

# November 16, 2017 Public Meeting

## Discuss RAI Responses with Lost Creek ISR

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## Purpose



Discuss and clarify certain aspects of Lost Creek's responses to Staff's RAIs on the KM and Lost Creek East Amendment Application

## Background



- RAI 1 through 15
  - Issued July 27, 2017 ML17199F574
- RAI 16 through 19
  - Issued August 28, 2017 ML17227A312
- **Lost Creek's Responses to RAI 1 through 19**
  - **September 25, 2017 ML17275A674**
- RAI 20 through 26
  - Issued October 30, 2017 ML17298B724

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## LC's 9/25/17 Response



- Pending NRC's administrative completeness review
  - Preliminary results
    - Several responses appear to be inadequate: RAI-2, -8, -11, -15, -16 & -19

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## RAI Response



## Completeness Review

- In addition to a determination that the response addresses NRC's RAI, the completeness review evaluates whether the response was sufficient for Staff to have a reasonable assurance determination for the SER

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## Other Consideration



- NRC staff is a cooperating agency with BLM in the preparation of a NEPA review document (a draft EIS) with a release date anticipated prior to completion of staff's SER
- The EIS needs to be consistent with the determinations in the SER

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# RAI-2a Barometric Efficiency (BE) Calculations



## a) Barometric Efficiency

In Volume 4 of the LCEEA, Section 5.2 discusses barometric corrections applied to the 2013 pumping tests. Appendix C presents calculations for aquifer barometric efficiency, which appear to **incorrectly assign the formation barometric efficiency to the coefficient of determination (i.e.,  $R^2$ ), rather than the slope of that line** (see page 109 of 576 of Volume 4). The error is compounded because the graph incorrectly assigns the barometric pressure to the ordinate rather than the abscissa. Water level corrections using the barometric efficiency values, including drawdown calculations, **are not accurate**. Also, Volume 4 of the LCEEA does not include figures depicting the uncorrected and corrected water levels.

Similar errors were noted in the barometric efficiency calculations in Volume 5 of the LCEEA. In addition, for several wells (e.g., MB11 and M-KM5A), the actual barometric efficiency appears to exceed a value of one.

The attachments to the KMA stated that the difference between barometric efficiency corrected and uncorrected drawdown was less than **one percent** and provided a figure depicting one example. While it may be true that the correction of one percent is for one example, it is difficult to make a **generalized statement for all wells**, especially if the uncorrected drawdown is quite low.

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# RAI-2a Barometric Efficiency (BE) Calculations



**Response:** The barometric efficiencies (BE) have been recomputed for the 2013 (Volume 4) and 2016 (Volume 5) hydrologic reports. The BE plots and revised summary tables are attached to this document, and should be inserted into the appropriate Volume in **Appendix C and D**, respectively.

Regarding the one percent difference between corrected and uncorrected drawdown, the reviewer is referred to the numerous other hydrologic reports conducted on this property by outside consultants since 2008 that have arrived at the same conclusion. Furthermore, not all barometric correction evaluation data was included in the original application but was retained by applicant for brevity purposes. Supplemental graphs are now provided to support our position that barometric correction is unnecessary. Accordingly, LCI takes exception to the statement inferring an insufficient data base upon which to draw this conclusion.

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## RAI-2a Barometric Efficiency (BE) Calculations



- Response is confusing
- Why did LC revise the drawdowns which used non-corrected water levels?
- Example of Well M-KM5A

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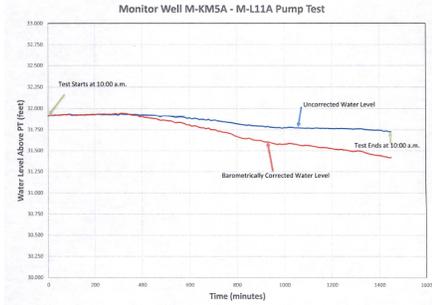
## BE Well M-KM-5A



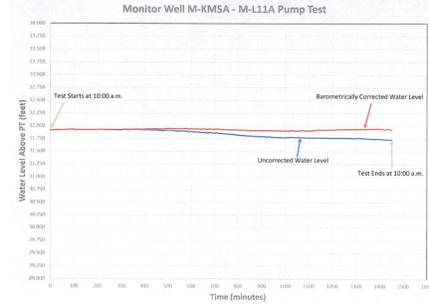
- Original application
  - BE=0.83 (Vol 5 pg 150) (0.66)
  - DD = 0.50 (corrected) Table 6-3
- Response
  - BE=0.55 (pg 115)
  - DD = 0.19 (un-corrected) Table 6-3
  - (pg 138)

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# M-KM-5A Hydrographs



Original  
Vol 5 (Part 2) Page 336



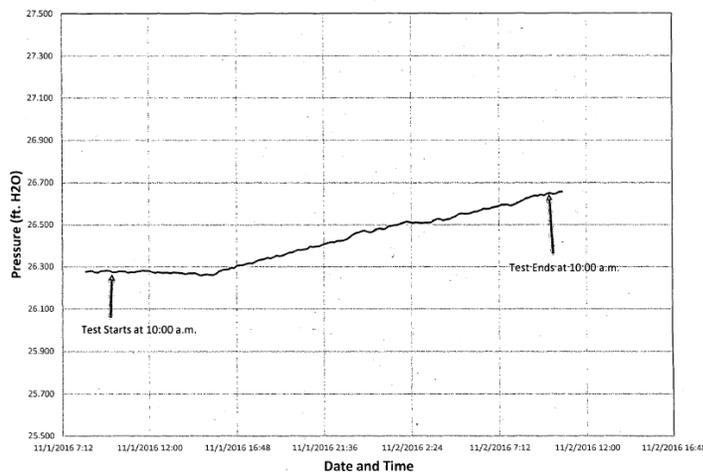
Responses  
Page 133

Which correction is correct?

# Barometric Pressure



Barometric Pressure for M-L11A Pump Test Period



Vol 5 Page 126

## BE Well M-KM-5A



- The response is correct; however the correct drawdown is essentially 0.0 feet compared to 0.19 feet for the uncorrected drawdown.

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## RAI-8 Cumulative Drawdown



- Request – Please provide an acceptable cumulative drawdown analysis
- Response – Academic exercise with no basis in reality – the best analysis is reviewing historical drawdown from operations at Mine Unit 1.

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## RAI-8 Cumulative Drawdown



- Response is inadequate. Intent is not to predict actual future drawdown but worst case based on license maximum.
- At a minimum, staff will have to develop its own analysis for a “hard look” under NEPA based on various assumptions (e.g., schedule).

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## RAI-8 Cumulative Drawdown



- The assumptions and staff’s analysis outside of any analysis by the licensee will not acceptable

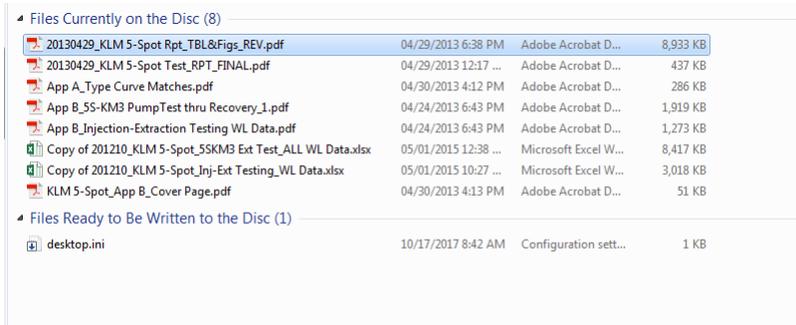
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# RAI-15 Missing Tables and Figures

- Request – Please provide tables and figures for the October 2012 KLM 5-spot test report
- Response – Tables and figures supplied electronically. However, the tables are missing from the electronic files.

# RAI-15 Missing Tables and Figures

- Here is the directory for the submittal



Files Currently on the Disc (8)				
 20130429_KLM 5-Spot Rpt_TBL&Figs_REV.pdf	04/29/2013 6:38 PM	Adobe Acrobat D...	8,933 KB	
 20130429_KLM 5-Spot Test_RPT_FINAL.pdf	04/29/2013 12:17 ...	Adobe Acrobat D...	437 KB	
 App A_Type Curve Matches.pdf	04/30/2013 4:12 PM	Adobe Acrobat D...	286 KB	
 App B_5S-KM3 Pump Test thru Recovery_1.pdf	04/24/2013 6:43 PM	Adobe Acrobat D...	1,919 KB	
 App B_Injection-Extraction Testing WL Data.pdf	04/24/2013 6:43 PM	Adobe Acrobat D...	1,273 KB	
 Copy of 201210_KLM 5-Spot_5SKM3 Ext Test_ALL WL Data.xlsx	05/01/2015 12:38 ...	Microsoft Excel W...	8,417 KB	
 Copy of 201210_KLM 5-Spot_Inj-Ext Testing_WL Data.xlsx	05/01/2015 10:27 ...	Microsoft Excel W...	3,018 KB	
 KLM 5-Spot_App B_Cover Page.pdf	04/30/2013 4:13 PM	Adobe Acrobat D...	51 KB	
Files Ready to Be Written to the Disc (1)				
 desktop.ini	10/17/2017 8:42 AM	Configuration sett...	1 KB	

## RAI-16 Wastewater Balance



- Request – Please discuss LCI’s plan to seek approval for permitting the three Class I wells
- Response – LCI will initiate permitting of the wells after the amendment approval and then only if the capacity necessitates

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## RAI-16 Wastewater Balance



- Response is unacceptable
- Staff will need some sort of commitment to ensure timely processing of the permitting process taking into account the time for the permitting to completion and disposal capacity.

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## RAI-11: Background Radiological Characteristics



*RAI:* Section D10 provides baseline information on direct gamma, air particulate and radon measurements collected as part of the preoperational monitoring program. Data gaps were identified in the preoperational monitoring program for the LC East.

Additional clarification is needed on the following items:

- RAI-11(b) – Gamma scans
- RAI-11(c) – Surface soil samples
- RAI-11(d) – Subsurface soils samples
- RAI-11(e) – Sediment samples
- RAI-11(g) – Vegetation samples

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## RAI-11(b): Gamma scans



- UTV-based gamma scans for exposure rate measurements need to use properly calibrated survey instruments.
- The correlation between the previous UTV-based gamma scans (2008 Tech Report volume 2 section 2.9) and the 2013 UTV-based gamma scans (2017 Tech Report section 3.12 and D-10) is not well documented.

***Request:*** Provide additional information on the calibration of the UTV-based radiation measurement instruments for exposure rate measurements and Ra-226 soil surface activity measurements.

Note: characterization of background radioactivity levels is needed for several radionuclides, not just Ra-226, as described in the 2017 Tech Report.

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## RAI-11(c): Surface soil samples



*RAI:* Section 2.9.1 (original Lost Creek Technical Report) describes soil sampling conducted in support of the preoperational monitoring program for the original Lost Creek license application.

- Information on soil sampling at 5-cm or 15-cm depths is not included for LC East.
- The September 2013 Tetra-Tech, Inc. report does not contain information on correlations between direct gamma measurements using sodium-iodide detectors with U-nat, Th-230 or Pb-210 in surface or subsurface soils.

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## RAI-11(c): Surface soil samples



*Response:* As mentioned in the RAI, surface soil samples were collected during the original licensing action around the mill and co-located at each air particulate monitoring station pursuant to RG 4.14. Additionally, thousands of direct gamma readings were collected to determine the background concentration of radionuclides in the soils. This data, especially the direct gamma readings, will be utilized during final reclamation to ensure proper soil cleanup.

Likewise, direct gamma readings collected at LC East will be the primary data used to ensure proper reclamation at the end of the project. Since an additional air particulate sampling station was established, HV-6, a surface soil sample was collected at this site and has been added to the Technical Report as Table 010-4. Lost Creek ISR, LLC believes that the data described above satisfies the intent of RG 4.14 and that additional surface soil samples are not necessary.

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## RAI-11(c): Surface soil samples



*Request:* Additional surface soil samples should be collected and analyzed as part of the preoperational monitoring program.

- RG 4.14 recommends up to 40 surface soil samples at 300 meter intervals in each of 8 directions from the center of the mill area. All samples should be analyzed for Ra-226 and 10% should be analyzed for U-nat, Th-230 and Pb-210.
- Alternative approaches to collecting surface soil samples.

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## RAI-11(d): Subsurface soil samples



*RAI:* Although subsurface soils samples were assayed as part of the original Lost Creek application, there is no information on subsurface soil sampling within LC East.

*Response:* RG 4.14 recommends the collection of subsoil data in the vicinity of the mill. The data already collected in the vicinity of the mill and presented in the original license application fulfills this obligation. Lost Creek ISR, LLC believes that collection of additional subsoil data is not necessary since a new mill is not being constructed.

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## RAI-11(d): Subsurface soil samples



**Request:** Collection of 5 subsurface soil samples to a depth of 1 meter, and that all subsurface soil samples should be analyzed for Ra-226, and 1 set of subsurface soil samples should be analyzed for U-nat, Th-232 and Pb-210.

- RG 4.14 provides guidance on the frequency of subsurface sampling, which includes locations disturbed by construction in addition to the center of the milling area.

## RAI-11(e): Sediment samples



**RAI:** Please provide information or a justification for not conducting sediment sampling downstream of stock ponds located in LC East.

**Response:** A pond located at the NE, NW quarter of Section 21, T25N R92W, is fed by a small drainage channel. One wellfield is close enough to the channel that a small deviation in the mine plan could result in extending the mine unit to the drainage area. Therefore, to be proactive a single round of sediment sampling from the pond will occur in the fall of 2017. The NRC reviewer asks for a justification for not conducting sediment sampling downstream of stock ponds. It is not clear why the reviewer would ask this questions since RG 4.14 is silent on this matter. Lost Creek ISR, LLC believes the sediment sampling plan described above fully complies with RG 4.14. It is unclear how sampling sediment from immediately downstream of ponds, especially when the sediment in the ponds is sampled, would provide useful information.

**Request:** RG 4.14 recommends collection of sediment samples from surface waters that pass through the site, at a location downstream of the site. Please inform the NRC staff if the drainage channel, downstream from the above stock pond, crosses the LC East or LC site boundary.

## RAI-11(g): Vegetation samples



*RAI:* Vegetation and food samples were collected and analyzed as part of the original Lost Creek preoperational monitoring program. Three grazing allotments were reported to provide forage for cattle, horses, and sheep. The NRC staff considered the vegetation baseline sampling acceptable for the existing LC licensed area.

Please provide additional information on the collection of vegetation samples within LC East, or provide sufficient justification that the preoperational monitoring program for the existing licensed area meets the recommendations of RG 4.14 and NUREG-1569 Acceptance Criterion 2.9.3(1).

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## RAI-11(g): Vegetation samples



*Response:* Regarding vegetation samples, RG 4.14 requires the collection of vegetation samples in areas with the highest predicted airborne particulate. The area with the highest particulate load is expected to be in the immediate vicinity of the Lost Creek plant. The samples necessary to satisfy RG 4.14 were submitted and approved as part of the original Lost Creek application (see TR Section 2.9.3.2). Therefore, Lost Creek ISR, LLC believes the requirement for vegetation sampling has already been met.

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## RAI-11(g): Vegetation samples



Request: There will be construction disturbances and possibly spills in LC East, and cattle graze in the area. Baseline information on preoperational forage samples could be useful. Acceptable approach is to analyze MILDOS calculations (performed for the LC and LC East sites) to verify that the highest predicted airborne radionuclide concentrations due to milling operations are in similar locations.

Request: Please clarify whether forage samples in LC East will be collected and analyzed as part of the operational monitoring program.

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## RAI-13: MILDOS-AREA calculations



RAI: The following items were identified for this RAI:

- 13(a) - Calculation of dose to nearest resident
- 13(b) - Meteorological data
- 13(c) - Radon release rates
- 13(d) - Population distribution for collective dose calcs
- 13(e) - Revised MILDOS-AREA calculations

Response: LC ISR will respond to this RAI once additional clarification is provided by NRC.

Request: Please provide an update on these items, since the NRC has provided clarification on this RAI.

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## RAI-18: Status of airborne effluent & environmental monitoring program



*RAI:* Please provide an updated description of the current airborne effluent and environmental monitoring program with a summary of the changes since the issuance of License Amendment No. 4

## RAI-18: Status of airborne effluent & environmental monitoring program



*Response for airborne monitoring:* The airborne effluent monitoring includes air particulates, radon, radon progeny, and direct radiation. Air particulate samples are collected continuously at the air monitoring ("HV") stations as well as passive radiation and radon. Additional monitoring locations ("PR") for passive radiation and radon are distributed throughout the permit area. Samples of effluents are collected at "E" locations in the Plant from vents that exhaust from process tanks to the exterior.

Air Effluent Monitoring Location	Analytical Parameters	Frequency
HV-2 through HV-6	Unat, Th-230, Ra-226, Pb-210	Quarterly composite
PR-2 through PR-5	Rn-222, gamma	Monitors changed quarterly
PR-9, PR-10, and PR-13	Rn-222, gamma	Monitors changed quarterly
PR-6 and PR-12	Rn-222	Monitors changed quarterly
E1 through E6	Rn-222, Rn progeny	Quarterly sample
E14 through E16		Quarterly sample

Monitoring at location HV-6 will be conducted upon commencement of operation of LCE. Effluent monitoring locations E14, E15, and E16 were added as authorized by SERP LC16-06, LC16-08, and LC16-11. Air particulate station HV-1 and passive radiological stations PR-1, PR-7, PR-8, and PR-11 were removed as authorized by SERP LC17-02.

## RAI-18: Status of airborne effluent & environmental monitoring program



*Request:* For airborne effluent, please explain why monitoring at location HV-6 is not being conducted at this time, and whether HV-6 was operational during the preoperational monitoring program. Also, please explain why air particulate station HV-1 and passive radiological stations PR-1, PR-7, PR-8, and PR-11 were removed, and any impacts to the operational monitoring program for airborne effluents.

*Request:* For well monitoring, please provide the rationale for not including Th-230, Pb-210 and Po-210 in the analyses of quarterly samples from stock watering ponds.

*Request:* For surface water monitoring, please explain further the ad hoc surface water sampling that will be conducted as necessary and as feasible at "LC" or other ad hoc locations within ephemeral drainage using storm water autosamplers. The explanation should focus on surface water sampling for LC East.

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## RAI-19: Confirmation of changes to the November 2016 Technical Report



*RAI:* Please provide a summary of the changes to the Quality Assurance Project Plan, and any other subsections of Section 5, since issuance of the original license.

*Response:* The Quality Assurance Program (QAPP) for radiological monitoring programs overviewed in TR Section 5.7.9 is detailed by and provided as the Quality Assurance Project Plan (QAPP). The QAPP was originally submitted to NRC (ML 13141A416) in April 2013 to satisfy License Condition 12.14. A request for additional information (RAI) was submitted by NRC in a letter dated June 13, 2013. The "revised" QAPP in response to the RAIs was submitted in July 2013 (ML 13228A019). Therefore, the QAPP is current as originally submitted following the responses to RAI and has not been revised as such, however, it was internally reviewed in 2016 and minor administrative revisions were made (i.e. job titles and minor grammatical changes). A good summary of the QAPP is provided in the document itself as a listing of major elements of the program in Section 1.5 [bullet list provided].

*Request:* Please submit the latest version of the QAPP, and describe any other changes to Section 5.

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## RAI-2: Conceptual Model for the Lower Confining Unit & Confinement



### NRC Staff's Request:

Please provide a uniform, conceptual model for the confining units that is consistent with supporting data and address the information requests noted in the "Description of Deficiency" section above. Furthermore, the information submitted suggests areas that may require a greater density of wells than one well per four acres (see RAI 4). Please provide a justification for maintaining the minimum well density, especially for the L Horizon.

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## RAI-2: Conceptual Model for the Lower Confining Unit & Confinement



### Lost Creek's Response:

The conceptual model only need demonstrate that solution mining is viable based on aquifer properties, mineralogy, and engineering controls. LC ISR believes that current operations, hydrologic field testing and computer modeling results have adequately demonstrated the ability to "control" lixiviant during ISR uranium mining operations.

Regarding the issue of monitor well density, until such time as mine units and wellfield patterns are located and delineated, LC ISR has no basis for determining what the monitor well density should be other than the default requirement of one well per four acres. Raising this issue seems premature since the wellfield patterns have not been determined.

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## RAI-2: Conceptual Model for the Lower Confining Unit & Confinement



### Lost Creek's Response:

The specific method for determining baseline and the monitoring plans will be outlined in each respective Mine Unit application but will follow guidance provided by both LQD and NRC. In areas where confinement appears to thin to less than five feet based on stratigraphic interpretation from drill logs or there is more than three feet of drawdown in the overlying or underlying aquifer during a pump test, the density of overlying and/or underlying monitor wells will increase to at least one well per two acres.

Page OP-21 of Revised Ops Plan

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## RAI-2: Conceptual Model for the Lower Confining Unit & Confinement



### Lost Creek's Response:

**Response:** The prior two-page dialogue regarding the purported lack of aerially extensive underlying geologic confinement (K Shale) has already been acknowledged and reported by LCI. However, as described, the K Shale is not represented by a single, discrete shale unit, rather the stratigraphic interval directly underlying the KM Horizon is typically a mudstone containing thin, coalescing sands and multiple overlapping shales of varying thickness. Therefore, at any given location, the K Shale interval or equivalent has been observed and interpreted as containing some thickness of shale, though potentially not the same laterally continuous bed. The presented isopach maps for the K Shale in both the KMA and the LCEEA are intended to illustrate thickness of the best confinement (or shale) within the interval, not the lack of continuity of each of the overlapping shales.

Page 21 of Response

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## RAI-2: Conceptual Model for the Lower Confining Unit & Confinement



- Lost Creek's response does not provide additional information or evaluation except to include a conditional commitment to increase the density of monitoring wells
- Lost Creek's response continues the commitment for an evaluation in the future as part of a specific wellfield package

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## RAI-2: Conceptual Model for the Lower Confining Unit & Confinement



- Staff cannot approve an action based on some future analysis
  - Especially for fundamental aspect to control the source and byproduct material
  - Especially because the current regulatory regime does not have staff approving any future wellfield package.

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## RAI-2: Conceptual Model for the Lower Confining Unit & Confinement



- The primary issue is confinement
- The regulatory monitoring programs are based on the existence of a confining unit
- Lost Creek states that confinement could be achieved through operational and management controls without specificity

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## RAI-2: Conceptual Model for the Lower Confining Unit & Confinement



NUREG-1569 Section 2.7.2

- At a minimum, the reviewer should evaluate whether the applicant has developed an acceptable conceptual model of the site hydrology and whether the conceptual model is adequately supported by the data presented in the site characterization

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## RAI-2: Conceptual Model for the Lower Confining Unit & Confinement



An alternative conceptual model (MU3)

- Faults are not barriers to flow in the KM Horizon and lower horizons
- Explains lack of offset to the potentiometric surface in the KM horizon along the major fault
- Explains minimum vertical gradients
- Explains distribution of drawdown
- Nearby analogue – schroeckingerite deposit