meaningful estimation of any or all potential restoration values for the Ross Project in the FSEIS. That said, the FSEIS describes the criteria for aquifer restoration that are applicable to Strata's Ross Project in the Executive Summary, Section 2.1.1.3, Section 4.5.1.3, responses to comments in Appendix B, and Appendix B1 (Ex. SEI009A). These criteria are also described in Section 2.5 of the GEIS (Ex. NRC007).

Q.2.4 **Contention 2 is premised on an assumption that Strata might not be able to restore groundwater to pre-mining baseline quality or to drinking water quality standards, necessitating that Strata obtain an ACL for groundwater restoration. Does the FSEIS explain the process for obtaining approval from the Commission for an ACL?**

A.2.4 (K. Johnson, J. Moore, J. Saxton) The Staff describes the process by which ACLs would be approved by the NRC in FSEIS Section 4.5.1.3, "Ross Project Aquifer Restoration" and in FSEIS Appendix B1, "Alternate Concentration Limits." In addition, the FSEIS discusses the process for ACLs in Appendix B, "Public-Comment Responses," in the responses to comments RP032-004, RP032-020, RP032-36, 032-041, and 041-006 in Appendix B of the FSEIS.

As discussed in the FSEIS, the process of establishing an ACL occurs only after the licensee concludes that restoring the water quality in the exempted aquifer to the post-licensing, pre-operational constituent concentration values (i.e., to the primary groundwater restoration standards) or

to the numerical values in Paragraph 5C of Criterion 5B(5) is not practical (Ex. SEI009A at 4-45). To request Commission approval of a proposed ACL, the licensee must submit an application for a license amendment. In its license amendment request, the licensee must provide the basis for the proposed ACL, including a discussion of practicable corrective actions that will keep constituent levels as low as are reasonably achievable, and information on the factors listed under Criterion 5B(6). The license amendment request must address surface water and groundwater quality and any expected impacts to human health and the environment from the proposed ACL.

The Commission will approve the requested ACL if it finds that the proposed limit is as low as reasonably achievable, after considering practicable corrective actions, and determining that the constituent will not pose a substantial present or potential hazard to human health or the environment as long as the ACL is not exceeded. To determine whether the ACL will pose a present or potential hazard to human health or the environment, the NRC will assess the risks of the hazards associated with the constituents, exposure pathways and corrective actions (Ex. NRC021).

Q.2.5 **Does the FSEIS address the possibility that an ACL would be required for one or more hazardous constituents during restoration of groundwater at the Ross Project site?**

A.2.5 (K. Johnson, J. Moore, J. Saxton) Yes, it does. First, as we explain in A.2.3 of our initial testimony, the Staff will not have the information necessary to evaluate an ACL application until the late stages of aquifer restoration. Therefore, it is not possible to include a meaningful estimation of a potential future ACL at the Ross Project in the FSEIS. Nevertheless, the Staff's analysis in the FSEIS of impacts due to Ross Project operations accounts for the

possibility that Strata would not be able to ensure that the concentration of a hazardous constituent does not exceed the Commission-approved background concentration of that constituent in the groundwater or the respective value given in the table in Criterion 5C and would, therefore, need to obtain approval from the Commission to use an ACL for restoration for that constituent. 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.

Q.2.6 **The Intervenors claim that the FSEIS is legally deficient because it fails to provide and evaluate information regarding the reasonable range of hazardous constituent concentration values likely to be applicable if Strata is required to implement an ACL in the future. Does the FSEIS provide and evaluate such information?**

A.2.6 (K. Johnson, J. Moore, J. Saxton) Yes, it does. As we explain in A.2.3 and A.2.5 of our testimony, because the Staff will not have the data to evaluate an ACL application until the late stages of aquifer restoration, it is not possible to provide a meaningful estimation of a potential future ACL at the Ross Project in a SEIS. Therefore, in Section 4.5.1.3 of the FSEIS (Ex. SEI009A at 4-46), as supplemented by the first Errata to the FSEIS (Ex. NRC010) and Dr. Johnson's

affidavit (Ex. NRC036), the Staff has presented actual groundwater quality concentration values for hazardous constituents at three commercial ISR facilities that have received the Commission's approval for aquifer restoration activities (See Exs. SEI004A, SEI004B) – Crow Butte Wellfield 1 (Exs. NRC022, NRC023, NRC024, NRC025, NRC026), Smith Ranch-Highland A Wellfield (Exs. NRC027, NRC028, NRC029), and Irigaray Mine Units 1-9 (Exs. NRC030, NRC031, NRC032, NRC033, NRC034, NRC035). In developing this discussion, the Staff reviewed the licensing documents related to the Commission's approval of groundwater restoration activities at these sites, and the information submitted by each licensee in support of its request for restoration approval. These source documents are collectively Staff Exhibits NRC022 through NRC035.

The Staff's analysis of these NRC-approved ISR restorations enabled us to describe in the FSEIS certain sets of hazardous constituent concentration values that the Commission has historically found to be protective of human health and the environment at the aquifer-exemption boundary of each ISR's production zone (See Exs. SEI004A, SEI004B). For each of the three facilities for which the Commission approved restoration, the FSEIS describes the proportion of constituents that were restored to post-licensing, pre-operational concentrations, to the existing Wyoming Class I Domestic Use standards, or to the EPA's drinking water maximum contaminant levels (MCLs) (Ex. SEI009A at 4-46). The range of concentrations of constituents for which there are no EPA MCLs or Wyoming Class I Domestic Use standards are described in the FSEIS as: (1) a percentage above the post-licensing, pre-operational baseline concentration for those constituents; or (2) in the qualitative terms used in the approval documents.

The Staff found that 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, pre-operational background values for uranium that ranged from 0.05 to 0.52 mg/L.

While it is important to note that none of these three facilities sought or received approval for an ACL because the regulations allowing for the use of ACLs were not in effect at those times, the Commission approved restoration values for constituents at each facility at levels that exceeded the post-licensing, pre-operational background values for those constituents. Therefore, while not ACLs in the strict sense, these “secondary values” functioned as “alternate” concentration levels for those constituents that exceeded the background concentration values in the groundwater at the site, and are therefore indicative of constituent levels that the Commission could find suitable for an ACL should one be required for the Ross Project. (The applicability of an ACL and not the “secondary values” for all ISR licensees in the future, including Strata, was noticed by Regulatory Issue Summary 09-005, issued on April 29, 2009 (Ex. NRC038)). The experience provided by the facilities evaluated in the FSEIS can be used to develop a possible range of

Commission-approved hazardous constituent concentration values that could potentially be applicable to Strata should it be required to seek and implement an ACL for the Ross Project wellfields in the future.

Q.2.7 How did the Staff select the facilities used to provide this bounding analysis in the FSEIS?

A.2.7 (K. Johnson, J. Moore, J. Saxton) The Staff used the historical groundwater restoration experiences of Crow Butte Wellfield 1, Smith Ranch-Highland A Wellfield, and Irigaray Mine Units 1-9 for this bounding analysis because these facilities are the only three commercial ISR facilities for which the Commission has approved restoration activities since the 1980s (See Exs. SEI004A, SEI004B). Therefore, these facilities are the best sources of information on the potential levels of hazardous constituent concentrations that may be approved by the Commission in the future as ACLs. No modern commercial ISR projects for which the Commission approved groundwater restoration were excluded from consideration in the FSEIS's analysis. The FSEIS notes that a fourth facility, Cogema Mining Company's Christensen Ranch Mine Units 2–6, has requested approval of restoration from the Commission, but the NRC has asked for additional information and has not taken action on Cogema's request (Ex. SEI009A at 4-46).

Q.2.8 What was the Staff's conclusion regarding the potential impacts of the Ross Project on groundwater quality in light of the FSEIS's assessment of these historical examples of NRC-approved wellfield restoration values?

A.2.8 (K. Johnson, J. Moore, J. Saxton) As we explain in A.2.6 of our testimony, we found that most of the groundwater quality parameters in wellfields for which the NRC has approved restoration were either returned to post-licensing, pre-

operational concentrations or to the equivalent of Wyoming's Class I Domestic Use standards. For the few parameters that exceeded post-licensing, pre-operational concentrations or the Class I Domestic Use standards, the FSEIS concludes that the concentrations of these constituents in the groundwater did not change the class of use and did not represent a potential impact to the groundwater outside the aquifer-exemption boundary for any of the three sites (Ex. SEI009A at 4-46).

The information developed from our examination of these restoration approvals did not affect the Staff's conclusion in the FSEIS that the potential impacts of aquifer restoration at the Ross Project site to groundwater quality of the exempted aquifer and the confined aquifers surrounding the exempted aquifer would be SMALL. Our determination that the potential impacts would be SMALL is based upon the requirement implicit in 10 C.F.R. Part 40, Appendix A, Criterion 5B(6) that ACLs present no significant hazard to the groundwater outside the exempted area. In addition, this determination does not differentiate between the impacts to groundwater quality that would result from the exempted aquifer being restored to either post-licensing, pre-operational values or an ACL. In either case, the Commission will only approve restoration if the hazardous constituent concentration values, including any values approved as an ACL, are shown to be protective of public health and safety. On that basis, the Staff determined in both the GEIS (Ex. NRC007 at 4.4-14) and 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 ISR operations would be expected to be SMALL and temporary.

Q.2.9 In paragraph 35 of the Joint Third Declaration, Drs. Abitz and Larson argue that the Staff's justification for approving restoration of radium-226

and uranium concentrations at the Crow Butte Wellfield 1 site was flawed. Can you address this argument?

A.2.9 (K. Johnson, J. Moore, J. Saxton) Drs. Abitz and Larson argue that the Staff "justified the failure" of Crow Butte Wellfield 1 to return radium-226 and uranium concentrations to post-licensing, pre-operational baseline values with its statement in the FSEIS that the NRC determined that the increased radium-226 and uranium concentrations, at 31 and 18 percent above those values, respectively, were protective of human health and the environment. (After corrections to the FSEIS through an Errata issued in April 2014 (Ex. NRC010) and as further explained in a Staff affidavit (Ex. NRC036), the FSEIS now correctly states that the Commission, in approving restoration of Wellfield 1, found uranium concentration levels of approximately 18 times the post-licensing, pre-operational value to be protective of human health and the environment.) Drs. Abitz and Larson further state that the Staff's discussion of the Commission's approval of Wellfield 1 restoration "demonstrates [the Staff's] failure to thoroughly analyze the significant environmental impacts that arise when ISR operators fail to restore contaminated groundwater at ISR sites."

We note at the outset that the FSEIS does not "justify the failure" of restoration of Crow Butte Wellfield 1. The FSEIS describes the historical record of Wellfield 1's restoration, and the Commission's determination in its technical evaluation report that at the time of restoration the concentrations of hazardous constituents, including radium-226 and uranium, were acceptable and below levels protective of human health and the environment, in accordance with 10 C.F.R. § 40.31(h) and 10 C.F.R. Part 40, Appendix A, Criterion 5F (Ex. NRC026 at 4). While Drs. Abitz and Larson appear to disagree with the Commission's decision in 2003 to approve restoration of this

wellfield based upon these values for radium-226 and uranium, among other constituents, the Staff is not in a position through the Strata Ross FSEIS to second-guess the Commission's licensing decision for Crow Butte's Wellfield 1. The FSEIS includes a discussion of the Commission's approval of restoration of Wellfield 1 in order to provide a point of reference for the potential impacts to groundwater that could arise if an ACL is required for any hazardous constituents at the Ross Project site. It would be infeasible for the Staff to reevaluate or catalogue all of the NRC's prior technical decisions in the FSEIS.

Furthermore, rather than the flawed analysis asserted by Drs. Abitz and Larson, 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. In the case of Crow Butte Wellfield 1, the Commission found that "[t]he submitted data show that ground-water quality has been restored to the baseline concentrations or the secondary restoration standards established by license condition 10.3C, SUA-1534" (Ex. NRC026 at PDF 4). For uranium, the average concentration over the initial period of monitoring for restoration stabilization of 1.73 mg/L (approximately 18 times the post-licensing, pre-operational concentration) was below the limit of 5 mg/L established by the underground injection permit (UIC) issued by the Nebraska Department of Environmental Quality (NDEQ) (Exs. NRC023, NRC024). The permit limit of 5 mg/L established by NDEQ as a class-of-use standard was a Commission-approved secondary restoration

standard, and is included as a groundwater restoration goal by license condition 10.3C in Crow Butte's license for the wellfield (Ex. NRC025). The FSEIS documents the Commission's decision-making process in 2003 for approving this wellfield restoration in order to provide a set of data that can be used as a reference for a bounding analysis of hazardous constituent concentration values that the Commission has historically found to be protective of human health and the environment.

Q.2.10 In paragraph 36 of the Joint Third Declaration, Drs. Abitz and Larson claim that the FSEIS does not discuss the post-restoration concentrations of uranium and heavy metals at the Smith Ranch-Highland A-Wellfield facility. They further state that long-term sampling at the site demonstrates that uranium concentrations in the ore zone are increasing over time. Can you respond to their claims?

A.2.10 (K. Johnson, J. Moore, J. Saxton) As with Crow Butte Wellfield 1, which the Staff discusses in A.2.9 of its testimony, the FSEIS describes the historical record of the Smith Ranch-Highland A-Wellfield restoration approval and the hazardous constituent concentration levels that the Commission determined to be acceptable for restoration. The post-restoration water quality data discussed by Drs. Abitz and Larson was collected in 2005-2011 (Ex. NRC029). Because the post-restoration concentrations of uranium and metals at A-Wellfield were not available when restoration of the wellfield was approved in 2004, they do not inform the bounding analysis of alternate restoration concentrations that may be approved by the Commission for the Ross Project if requested by Strata.

Nevertheless, we have reviewed the post-restoration groundwater quality monitoring information for this wellfield discussed by Drs. Abitz and

Larson, and we do not believe that it alters the validity of the Commission's basis for the restoration of A-Wellfield as suggested by Drs. Abitz and Larson. The post-restoration data under discussion were reported to the WDEQ by Cameco (Ex. NRC029). The collection of this post-restoration data was a requirement imposed upon Cameco by WDEQ and the NRC as part of the restoration approval (Ex. NRC028 at PDF 155). An element of the restoration approval was the recognition that the process of natural attenuation would lower the concentrations of uranium and other constituents along the flow path from the production wells containing elevated levels of uranium to the perimeter monitoring wells (Ex. NRC028 at PDF 64). The monitoring program was designed to assess the progress of natural attenuation. Five wells were selected for the monitoring program: MP-4, which had been used as a production well and contained the highest concentrations of uranium at the time restoration was approved; I-21, which had been used for injection and located at the edge of the wellfield approximately 150 feet down-gradient of MP-4; and three monitoring wells, LTM-4, M3, and M4, which were located downgradient of the wellfield but within the exempted aquifer (Ex. NRC037).

As 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).

Q.2.11 In paragraphs 37-41 of the Joint Third Declaration, Drs. Abitz and Larson argue that the FSEIS has "failed to address the almost certain impacts to groundwater resources that will accrue if an ACL is used" because, in approving restoration of Irigaray Mine Units 1-9, the Commission accepted Cogema Mining Company's use of a composite average "baseline" and restoration uranium concentration to derive a post-restoration uranium concentration that is lower than the individual wellfield average post-restoration uranium concentrations as calculated using the initial average "baseline" concentrations for each individual wellfield. Can you respond to this claim?

A.2.11 (K. Johnson, J. Moore, J. Saxton) As with the two wellfields discussed in A.2.9 and A.2.10 of our testimony, the purpose of the discussion in the FSEIS of Irigaray Mine Units 1-9 is to provide context for a range of hazardous constituent concentrations for which the Commission may in the future approve an ACL, based on the historical experience of restoration approvals by the Commission at previously operated commercial ISR sites, including Irigaray. Therefore, the Staff's discussion of the Irigaray and other restoration approvals is limited by the data and approaches actually involved in the Commission's

restoration approval decisions, as documented in its technical evaluations. This is appropriate to the purpose of this discussion in the FSEIS, however, because the actions of the Commission in using or accepting a particular approach or data set in approving restoration concentration values is also indicative of the type of approach or data set that may be utilized by the Commission in approving alternate concentration limits in the future. The Intervenors do not explain how the FSEIS's documentation of the Commission's restoration approval decision for Irigaray, whether or not the Commission's prior decision was based upon a flawed approach, amounts to a failure to comply with NEPA.

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 A-Wellfield. 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.

CONTENTION 3

Contention 3-1

Q.3.1.1 In Contention 3, the Intervenors argue that the FSEIS fails to analyze sufficiently the potential for and impacts associated with fluid migration associated with unplugged drillholes. Additionally, the Intervenors claim that the FSEIS does not adequately analyze Strata's plans to mitigate possible borehole-related migratory impacts by monitoring wellfields surrounding the drillholes. Where in the FSEIS does the Staff address these issues?

A.3.1.1 (A. Burgess, J. Saxton) The Staff identified and addressed extensively the potential for fluid migration associated with unplugged drillholes in the FSEIS (Ex. SEI009A and SEI009B). In Section 3.5.3.2, "Local Ground Water Resources," the FSEIS discusses results of the on-site pumping test data report by Strata and analyzed by the Staff (Ex. SEI009A at 3-30–3-37); in Section 4.5.1.2, "Ross Project Operation," the FSEIS identifies discussions in

the GEIS on the potential for vertical excursions at an ISR setting based on various site-specific factors including vertical hydraulic head gradients, vertical hydraulic conductivities and thicknesses of the confining units, and whether or not the confining units are contiguous (Ex. SEI009A at 4-37); in Section 4.5.1.2, the FSEIS discusses more fully license conditions imposed on Strata to identify and properly abandon old exploratory drillholes prior to conducting operations, monitor the effectiveness of the corrective actions, and establish mitigation actions should the monitoring identify that a vertical excursion had occurred (Ex. SEI009A at 4-38 and 4-42); and in Section 4.5.1.2., the FSEIS describes the methods Strata plans to use to abandon the old exploratory drillholes prior to operations (Ex. SEI009A at 4-42).

FSEIS Section 3.5.3.2, pages 3-34 and 3-37, and Section 4.5.1.2, page 4-42, documents the Staff's summary of the pumping tests and groundwater numeric model analyses. The Staff found that the upper and lower confining units provide adequate containment of the proposed operational fluids at the maximum licensed operational pumping rate without significantly impacting the quality and quantity in the overlying or underlying designated aquifers. The Staff's conclusion was that the potential for vertical excursions was low because properties of the confining units at the Ross site were bounded by units similar to or better than those evaluated in the GEIS (see Ex. NRC007 AT 4.2-23).

The FSEIS documents a small but measurable response in the underlying aquifer during several pumping tests at which the nearby exploratory drillholes were not re-abandoned prior to the tests. As documented in the FSEIS, Strata concluded, and the Staff agreed, that the response in the underlying aquifer was potentially attributed to communication between the ore

aquifer and the underlying aquifer facilitated through nearby improperly or poorly abandoned exploratory drillholes. Consequently, the Staff concluded that this potential would be minimized by License Condition 10.12, which requires Strata to "attempt to locate and abandon all historic drillholes located within the perimeter well ring for a Wellfield" (Ex. SEI015 at 9).

As documented in Section 3.5.3.2 of the FSEIS (Ex. SEI009A at 3-37), Strata has shown the ability to accomplish successfully this process as evidenced by the testing of Well No. 12-18OZ. Prior to undertaking the test, all known historic drillholes in the vicinity of that well were located and plugged (Ex. SEI014G at 13-14). During the test, there was no indication of a cross-connection with either the overlying or the underlying aquifers.

Q.3.1.2 Why did the staff determine that abandoning only those drillholes within the perimeter well ring was sufficient, rather than filling all drillholes?

A.3.1.2 (J. Saxton) License Condition 10.12's requirement of abandoning all historic drillholes within the perimeter well ring is based on the facts that: (1) by design, lixiviant is limited to the wellfield and if detected in the production aquifer at or beyond the perimeter well ring, then corrective actions will be pursued under License Condition 11.5 (Ex. SEI015); and (2) the potential for excursions is based on potentiometric head differences between the overlying and production aquifers (i.e., for flow to occur between aquifers, the groundwater pressure (potentiometric head) in the source aquifer must be greater than the groundwater pressure in the receiving aquifer). Therefore, the highest potential for flow from the production aquifer to an overlying or underlying aquifer is if a borehole were located within the production area, specifically, next to an injection well, because the injection of fluids causes a localized increase in the potentiometric head within the production aquifer. By

maintaining a net inward gradient at the perimeter ring, the potentiometric head differences are expected to be negligible and in fact lower in the ore aquifer than in the overlying aquifer.

Q.3.1.3 In support of Contention 3, the Intervenors reference the declarations of Dr. Robert E. Moran, Dr. Ronald L. Sass, the first and second declarations of Dr. Abitz, and the joint declaration of Dr. Abitz and Dr. Lance Larson. Are you familiar with these declarations?

A.3.1.3 (A. Burgess, K. Johnson, J. Moore, J. Saxton) Yes. We have reviewed the declarations made in this proceeding by Drs. Moran, Sass, Abitz, and Larson, as well as the relevant documents to which they refer in their declarations.

Q.3.1.4 In paragraph 11 of his first declaration, Dr. Sass states that the water quality information presented by Strata and subsequently relied upon by the Staff may not be valid because of changes to the aquifer water quality by water movement through the drillholes that were drilled over 30 years ago. Can you respond to this claim?

A.3.1.4 (A. Burgess, K. Johnson) The Staff has reviewed the potential impact of unplugged drillholes on pre-license water quality data and have concluded that the data are representative of natural conditions based on the following:

- Although drillholes may not have been plugged and abandoned to current practice, it is likely that drilling mud remaining in the hole will have reduced ground water migration between aquifers. This is discussed in further detail in A.3.1.11 of our testimony.
- Section 5.7.2 of the FSEIS states: "The data presented in Tables 3.6 and 3.7 in FSEIS Section 3.5.3 suggest that the current water quality in the ore zone (OZ) and the shallow-monitoring (SM) aquifers are the same as each were at the time of Nubeth's pre-operational sampling" (Ex. SEI009A at 5-

29). This indicates that the presence of the drillholes has not perturbed the recent water quality data.

Q.3.1.5 In paragraph 31 of his second declaration, Dr. Abitz states that the Staff's analysis "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.'" Similarly, in paragraph 54 of the Joint Third Declaration, Drs. Abitz and Larson fault the FSEIS for "simply assum[ing] the feasibility of locating and plugging these thousands of drillholes and rel[ying] on the applicant to correctly perform that action." Could you respond to these statements?

A.3.1.5 (A. Burgess) The potential for water quality impacts beyond the exempted aquifer due to unplugged historical drillholes has been extensively considered in the FSEIS and a three-pronged defense is proposed.

The first line of defense is to significantly reduce the number of unplugged historical drillholes. Strata has demonstrated the feasibility of locating and plugging historical drillholes. As stated in the FSEIS, as of May 9, 2013, 625 of the known 1,483 Nubeth exploratory holes had been located within the Ross Project area, and of these, 86 had been plugged (Ex. SEI009A, Appendix B, at B-85 (Comment RP032-060 Response)). Strata stated in its TR that prior to performing the pumping test on well 12-18OZ, 55 historical drillholes within a 522-feet radius feet of the test well were located and plugged (Exs. SEI014F, Addendum 2.6-E at 1; SEI014G, Addendum 2.7-F at 13). No response was observed in either the SM or deep monitoring (DM) aquifers, indicating that the location and plugging of historical drillholes was successful.

Condition 10.12 of Strata's license requires Strata to document efforts to identify and properly abandon all drillholes in the wellfield data package (Ex. SEI015). License Condition 10.13 requires Strata to prepare and submit the wellfield data package for staff's review and verification, prior to conducting principal activities in a new wellfield (Ex. SEI015).

Sections 4.5.1.2 and 6.3.2.2 of the FSEIS (Ex. SEI009A at 4-42 and 6-11) address the second line of defense, which is to detect a vertical excursion. License Conditions 11.3 and 11.4 set out the procedures for establishing baseline water quality, the frequency of water quality sampling in the perimeter monitoring wells, and the criteria by which an excursion will be determined.

The third line of defense is to implement both immediate and longer term corrective actions. In the event that a vertical excursion is detected, then "injection of lixiviant into the production area surrounding the monitoring well will cease until the licensee demonstrates to the satisfaction of NRC that the vertical excursion is not attributable to leakage through any abandoned drill hole" (Ex. SEI015, License Condition 11.5). If an unplugged drill hole is identified as the pathway for the excursion, the drill hole would be located, plugged and properly abandoned. Additional corrective actions may include numerical ground water modeling to better understand the potential extent of the excursion, and extraction and treatment of contaminated ground water from the affected aquifer.

Q.3.1.6 What role did Strata's commitment to fill the drillholes prior to operation play in the Staff's analysis?

A.3.1.6 (A. Burgess) Strata's commitment to plug and abandon historical drillholes prior to operation was an important consideration in the analysis of the potential for fluid migration because it provided the Staff with more confidence that

potential pathways would be plugged prior to operation, thereby minimizing the chances of vertical excursions. More importantly, this commitment is memorialized in Conditions 9.1 and 10.12 of Strata's license.

Q.3.1.7 How are these requirements administered, and what options would be available to the Staff if Strata failed to comply with these requirements?

A.3.1.7 (A. Burgess, J. Saxton) Condition 10.12 of Strata's license requires Strata to document their efforts to abandon all exploratory drillholes within the perimeter well ring, and include that documentation in the wellfield data package. License Condition 10.13 requires Strata to submit each wellfield data package for the Staff's review and verification. Further, based on the performance-based license, Strata will have to process the wellfield data package to determine whether or not an amendment request is needed for the additional wellfield data package. The Staff reviews the package to verify that Strata has complied with those license conditions.

After a license is issued, the Staff will also perform routine on-site compliance inspections of the facility. The purpose of the inspections is to ensure the licensee complies with the regulations and license conditions in the approved license. The frequency of the inspections is either semi-annual or annual. If the Staff identifies that a licensee's operations are contrary to its requirements under the regulations and license conditions, the NRC has the authority to pursue enforcement actions under its statutory and regulatory authority.[1] 10 C.F.R. Part 2, Subpart B, "Procedure for Imposing Requirements by Order, or for Modification, Suspension, or Revocation of a License, or for

[1] *See* 10 C.F.R. Part 2 Subpart B "Procedure for Imposing Requirements by Order, or for Modification, Suspension, or Revocation of a License, or for Imposing Civil Penalties." (describing the formal procedures that the NRC uses to implement its enforcement authority.

Imposing Civil Penalties," describes the formal procedures that the NRC uses to implement its enforcement authority.

Q.3.1.8 Why did License Condition 10.3 only require that Strata "attempt" to locate and abandon the drillholes?

A.3.1.8 (J. Saxton) In developing this license condition, the Staff recognized the difficulty in locating all drillholes in the field and weighed the risk of not identifying all drillholes. Although past abandonment procedures as defined by the State of Wyoming were less stringent than today's standards, the historic abandonment procedures generally required sealing the top of a drill hole below ground surface. Therefore, identifying the location of an old drill hole today is based on accurate prior survey information, visible remnant areas of surface disturbance, or the use of non-destructive or destructive testing (metal detectors, ground-penetrating radar or excavation). Strata committed to attempting to plug and abandon all old exploratory drillholes located within a perimeter monitoring well ring in the license application (Exs. SEI014C at 3-20; SEI014F, Addendum 2.6-E), and the Staff accepted this commitment and memorialized it as License Condition 10.12.

As discussed in A.3.1.11, the risk of not identifying a drill hole resulting in fluid migration is based on its location with respect to the injections wells and transmissivity of the materials used to abandon the drill hole. Similar risks are associated with faulty cementation of new wells. The Staff determined that, after performing hydrologic tests to demonstrate confinement of the ore aquifer and routine excursion monitoring, a drill hole not abandoned would be detected and proper corrective actions would be undertaken. Thus, due to the difficulty of identifying the drillholes and the additional mitigation measures proposed by Strata, the Staff accepted Strata's commitment and included it as a license

condition to attempt to locate and abandon the drillholes as part of a risk-informed, performance-based licensing strategy rather than prescriptively requiring Strata to locate and abandon all drillholes.

Q.3.1.9 If Strata tries, but fails, to locate all drillholes, would this constitute a violation of their license?

A.3.1.9 (J. Saxton) Implicit in License Condition 10.12 is that Strata will make a good faith effort to abandoned all drillholes and report this effort in the wellfield data package. License Condition 10.12 requires that Strata document its efforts, and include that documentation in the wellfield data package. License Condition 10.13 requires that the wellfield data package be submitted to the Staff for review and verification. The Staff will not concur on the wellfield package if insufficient efforts were made to properly abandon the drillholes. The non-concurrence would result in a violation if Strata began operations in the wellfield.

If a vertical excursion is detected, then, by License Condition 11.5, Strata would have to cease operations in that area until the licensee demonstrates to the satisfaction of NRC that the excursion is not attributed to leakage through any abandoned drill hole.

Q.3.1.10 After Strata attempts to locate and abandon all the drillholes, what role will the hydraulic tests play in determining whether that effort was successful?

A.3.1.10 (J. Saxton) Whether the lack of confinement is due to leakage through abandoned drillholes, inadequate cementation around the casings of future production wells, or the lack of a competent confining unit, the hydraulic tests will demonstrate this lack of confinement. If there is adequate confinement, then the licensee would address the source of the fluid migration and then

perform additional hydraulic tests for the wellfield data package to demonstrate adequate confinement of the wellfield exists such that the licensee shall confine its possession and use of source and byproduct material to the locations and purposes authorized by the license in accordance with 10 C.F.R. § 40.41(c).

Q.3.1.11 In paragraphs 55-56 of the Joint Third Declaration, Drs. Abitz and Larson are troubled that a small percent of drillholes have been filled by Strata. Does the fact that most drillholes in the Ross project area are currently unfilled play a major role in your analysis? Why or why not?

A.3.1.11 (A. Burgess) The fact that most of the historical drillholes have not been plugged did not have a major influence on the analysis performed by the Staff for the following reasons:

- Although there is currently only a small percentage of drillholes that have been located and plugged, the license is conditional with a requirement that Strata attempt to locate and abandon all historical drillholes within the Ross Project area prior to operation. This requirement will greatly minimize any potential for impact due to vertical excursions during operation.
- Analysis of the potential for excursions considers the conditions during operation, not the present pre-operational conditions.
- An unplugged borehole does not necessarily result in unfettered communication between aquifers. Upon termination of hole drilling, a column of drilling mud very likely may remain in the in the drillhole as there is no incentive for the driller to pump out mud as it would mean more mud to deal with at the surface. This mud would consist of bentonite clay, drill cuttings, drilling additives, and water. This will “cake” the drillhole and reduce the permeability between the host formation and the drillhole, even if the drillhole has not been properly plugged and abandoned.

- For an unplugged drillhole to result in a vertical excursion, it must it must be located within an area of the wellfield where the piezometric head in the OZ aquifer is greater than the piezometric head in the aquifer with which the drillhole is connected. Considering the potential for connection between the SM aquifer and the ore zone, the piezometric head in the SM aquifer zone is about 30 feet above the piezometric head in the ore zone, based on numerical groundwater simulations of conditions prior to the operation of the industrial water supply wells (Ex. SEI014H at 59-60, Addendum 2.7-H, Figures 4.7-1 and 4.7-2). However, until the ore zone piezometric heads fully recover from the effects of the long-term pumping of the industrial water supply wells, the piezometric head difference will be even greater. Strata performed numerical simulations of the Module 1-1 well field operations and the piezometric pressure contours are shown on TR, Addendum 2.7-H, Figure 4.11-4. As can be seen from this figure, simulated piezometric heads decrease rapidly away from injection wells, and would be above the SM aquifer piezometric head for only very limited areas of the wellfield. The DM aquifer was not included in the numerical model. However, the piezometric heads in the DM zone will be uniformly below heads in the ore zone, absent pumping from the industrial water supply wells. Thus, there will be downward gradients from the ore zone to the DM aquifer during operations, although this may be reversed in the immediate vicinity of recovery wells, depending upon pumping rates and local aquifer properties. This condition will be satisfied only within a limited distance of an injection well and will be dependent upon the injection pressure. For these reasons, the concerns of Drs. Abitz and Larson do not alter the Staff's conclusions.

Q.3.1.12 What is the total number of drillholes referenced in the staff's analysis?

A.3.1.12 (A. Burgess, J. Moore) Strata identified data on the wells and drillholes as of October 2010 and summarized them in the TR, Addendum 2.6-B, Table 1 (Ex. SEI014D). A complete tabulation of data for the individual drillholes is also provided in that Addendum. Additional details of the plugging of drillholes as well as the repair and abandonment of wells are provided in the TR, Addendum 2.6-E (Ex. SEI014F). The FSEIS, Section 3.4.1.2, notes that Strata possessed information from the 1,682 drillholes installed by Nubeth, as well as 540 of its own exploration drillholes, located within a ½ mile radius of the Ross Project area (Ex. SEI009A at 3-13). These numbers are consistent with the data in TR, Addendum 2.6-B, Table 1 (Ex. SEI014D).

Q.3.1.13 In Paragraph 56 of the Joint Third Declaration, Drs. Abitz and Larson state that the current number of drillholes (i.e., 1,682) contrasts with the figure of 5,000 drillholes identified in the ER. Similarly, Dr. Moran states in in paragraph 17 of his first declaration that the 5,036 drillholes cited by Strata's parent company is clearly more than those considered by Strata. Can you explain this discrepancy or any other apparent discrepancy in the number of drillholes?

A.3.1.13 (A. Burgess, J. Saxton) The apparent discrepancy results from comparing the number of historic drillholes in the larger Lance District (approximately 5,000) with the 1,682 historic drillholes within the area of the Ross Project plus a ½ mile radius around the Project area. The number of historic and recent drillholes within the Ross Project area and the number that were plugged and properly abandoned as of October 2010 are provided in Strata's TR Addenda 2.6-B and 2.6-E (Exs. SEI014D, SEI104F). The numbers reported in Strata's

TR are consistent with the information provided in the ER and used consistently throughout the FSEIS (see Ex. SEI009A at 2-48, 3-13, 4-42).

Additionally, in paragraph 17 of his first declaration, Dr. Moran states that Peninsula Energy's website reports 5,036 drillholes constructed in the Lance District, which includes the Ross Project. Strata and the Staff have consistently reported the number of drillholes at the Ross Project, which is the scope of the current application, and not the entire Lance District.

Q.3.1.14 Did you analyze the foreseeable environmental impacts that would result from Strata's potential inability to locate and fill all the drillholes? Why or why not?

A.3.1.14 (A. Burgess) Yes, the Staff analyzed the foreseeable environmental impacts that would result from the potential inability to locate and fill all drillholes. The foreseeable environmental impacts from a vertical excursion, including one which travels through an unplugged drillhole, were considered and are addressed in Section 4.5.1.2 of the FSEIS (Ex. SEI009A at 4-42). As noted above, the failure to locate and abandon a historical drillhole within a wellfield would not automatically lead to a vertical excursion. However, if an unplugged historical drillhole were to provide a pathway for migration of fluid vertically away from the ore zone, this would result in changes in the water quality within the overlying or underlying aquifer. As discussed in Section 4.5.1.2 of the FSEIS (Ex. SEI009A at 4-41), a vertical excursion would lead to an increase in the concentrations of one or more of the excursion indicator parameters associated with lixiviant relative to baseline conditions (i.e., chloride, conductivity, total alkalinity in the overlying monitoring aquifer, sulfate, conductivity and total alkalinity in the underlying monitoring aquifer as explained in License Condition 11.4). In addition, the hydrostatic pressure

would increase at the location of the discharge from the unplugged drillhole into the overlying or underlying aquifer. This anomalous pressure would decrease away from the point of discharge into the aquifer. The excursion-monitoring program required by License Condition 11.5 is designed to detect these changes in water quality and hydrostatic head. License Condition 11.5 requires that, upon confirmation of an excursion, "injection of lixiviant into the production area surrounding the monitoring well will cease until the licensee demonstrates to the satisfaction of the NRC that the vertical excursion is not attributed to leakage through any abandoned drillhole." The Staff concludes in the FSEIS that "The 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" (Ex. SEI009A at 4-43).

Q.3.1.15 In paragraph 56 of the Joint Third Declaration, Drs. Abitz and Larson state that the FSEIS should have a "full accounting of all improperly abandoned drillholes," and the FSEIS must provide a time table for locating and plugging all the drillholes. Please respond to their claim.

A.3.1.15 (A. Burgess, J. Moore) In the TR, Strata provided a tabulation of the status of all drillholes identified, current to October 2010 (Ex. SEI014D, Addendum 2.6-B). The Staff considers that the detail provided by Strata and the ongoing investigations by Strata were appropriate for the needs of the FSEIS. As noted in A.3.1.4, the Staff does not believe that the presence of unplugged historical drillholes has materially affected the pre-license water quality data or the interpretation of pumping test data to determine aquifer properties. License Condition 10.12 has been included to require Strata to "attempt to locate and abandon all historic drillholes within the perimeter well ring for the Wellfield." Historical drillholes and subsequent abandonment measures will be

documented in the "wellfield data package." With regard to a timetable for Strata's locating and plugging historic drillholes, the License Application in Figure 1.9-1 (reproduced as Figure 2.6 in FSEIS) provided a tentative schedule for construction and operation of the Ross Project facility. Location and abandonment of the unplugged drillholes would be undertaken as part of the preparation of an individual wellfield data package. Per License Condition 10.13, review and verification of the wellfield data package by the Staff would be a necessary prerequisite to Strata's starting wellfield operation.

A timetable for Strata's efforts to locate and plug all the drillholes was not provided because this information was not determined to be necessary for the analysis in the FSEIS. The key to the analysis is that Strata would be required by License Condition 10.12 to attempt to locate and abandon all historic drillholes located within the perimeter well ring for the wellfield prior to conducting tests for a wellfield data package. The fact that this activity will occur prior to operation is the information necessary for the analysis, not the specific date.

Contention 3-2

Q.3.2.1 In Contention 3, the Intervenors claim that the Staff had insufficient information to adequately assess the fluid migration impacts due to Strata's procedures in collecting the data. Where in the FSEIS does the Staff assess fluid migration impacts?

A.3.2.1 (A. Burgess, J. Moore, J. Saxton) Fluid migration away from a wellfield IS addressed in Section 4.5.1.2 of the FSEIS, Section 4.5.1.2 (Ex. SEI009A at 4-40–4-43).[2] This FSEIS section notes that ground-water quality of the OZ

[2] The Staff assesses fluid migration in Sections 2 and 4 of the FSEIS, but provides the impacts analysis of the fluid migration in Section 4.

aquifer within the wellfields would be impacted from uranium-recovery activities during the Ross Project's operation. The uranium and vanadium in the OZ aquifer would be oxidized and mobilized by the introduction of lixiviant into the OZ aquifer through injection wells. In addition to the uranium and vanadium, other constituents would also be mobilized, including anions, cations, and trace metals. The FSEIS points out that Strata has received approval from the EPA and WDEQ/LQD to exempt the OZ aquifer within the area of the wellfields from the requirements of a USDW (see Ex. SEI034).

The Staff addressed the potential for water-quality impacts to the SM and DM aquifers due to vertical excursions of the lixiviant-fortified ground water during injection and withdrawal from the OZ aquifer. Temporary increases in concentrations of total dissolved solids (TDS) outside the production zone would occur in the event of an excursion. Levels of radionuclides and elements such as arsenic, selenium, and vanadium that are mobilized with the uranium may increase in aquifers outside the production zone if excursions were to occur. It is noted in these sections of the FSEIS that Condition No. 11.5 of Strata's license prescribes the excursion-monitoring program and the procedures for confirmation in the event that the monitoring signals an excursion as well as corrective actions that would be required to recover an excursion.

Horizontal excursions are also discussed in this section of the FSEIS. The FSEIS states that the quality of the non-exempted OZ aquifer (i.e., that which is outside the perimeter-monitoring-well ring in the wellfields) could be impacted by a horizontal excursion resulting from a local wellfield imbalance. A wellfield imbalance can occur when the rate of injected lixiviant exceeds the rate of extraction from the recovery wells, either in a local area of the wellfield

or the wellfield as a whole, resulting in a potential migration of lixiviant laterally, away from the respective wellfield.

Typical lixiviant circulating through the ore zone would contain concentrations of TDS up to 12,000 milligrams per liter (mg/L) that consist primarily of sodium, bicarbonate, chloride, and sulfate and concentrations of uranium, vanadium, and radium greater than 100 mg/L. The surrounding aquifers, by comparison, have lower TDS, averaging 1,145 mg/L, 1,574 mg/L, and 1,321 mg/L in the SM, OZ, and DM aquifers, respectively. These values are approximately 10 percent of the TDS contained in the proposed lixiviant. The FSEIS explains that chloride, conductivity, and total alkalinity would be measured twice monthly in the monitoring wells to detect excursions, because 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.

The FSEIS discusses the measures proposed by Strata to mitigate the potential for horizontal excursions, including a computer-based control system, which is staffed 24 hours a day at the Central Processing Plant, to monitor injection pressures and recovery-well flow rates so that wellfield balance would be maintained. In addition, water level and water quality would be monitored in wells installed around the perimeter of each wellfield. As described in Section 3.5.3.2 of the FSEIS, the potential for vertical excursions would be mitigated by the naturally confining units of fine-grained mudstones, siltstones, and claystones above and below the OZ aquifer. In addition, Strata's testing program would ensure the integrity of well casings in injection and recovery wells as well as in monitoring wells installed in the SM and DM aquifers.

These sections of the FSEIS analyze the testing conducted by Strata to demonstrate confinement. Strata would continue geologic evaluation and hydrologic testing to characterize the integrity of the confining unit, through observations of piezometric levels in the SM and DM aquifers. To ensure the integrity of confining layers, Condition No. 10.13 of the license requires Strata to submit a hydrologic-test data package as part of the wellfield data package to the NRC staff for review and verification prior to conducting operations in a wellfield. The hydrologic-test data package must adequately define ground-water-flow paths, demonstrate the lateral continuity of the OZ aquifer, provide an evaluation of the heterogeneities within the ore zone, and confirm the hydraulic isolation of the OZ aquifer, as described in Sections 2.7.3.2.3, 3.1.1 and 5.7.8.1 of the approved license application.

Breaches to the integrity of the confining unit from historical exploration and delineation drillholes will be minimized by the Strata's locating and abandoning the drillholes within the wellfields. The FSEIS notes that, as of October 2010, Strata had located 759 of the estimated 1,682 holes from Nubeth exploration activities and had plugged 55 of them. The FSEIS goes on to explain that number of historical drillholes located and plugged would increase as wellfields are developed.

Additionally, the FSEIS discusses License Condition11.3, which requires Strata to install monitoring wells around each wellfield at approved maximum spacing. The perimeter-monitoring wells would allow Strata to monitor the OZ aquifer, while the monitoring wells in the overlying and underlying aquifers would allow monitoring of the SM and DM aquifers, respectively.

In addition to sampling the monitoring wells for water-quality parameters, the FSEIS discusses that Strata would measure water levels during the semi-monthly sampling to detect anomalous hydrostatic-pressure increases which may signal an operational upset. The FSEIS notes that Condition No. 11.5 of the license requires Strata to cease injecting lixiviant into the uranium production area surrounding the monitoring-well that is on excursion status if a vertical excursion is detected during operation. Operation would cease until Strata demonstrates that the vertical excursion cannot be attributed to leakage through any abandoned drillhole. Mitigation in the event of an excursion of lixiviant-containing ground water could require withdrawal and treatment of contaminated ground water from the adjoining aquifers.

The FSEIS concludes, in this section, that the potential impacts of the operation of the Ross Project to groundwater quality in the confined aquifers above and below the ore zone would be SMALL. The short-term potential impacts of lixiviant excursions from uranium-recovery operation to the OZ aquifer outside the exempted area would be SMALL to MODERATE. Detection of excursions through the network of monitoring wells, followed by Strata's pumping of ground water to "recover" the excursion, would reduce long-term potential impacts to the OZ aquifer outside the exempted portion to SMALL.

Q.3.2.2 Please describe the methodology used by the Staff to assess the fluid migration impacts.

A.3.2.2 (A. Burgess) In assessing the potential impacts, the Staff reviewed GEIS Sections 2.4.1.3, "Excursions," and 2.4.1.4, "Excursion Monitoring" (Ex. NRC007 at 2-18–2-20), and Section 2.11.4, "Excursions" (Ex. NRC007 at 2-46–2-48, which specifically address excursions, and concluded that they were applicable to the Ross Project. The Staff first considered the mechanisms by

which fluid migration beyond a wellfield's ore zone could occur: through an unplugged drillhole, by a wellfield imbalance, or by a natural breach (i.e., thinning) of a geologic confining unit. Pre-operational activities that would reduce or eliminate these mechanisms were evaluated. These activities consisted of unplugged drillhole location and abandonment, geologic and hydrologic conceptual-model improvement as a result of additional well drilling and testing, and synthesis of wellfield data into the wellfield data package. The operational and monitoring activities designed to detect an excursion were also considered. These activities were injection flow and pressure measurements in operation wells, and hydrostatic-pressure observations and water-quality sampling and testing in monitoring wells. Finally, methods for recovering an excursion were evaluated; these methods consisted of identification of the cause of the excursion as well as modifications to operational procedures in order to enhance the zone of drawdown around the particular wellfield so as to draw-back OZ fluids.

The Staff reviewed Strata's proposal for excursion monitoring in the TR, Section 5.7.8.2 (Ex. SEI014C at 5-88–5-92), and concurred with selected major ions and TDS as indicators, as they are non-reactive with the formation. They would therefore be observable in the monitoring well system ahead of other ionic species such as radionuclides and metals associated with uranium mineralization. Requirements for monitoring are set out in conditions 11.3, 11.4 and 11.5 of Strata's license (Ex. SEI015).

The Staff reviewed the numerical ground water simulations by Strata of horizontal excursion and recovery due to wellfield imbalance as outlined in TR, Addendum 2.7-H, Section 4.11 (Ex. SEI014H at 87-105). The excursion was simulated by shutting off two recovery wells. Excursion reversal was simulated

by turning on the shut-off wells and turning off or reducing the injection rates at nearby wells. These simulations indicated that a horizontal excursion could be controlled and recovered by selectively adjusting the injection and pumping rates in the wellfield. This is consistent with published data on horizontal excursions in GEIS Section 2.11.4 (Ex. NRC007 at 2-47).

The Staff's review of published summary case histories of vertical excursions indicates that they are more difficult to recover than horizontal excursions (Ex. NRC007 at 2-47). In the event of a vertical excursion into an overlying or underlying aquifer, License Condition 11.5 requires that injection of lixiviant into the production area surrounding the monitoring well cease until it is demonstrated that the vertical excursion is not attributable to leakage through any abandoned well. Recovery from vertical excursions requires identification of the root cause. If this is geological, such as thinning of a confining unit, then modifications to the well field operations could be required. These modifications might include decreasing injection pressure, increasing recovery well pumping rates or shutting in a section of the wellfield. If the root cause is anthropogenic, such as a well casing failure or an unplugged drillhole, corrective actions such as casing, recementing or drillhole plugging to current standards would be required. Once these corrective actions had been undertaken and the integrity of the confining unit confirmed, wellfield operations could be resumed.

Additional well installations, water quality and piezometric observations, together with numerical modeling, may be needed to determine the extent of the excursion in the affected aquifer. Ore zone fluids in an aquifer above or below the ore zone aquifer cannot be recovered by manipulation of the wellfield operations. Instead, withdrawal and treatment of contaminated ground water

would be required. Withdrawal could use existing monitoring wells or new wells located specifically to recover the contaminated ground water.

Q.3.2.3 Do you believe this methodology provided the Staff with sufficient information to make an informed migration impact assessment? Why or why not?

A.3.2.3 (A. Burgess) Yes. The methodology allowed the potential for fluid migration impacts to be evaluated. The Staff considered previous experiences of ore zone fluid migrations and considered them relevant to the Ross Project. The license application contained sufficient information relating to the geology, ground water and previous exploration and operation history to evaluate excursions in a site-specific context. Finally, the ore zone fluid migration impact assessment informed the development of license conditions to minimize the probability of an excursion, and if one were to occur, to ensure detection and recovery.

Q.3.2.4 Dr. Moran disagrees, stating in paragraph 29 of his declaration that the testing durations were too short and the pumping rates too low to adequately evaluate leakage between aquifers. Dr. Abitz similarly states in paragraph 32 of his second declaration that the number of wells and the duration of the test could not establish adequate hydrological information. Drs. Abitz and Larson further state in paragraph 58 of their joint declaration that the numbers of wells and duration of pump tests would not establish adequate information to demonstrate control of groundwater over the project area. Do you agree with these claims? Why or why not?

A.3.2.4 (A. Burgess, J. Saxton) We do not agree. The Staff considers the level of data provided sufficient for the FSEIS. The objective of the pumping tests was to

determine the range of values for aquifer parameters and to establish a site conceptual model for the hydrogeologic setting. The NRC has published a Standard Review Plan (SRP), NUREG-1569 (Ex. SEI007), which provides guidance for Staff reviews of license applications to develop and operate in situ uranium-recovery facilities. The type of pumping test used, i.e., modified single well pumping tests, are specifically listed in acceptance criterion (3) in Section 2.7.3 of NUREG-1569. In addition, the pumping tests data were used as guidance for the numerical model of the Ross Project area. The model was calibrated to observed piezometric heads by varying the aquifer parameters within a reasonable range consistent with the data obtained from the pumping tests. Groundwater control and upset conditions (i.e., excursions) during wellfield operation were simulated by the numerical model to demonstrate that control of groundwater over the project area could be achieved. As individual wellfields are proposed for operation, more detailed hydrogeologic investigations will take place and confirmation of Strata's ability to control ground water within the ore zone will be undertaken by Strata. The data will be analyzed and submitted to the NRC for review and verification, in accordance with License Condition 10.13, prior to the start of lixiviant injection in wellfields.

Q.3.2.5 Drs. Abitz and Larson further criticize the Staff's analysis by stating that it should have included an analysis of the "significant data gaps in the conceptual and numerical hydrologic models put forward." Do you agree with this assessment? Why or why not?

A.3.2.5 (A. Burgess) The Staff disagrees that there are significant data gaps in the conceptual and numerical hydrologic models that would affect the adequacy and conclusions of the FSEIS. Section 2.7.3 of NUREG-1569 sets forth the Acceptance Criteria for the hydrologic characterization, and Section 7.2.3 sets

forth the Acceptance Criteria for the environmental-impacts analysis. The Staff used the guidance provided by NUREG-1569 in its evaluation of Strata's license application and in its development of the FSEIS, and the Staff concluded that the available data met the relevant acceptance criteria.

Q.3.2.6 In paragraph 57 of their declaration, Drs. Abitz and Larson reference Staub et al. (1986) (Ex. NRC020) and conclude that, based on that study and the Staff's conclusion in the FSEIS, "that impacts from horizontal and vertical excursions could be 'MODERATE to LARGE,'" Strata will have limited options to correct vertical excursions at the time they occur. Do you agree with their analysis? Why or why not?

A.3.2.6 (A. Burgess, K. Johnson, J. Moore) We do not agree with their analysis. The full text cited by Drs. Abitz and Larsen from FSEIS Section 4.5.1.2 (Ex. SEI009A at 4-37) states:

> GEIS Section 4.2.4.2.2.2 discussed the potential for vertical and horizontal excursions of degraded ground water outside of the uranium-production zone (i.e., the ore zone). The impact of horizontal excursions could be MODERATE to LARGE, if a large volume of contaminated water leaves the ore zone and moves down-gradient and impacts an area outside the ore zone which is being used for consumption.

Thus, the GEIS recognizes that, for the consequent impacts to be MODERATE to LARGE, both a large volume of contaminated water from the ore zone as well as the impacted area's being used for consumption are required.

Similarly, in Section 4.5.1.2, the FSEIS concludes that the potential impacts of the operation of the Ross Project to groundwater quality in the confined aquifers above and below the ore zone would be SMALL. The short-term potential impacts of lixiviant excursions from uranium-recovery operation to the OZ aquifer outside the exempted area would be SMALL to MODERATE.

Detection of excursions through the network of monitoring wells, followed by Strata's pumping of groundwater to "recover" the excursion, would reduce long-term potential impacts to the OZ aquifer outside the exempted portion to SMALL.

Drs. Abitz and Larson reference Staub et al. (1986) (Ex. NRC020), and state in paragraph 57 of their declaration that "[c]ontrol, prevention and remediation of vertical excursions were largely unsuccessful at previous ISR sites in the United States." What is not mentioned by Drs. Abitz and Larson is that Staub et al. (1986) concludes that manipulation of injection and production rates is adequate for controlling horizontal excursions. Staub et al. (1986), page 2, considered case histories from operations in the 1970s and early 1980s, and these case histories represented historical practices from over 35 years ago. Since that time, license conditions have become more stringent, requiring, for example, more rigorous mechanical integrity testing (MIT) of wells and improved monitoring programs to detect excursions. GEIS Section 2.11.4 (Ex. NRC007) summarizes more recent data on excursions, and it concludes that:

> Most horizontal excursions were recovered quickly (weeks to months) by repairing and reconditioning wells and adjusting pumping rates in the well field, consistent with the findings of Mackin, et al. (2001a). Vertical excursions tended to be more difficult to recover than horizontal excursions, and in a few cases, a well remained on excursion status for as long as 8 years.[3]

Thus, the Staff concluded that, although vertical excursions are more difficult to address, the current standard of practice required in licenses for

[3] This section of the GEIS is discussed on page 2-32 of the FSEIS and on page B-86 in response to public comments.

monitoring, detection, and restoration activities have been successful in ameliorating vertical excursions.

Q.3.2.7 In paragraph 59 of the Joint Third Declaration, Drs. Abitz and Larson state that communication between the SM and OZ horizons is evident in the 24-hour pump test data from well 12-18OZ. Do you agree with their interpretation, and if not why not?

A.3.2.7 (A. Burgess) I do not agree. The Staff reviewed the data from the pumping test at Well No. 12-18OZ. Contrary to Drs. Abitz's and Larson's claims, this was a 72-hour test and not a 24-hour test. Before, during, and after pumping, ground water elevation data were measured in Well No. 12-18OZ and in Monitoring Well No. 12-18SM in the overlying-aquifer's SM zone. These data are provided graphically in Strata's TR, Addendum 2.7-G (Ex. SEI014H). Measurements in these Wells during the pumping test are presented graphically in Strata's TR, Addendum 2.7-F (Ex. SEI014G). As can be seen in these graphs, fluctuations in water levels in Well No. 12-18SM are not related to the pumping of Well No. 12-18OZ, and the fluctuations are typical of those seen in the longer-period hydrograph. Therefore, the Staff does not see piezometric-pressure effects in the overlying SM aquifer that are attributable to pumping in the ore zone and, hence, do not see evidence of direct communication between the overlying and OZ aquifers.

Q.3.2.8 In paragraphs 59-61 of the Joint Third Declaration, Drs. Abitz and Larson state that water quality results from wells 12-08OZ and 22X-19 indicate mixing of the groundwater from the SM and OZ horizons. Do you agree with their interpretation and if not why not?

A.3.2.8 (T. Burgess, K. Johnson) We do not agree. Drs. Abitz and Larson do not accurately report the information from Strata's TR that describes the screened

interval of well 22X-19 and is used to justify their position of mixing in groundwater between the OZ and SM aquifer zone. Drs. Abitz and Larson state in paragraph 59: "[H]owever, mixing of the groundwater from these two horizons [SM and OZ] is clearly indicated by the linear trace of the sodium and sulfate trend on Figure 2. In our expert opinion this is unquestionably demonstrated by the mid-location of plotted samples from 22X-19, a well that is screened through the OZ and SM zones (Section 2.7.3.3.1, page.2-169, Strata TR)." They assert that through this alleged screen, mixing of the OZ and SM aquifers occurs. However, the position that well 22X-19 is screened in both the OZ and SM zones is erroneous. The TR (Ex. SEI014A at 2-169) states that well 22X-19 is completed in, or passes through, the OZ and DM zones:

> The 19XX18 and 22X-19 wells, located within the proposed project area, have water chemistry similar to the OZ wells of the regional baseline monitoring network. This similarity in water quality would be expected since these two wells are completed in the OZ unit, although the 22X-19 is also completed in the DM zone as described in Section 2.7.3.3.1.

Section 2.7.3.3.1 of the TR (Ex. SEI014A at 2-150) also states that well 22X-19 is completed in both the DM and OZ zones and that the completion of these zones is displayed by the potentiometric surface:

> There is a distinct trough in the DM potentiometry in the vicinity of the 21-19 well cluster. This trough is due to abstractions from an oil field water supply well (22X-19) in this area that is completed in both the DM and OZ intervals.

Since well 22x-19 is completed in the DM and OZ aquifers, the argument made by Drs. Abitz and Larson in paragraphs 59, 60 and 61 of their declaration, that the concentrations of sulfate and sodium in well 22X-19 compared to the concentrations of sulfate and sodium in the OZ monitoring wells is evidence of mixing between the OZ and SM zones, is incorrect, as it is based upon an incorrect characterization of well 22X-19.

Drs. Abitz and Larson point to the 2010 water quality data from well 12-18OZ as indicative of mixing of SM ground water into the OZ. These data were taken both before and after the pumping test at that location. Historical drillhole location and plugging was undertaken in the 12-18OZ vicinity March through July, 2010 (Ex. SEI014D, Addendum 2.6-B), with the pumping test starting on July 21, 2010 (Ex. SEI014G, Addendum 2.7-F, at 31). As shown in their figure in paragraph 60, only two of the four 12-18OZ data points fall within the SM cluster. Given these pump-test activities, variability in the water quality data is not surprising. Drs. Abitz and Larson note that the distinctly different water chemistry from wells 14-18OZ and 14-18SM does not indicate mixing and hypothesize that "[A]n explanation for the distinct separation of the 14-18 horizons on the sodium-sulfate plot may be that the density of exploration drillholes is lower around this cluster well and less communication between the SM and OZ horizons has occurred." However, a comparison of the density of historical drillholes around 14-18 and 12-18 clearly shows that the density of exploration drillholes is not lower around cluster 14-18 compared with cluster 12-18 (see SEI014A, Figures 2.7-18 and 2.7-20). It is more likely that the spread of the OZ data represents natural heterogeneity in the water chemistry, emphasized by the pumping test activities that were taking place during the period of sampling.

Q.3.2.9 In paragraph 62 of the Joint Third Declaration, Drs. Abitz and Larson state that Well 22x-19, an industrial water supply well, is known to be screened through the SM and OZ zones. Was this cross-connection between the ore zone and the overlying aquifer considered in the Staff's analysis, and what were the conclusions?

A.3.2.9 (K. Johnson) As stated in A.3.2.8 of our testimony, Drs. Abitz and Larson are incorrect in their assertion that well 22X-19 is screened in the OZ and SM aquifer zones. However, despite that error, the construction and potential for operation of the industrial water-supply wells, including Well No. 22x-19, were considered in the Staff's analysis. In particular, temporally varying pumping from these wells during nearby uranium-recovery wellfield operation would result in unstable control of the injection/recovery system. The Staff has, therefore, included License Condition 10.19, which places restrictions on wellfield operations in areas influenced by continued pumping from the industrial water-supply wells. License Condition 10.19 allows that development of a wellfield that includes one or more of the industrial water-supply wells within the wellfield area may only be proposed by Strata, once the pumping of these wells has ceased or diminished to an acceptable level. Elimination of the potential for cross-connection between the OZ aquifer and the underlying DM aquifer in the industrial water-supply wells would be undertaken in accordance with License Condition 10.12.

Q.3.2.10 In paragraphs 48-51 of their declaration, Drs. Abitz and Larson state that the Staff failed to analyze and model subsurface geochemistry and potential for site contaminant excursions, and that the information the Staff did provide is vague and contradictory. To support their claim, they cite page 4-41 of the FSEIS and state that the discussion is "inaccurate and an oversimplification of the dominant geochemical mechanisms which dictate subsurface transport of soluble uranium." Do you agree with their assessment? Why or why not?

A.3.2.10 (K. Johnson) I do not agree. First, the assertion by Drs. Abitz and Larson in paragraph 49 that the FSEIS is "silent on how mining activities will disturb

reducing geochemical conditions," is incorrect. The FSEIS and the GEIS clearly describe how lixiviant will disturb the geochemical conditions of the OZ. GEIS Section 2.4.1.2, Lixiviant Injection and Productions (Ex. NRC007 at 2-17) states:

> The principal geochemical reactions caused by the lixiviant are the oxidation and subsequent dissolution of uranium and other metals from the ore body (Davis and Curtis, 2007 [Exhibit NRC042]). These reactions are effectively the reverse of those that initially caused the uranium deposition. The oxidant (oxygen or hydrogen peroxide) in the lixiviant oxidizes uranium from the relatively insoluble tetravalent state (U^{4+}) to the more soluble hexavalent state (U^{6+}). Once the uranium is in the 6+ oxidation state, the dissolved carbonate/bicarbonate causes the formation of aqueous uranyl-carbonate complexes that maintain oxidized uranium in solution as uranyl ion (UO_2^{2+}).
> …
> During the uranium recovery process, the groundwater in the production zone becomes progressively enriched in uranium and other metals that are typically associated with uranium in nature. The most common metals are arsenic, selenium, vanadium, iron, manganese, and radium. These and other constituents such as chloride, which is introduced by the ion-exchange resin system, are removed or precipitated from the groundwater during aquifer restoration after uranium recovery is completed.

Section 2.1.1.2 of the FSEIS (Ex. SEI009A at 2-28) incorporates the information from Section 2.4 of the GEIS by reference.

Second, the level of discussion in the FSEIS on the subsurface geochemistry and geochemical mechanisms of uranium transport is appropriate for the purpose of the FSEIS. The statement from page 4-41 of the FSEIS that is referenced by Drs. Abitz and Larson is simply a statement of fact,[4] and an explanation for the selection of excursion monitoring parameters.[5]

[4] "As described in Section 2.1.1.2 of this FSEIS, chloride, conductivity, and total alkalinity would be measured twice monthly in the monitoring wells to detect excursions" (Ex. SEI009A at 4-41).

[5] "These constituents move through the aquifer faster than other water-quality parameters, and therefore levels above these would indicate excursions before

The NRC Staff's approval of chloride, conductivity, and total alkalinity as described in the SER (Ex. 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) (Ex. NRC020 at 37-39). Staub et al. (1986) concludes that TDS and chloride have no potential interfering chemical reactions; whereas, trace elements (including uranium) are subject to chemical precipitation and adsorption on clay minerals. The 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.

As noted by Drs. Abitz and Larson in paragraph 51 of their declaration, the FSEIS further states on p. 4-41 that:

> Temporary increases in concentrations of TDS outside the production zone would occur in the event of an excursion. Levels of radionuclides and elements such as arsenic, selenium, and vanadium that are mobilized with the uranium may increase in aquifers outside the production zone if excursions were to occur, but corrective actions in response to increased TDS would likely prevent increases of these elements.

The FSEIS does state that levels of radionuclides and elements such as arsenic, selenium, and vanadium that are mobilized with the uranium may increase in aquifers outside the production zone if excursions were to occur. But 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. In 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

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radionuclides and other elements move outside the production (i.e., uranium-recovery) zone" (Ex. SEI009A at 4-41).

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.

Q.3.2.11 Drs. Abitz and Larson further state in paragraph 51 that Strata's proposed corrective actions do not have a credible scientific basis and analysis that address 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 deposit. Can you respond to this claim?

A.3.2.11 (K. Johnson) The scientific basis for the methods proposed by Strata and accepted by NRC to correct for excursions in License Condition 11.5 is the hydrologic principles of water movement in the aquifer (Exs. SEI014A at 280-81; SEI015, License Condition 11.5). The historical record of excursions demonstrates that adjustments in pumping and injection rates are successful in correcting excursions and that the geochemical characteristics (redox conditions in the aquifer, the availability of various complexing anions, microbial community structure) asserted by Drs. Abitz and Larson are not relevant except perhaps for specific isolated incidents.

The two examples cited by Abitz and Larson support the standard approach to corrective action approved by NRC (Exs. NRC039 at PDF 1-5; NRC029 at 35; NRC040 at PDF 12; NRC041 at PDF 9). Each historical example describes a single well (CM-32 at Smith Ranch and 5MW-66 at Irigaray) at each site that was or is on excursion status (i.e the well in which the excursion monitoring constituents exceed the UCL according to the prescribed sampling protocol) (Exs. NRC039 at PDF 3-5; NRC040 at 2, 9). Uranium was measured in the groundwater from the well because the excursion status

continued greater than 60 days (Ex. NRC039 at Section 12(d)(i)). The important aspects of the excursions that are the subject of the documents referenced by Drs. Abitz and Larson are: (1) the excursions were detected by analysis of the usual indicator parameters, chloride, TDS, and alkalinity (Exs. NRC039 at PDF 3; NRC040 at 12); (2) the monitoring wells that went on excursion status were within the production zone, i.e., they were not outside the area of exempted aquifer (Exs. NRC029 at 35; NRC040 at 2); (3) adjustment of pumping and injection rates successfully recovered the excursions (Exs. NRC039 at PDF 3; NRC041 at 2); and (4) although uranium data at well CM-32 was not found, the uranium concentrations in 5MW-66 was lowered to <0.04 mg/L U_3O_8 (<0.13 mg/L U) after pumping to correct the excursion (Ex. NRC041 at 2, 9).

Strata's proposed approach to corrective actions for excursions is outlined in TR Section 5.7.8.2 (Ex. SEI014A at 5-91–5-92):

If an excursion is verified, the following methods of corrective action will be instituted depending upon the circumstances:

- A preliminary investigation is completed to determine the probable cause;
- Adjustment of production and/or injection rates in the vicinity of the monitor well to increase the net over-recovery, thus inducing a hydraulic gradient toward the production zone; and
- Pumping of individual wells to enhance solution recovery.
- Injection into the wellfield area adjacent to the monitor well may be suspended. Recovery operations would continue, thus increasing the overall bleed rate and the recovery of wellfield solutions.

These commitments have been discussed in the SER (Ex. SEI014A at 272-73) and are set forth in License Condition 11.5.

In addition to the above corrective actions, the monitor well on excursion status would be sampled weekly. An excursion would be considered concluded when the concentrations of excursion indicators do not exceed the criteria defining an excursion for three consecutive samples.

If an excursion is not corrected within 60 days of confirmation, injection of lixiviant into the wellfield will be terminated until the excursion is controlled, or the reclamation surety will be increased an amount that is agreeable to the NRC, which would cover the expected full cost of correcting and cleaning up the excursion. The surety increase would remain in force until the excursion is controlled. The written 60-day report would explain and justify the course of corrective action that be followed.

In addition to the scientific basis from principles of groundwater hydrology, empirical evidence supports the approach to corrective actions approved for the Ross Project. Staub et al. (1986) determined after evaluating the history of excursions at ISR facilities that: “Horizontal excursions are not of serious concern in in-situ mining. First, the manipulation of injection and production rates is adequate for controlling horizontal excursions. Second, eventual restoration of an ore zone aquifer is an extension of horizontal excursion control” (Ex. NRC020 at 31). Furthermore, evaluation done for the GEIS (Ex. NRC007) of the history of excursions and the corrective actions implemented at ISR facilities operating in the 1980s–2000s showed that: “Most horizontal excursions were recovered quickly (weeks to months) by repairing and reconditioning wells and adjusting pumping rates in the wellfield, consistent with the findings of Mackin et al. (2001a)” (Ex. NRC007 at 2-37–2-48). The

corrective actions for excursions used by the ISR facilities evaluated by Staub et al (1986) and in the GEIS are the same as those accepted by the NRC Staff for the Ross Project. The assessment of the history of excursions and conclusions from Section 2.11.4 and the impact analysis in Section 4 in the GEIS are incorporated by reference in Sections 2.1.1.2 and 4.5.1.2 of the FSEIS (Ex. SEI009A at 2-32, 4-37, 4-38, 4-41).

The assertion by Drs. Abitz and Larson in paragraph 51 that the proposed corrective actions for excursions do not address "hydrologic properties in the exempted aquifer" and "structural heterogeneity of the fluvial deposits" is incorrect. The hydrologic properties and the heterogeneity of the OZ aquifer are understood by the numeric groundwater flow model developed by Strata and described in Addendum 2.7-H of the TR (Ex. SEI014H). In addition, License Condition 10.13 requires a wellfield hydrogeologic test data package prior to conducting principal activities in a new wellfield. As stated by the Staff on page 276 of the SER (Ex. SEI010):

> [A] significant component of a wellfield data package will be demonstrating wellfield and monitoring well integrity by hydrologic testing through pumping of recovery wells in the wellfield area and measuring responses in the surrounding perimeter monitoring wells.
>
> The applicant states the purpose for the aquifer testing for the wellfield data package is to demonstrate that the ore aquifer is isolated from the overlying and underlying aquifers, to demonstrate the perimeter monitoring are in communication with the ore zone wells, and to further improve and calibrate the numeric groundwater flow model.

The perimeter monitoring wells included in the tests for the hydrologic data package are the wells that would be used to monitor for excursion.

Q.3.2.12 To further support their claims, in paragraph 52 of the Joint Third Declaration, Drs. Abitz and Larson cite evidence collected from the Bison

Basin ISR mine. Can you discuss how this example relates to Strata's Ross ISR project?

A.3.2.12 (K. Johnson) The case study of excursions from the Bison Basin ISR facility that is described by Staub et al (1986) (Ex. NRC020) does not relate to Strata's Ross Project because the method for establishing upper confidence limits (UCLs) for the Bison Basin ISR project was different than that used in the Ross Project. As established in License Condition 11.4, the UCLs for the Ross Project would be established by statistical analysis; i.e., mean plus five standard deviations, where the UCLs for Bison Basin were simply the maximum value plus 20 percent for all parameters except for uranium (Ex. NRC020 at A-55). The uranium UCL was set at 0.015 mg/L above baseline. Monitoring for excursions between 1979–1981, the duration of operations, provided evidence that the UCL for uranium in Bison River was within the natural variation of uranium in the groundwater and resulted in false positives in several of the monitoring wells (Ex. NRC020 at A-57–A-59).

Furthermore, the data reported from Bison Basin supports Strata's selection of excursion monitoring parameters, contrary to Drs. Abitz and Larson's position that the empirical evidence from the Bison Basin ISR facility disputes NRC's practice of approving chloride, conductivity and alkalinity as monitoring parameters for excursions. The excursion detected in monitoring well M-2 that is noted by Drs. Abitz and Larson "was based on carbonate plus bicarbonate and chloride" (Ex. NRC020 at A-57–A-59). It should be noted that carbonate plus bicarbonate describes alkalinity, which is the term used for the Ross Project. The selection of chloride, conductivity and alkalinity as monitoring parameters for excursions was effective at identifying excursions in 1981 and is still an effective practice today.

Q.3.2.13 In paragraph 53 of the Joint Third Declaration, Drs. Abitz and Larson refer to a 2007 USGS study on U(VI) transport processes, and claim that none of the considerations from that study were applied in the FSEIS. Can you respond to this claim?

A.3.2.13 (K. Johnson) The document described by Drs. Abitz and Larson as a 2007 USGS study and referenced as "Davis, J. and Curtis, G., 2007. *Consideration of Geochemical Issues in Groundwater Restoration at Uranium In-Situ Leach Mining Facilities*. U.S. Geological Survey, Menlo Park, Ca 94025. NUREG/CR-6870" was used throughout Section 2 of the GEIS (Ex. NRC042). Information from Davis and Curtis (2007) was used by NRC Staff in the GEIS to describe how different lixiviants interacted with subsurface materials, the general principals of ISR, as well as the methods used for restoration and their effects on the aquifer. In addition, the compilation of information on restoration at various ISR projects from Davis and Curtis (2007) was reviewed in Section 2.11.5 of the GEIS and informed the analysis of the impacts to groundwater after restoration in Section 4 of the GEIS.

Davis and Curtis (2007) was also cited in Section 5.7.2 of the FSEIS (Ex. SEI009A at 5-30) as "NRC, 2007" and referenced in the FSEIS as "(US)NRC. 'Consideration of Geochemical Issues in Groundwater Restoration at Uranium In-Situ Leach Mining Facilities.'" NUREG–6870. Washington, DC: USNRC. 2007. ADAMS Accession No. ML070600405." (Ex. SEI009A at 5-59). Information from this report on how the oxygen deficient conditions in the aquifer downgradient of the wellfield affect dissolved concentrations of uranium and other metals was used in describing the potential cumulative effects on groundwater quality of multiple wellfields in the Lance District.

August 25, 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
	)	

AFFIDAVIT OF JOHARI MOORE

I, Johari Moore, do hereby declare under penalty of perjury that my statements in the foregoing testimony and in prefiled Exhibit NRC002 (Statement of Professional Qualifications of Johari Moore) are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 CFR 2.304(d)

_____

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Executed in Rockville, MD
this 25th day of August, 2014

August 25, 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
	)	

AFFIDAVIT OF JOHN SAXTON

I, John Saxton, do hereby declare under penalty of perjury that my statements in the foregoing testimony and in prefiled Exhibit NRC003 (Statement of Professional Qualifications of John Saxton) are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 CFR 2.304(d)

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this 25th day of August, 2014

August 25, 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
	)	

AFFIDAVIT OF KATHRYN JOHNSON

I, Kathryn O. Johnson, do hereby declare under penalty of perjury that my statements in the foregoing testimony and in prefiled Exhibit NRC004 (Statement of Professional Qualifications of Kathryn Johnson) are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 CFR 2.304(d)

_____

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Executed in Hill City, South Dakota
this 25th day of August, 2014

August 25, 2014

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

AFFIDAVIT OF ANTHONY BURGESS

I, Anthony S. Burgess, do hereby declare under penalty of perjury that my statements in the foregoing testimony and in prefiled Exhibit NRC005 (Statement of Professional Qualifications of Anthony Burgess) are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 CFR 2.304(d)

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