ENCOURAGING RESPONSIBLE DEVELOPMENT TODAY ~ FOR TOMORROW

934 N. MAIN ST. SHERIDAN, WY 82801 (307) 672-5809 FAX (307) 672-5800
INFO@POWDERRIVERBASIN.ORG WWW.POWDERRIVERBASIN.ORG

POWDER RIVER BASIN
Resource Council

To: John Passehl **From:** Jill Morrison

Fax: **Date:** 6-10-11

Phone: 672-5809 **Pages:** 12 (Including Cover Sheet)

Re: **CC:**

☐ Urgent ☐ For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

•Comments:

Please note the large attachment - Luca report - noted on Page 4 and mentioned in attachments that it will be mailed with a hardcopy of our comments. This Luca report is about 45 pages.

ENCOURAGING RESPONSIBLE DEVELOPMENT TODAY – FOR TOMORROW

934 N. MAIN ST. SHERIDAN, WY 82801 (307) 672-5809 FAX (307) 672-5800
INFO@POWDERRIVERBASIN.ORG WWW.POWDERRIVERBASIN.ORG

POWDER RIVER BASIN
Resource Council

June 10, 2011

Wyoming Department of Environmental Quality
Attn: John Passehl, Water Quality Division
Herschler Building, 4th Floor West
122 West 25th Street
Cheyenne, Wyoming 82002
Submitted via first class-mail and via facsimile to: (307) 777-7610

RE: Draft Permit 10-498 – Patriot Energy Resources, LLC South Kitty CBM Injection

Comments and Request for Public Hearing

Dear Mr. Passehl,

Thank you for the opportunity to submit comments on the draft permit for Patriot Energy Resources (also known as Luca Technologies) to inject produced water mixed with chemicals designed to transform coal into methane gas through the "microbial conversion" process.

According to the draft permit, the purpose of the injection is "to stimulate coal bed methane production by encouraging microbial growth within the Wyodak coal seam." Draft permit at 9. However, at least the way we understand the process, the injection will not be stimulating naturally occurring methane, but rather will be using microbes to convert coal into natural gas. Thus, the process is more akin to in-situ coal gasification and regulation is appropriate with the Department of Environmental Quality under the Class V permit structure (as opposed to a Class II permit from the Oil and Gas Conservation Commission).

Our organization has a number of concerns about this process. First and foremost is a concern about the protection of our water resources. As identified in the draft permit and the notice, the formation where the company will be injecting its water mixed with chemicals is a drinking water aquifer. Draft permit at 9. Members of our organization obtain domestic and livestock water from this aquifer and we therefore have a significant interest in maintaining the quality of water in this formation.

To further complicate matters, the regulatory process for microbial conversion has yet to be established. There are rules currently pending with the Wyoming Oil and Gas Commission (WOGCC) following legislation that was passed in Wyoming in February. We are concerned that Luca may be jumping the gun by obtaining this permit prior to the regulatory structure being finalized. Please explain if and how DEQ considered the legislation and draft rules from the WOGCC.

Beyond these over-arching comments, we have several specific comments and questions regarding the permit.

Disclosure of the chemical additives

According to the fact sheet associated with this draft permit, the injectate consists of Wyodak and Smith aquifer produced water with "a very small component of additives designed to enhance microbial methanogenesis." The fact sheet goes on to say that, "The additives are primarily nutrients, such as those used in laboratories to culture microbes, and a very small amount of tracer." However, nowhere in the draft permit or accompanying information are the chemical additives listed and quantified. It is therefore impossible for members of the public reviewing this draft permit to determine what impacts will result to water sources. We believe DEQ should list and quantify the additives, tracers, and other constituents that were added to the water that will be injected with this permit. This disclosure would be consistent with the draft WOGCC rules for the microbial conversion process.

Through conversations with DEQ staff, we understand that Luca has claimed that such a list should be exempt to public disclosure because of concerns regarding proprietary information. However, Luca has previously disclosed its chemical list to the public through its website, emails, and even a news story. Please see attached chemical list and Gillette News Record article. Even if the specific formula of chemicals should remain exempt, the names of the additives and basic information about their amounts should not be held confidential given this previous disclosure by the company.

Determining Baseline Water Quality

The DEQ should fully disclose what "baseline" it will be using to determine whether there is a change in groundwater quality. According to WOGCC records, Luca already injected the chemical additives into these wells from 2008 through 2010. Therefore, the baseline for this permit should be the groundwater quality prior to that first injection, not what the groundwater quality is now. Determining the proper baseline is particularly important because under the draft permit the baseline concentration could be the permit limit: "the water quality of the Wyodak coal seam shall not exceed the permit limits identified in Table 6 or baseline concentrations as determined from baseline samples (see Section J(2)), *whichever is greater*." Draft permit at 9 (emphasis added). Please explain what the baseline values are and how they were established to set limits for this permit. Luca conducted water testing prior to its injections that could be incorporated into a baseline analysis.

Under section J, the permit requires Luca to offer all landowners with State Engineer permitted domestic wells within ½ mile the option of having their water wells tested. Did the water well owners that are listed in the permit receive notification of this proposed Class V permit? We believe that water well owners within the DEQ's proposed zone of influence should receive notice of the proposed permit and be offered an opportunity to comment on the proposed permit.

How did DEQ arrive at the ½ mile distance for monitoring? Is the ½ mile monitoring radius adequate in terms of a radius of influence given the proposal? In addition, it is unclear in the way the permit currently reads whether the testing, which is supposed to be baseline testing, will actually occur prior to the injection of produced water. The permit should be clarified to require testing of domestic water wells within a sphere of influence to take place at least thirty days before injections begin. Ideally, multiple tests in different seasons would be conducted to determine an accurate baseline.

We also believe that static levels in these wells should be monitored since the injection of water may influence the static head. What information does DEQ have regarding the influence on static level when water injections occur? In addition to horizontal transmission of the treated water that will be injected does DEQ have data on vertical transmission of injected waters? We believe the permit should require some monitoring above and below the injected coal zones.

The permit should also clarify at what intervals and frequency testing will be required to occur as testing will be necessary throughout the life of the permit and post-injection for groundwater quality monitoring. Additionally, we believe DEQ needs to require baseline testing and water quality monitoring of livestock wells within the area of review. Are livestock wells included in the monitoring proposal? If not, why not.

Impacts to water resources

The draft permit does not include a statement of basis with technical information to justify DEQ statements. This is problematic because it is difficult for the public to independently verify the information and meaningfully participate in the public review process under the Safe Drinking Water Act. For instance, DEQ states that "Since the primary component of the injectate is groundwater, the character of Wyodak formation water in the area of review should not change significantly" but the agency does not provide a technical explanation for this conclusion in the draft permit. Merely because the injectate will be mostly groundwater does not ensure protection of water resources if chemicals/nutrients have already been added (DEQ fact sheet) or will be added that could change groundwater quality. As discussed above, without a chemical list, it is difficult for the public to independently assess whether impacts are likely to occur. The permit also says that water will be injected from the Wyodak and the Smith zones. What is the water quality of the Smith zone? Does is vary significantly from the Wyodak? The majority, 81%, of water to be injected will be from the Smith zone please explain the quality of that formation and what influence, if any, it will have on the Wyodak formation.

Please explain how DEQ considered information from Luca and the WOGCC related to its previous injections during the permit review and writing. For instance, did the DEQ review information Luca submitted detailing what chemicals and constituents were injected at what locations and volumes? Did the DEQ review the groundwater monitoring data Luca compiled and submitted to the WOGCC? Did DEQ review the changes in groundwater quality? The DEQ should utilize the information submitted and provided to the WOGCC from 2008 to 2010 when Patriot/Luca was injecting chemicals/nutrients

In March of 2010, Luca submitted a copy of a report entitled, "A Review of the Effects of Restoration Operations on the Quality of Groundwater" by Roland DeBruyn, Glenn Ulrich and Brandon Hoffman. We have attached a copy of this report to these comments and we believe the information should be fully considered through this permit process. In the report Luca notes that, "A slight increase in TDS occurred as nutrients were added to field waters, however the resulting TDS of restoration fluids was still well below the 2,000 mg/L ceiling imposed by WOGCC." Page 4. On page 12 of the document, Luca states, "The median and average TDS of unamended field source waters was 830 mg/L and 916 mg/L respectively, compared to 1,100 and 1,170 mg/L for restoration fluids after amendment with nutrients. The addition of nutritional amendments resulted in an average 28% increase to the TDS of emplaced water." This information demonstrates a clear trend of increasing TDS after injection of the chemical additives.

In addition to this report, other information about post-injection water quality should be considered. Since the post-injection sampling was a very short-term exercise, how does DEQ know that the TDS levels will not continue to increase?

Under section G of the permit it says, "The Permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit." Does DEQ require a bond to be posted to ensure correction of adverse impacts? If not, why not?

Under section I at 2 the permit notes that some records regarding monitoring information and other application information will be maintained for three years. At #6 or section I, the permit states the Permittee shall retain records concerning the nature and composition of injected fluids for 5 years after plugging and abandonment. Please explain why these requirements for maintaining records regarding the monitoring information should not be the same as the records maintained for the injectate? Under section L. Records and Reports, the permit requires all records and reports for the permit will be retained for 3 years following permanent well abandonment. Please explain how this differs from the other record retention requirements and why the difference?

Hazardous or Dangerous Chemicals

We are concerned about the possible health impacts of some of the chemical additives. Luca's report to the WOGCC states that "[w]ith the exception of bromide anion, all analytes in restored samples fall within background concentration ranges measured in unrestored wells." Page 26. The use of the bromide anion as a tracer is a concern since experts have informed us that if water undergoes disinfection or is treated with chlorination, as some water wells are, then it is possible that the bromide added as a tracer could be oxidized to bromate, which is considered a carcinogenic disinfection by-product regulated by the Safe Drinking Water Act. Has DEQ considered the possible impacts of this? How is DEQ addressing this issue? Has the bromide tracer already converted to bromate in the area where it was injected?

The post-injection groundwater analysis conducted by Luca for WOGCC included some sampling for e-coli, but there was no sampling conducted regarding a clostridium bacteria that

causes black leg in livestock. Some scientists and landowners we have spoken with raise the concern that the nutrients or chemicals added could increase the strength and presence of the clostridium bacteria that causes black leg. What information or analysis does DEQ have on this issue and what testing would determine whether this type of microbial bacteria increases with the injection?

Abandonment or Conversion to Water Wells

This section of the permit requires notification to the administrator at least 7 days prior to abandonment and plugging and reclamation or the conversion to a water well. The permit should require DEQ to conduct a water quality test and inspection on any well prior to plugging and abandonment or conversion. Please explain how DEQ will know what the quality and status of the water in the well is prior to plugging if no final inspection and testing is conducted prior to the plugging of the well?

Future Permit Modifications

We appreciate the inclusion in the draft permit that "The Permitee may not add any chemical, nutrient restorations, or other amendments to this injectate without applying for a modification to this permit and obtaining authorization from the Department." Draft permit at 9.

Please clarify that any such modification will be open to public notice and comment. A public comment process for any modification should be part of this permit.

Additionally, we recommend that DEQ expand this permit requirement to prevent the injection of non-native or biologically altered microbes without a permit modification. Although Luca has claimed that they only intend to feed native microbes "nutrients," the company's patent application includes the possibility of injecting non-native microbes or microbes that have been biologically or genetically altered. The injection of non-native microbes is of great concern to our organization.

Request for a Public Hearing

As an organization consisting of more than 25 people, we request that DEQ conduct a public comment hearing pursuant to the Environmental Quality Act. We request that such a hearing be located in the Powder River Basin, close to Luca's proposed injection site, in Sheridan, Gillette, or Buffalo.

Thank you for your time and consideration of these comments. We look forward to your reply. Please keep us on the mailing list for notice of developments regarding this permit.

Sincerely,

Shannon Anderson
Jill Morrison
Powder River Basin Resource Council
934 N. Main St.
Sheridan, WY 82801

Attachments (sent via hardcopy only):

1) A Review of the Effects of Restoration Operations on the Quality of Groundwater" by Roland DeBruyn, Glenn Ulrich and Brandon Hoffman
2) Chemical list provided by Luca Technologies
3) Article from the Gillette News Record, *Luca: Here's what is going down the well*

Luca's Nutrients: Presence in Human Foods

May 2010

Vitamins and minerals

Calcium (added as Calcium chloride): ***milk***

Magnesium (added as Magnesium chloride): ***vegetables, cereal***

Phosphate (added as Magnesium phosphate, Phosphoric acid, Calcium phosphate, Sodium phosphate, Potassium phosphate, or Sodium tripolyphosphate): ***milk, cheese, meats***

Potassium (added as potassium chloride): ***milk, fruits, vegetables***

Vitamin B-12, Niacin, Thiamin, Riboflavin, Biotin, Pantothenic Acid, Folate: ***many foods, human vitamin supplements***

Multi-nutrients

Casein hydrolyzates: ***special dietary foods as a protein source***

Yeast Extract, Brewer's Yeast, Soy protein, Peptones: ***food flavorings***

Cell vitality enhancers

Glycerol: ***many prepared foods***

Weak organic acids (and sodium, potassium, calcium and magnesium forms):

Formic: ***fruits, honey***

Acetic: ***vinegar***

Propionic: ***butter, cheese***

Butyric: ***butter, cheese***

Lactic: ***yogurt, cottage cheese***

Decanoic: ***added to coat fruits and vegetables***

Glyceryl triacetate: ***food additive***

Ethyl lactate: ***wine, fruits, chicken***

Polyoxyethylene: ***sweeteners***

Tracers

Potassium iodide: ***most foods, especially seafood***

Sodium chloride: ***table salt***

Potassium chloride: ***substitute for table salt***

Sodium bromide: ***pharmaceutical, not present in foods***

Potassium bromide: ***pharmaceutical, not present in foods***

Luca: Here's what is going down the well

By STEVE MCMANAMEN, News-Record Writer smcmanamen@gillettenewsrecord.net

Published: Wednesday, May 19, 2010 12:43 PM MDT

A company wanting to farm methane in the Powder River Basin made its case to landowners Tuesday night, saying it will be profitable, it won't harm water resources and it may be able to steadily produce methane for 356 years.

Luca Technologies officials took questions from landowners and released the list of "nutrients" that it plans to put into old methane wells to stimulate native microbes to produce methane. They also will present that information, along with proposed rules and regulations for the burgeoning industry, to the Wyoming Oil and Gas Conservation Commission on June 8.

Most of the ingredients needed to make the microbes grow are also things humans need and regularly eat, Luca Technologies CEO Robert Pfeiffer told the crowd of more than 200 at the Clarion Inn and Convention Center.

"We have, up to this point, been working with the commission and they have approved what those ingredients are. But we thought it made a lot of sense to disclose those items and tell you what it is we put down there," Pfeiffer said. "So tonight is the night we are kind of unveiling that and making public what these ingredients are."

The ingredients, listed on a large poster at the presentation, are worth about $30 million, Pfeiffer said.

"It doesn't look like $30 million, but I can tell you it is about eight years of hard research and about $30 million," he said. "We thought that you would look at it and go 'Gee, I had a bunch of this for breakfast this morning.'"

Luca's process, which it calls a restoration, involves sending about 700 pounds of a precise mixture of the nutrients down into old methane wells with about 5,000 barrels of water out of the Wasatch Formation. The water and nutrients will sit in the coal formation — not the sands where water wells are — for a year or more. They will help to activate the microbes so they will eat the coal and produce methane. That methane can then be pulled off and sold just like a traditional methane operation.

The wells Luca has treated so far are producing from 30,000 to 40,000 cubic feet of gas a day. Those aren't high-producing wells. But because a restoration only costs about $10,000, Luca is still profitable at current gas prices, Pfeiffer said.

Luca expects to improve its technology to return more gas in coming years and hopes gas prices will go back up, which will increase profits.

Based on calculations of Powder River Basin coal and Luca's research, the company should be able to continue stimulating growth and producing methane for 356 years.

"And I am not being flippant," Pfeiffer said.

Landowners had some concerns and questions.

WATER: Luca recently bought 725 former Devon Energy wells, some of which are on land owned by Dudley and Marilyn Mackey. Luca has told landowners they will reuse the water pumped from the coal and no longer discharge it for ranch use.

"We've come to kind of depend on it, so if they inject all the water and don't let us use any of

it, it is going to hurt us," Dudley Mackey said.

Luca officials said they will allow use of some water for cattle, which Mackey said was satisfactory.

CONTAMINATION: Mackey wondered how far the nutrient water would travel when put back into the coal seam. He wanted to know if it could possibly contaminate other wells and move into other water aquifers. That shouldn't be a problem because of the amount of water being put back in the ground, Luca officials said.

JURISDICTION: One of Luca's issues is which agency will oversee the project — the Bureau of Land Management or the Wyoming Oil and Gas Commission. Luca is producing gas, which is regulated by the state commission, but the microbes are making the gas by consuming coal, which is regulated by the BLM.

"The BLM is throwing up its arms, as they should, and said what does that mean? Who owns that gas now?" Pfeiffer said. "We have made the arguments that it is the oil and gas (commission)."

Who is Luca?

☐ Luca Technoloties Inc. was founded in 2001 after researching biogenic methane production at its Golden, Colo., lab for several years.

☐ It started pilot programs in the Powder River Basin in 2006.

☐ The company first bought 100 wells near Sheridan. In 2008, it bought 529 more wells just east of Gillette. Luca recently bought another 725 adjacent wells and is moving toward commercialization of its technology.

What are the NUTRIENTS?

A typical restoration includes about 700 pounds of nutrients diluted in about 5,000 barrels of coal formation water.

- Vitamins and minerals / multi-nutrients: About 1.4 percent

Calcium, magnesium, phosphate, potassium, vitamin B-12, niacin, thiamin, riboflavin, biotin (in milk, cheeses and vegetables)

Casein hydrolyzates (protein source)

Yeast extract, brewer's yeast, soy protein

- Cell vitality enhancers: About 98 percent

Glycerol

Weak organic acids

Formic acid (in fruit)

Acetic acid (vinegar)

Propionic and butyric (butter, cheese)

Lactic acid (yogurt, cottage cheese)

Decanoic (used coat fruits and vegitables)

Glyceryl triacetate (food additive)

Ethyl lactate (wine, fruits, chicken)

Polyoxyethylene (sweetener)

- **Tracers: about 0.5 percent**

Potassium iodide (most food, especially seafood)

Sodium chloride (table salt)

Potassium chloride (substitute table salt)

Sodium bromide (pharmaceutical, not in food)

Potassium bromide (pharmaceutical, not in food)

Source: Luca Technologies