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POWDER RIVER BASIN
Resource Council

December 28, 2011

Mr. John Passehl
Wyoming Department of Environmental Quality
Water Quality Division
Herschler Building, 4th Floor West
122 West 25th Street
Cheyenne, Wyoming 82002
Fax: (307) 777-7610

Via first-class mail and facsimile

Dear Mr. Passehl,

Thank you for the opportunity to submit comments on the revised draft Class V Underground Injection Control ("UIC") permit for the Rough Draw bioconversion project operated by Patriot Energy Resources, a subsidiary of Luca Technologies. We have reviewed DEQ responses to our original comments submitted on November 30th, and consider your responses to comments 2, 4, 6, 8, 9, 10, 11, 12, 13, 14, 15, 18, 19, 20, 22, 23, 24, 25 and 26 to adequately address our stated concerns. We believe comments 1, 3, 5, 7, 16, 17 and 21 of our original submittal to still reflect valid concerns. We respectfully request that DEQ respond to these comments in addition to the following additional comments relative to the revised permit.

Contradictory Statements in the permit regarding the permit term:

The first page of the permit states that the Permit is valid for 10 years but later on page 22 the permit states that the permit is valid for 10 years but that injection may only occur within the first 5 years. Then under the permit action section on page 36 the language seems to contradict this requirement, stating that the permit is valid for 10 years and if the permittee wants to continue injection the permit must be renewed. Please explain and clarify the term of the permit and the term of injections within the permit so they are clear and consistent.

In our previous comments, we suggested that DEQ should consider a post-injection monitoring and compliance phase. Therefore, we believe the permit term should be 10 years, with injections only allowed in the first five years, which would create a five year post-injection monitoring period. We believe this is what the draft permit establishes under Section E (quoted below), but want to clarify given the conflicting language in the draft permit.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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DEC 28 2011

Ref: 8P-W-GW

Mr. John Passehl
Wyoming Department of Environmental Quality
Water Quality Division
122 West 25th Street
Herschler Building 4-W
Cheyenne, Wyoming 82002

RE: Comments on Patriot Energy Resources, LLC's Draft Class V UIC Permit for CBM Injection to Convert Coal to Methane in the Rough Draw Area 11-207

Dear Mr. Passehl:

The Environmental Protection Agency Region 8 has reviewed the above draft permit which proposes to authorize injection of coal bed methane produced water and "nutrient enhancements" (consisting of food grade additives) for the purpose of microbial conversion of coal to methane gas. This project is located in Campbell County's "Rough Draw Area" within the Powder River Basin, and proposes to employ up to 300 wells injecting a total of 54,000 barrels per day. The produced water will originate from the Anderson, Wall, Canyon and Lower Canyon coal seams with all four coals to receive produced water blended from one or more of these formations.

We appreciate the Wyoming Department of Environmental Quality reviewing and utilizing all available pilot scale testing results of this new technology in establishing draft permit conditions for the first commercial-scale "methane farming" project of its kind in Wyoming. Based on our discussions held with WDEQ staff and management on December 12, 2011, via conference call, it is our understanding that these results did not show evidence of any adverse impacts to existing water quality.

We also understand that and support requiring monitoring for changes in concentrations of various organic (for example, total organic carbon) and inorganic (for instance, iron) compounds in the injectate, receiving groundwater and local domestic wells for this project. We agree this information will serve as important indicators for assessing any potential for: 1) generation of detrimental reaction by-products from the microbial conversion process, 2) mobilization of in-situ constituents (for example, metals) through mineralization or chemical reactions or 3) growth of non-desirable microbes and/or their byproducts.

If potentially adverse impacts are indicated by subsequent monitoring results, we would encourage the WDEQ to consider additional monitoring and/or other permit requirements as appropriate to help ensure the existing water quality of current and future underground sources of drinking water within these receiving coals is protected. We would also appreciate the opportunity to review the initial sampling results once field operations commence and stand ready to provide any technical assistance, if needed.

Thank you for the opportunity to comment. We believe this new and innovative practice, when properly regulated, holds real potential for further developing Wyoming's gas resources. Please contact me at (303)312-6575 or Douglas Minter on my staff at (303)312-6079 with any questions or comments.

Sincerely,

Craig Bassett

for Steven J. Pratt, PE, CAPM (inactive)
Director, Groundwater Program

cc: Janie Nelson, WOGCC

December 19, 2011

Mr. John Passehl, P.G.
UIC Geological Supervisor
Wyoming Department of Environmental Quality – Water Quality Division
Herschler Building, 4th Floor West
122 West 25th Street
Cheyenne, WY 82002
(307) 777-5623

Re: Comments on Draft UIC Permit 11-207, Rough Draw Area Class V Injection Well (Area Permit)

Dear Mr. Passehl:

Luca has some comments on the second Rough Draw Area Draft UIC Permit 11-207 draft that was posted on the WDEQ website on November 30, 2011.

1. Pages 3-12, Tables 1A & 1B: Luca has thoroughly reviewed the well names, coal seams, coal thicknesses, and perforation intervals in Tables 1A and 1B for the 300 proposed injection wells in the Rough Draw permit application, and we have several changes, highlighted in the attached Tables. We are also sending these changes electronically to facilitate correcting the permit.

2. Pages 13-19, Tables 2 & 3: Several well names need to be changed (these are the same wells in Tables 1A and 1B, above).
    - Butcher 12LC-423 – Should be Butcher Fed 12LC-423
    - Butcher 41LC-2833 – Should be Butcher State 41LC-2833
    - Hensley 13LC-2833 – Should be Hensley Fed 13LC-2833
    - Landeck 21WA-423 – Should be Landeck 21WA-323
    - State 24C-3533 – Should be Hall Fed 24C-3533
    - Taylor 34C-923 – Should be 20 Mile 34C-923
    - Taylor Fed 21LC-823 – Should be Harris Fed 21LC-823

3. Pages 20-21, Tables 4 & 5: There are some inaccuracies in the section (¼, ¼) designations in Tables 4 and 5, these changes are attached and will also be sent electronically.

4. Page 22, section D, second sentence: "… this classification is assigned because there are several permitted domestic wells within the immediate vicinity utilizing ground water from the Anderson, Canyon, Lower Canyon and Wall coal seams…". None of the domestic wells listed in Table 5 are known to be completed into coal. Rather, some of the wells don't have a definitive completion so we can't rule out that they are completed to the coal seams. Therefore, we request a wording change to "… this classification is assigned because there are several permitted domestic wells within the immediate vicinity <u>that may be</u> utilizing ground water from the Anderson, Canyon, Lower Canyon and Wall coal seams…".

5. Page 24, section I, first sentence: should read "Hydrogen Sulfide" instead of "Sulfide".

6. Page 29, Table 6: by definition, the UPL for Nickel shouldn't be lower than the UTL.

7. Page 37, first paragraph: "As a result, reservoir pressures in the Anderson, Wall, Canyon and Lower Canyon are approximately 25 psig", the pressures vary widely from coal seam to coal seam, therefore we request that "approximately 25 psig" be changed to "generally low".

Sincerely,

Matt Micheli
Corporate Counsel

Enclosures:

- Modified Tables 1A & 1B (changes highlighted in yellow)
- Modified Tables 4 & 5 (changes marked with comments)

December 22, 2011

Neil O. and Jennifer S. Miller
P.O. Box 742
Basin, WY 82410

Wyoming DEQ: Water Quality Division
John Passel
Herschler Building
4th Floor West
122 West 25th St.
Cheyenne, WY 82002

RE: Patriot Rough Draw Permit

Dear Wyoming DEQ John Passel,

Microbial conversion of coal to gas through the injection of chemicals and microbes into Wyoming's drinking water aquifers sounds insane to us. First off, do you have baseline water quality data of the affected areas? Near Basin we faced this very problem. A local stream might have been compromised by the injection of chemicals, but we had no baseline data to help with analyzing the future effects. The cost of obtaining baseline data should fall on Patriot/Luca.

Do you know the impacts of the chemicals on the health of Wyoming citizens? Have long-term studies been done and what are the results?

What will be the waste by-products of these chemicals and microbes? Have controlled experiments been performed in a safe lab situation? Have these results been achieved by other scientists?

Does the Wyoming DEQ really have a way to monitor this proposal so that our aquifers will not be compromised?

And are you really going to allow produced water from other aquifers to be injected into the project site!?! That's cross contamination!

Please deny this permit. Cleaning up contaminated aquifers is an impossible task. Don't go there for the profit of a few. Safeguard Wyoming's drinking water for our present and future citizens.

Respectfully,

Neil and Jennifer Miller

Neil O. Miller

Jennifer Miller

This post-injection monitoring period would be consistent with other experimental technologies under the UIC program, such as carbon sequestration. Therefore, it is clearly appropriate for DEQ to impose such a post-injection monitoring period.

Comments Regarding Section E Authorized Operations, the permit states:

After the cessation of Phase II operation, the Permittee shall perform post-injection monitoring and reporting for the remainder of the permit term. Should the first year of post-injection monitoring and reporting reveal no statistically significant change to groundwater water quality as determined by the Administrator, the permittee may petition the Administrator to reduce post-injection monitoring, modify the monitoring schedule, or to renew the permit.

1. Please explain or provide specifically how the DEQ reviews and determines there is not statistically significant change to groundwater quality and how the public will be involved in reviewing and participating in this provision in the permit? What would the Administrator consider to be a statistically significant change to groundwater?

2. Also, under this section we believe that any request or petition by the permittee to reduce post injection monitoring or modification to the monitoring schedule or renewal of the permit is actually a major modification to the permit and must go through the public notice process. Does DEQ consider this to be a major or minor modification? Please rewrite this section to address that concern and require any reduction of post injection monitoring or monitoring modification or renewal of the permit to go to public notice. Certainly, a permit renewal should go out for public notice and comment and not merely renewed through a petition to the Administrator.

The permit states: "*An amendment mixture comprised of vitamins and minerals, multi-nutrients, cell vitality enhancers and produced water (i.e. "injectate") will be added periodically. The amendment mixture is designed to support and encourage native microbes to produce methane.*"

1. Please provide specific evidence that you have in your possession that these "amendment mixtures" are comprised of vitamins, minerals, multi-nutrients and cell vitality enhancers and please list which specific constituents that will be injected fall under that category.

2. The material safety data sheets provided by DEQ that we reviewed of the proposed injectate constituents consists of chemicals and chemical compounds that according to the material safety data sheets can cause: severe irritation to skin and eyes, severe irritation to the respiratory system, ingestion causes nausea and vomiting, central nervous system effects, brain effects, renal failure and mutagenic effects. Please explain how the DEQ can permit the injection of chemicals carrying these warnings into drinking water aquifers that cause these types of human health effects? These specific chemicals include the following: Acetic Acid, Butyric Acid, Calcium Chloride, Calcium Lactate Mono Trihydrate, Decanoic Acid, Diposassium phosphate anhydrous, Formic Acid, Lactic Acid, Phosphoric Acid and Propionic Acid.

3. Please explain why DEQ is not requiring monitoring in the drinking water aquifer for the chemicals that will be injected? We believe that the mixture of chemicals that will be injected can damage and degrade the aquifer and cause health impacts to people and animals

drinking that water. DEQ asserts that the buffering capacity of the coal seams will prevent acidification of formation water by injected acids. It also expresses an expectation that injected nutrients will be consumed by microbial activity. It seems reasonable to test for these injected chemicals in the produced water, to confirm these assertions. We therefore request that DEQ require monitoring for all the chemicals or constituents that are proposed to be injected.

The permit states: "*An approved **Sampling and Analysis Plan (SAP)** that describes all injectate and groundwater sampling locations, sampling frequency, sampling constituents and parameters, equipment and procedures associated with sample collection, laboratory analysis, equipment decontamination, Quality Assurance/Quality Control, sample custody, data reporting, etc. from all sampled wells is required prior to authorization to inject.*

1. Please explain why the Sampling and Analysis plan is not included as part of this permit. We do not believe that the promise of reliance upon RCRA requirements is an appropriate substitute for a pre-approved SAP that addresses Class I waters. DEQ states in its own guidance, "In an effort to improve the consistency and quality of water-quality data submitted to the Land Quality Division, a groundwater sampling and analysis plan is recommended to be prepared and implemented as part of each research and development (R&D) and commercial scale in-situ mining permit."

2. Please explain how is the permit considered to be complete without an approved SAP plan that is also available for public review and comment?

3. Will the public have an opportunity to review and comment on the Sampling and Analysis plan? If not, why not?

Comments on Section I – Environmental Monitoring Program for Groundwaters of the State

1. Determination of UTL and UPL values

   PRBRC utilized EPA's ProUCL software to arrive at upper confidence limits (comparable to UTL's) for those parameters with baseline data. The analyses were conducted by seam and by phase. Phase 1 results are shown below, with various assumptions on data distribution characteristics. It can be seen that the choice of data distribution had only a minor effect on the resulting values.

Parameter and Seam	Distribution Model	Anderson	Canyon	Lower Canyon	Wall
Ammonia	Normal	0.62	0.96	0.87	0.71
	Lognormal	0.62	0.96	0.87	0.71
Iron	Normal	0.75	0.58	0.45	0.54
	Lognormal	0.75	0.58	0.45	0.54
	Gamma	0.77	0.59	0.45	0.54
Manganese	Normal	0.052	0.038	0.029	0.037
	Nonparametric	0.052	0.038	0.029	0.037
Sulfide	Normal	0.217	0.092	0.028	0.048
	Nonparametric	0.353	0.154	0.041	0.081
Total Dissolved Solids	Normal	1066	905	877	533
	Nonparametric	1075	905	877	534
	Lognormal	1066	905	877	534
pH	Normal - Right Tail	7.83	7.37	7.46	7.54
	Normal - Left Tail	7.58	7.21	7.35	7.43
Phenolics	Nonparametric	0.02	0.02	0.02	0.02
Sodium	Gamma	374	317	317	198

The Phase 1 calculations are simplified and repeated below.

PRO-UCL CALCULATIONS - Phase 1 Only

Parameter and Seam	Anderson	Canyon	Lower Canyon	Wall
Ammonia	0.62	0.96	0.87	0.71
Iron	0.75	0.58	0.45	0.54
Manganese	0.052	0.038	0.029	0.037
Sulfide	0.217	0.092	0.028	0.048
Total Dissolved Solids	1066	905	877	533
pH - Min	7.83	7.37	7.46	7.54
pH - Max	7.58	7.21	7.35	7.43
Phenolics	0.02	0.02	0.02	0.02
Sodium	374	317	317	198

For comparison, below is a table of upper tolerance limits and/or standards set forth in WDEQ Permit 11-207.

WDEQ PERMIT UTL STANDARDS - Phase 1

Parameter and Seam	Anderson	Canyon	Lower Canyon	Wall
Ammonia	1.01	1.74	1.25	1.01
Iron	1.74	1.14	0.74	1.14
Manganese	0.09	0.07	0.06	0.07
Sulfide	0.21	0.21	0.21	0.21
Total Dissolved Solids	1083	1083	1083	835
pH - Min	6.50	6.50	6.50	6.50
pH - Max	8.50	8.50	8.50	8.50
Phenolics	NA	NA	NA	NA
Sodium	NA	NA	NA	NA
Total Organic Carbon	NA	NA	NA	NA
Nickel	0.7	0.7	0.7	0.7
Nitrate	10	10	10	10
Nitrite	1	1	1	1
Sulfate	250	250	250	250
Zinc	5	5	5	5

The yellow cells indicate either state or federal regulatory standards, while the pink cells indicate an absence of baseline monitoring data.

For those parameters for which UTL values were derived by WDEQ, the differences between the two tables above may be attributable to treatment of non-detects or to the need to standardize among coal seams for certain parameters. Regardless, the differences are not sufficient to raise concerns.

2. Designation of parameters to monitor and regulate

Of greater concern to PRBRC is the suite of water quality parameters selected for baseline and ongoing monitoring. It is difficult to anticipate impacts from a new process such as this, for which the composition of the injectate has not been publicly disclosed. It seems reasonable, however, to expect increased microbial presence. One might also expect (potentially) dissolved organic compounds, either from pretreatment designed to solubilize the in-situ coal, or from the biogenic process itself. The test for phenolics could reveal some intermediate compounds, although WDEQ has not set a standard for this parameter. But this test might also miss simple organics or light hydrocarbons, which other biogenic processes have been known to produce. While these constituents, if present, may or may not pose a risk to human health, it is important to quantify them for public disclosure.

PRBRC therefore recommends that baseline samples be collected and analyzed for Total Organic Carbon (TOC, EPA Method 415.1), which appears in the table above but was apparently not included in the baseline monitoring program. We also recommend analysis of produced water, for Gasoline Range Organics and Diesel Range Organics (GRO/DRO, EPA Method 8015B). Phenolics should also be tested and regulated, such that no produced water samples exceed the maximum baseline level of 0.02 mg/L. Initial studies by Luca (February 2010) showed an increase in sodium concentrations therefore we recommend sodium be measured and regulated. Finally, as a measure of bacterial presence, we recommend a Heterotrophic Plate Count. Once operations begin, these parameters should be monitored with sufficient frequency and spatial coverage to demonstrate no statistical change from baseline.

3. Table 6 in the Permit lists the parameters to be regulated and their respective standards. This is a subset of the parameters listed in the Safe Drinking Water Act and in the Wyoming Water Quality Rules and Regulations, Chapter 8, Table I. However, we believe there are additional parameters that should be monitored and regulated based on the nature of the biogasification process proposed. For example, if fertilizers are included in the injectate, should phosphate (or other chemical) levels be tested? Since Table 6 includes TOC but does not impose any limits on this parameter, should a limit be established? If TOC is detected, at what level and what action does DEQ take?

4. According to the footnote on page 12 of the permit it appears that just over half of the 300 wells were actually sampled for background water quality. Based on our review of the maps provided by DEQ, it appears that the sampled wells are not spatially representative of all the wells. This is particularly true for the Wall, the Canyon and the Anderson seams. It is critical that DEQ ensure that there is no selection process going on that would compromise the validity of the background sampling. According to the experts we contacted, in the absence of such a

demonstration, a second round of sampling and analysis should be required for a randomly selected subset of the non-tested wells (once they have been repaired).

5. According to well data provided by DEQ, the Anderson seam was only sampled in 23 wells (all other seams had at least 40 data points). A sample size of 23 is small enough to introduce considerable uncertainty. More importantly, EPA's Unified Guidance document states that due to spatial variations, "appropriate background data must be obtained from each compliance point well." Please explain how compliance will be enforced for wells that have no background water quality data. Also, please explain how a single set of samples, almost 95% of which were taken within a two-week period, is representative of year-round water quality.

Section N – Mechanical Integrity

1. Please justify why pressure falloff testing requirements are relaxed in the Permit to only one per section on the premise that injection pressures will not exceed hydrostatic pressures? According to experts we consulted it seems counterintuitive since 15 psig at the surface would normally translate to slightly-higher-than-hydrostatic pressure at the perforation zone. DEQ needs to explain why, if the top of the hydrostatic surface is below the ground surface, or the producing zone has been dewatered, there is no potential to create an even higher differential pressure or fracture gradient between the injection well and the surrounding formation? The Permit states that CBM dewatering may have lowered the formation pressures to 25 psig. If that is the case, isn't it true that standing water alone would create a substantial pressure differential between the well (at depth) and the dewatered formation?

   We agree with the BLM comments filed in November that also recommends these injection wells should be held to the same standards as any other injection well in the PRB. Please justify the reduction in pressure falloff testing requirements or reinstatement of full pressure falloff test requirements.

Thank you again for your consideration of our comments. We look forward to additional information regarding the proposed permit and your responses.

With Best Regards,

Jill K Morrison

Jill Morrison
Powder River Basin Resource Council