

## **Discussion Regarding Strata's Compliance with Amended LC 10.12 of SUA-1601**

### **BACKGROUND**

Source and byproduct materials license SUA-1601 was amended on June 23, 2015 to reflect the Atomic Safety and Licensing Board (ASLB) initial decision in LBP-15-3. The amended license condition (LC) 10.12 requires an expanded area to locate and abandon historic drill holes that penetrate the underlying aquifer to either the license boundary or aquifer exemption boundary (whichever is closer) in the downgradient direction. Strata concluded that the intent of the amendment to LC 10.12 was to prevent the potential future migration of contaminants into the underlying DM monitoring interval a specified distance beyond the perimeter monitor well ring in the downgradient direction. In other words, after groundwater restoration is concluded and along with it the requirement to maintain a net inward hydraulic gradient, the concern is that any elevated constituent concentrations in the production zone (i.e., associated with an approved alternate concentration limit [ACL]) could be carried downgradient in the OZ aquifer and eventually affect the DM interval if there is an unplugged or improperly plugged historic drill hole beyond the perimeter monitor well ring.

To address this concern, the ASLB initial decision in LBP-15-3 and ensuing license amendment require Strata to attempt to locate and re-abandon downgradient historic drill holes that penetrate into the DM interval and are a specified distance from the perimeter monitor well ring. That distance is the closer of the aquifer exemption boundary or the license boundary; however, in practice, the closer will always be the aquifer exemption boundary, since it lies entirely within the license boundary. The distance from the perimeter monitor well ring to the aquifer exemption boundary was determined to be 100 feet from a site-specific, science-based calculation that considers the worst-case time to detect and retrieve a horizontal excursion. Since the natural

groundwater gradient in the OZ aquifer is southwesterly, MU1 is the most upgradient of the planned mine units. Therefore, the “maximum approved” aquifer exemption boundary for the Ross ISR Project – which is depicted in Map D12-1 accompanying WDEQ’s aquifer exemption request to EPA – is much farther than 100 feet in the downgradient direction from MU1, since there are additional mine units planned in the downgradient direction, all of which are surrounded by a single, “maximum approved” aquifer exemption boundary. In order to meet the intent of the ASLB initial decision in LBP-15-3, Strata attempted to locate and abandon all historic drill holes that are downgradient of MU1 and within 100 feet of the MU1 perimeter monitor well ring. This 100-foot buffer distance beyond the perimeter monitor well ring is for all practical purposes the aquifer exemption boundary for MU1. It would be illogical and impractical instead to attempt to locate all historic drill holes penetrating the DM interval that are farther away (i.e., within several thousand feet downgradient to the maximum approved aquifer exemption boundary), since those drill holes eventually will be within or downgradient of other planned mine units and will be subject to the provisions of LC 10.12 as those mine units are developed.

## DISCUSSION

### **I. Aquifer Exemption Basis and Approval**

The language in EPA’s aquifer exemption approval letter dated May 15, 2013 (ML13144A108), describes the aquifer exemption boundary as follows (emphasis added): “**It is horizontally described by the monitor well ring plus an additional 100 feet beyond the monitor well ring** as shown by Map D12-1 accompanying WDEQ’s aquifer exemption request.” The aquifer exemption boundary in the map submitted to EPA was based on areas of known and suspected mineralization and *a proposed perimeter monitor well*

*ring*<sup>1</sup>, not on an actual perimeter monitor well ring, and was intended to allow for typical, phased wellfield development to proceed within the licensed area. However, the actual aquifer exemption is limited to 100 feet beyond the perimeter monitor well ring of an actual mine unit as specifically stated by EPA in its exemption approval: “It is horizontally described by **the** monitor well ring plus an additional 100 feet beyond **the** monitor well ring.” Until Strata expands *the* (i.e., “the actual”) monitor well ring to encompass additional mine units, the exempted aquifer for Point of Exposure (POE) purposes only includes that portion of the aquifer 100 feet beyond the MU1 monitor well ring.

Regarding phased wellfield development and review of each wellfield for “exemptibility,” the approved license application, specifically the Technical Report at pg. 7-36 (ML110130335, PDF pg. 359), discusses providing the wellfield data package to the WDEQ/LQD and EPA to demonstrate wellfield integrity and “exemptibility” (justification for the exemption of the wellfield from the Safe Drinking Water Act [SDWA]). Two circumstances make it unnecessary for WDEQ/LQD to forward the MU1 wellfield data package to the EPA. First, the MU1 wellfield data package does not propose to expand operations beyond what was reclassified and ultimately exempted by the EPA in May 2013. The approval of the overall project aquifer exemption is designed to allow for phased development without the need for additional approvals unless a specific mine unit requires an expansion of the previously-approved aquifer exemption, which would then be 100 feet from the *actual* perimeter monitor well ring. Second, the OZ aquifer within MU1 satisfies the two aquifer exemption criteria upon which EPA’s exemption was granted (i.e., the water does not currently serve as a source of drinking water and it is demonstrated to contain minerals that are expected to be commercially producible). No domestic wells are present within MU1, and results of delineation drilling<sup>2</sup> indicate high concentrations of

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<sup>1</sup> The Ross ISR Project Aquifer Exemption Map was provided to NRC on June 21, 2013 (ML13210A245).

<sup>2</sup> See Peninsula Energy Press Release dated August 17, 2015, URL <http://www.pel.net.au/images/peninsul---reeshootoo.pdf>.

in-situ uranium with corresponding high concentrations of dissolved uranium as evident in the MU1 wellfield data package. Therefore, Strata did not request that WDEQ/LQD provide the MU1 wellfield data package to EPA as no further action by the agency is necessary.

## **II. Implication for Potential Future ACL Application**

In ¶ 4.130 of LBP-15-3, the ASLB contemplated potential impacts to the underlying DM monitoring interval downgradient from the production zones of the OZ due to the uncertainty of declining concentrations of uranium in an ACL scenario decades after restoration. In such a scenario, the ACL analysis would have to include evaluation of the risk to the public at the POE, which Strata maintains would need to be 100 feet from the perimeter monitor well ring according to the aquifer exemption basis. It would not be practical in an ACL application to evaluate the risk to the public thousands of feet downgradient from a mine unit simply because that was where a line was drawn to accommodate future wellfield development. Indeed, interpreting the ASLB initial decision in LBP-15-3 to require plugging all wells downgradient of MU1 to the “maximum approved” aquifer exemption boundary would seem to provide a strong basis for Strata to propose, in a potential future ACL application, that the POE would be the “maximum approved” aquifer exemption boundary rather than the distance of 100 feet beyond the monitor well ring. Strata does not think this approach would be reasonable or practical. Therefore, Strata elected to use the 100-foot, science-based distance from the perimeter monitor well ring in the downgradient direction as the area of review for the expanded drill hole re-abandonment program.

## **III. Consideration of Phased Wellfield Development**

Pursuant to the ASLB initial decision in LBP-15-3, Strata has attempted to locate and properly plug and abandon all historic exploration drill holes that penetrate the DM interval between the MU1 perimeter monitor well ring and the 100-foot science-based buffer used to establish the aquifer exemption

boundary. Strata's future Ross wellfield development encompasses land areas downgradient of MU1, and the same well identification, plugging, and abandonment procedures will be applied in future wellfield data package development. Consistent with the ASLB's LBP-15-3 initial decision and its analysis therein, Strata will then identify, plug, and abandon all drill holes downgradient of future mine units that penetrate the DM interval and that can be located between future mine units and their associated science-based buffer areas. In the case of the most downgradient mine units this may be to the maximum approved aquifer exemption boundary as shown in Figure 1-2 of the MU1 Wellfield Data Package (ML15209A700, pg. 4), while in upgradient mine units such as MU1 it will be 100 feet downgradient of the perimeter monitor well ring. These efforts are all conducted to ensure that the risk of future vertical migration of contaminants into the DM interval is reduced or eliminated. In other words, through the process of phased wellfield development and assuming that all mine units are developed, eventually Strata will make an attempt to locate and plug all historic drill holes that are downgradient of wellfields, penetrate the DM interval and are between the perimeter monitor well ring and the aquifer exemption boundary.

#### **IV. Mitigation of Potential Excursions**

Strata's procedures to abandon historic drill holes in a phased manner as mine units are developed are consistent with the ASLB's intent to reduce or eliminate the potential impacts from vertical excursions. Specifically, footnote 66 in LBP-15-3 states that "SEI's LC-required 'attempt' to locate and abandon all drill holes within the monitoring well ring embodies a level of effort that maximizes the potential for eliminating excursions..." This statement is consistent with the standard industry practice of identifying drill holes during wellfield hydrologic testing that potentially could result in vertical or horizontal excursions. Further, by locating and re-abandoning an additional 14 of 16 drill holes within the 100-foot science-based buffer surrounding/downgradient of

the MU1 perimeter monitor well ring, Strata has exceeded standard industry practice. In other words, the ASLB recognized that Strata's requirement to attempt to locate and abandon every historic drill hole within the perimeter monitoring well ring of each wellfield will maximize the potential for eliminating excursions. By extending these efforts 100 feet in the downgradient direction, the potential for eliminating vertical excursions can only be increased.

#### **V. Level of Effort Contemplated by ASLB to Comply with Revised LC**

When determining the level of effort required to comply with the revised license condition, the ASLB clearly did not consider that it would involve historic drill holes that are within the planned perimeter monitor well rings of future wellfields. Rather, they indicate that complying with the revised LC will not be "an inordinate requirement," since it will involve "only about 100 boreholes" (i.e., those between the project-wide perimeter monitor well ring and the project-wide aquifer exemption boundary). More specifically, in Section 4.131 of LBP-15-3, the ASLB included a clarifying footnote (footnote 69) that immediately preceded their revised language for LC 10.12. Footnote 69 states:

"The Board recognizes that the protective measure we are imposing is not one that addresses a high-probability event. Nonetheless, because there are likely to be only about 100 boreholes potentially involved, see Tr. at 368-69 (Schiffer), this does not seem an inordinate requirement, particularly given it is intended to ensure the integrity of the exempted aquifer area as a buffer. Moreover, with only about 100 drill holes potentially at issue, of which apparently only 12 still need to be located, it could well be that SEI may find it more cost effective simply to locate and fill all the beyond-the-perimeter monitoring ring area drill holes, consistent with its approach to addressing the boreholes within the perimeter monitoring well ring, regardless of their depth."

The verbal exchange on pages 368-69 of the transcript goes as follows:

*JUDGE WHITE: All right. And one of the license conditions is that the monitor wells cannot be outside the exempt aquifer. Is that correct? How far does the exempt aquifer extend from a well field? And this is more a matter of curiosity.*

*MR. SCHIFFER: In this case the exempted aquifer extends 100 feet beyond the perimeter monitor well ring, and that is a site-specific calculation based on groundwater velocity in this ore zone aquifer.*

*JUDGE WHITE: I see. Thank you.*

The verbal exchange between Judge White and Mr. Schiffer in the transcript demonstrates that in making their decision the judges understood the exempted aquifer extends 100 feet beyond the perimeter monitor well ring, and there are only a limited number of boreholes (approximately 100) between the project-wide perimeter monitor well ring and the project-wide aquifer exemption boundary. This number was discussed during the evidentiary hearing (see pages 679-680 of the transcript). Strata witness Mr. Knode testified in response to questions from Judge White that there are 1,483 historic drill holes within the license boundary, of which approximately 1,382 are within “the proposed or the estimated boundaries of mine units 1, 2, 3 and 4.” The difference between 1,483 and 1,382 (101) is clearly the “only about 100 boreholes” to which the ASLB referred (see also ¶ 4.129 of LBP-15-3). These are the historic drill holes within the “donut area” outside of the planned perimeter monitor well rings but inside of the maximum aquifer exemption boundary.

The key issue here is that the ASLB contemplated that during the life of the project, the revised license condition would only involve attempting to locate and abandon up to around 100 additional drill holes in this “donut area” beyond what was already required by LC 10.12. Moreover, at no time did the ASLB indicate that all of these approximately 100 drill holes would need to be abandoned prior to operating the *first* wellfield. They made it clear in the revised LC 10.12 that the added requirement to plug historic drill holes penetrating the DM interval applies to those holes downgradient and in proximity to *each* wellfield prior to conducting tests for that wellfield package.

This is illustrated by the ASLB's use of "the Wellfield" no less than three times in the revised license condition (see page 98 of LBP-15-3).

## **VI. Practical Consequences of Plugging Only Downgradient Holes Penetrating DM Interval**

Extending the reach of the revised LC 10.12 beyond the proximity of each wellfield would result in an impractical and inconsistent hole plugging effort for wellfields like MU1 that are in the upgradient portion of the license area. This can be illustrated by considering the scenario where MU1 would be the only mine unit developed in the license boundary. Since the natural groundwater gradient in the OZ aquifer is to the southwest, MU1 is upgradient of hundreds of historic drill holes. However, only a minority of these penetrate the underlying (DM) interval. Refer to the evidentiary hearing transcript on page 716, where NRC staff witness Mr. Burgess testified that "there are a lot less unplugged bore holes from the OZ to the DM ... [t]han the OZ to the SM." See also ¶ 4.129 of LBP-15-3 ("we are aware that the evidentiary record suggests that most of the Nubeth boreholes bottomed in the OZ aquifer and therefore are not potential conduits for fluids moving from the OZ to the DM horizon"). If the revised LC 10.12 were interpreted to require Strata to plug essentially all historic drill holes that penetrate the DM interval and are downgradient of MU1, this would result in a checkerboard of plugged/unplugged boreholes, where the majority were not plugged. This would not significantly reduce the potential for excursions or long-term migration of potential contaminants.

## **VII. The ASLB Determined That 100 Feet beyond the Perimeter Monitor Well Ring Is an Adequately Protective "Buffer Area"**

As described previously, the ASLB considered the area between the perimeter monitor well ring and the aquifer exemption boundary to be an adequate "buffer" to address historic drill holes penetrating the DM interval (refer to footnote 69 in LBP-15-3 and the discussion under Section V). Further,



when making this determination, the ASLB explicitly cited Mr. Schiffer's testimony that the distance from the perimeter monitor well ring to the aquifer exemption boundary is 100 feet. Clearly, then, the initial decision in LBP-15-3 supports the finding that plugging historic drill holes that penetrate the DM interval and are in a buffer area extending 100 feet beyond the perimeter monitor well ring in the downgradient direction is adequately protective of public health and the environment.

This can be illustrated by considering two different mine unit development scenarios. In the first scenario, Strata would first develop a mine unit in the southwestern (most downgradient) portion of the license boundary. In this case there would be no ambiguity regarding the historic drill holes to which the provisions of LC 10.12 would apply; Strata would be required to attempt to locate and abandon downgradient drill holes that are within 100 feet of the perimeter monitor well ring and that penetrate the DM interval (in addition to all historic drill holes within the perimeter well ring). The ASLB determined that plugging holes within this "buffer" area will be adequate to address its concern regarding long-term migration of potential contaminants into the DM interval such as during an ACL scenario. The ASLB specifically state in footnote 69 of LBP-15-3 that this is not "an inordinate requirement" since only about 100 holes would potentially be at issue project-wide, so the number for an individual mine unit would be much less.

Now consider the second scenario, which is to first develop a mine unit in the upgradient portion of the license boundary, such as MU1. It would be inconsistent to conclude that the same 100-foot "buffer" area downgradient of the perimeter monitor well ring that was determined to be adequately protective for the downgradient mine unit is somehow inadequate for the upgradient mine unit. The ASLB initial decision did not distinguish relative risk between different mine unit, only that a 100-foot "buffer" area beyond the perimeter monitor well ring would be adequately protective.

## **VIII. Wyoming DEQ Implications**

The Wyoming Department of Environmental Quality/Land Quality Division (WDEQ/LQD) will consider the perimeter monitor well ring the point of compliance for the purposes of evaluating aquifer restoration. As described in Chapter 11, Section 5(a)(ii)(E)(I) of the WDEQ/LQD rules, the agency has a process in place by which the post-restoration water quality criteria within the production zone (defined vertically as the geologic interval into which recovery fluids to be injected or extracted and spatially as the area within the perimeter monitor well ring) may be modified by the Environmental Quality Council upon request from the Director of the WDEQ. This process, which is clearly similar to an ACL application, would not consider a POE thousands of feet beyond the perimeter monitor well ring. Therefore, the 100-foot science-based aquifer exemption boundary considered by Strata in the MU1 wellfield data package will conservatively include an area larger than the perimeter monitor well ring.

## **IX. Consistency with Powertech (USA), Inc. Initial Decision**

In the Powertech (USA), Inc., Dewey-Burdock Project partial initial decision in LBP-15-16 (pg. 72), that ASLB concluded that:

“It is apparent that some boreholes on the site have not been adequately plugged, because leakage between formations was attributed to open boreholes in the TVA studies of the late 1970’s, [and] was again cited as the cause of leakage by Powertech and NRC Staff witnesses who analyzed the more recent pumping tests ...”

This conclusion came about due to similar arguments regarding integrity of the uranium host interval confinement and ultimately resulted in that ASLB amending Powertech’s source and byproduct material license SUA-1600 with the addition of a license condition stating (reference LBP-15-16 on pg. 73):

“Prior to conducting tests for a wellfield data package, the licensee will attempt to locate and properly abandon all historic drill holes located within the perimeter well ring for the wellfield. The licensee will document, and provide to the NRC, such efforts to identify and properly abandon all drill holes in the wellfield data package.”

The Powertech licensing board had access to the Strata initial decision and cited it in the Powertech partial initial decision (e.g., on pg. 53). Moreover, Judge Cole served on both ASLBs. The fact that the ASLB for Powertech did not require Powertech to plug holes outside the perimeter monitor well ring in the downgradient direction supports the conclusion that plugging holes within the perimeter monitor well ring is adequately protective to prevent the vertical migration of wellfield solutions due to unplugged or improperly plugged historic drill holes. The fact that Strata is required to plug additional historic drill holes within 100 feet of the perimeter monitor well ring in the downgradient direction demonstrates again that Strata's requirements exceed standard industry practice.

In summary, Strata's actions to comply with the amended license condition are both protective of human health and the environment and consistent with the intent of the ASLB in LBP-15-3 based on the following:

- The exempted aquifer is clearly described by EPA as **the** monitor well ring plus an additional 100 feet.
- It would not be reasonable or practical in a potential ACL application to define the Point of Exposure as being thousands of feet downgradient of MU1, yet extending the reach of LC 10.12 to the "maximum approved" aquifer exemption boundary would provide basis for such an application.
- The exempted aquifer accommodates future, phased development of mine units and LC 10.12 is not specific to MU1; therefore, subsequent downgradient wellfield data packages will demonstrate project-wide re-abandonment efforts consistent with the intent of the ASLB.
- Abandoning historic drill holes within the 100-foot buffer area downgradient of the perimeter monitor well ring will minimize the potential for vertical excursions and exceeds standard industry practice.
- The level of effort contemplated by the ASLB in LBP-15-3 was not "an inordinate requirement" based on the assumption that the revised LC

would apply to “only about 100 boreholes” project-wide. There is no evidence that the ASLB contemplated extending the reach of LC 10.12 to include historic drill holes that are within potential future perimeter monitor well rings.

- Extending the reach of LC 10.12 beyond the proximity of each wellfield would result in an impractical and inconsistent hole plugging effort, where most downgradient holes would be unaffected, while a minority (those that penetrate the DM interval) would be subject to the provisions of LC 10.12. This would not significantly reduce the potential for excursions or long-term migration of potential contaminants.
- The ASLB determined that the distance of 100 feet from the perimeter monitor well ring to the aquifer exemption boundary is an adequate “buffer” area to address historic drill holes penetrating the DM interval. It would be inconsistent to determine that this distance is adequately protective for a downgradient mine unit, while concluding that it is inadequate for an upgradient mine unit such as MU1.
- The ASLB clearly contemplated the 100-foot buffer in LBP-15-3 and in modifying LC 10.12.
- WDEQ/LQD in evaluating post-restoration water quality criteria would consider the perimeter monitor well ring as the POC and POE if a request were made pursuant to Chapter 11, Section 5, (a)(ii)(E)(I). Interpreting the POE as being thousands of feet downgradient of MU1 would be inconsistent with Wyoming DEQ regulations
- In partial initial decision LBP-15-16, that ASLB evaluated a similar situation and correspondingly modified Powertech’s license SUA-1600 to require the licensee to locate and abandon drill holes within the perimeter monitoring well ring only.