NRDC
THE EARTH'S BEST DEFENSE

NATURAL RESOURCES DEFENSE COUNCIL

September 27, 2013

Mark Novak
UDEQ Environmental Scientist
Utah Department of Environmental Quality
195 North 1950 West
Salt Lake City, UT 84116

**Re: Ground Water Permit for Red Leaf Resources to operate an oil shale mine in Uintah County, UT**

Dear Mr. Novak:

Enclosed is a CD of 35,761 comments submitted by NRDC online activists urging the Utah Department of Environmental Quality to reject the permit for Red Leaf Resources to operate an oil shale mine near Book Cliffs, Utah.

The majority of electronic messages failed to deliver to uwqcomments@utah.gov due to technical problems.

If you have any questions, please feel free to contact me at (212) 727-4456.

Sincerely,

Joyce Yeung
Online Advocacy Associate
Natural Resources Defense Council

Document Date 9/30/2013
DWQ-2013-006682

Document Date 12/17/2013
DWQ-2013-008594

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# Public comment for Red Leaf Resources Ground Water Discharge Permit No. UGW47002

**Bryan Larsen** <bklarsen@wheelercat.com> Tue, Aug 27, 2013 at 11:31 AM
To: "dhall@utah.gov" <dhall@utah.gov>, "wbaker@utah.gov" <wbaker@utah.gov>
Cc: Bryan Larsen <bklarsen@wheelercat.com>

Mr. Hall and Mr. Baker,

Please accept this email message as my contribution to the current public comment period in reference to Red Leaf Resources Ground Water Discharge Permit No. UGW47002.

To my understanding, a ground water discharge permit was initially issued to Red Leaf Resources in 2011 and now this permit approval is being challenged by an appeal from the Living Rivers group based in Moab, UT. Although I do not know of the specific information being presented by Living Rivers to support an appeal, I am continually surprised at the attention that these appeals from the same groups time and time again receive.

I agree that we need to be good stewards of the environment. I am a supporter of sustainable growth and sustainable use of natural resources, and I think a good balance of conservation and development benefits everyone. I do not agree that so many baseless appeals can have such a large impact in slowing or stopping construction / mining projects, and that they incur such a large amount of unnecessary costs to both public and private organizations for permits that have already been evaluated and issued.

From what I know of Red Leaf Resources and their processes they will do an outstanding job of operating an environmentally responsible project.

I would encourage the Utah Division of Water Quality to maintain their approval for the ground water discharge permit to Red Leaf Resources.

Thank you for your consideration.

Regards,

Bryan Larsen | Site Manager | Wheeler Mining Systems

# UINTAH COUNTY

## STATE OF UTAH

*Our past is the nation's future*





Mark Novak
Division of Water Quality
Mnovak@utah.gov
801-536-4358

RE: Red Leaf Resources Ground Water Discharge Permit DEQ Permit No. UGW470002

Dear Mr. Novak:

Uintah County appreciates the opportunity to provide comments on the above matter. Uintah County takes the position that the responsible development of mineral resources is beneficial to communities within Uintah County and the State of Utah as a whole. The revenue generated from mineral extraction provides jobs, resources and opportunities for our community (see generally Uintah County General Plan). As such, Uintah County supports Red Leaf Resources project. The following comments are not listed in any particular order of importance.

The County understands that The Natural Resources Defense Council (NRDC), Utah Oil Sands Resistance and other environmental groups have pre-written comment forms on their websites that only require the input of a person's name to automatically submit a comment opposing Red Leaf's permit. We anticipate many such submissions. Facts cannot be defined by the sheer volume of chatter.

Here are some facts about the Red Leaf process. Red Leaf doesn't use any water in the oil extraction process. Red Leaf only uses water for dust control, manpower and mixing the capsule clay liners. Further, it is our understanding that there are no aquifers near Red Leaf's production, so there is no water table to impact. Red Leaf has designed technology that is much cleaner than traditional oil shale development. Additionally, Red Leaf has reported to the County that it has committed to DWQ that it will monitor groundwater during the demonstration phase and relay its findings in order to ensure the process works as designed with no impact. Finally, because Red Leaf's process has no discharge water, the permit should be granted.

It is also appropriate to highlight some of the other benefits of this project. The oil shale industry in Utah could mean thousands of good paying jobs in the Uinta Basin. Over time, oil shale developers will contribute tens of millions of dollars will be paid to state and local governments in taxes and royalties. Increased domestic production will limit the nation's dependence on foreign oil.

Please feel free to contact us should you have any questions concerning our comments. We have no further comments at this time, but reserve the right to comment at a later date, if warranted.

UINTAH COUNTY COMMISSION

Mark D. Raymond, Chair

Michael J. McKee

Darlene R. Burns

**Ames Construction, Inc.**
3737 West 2100 South
West Valley City, UT 84120
801-977-8012 • Fax 801-977-8059



September 20, 2013

Division of Water Quality
P.O. Box 144870
Salt Lake City, UT 84114-4870

Attention: Mark Novak

Reference: Public Notice of Issuance of Ground Water Discharge Permit – Red Leaf Resources - Permit No. UGW470002

Dear Mr. Novak,

Ames Construction, Inc. is a heavy civil, mining and industrial general contractor that has maintained its regional headquarters office in West Valley City, Utah since 1985. We are a major supplier of construction services to the US mining industry and to Departments of Transportation through the US.

We are the selected contractor for the Red Leaf EPS Seep Ridge Project. We understand the approaches to permitting, environmental protection, engineering, and construction of the project. We are working closely with the Red Leaf team in the design phase and will be constructing the project. Red Leaf has a well thought out, through plan.

Having performed work the Utah/Nevada/Colorado Region for over 30 years, we are very familiar with the challenges and concerns of performing construction in harmony with nature. Being a professional in the environmental, mining, and construction field for 40 plus years, I am familiar with the necessary actions required for project development in concert with environmental and economic stewardship. We support and understand the environmental discipline's required to protect our natural resources and human health. We also understand and support the need to make beneficial use of the natural resources to maintain and enhance the quality of life.

We believe Red Leaf is and will continue to implement responsible actions and safe guards to protect the environment and people. We believe DEWQ should issue Red Leaf a permit for their project.

This project will provide direct employment for approximately 150 Ames employees over a two year period.

Sincerely,

Mark Brennan
President

SALT LAKE
EST. 1887
CHAMBER
UTAH'S BUSINESS LEADER

September 27, 2013

Mr. Mark Novak
Utah Department of Environmental Quality
Division of Water Quality
195 North 1950 West
Salt Lake City, Utah

Re: RED LEAF RESOURCES GROUND WATER DISCHARGE PERMIT DEQ Permit No. GW470002

Dear Mr. Novak

The Salt Lake Chamber supports Red Leaf Resources' (Red Leaf) planned oil shale project in the southern part of the Uintah Basin, and specifically the issuance of Red Leaf's ground water discharge permit.

Red Leaf's development will contribute to Utah's energy security, produce long-term jobs that will help our community grow and keep families closer together. Further, Red Leaf and other oil shale developers will contribute millions of dollars to Utah's economy and tax base in an environmentally responsible and economically viable manner.

The Salt Lake Chamber recently toured Red Leaf's development site in June of 2013 where Red Leaf demonstrated it's commitment to being a good corporate citizen and a responsible water user. Additionally, Red Leaf staff have shown their commitment to environmental stewardship and desire to work together with our community to develop this project in the most responsible manner possible. Red Leaf has also committed to monitor groundwater during the demonstration phase and report its findings in order to ensure the process works as designed with no negative impact on groundwater. If these findings hold true and Red Leaf has no discharge water, a permit should be granted.

Utah needs productive businesses like Red Leaf Resources that will produce economically and environmentally sound energy to help Utah and the nation become more energy independent.

Sincerely,

Lane Beattie
President and CEO
Salt Lake Chamber

175 E. University Blvd (400 S.) Ste. 600 Salt Lake City, Utah 84111 Office: 801.364.3631 Fax: 801.328.5098 www.slchamber.com

September 20, 2013

Division of Water Quality
P.O. Box 144870
Salt Lake City, UT 84114-4870

Attention: Mark Novak

Reference: Public Notice of Issuance of Ground Water Discharge Permit
Permit No. UGW470002

Subject: Comments

Mr. Novak,

I support the Red Leaf Resources Early Phase Capsule (EPS) Seep Ridge Project and based on review of the provided materials, it appears that this project will not adversely affect the State's groundwater resources. In fact from my little understanding of the regions hydrogeology, the water table elevation is unknown. This coupled with the fact that the best available technology applied will alleviate the potential for a discharge to the environment. Even if some kerogen oil did find its way to the environment, it is naturally occurring there to begin with and from my understanding of the process, the closed loop system will not discharge water. No chemicals are added to the process.

This project also contributes to the nation's domestic oil production diplomacy thereby lessening the dependency of foreign oil bettering the U.S. economy. Consequently, this directly bolsters Utah's economy with jobs creation and equity for schools.

The Red Leaf Resources EPS Seep Ridge Project has my unqualified support!

Sincerely,

Chris Ennes


September 19, 2013

Division of Water Quality
P.O. Box 144870
Salt Lake City, UT 84114-4870

Attention: Mark Novak

Reference: Public Notice of Issuance of Ground Water Discharge Permit
Permit No. UGW470002

Subject: Comments

Mr. Novak,

I have reviewed the technical documents supporting Red Leaf Resources ground water discharge permit application for the Early Phase Capsule (EPS) Seep Ridge Project.

The technical research coupled with drilling data identified a possible aquifer under the mine site to be greater than 600 feet below ground surface. Shallow perched water zone(s) are of poor water quality with no recharge. The area geology is made up of very low permeability strata's. Trace levels of petroleum constituents were reported in water samples taken from most wells.

The capsule design contains extensive containment materials in excess of what is necessary for toxic chemicals. There are no chemicals or water used in the extraction and processing of the oil and gas products. This in itself protects the environment. The product(s) that could be released to the soils are hydrocarbons, which currently exist in the undisturbed geologic strata's.

The above natural environment facts coupled with the best available technology for extraction and process design elements, alleviates the potential for a discharge to the environment and will not adversely affect the State's groundwater resources.

This project will have a direct and indirect positive effect on Utah's economy. Additionally, with the project being predominately on State Lands, the State's schools and children will be greatly benefited. Development of the resource contributes to the nation's domestic oil production diplomacy lessening the dependency of foreign oil.

I am in support of the Red Leaf Resources EPS Seep Ridge Project. DWQ should move forward with issuing a ground water permit to Red Leaf as soon as possible after the public comment period.

Sincerely,

Lennie Boteilho

September 24, 2013

Mr. Mark Novak
Ground Water Quality Protection Program
Division of Water Quality, Utah Department of Environmental Quality
195 North 1950 West
Salt Lake City, Utah 84116

RE: Please Reject the Permit for Red Leaf Resources

I am writing because I deeply admire Utah's special lands and wildlife. I urgently ask you to deny a company called Red Leaf Resources a permit for oil shale operations on state land near Book Cliffs. Located in eastern Utah, the Book Cliffs area contains some of the West's most important wildlife habitat (home to bighorn sheep, pronghorn golden eagles and more), stunning landscapes, as well as a spectacular stretch of the Green River. This area is home to outstanding outdoor recreation opportunities and local small businesses that depend on a pristine landscape for tourism.

All of that could be destroyed in a matter of months, if Utah allows Red Leaf Resources to use experimental technology to strip-mine oil shale less than 15 miles from the Book Cliffs wilderness.

This project would involve intense strip mining using an experimental technology that has never been tried before. The potential threats to local landscapes and water sources are enormous, yet the Department is not planning to require sufficient provisions to protect water, or even adequate monitoring of water sources like seeps and springs to ensure they are not contaminated. The Department has concluded that Red Leaf project will not degrade the ground water in the area, even though this is an experimental technology. (Red Leaf must be held to the highest environmental standards to protect ground water, rivers and wildlife habitat, to require the most stringent protections, and ensure monitoring to measure all the risks and impacts of the technology being used.)

While this project may be described as experimental, it could pave the way for much more extensive development in the region and pose serious threats to the natural resources of the Book Cliffs area.

Commercial scale oil shale development would lead to industrialization of vast tracts of land, as well as intense greenhouse gas emissions from extracting, cooking, and producing fuel in an area already suffering from drought and water shortages. Producing oil shale involves heating rock to high temperatures and turning it to liquid oil.

Not only does oil shale development dramatically increase global warming pollution - up to five times more than conventional oil, it threatens wildlife habitat and could lead to groundwater contamination.

The consequences of large-scale oil shale development would be devastating. I urgently ask the State not to issue a permit and reject the Red Leaf project.

Thank you for your help on behalf of Utah's, and America's, irreplaceable lands and wildlife.

Yours truly,
J. Capozzelli, New York

WESTERN RESOURCE
ADVOCATES

September 27, 2013

*Sent via email and hand delivery*



Mark Novak
Ground Water Section
Utah Division of Water Quality
195 North 1950 West
P.O. Box 144870
Salt Lake City, UT 84114-4870

*RE: Red Leaf Southwest # 1 Mine, Ground Water Discharge Permit No. UGW470002*

Mr. Novak:

Thank you for the opportunity to comment on the draft for Ground Water Discharge Permit No. UGW470002. These comments are submitted on behalf of Living Rivers, Grand Canyon Trust, Utah Chapter of Sierra Club, Southern Utah Wilderness Alliance, and Great Old Broads for Wilderness (Collectively Living Rivers).

Initially, we would like to credit Red Leaf Resources, Inc. (Red Leaf), for its efforts to quantify the extent of ground water resources in the area of the mine. Although these efforts fall short of what is needed, the company's actions show a willingness to respond to concerns raised previously in the Division of Oil, Gas and Mining permitting process. Additionally, Red Leaf has shown its willingness to monitor for possible leakage outside the Early Production System (EPS); and while these efforts fall short of what is needed, they are at least a step in the right direction. Unfortunately, the Division of Water Quality's (DWQ) approach to permitting oil shale and tar sands development undermines any attempts by Red Leaf to verify whether or not the EcoShale capsule design will perform according to the company's expectations. Rather than recognize this proposal for what it is – a first-generation proof-of-concept design requiring verification of its results – DWQ marginalizes numerous reports of ground water at the mine site that could be impacted by this operation and waves off attempts by the company to verify possible impacts from this prototype. Further, rather than treating this permit as a stand-alone operation and requiring the company to show that construction and testing of the EPS would not be harmful to ground water, DWQ treats this as the first part of a much larger, commercial-scale permit and defers many of the regulatory reporting requirements until some indefinite point in the future when the company will supposedly proceed with an application for modification of this permit. However, as there is no guarantee that the company will seek modification of this permit and therefore meet these regulatory requirements, those mandates must be part of the present permit.

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In a situation, such as this, it is imperative that DWQ recognize that one of the primary functions for constructing and testing the EPS is to determine whether the design of the capsule will perform as expected. For that reason, verifying the results of that testing is of critical importance. In order to determine whether or not, for instance, the design of the EPS will prevent release of contaminants into the environment, DWQ must require the company to undertake a stringent monitoring regimen as a critical part of this permit. Inexplicably, in this draft permit DWQ actually takes several steps backwards from what the company has proposed by requiring less, rather than more, monitoring of the capsule performance.

In order to comply with the law, DWQ is obligated to issue a permit that requires the company to conduct sufficiently rigorous sampling and analysis monitoring of the performance of the EPS to ensure protection of ground water, R317-6-6.3(I) and R317-6-6.4, to perform timely and thorough analysis of both the toxic characteristics of the spent shale within the EPS and the discharge rate emanating from the EPS, R317-6-6.3(F) and R317-6-6.4, to provide complete and accurate descriptions of the geology and hydrology in the area of the mine, R317-6-6.3(E) & (K) and R317-6-6.4, and to provide whatever information is required to show that any possible discharges from the EPS will be protective of waters of the state. R317-6-6.3(G) and R317-6-6.4. Further, DWQ may not treat the present proposal as part of some larger, commercial-scale operation that is not before the agency at this time, but must instead make a permitting decision on the company's request to permit the EPS. With that in mind, if DWQ chooses to issue a permit for the EPS, it must require the company to both conduct sufficient monitoring to determine whether or not the EPS has the potential to harm ground water and require the company to report the results of that monitoring on a timely basis.

**The Permit Must Contain a Detailed Sampling and Analysis Monitoring Plan for the Testing of Spent Shale.**

In its Statement of Basis, DWQ admits that some hydrocarbon product will remain in the capsule after heating and that this product will likely adhere to rock fragments and the metal collection plan. SOB at 3. Pursuant to R317-6-6.3(F), Red Leaf is required to identify the characteristics of its effluent or leachate. In order to accomplish this, the company has briefly outlined a plan for the sampling and analysis of spent shale taken from within the EPS following cooling of the capsule. Application at 6. Rather than requiring the company to finalize the sampling and analysis plan as part of its permit application, DWQ has chosen to defer this regulatory requirement until some indefinite point in the future. SOB at 3; Permit at 6. By taking this approach, DWQ has chosen to ignore the plain language intent of R317-6-6.3(F) and R317-6-6.4, under which it is necessary to determine whether the spent shale has the potential to cause contamination to local ground water. Instead, DWQ has tied the requirement to report the testing of this material to Red Leaf's theoretical modification of the permit at some indefinite future date. This approach by DWQ violates the requirements outlined in R317-6-6.3 and R317-6-6.4, deprives the public of the opportunity under R317-6-6.5 to meaningfully comment on how the company intends to meet this regulatory obligation, and completely sidesteps the agency's legal duty to treat this as a single and stand alone project with potential to impact ground water.

In approaching matters in this fashion, the agency has failed to account for the distinct possibility that Red Leaf – for any number of reasons – may choose to forego modification of the permit. Under the current permit provisions, the company would only be obligated to submit a plan for testing the spent shale 90 days before it intends to conduct the testing and would not be obligated to report the results of that testing unless the company decides to move forward with commercial production. Permit at 6. The same is true of the company's evaluation of the upper Bentonite Amended Shale (BAS) liner performance and the hydrologic properties of the spent shale as discussed in detail below. None of these results is required to be reported to DWQ unless and until the company seeks modification of its permit. However, this information is critical to determining to what extent the EPS could contaminate ground water. There is no justification for DWQ to waive these requirements until some uncertain future date. The Ground Water Quality Protection regulations require this information to be included as part of the application and incorporated into the current – rather than for some possible future – permit.

Further, DWQ is only requiring that the company conduct Synthetic Precipitation Leaching Procedure (SPLP) testing of these materials. Permit at 6. Because the SPLP uses a 20:1 liquid to solid ratio, the results of the test are a highly dilute leachate. Kuipers at 6, attached as Exhibit A.[1] Therefore, the appropriate test is the Meteoric Water Mobility Procedure (MWMP) which provides for the column percolation extraction of mine rock in order to determine the potential for dissolution and mobility of constituents by meteoric water. *Id.* The extract is then used to determine the final pH and release of certain constituents of the test sample under laboratory conditions. *Id.* In addition, the Toxic Characteristic Leaching Procedure (TCLP) method may also be appropriate for testing the spent shale. *Id.* Because the TCLP is designed to determine the mobility of both organic and inorganic analytes, this test may provide essential information in a setting where the identification of gasoline and diesel organics is critical. *Id*; *see also* Permit at 6. Ultimately, a full suite of tests including the SPLP, the MWMP and the TCLP should be performed on the spent shale.

Because there is no valid reason for DWQ's decision to waive the requirement that the company submit a sampling and analysis plan as required by R317-6-6.3(F) as part of its application and to defer such a submission until some uncertain future date, and because DWQ is not requiring Red Leaf to conduct an appropriate suite of testing on the spent shale, the agency's action is arbitrary and capricious and a violation of the law.

**The Permit Must Contain Provisions Requiring Rigorous Sampling and Analysis Monitoring of Liquid Buildup Within the Capsule.**

It is also a violation of the law for DWQ to brush aside Red Leaf's offer to conduct more extensive monitoring of liquid build-up on the top of the BAS near the collection drain trough on the steel floor. Application at 6. This monitoring would involve the collection of liquids in both the monitoring pipes and trench sumps on a weekly basis for a period of up to 2 months following their installation and thereafter on a monthly basis. *Id.* at 6-7. When liquids are detected in the monitoring pipes or trench sump, that detection would trigger resumption of weekly monitoring until four consecutive weeks have passed without liquid accumulation. *Id.*

[1] The Kuipers Report references the Red Leaf Notice of Intent to Commence Large Mining Operation, attached as Exhibit B.

The company then goes on to suggest that semi-annual sampling would replace monthly monitoring when six months have passed without additional liquid accumulation. *Id.*

Rather than requiring this level of monitoring of the discharge, DWQ is content to have the company monitor the drains leading from these points on a semi-annual basis beginning six months after shutdown. SOB at 8. Further, instead of having Red Leaf submit a complete monitoring plan of this discharge as required in R317-6-6.3(I), and evaluating that plan as part of the draft permit as required by R317-6-6.4, DWQ intends to allow the company to forego this requirement until some unnamed date in the future. In addition to illegally sidestepping the requirement to outline a thorough monitoring plan as part of this permit, DWQ is also depriving the public of an opportunity to meaningfully comment on this plan as provided for in R317-6-5. Because there is no valid reason for DWQ's decision to waive this requirement until some uncertain future date, the agency's action is arbitrary and capricious and a violation of the law.

**The Permit Must Contain Provisions for Monitoring for Liquids Beneath the EPS Capsule.**

The permit does not require complete and accurate information that shows that the discharge can be controlled as required by R317-6-6.3(G) and R317-6-6.4. While the company proposed to conduct additional monitoring in the trenches for product and heating pipes beneath the capsule, Application at 43, DWQ is of the opinion that such monitoring is of no value in this situation. As noted by the company, the analysis of water samples from these locations would provide an indication of any possible discharge of petrochemicals from the capsules. *Id.*

There are several reasons why monitoring beneath the capsule is critical. First, in spite of the fact that no information is presented to the public on the viability of the metal sheet design or any quality assurance/quality control measures which would be used to ensure the proper installation of this equipment, DWQ assumes that the metal sheet designed to collect the fluids and prevent seepage below the sheet will work as advertised. However, the metal sheet pan collection system is novel to this process and it is highly likely that the metal sheet will be affected by the heating and pressurization process, as well as by the weight and settling of the material. Kuipers at 4. These forces will cause warping and weld failures that will result in the sheet allowing solution to pass through the sheet and result in increased reliance on the BAS liner to capture and prevent solution discharge. *Id.*

Second, the stability of the backing walls and the integrity of the BAS liner are likely to be adversely affected by the heat and pressure generated within the capsules during the retorting process. *Id.* Other cover systems such as geomembrane liners and composite liners have been shown to be highly susceptible to conditions such as heating, which has resulted in significant degradation of liner integrity over time. *Id.* Liner integrity could also be affected by conditions such as the pressure and associated solution contact in the form of retort steam and liquid products. *Id.* Further wetting and drying of BAS liners can result in material shrinkage and desiccation. *Id.* Potential chemical alteration by mechanisms such as ion exchange can degrade the liner and compromise the integrity of the BAS. *Id.* If any of these conditions compromise the BAS liner, both the stability of the EPS and the ability of the liner system to prevent discharge would be adversely affected and it is highly likely that the result would be the release of contaminants from the capsule. *Id.* While the company claims that the BAS liner will have a

uniform hydraulic conductivity of 1x10-7 cm/sec across the entire surface of the capsule, if the permeability is not uniform because there are defects or cracks in the BAS layer, the seepage of water into the processed ore zone and from within the capsule to the exterior would be several orders of magnitude higher than modeled. Lips at 7, attached as Exhibit C.

Third, while the EPS is being proposed as a zero-discharge operation that will contain primary and secondary containment, Application at 10, only the primary BAS system offers containment and no secondary systems, such as a drainage and capture network below the BAS, have been proposed. Kuipers at 5; Lips at 10-11. Given the likelihood of failure of the BAS, DWQ should only issue a permit for the EPS if it is constructed on a liner system that incorporates a leak detection system, such as a geomembrane liner overlain by a geogrid draining to a collection point. *Id.*

Fourth, while the Application states that this is a zero-discharge operation, as noted in detail below the seepage analysis conducted by Red Leaf shows that a significant amount of water from precipitation will infiltrate through the upper BAS layer and, in all probability, through the bottom EPS layer. Lips at 7-9.

Fifth, there is the potential for differential settling over a longer period of time – years versus months – than is predicted. Kuipers at 5. This differential settling would mean that some areas of the capsule would settle more than others, *id.*, and that this settling would likely result in significant gaps in the upper BAS layer that would allow moisture from precipitation to enter the capsule relatively unimpeded. Lips at 7. Because the settling may occur over an extended period of time – in excess of five years and possibly as many as 25 years, *id.* – DWQ must account for the possibility that the resulting settling of the pile will make long-term effectiveness of the containment questionable and short-term reclamation of the surface difficult. *Id.* at 7.

Because there is a strong possibility that the BAS liner will fail due to heat and pressure, that the metal sheet could fail to perform as expected, and that differential settling will make the long-term effectiveness of the containment questionable thus allowing a significant amount of precipitation to infiltrate through the upper – and ultimately lower – BAS layers, and because DWQ is not requiring the company to construct the EPS on a liner system that incorporates a leak detection system, the agency's action is arbitrary, capricious and a violation of the law.

**The Permit Must Require Red Leaf to Excavate the Decommissioned Capsule to Verify Performance of the BAS Layer and Other Critical Components and Must Require the Company to Report the Results of its BAS Testing on a Timely Basis.**

In its Application, the company has stated that it is considering alternative design and construction methods for the bottom, side and cover BAS layers. Application at 32. However, the total lack of monitoring on the capsule exterior required in the DWQ permit will not allow the agency to determine whether the BAS layer remains intact across the majority of the capsule surface. As the company admits, "[n]o direct post operational evaluation or monitoring of the basal BAS layer will be performed." Application at 34. This is a fatal flaw in the company's plan and the resulting permit. While the company is appropriately proposing to construct a prototype of sufficient scale, in order to examine the impacts that the retort process has on the

BAS layer and other critical components such as the metal sheet, the company must excavate into the decommissioned capsule. Kuipers at 4. Without such excavation, there is no way for the company or DWQ to properly evaluate the results of the testing process. *Id.* Because DWQ is not requiring Red Leaf to excavate into the capsule in order to account for the performance of both alternative designs on the bottom and sides of the EPS and critical capsule components, there is no way for DWQ to verify whether the EPS will perform as expected as required by R317-6-6.3(G) and R317-6-6.4. Therefore DWQ's action is arbitrary, capricious and a violation of the law.

**The Application Fails to Accurately Characterize the Geology and Hydrology in the Area of the Mine.**

First, while Red Leaf's Application documents the presence of ground water in the wells drilled at the mine site and emanating from nearby springs, the company does not provide, and DWQ does not require, complete and accurate descriptions of these systems as required by the Ground Water Quality Protection regulations. *See* R317-6-6.3(E) & (K) and R317-6-6.4. For instance, while the Application indicates that there are layers containing ground water immediately below the mine site, the Application fails to properly document those aquifers. Lips at 4. Specifically, the Application notes the presence of an aquifer as close as 20 feet below the proposed mining operation, but fails to contain an adequately document such things as the quality of the water, the thickness of the aquifer, the direction of flow, porosity, hydraulic conductivity and flow systems characteristics. *Id.* at 5.

Second, while the Application contains a brief description of the October 2012 seep and spring survey, it completely fails to incorporate any of the information contained in the Supplemental Inventory conducted in May 2013. This omission is significant because the 2013 inventory corrected many of the conclusions drawn from the 2012 inventory, noting that "several areas marked as potential seeps were verified to be springs[,]…that seeps inventoried in October 2012 should now be classified as springs in May 2013[, and that] some of the smaller, previously identified individual springs were, in fact, larger springs that were part of gaining/losing systems." 2013 Inventory at 6. Rather than seriously considering the information contained in the 2013 Inventory, DWQ dismissed this information out of hand concluding that "no distinctly new seeps and springs were found in the May 2013 survey" and that the discharge of one of the springs identified in 2012 "appeared slightly higher in May 2013." SOB at 5.

The fact is that the 2013 Inventory documented two springs that showed appreciable amounts of water – .42 gallons per minute permit in one case, and .52 gallons per minute in another – and showed that all of the springs have less than 3,000 mg/l of total dissolved solids and therefore qualify for protection as Class II Drinking Water Quality Ground Water under the regulations. Lips at 5; *see also* R317-6-3.5 The 2013 Inventory also documented surface flow of up to 3,900 feet which supports vegetation and wildlife. Lips at 5; *see also* 2013 Inventory at 9-12.

The question left unanswered by both the Application and the SOB is what constitutes the source of the water that feeds these springs and what is the significance of the finding that eight individual springs exist down gradient of the mine site. Specifically, the question of whether

those springs could be impacted by the mine must be answered. In spite of that, the Application does not contain any geologic and hydrologic descriptions of the aquifers from which these springs emanate, or the ground water flow direction and aquifer materials. Lips at 5; R317-6-6.3(E). Rather than require Red Leaf to resubmit the Application in order to properly account for the new information regarding ground water that could be impacted by the mining operation, DWQ merely includes the information in its public notice and makes passing reference to it in the SOB. SOB at 5.

Third, there is no basis for the statement in the Application and the inventories that "[a]lluvial deposits are minimal in the RLR parcels and are insufficient to meet the state definition of an aquifer." Application at 17. Alluvium is not a condition necessary for the occurrence of ground water, as seen in the fact that there are many productive bedrock aquifers. Additionally, the importance of recharge to bedrock is emphasized in other sections of the Application, where the Douglas Creek outcrop is identified as an important zone of recharge. Finally, the assertion that alluvial deposits are insufficient and the assertion that marlstone is too impermeable to conduct significant ground water is contradicted by evidence in the record that notes that the B Groove, which is described in the Application as marlstone, is described as a productive aquifer in certain locations.

Fourth, DWQ's assumptions regarding possible impacts of the mine are based on an inaccurate characterization of ground water quality beneath the mine. In the SOB, DWQ makes the statement that ground water in the area of the mine is of such poor quality that it would not be impacted by contaminants from the mine. SOB at 7. However, DWQ has no basis for such an assumption. Lips at 6-7. Specifically, the manner in which Red Leaf conducted the monitoring of its wells does not make it possible to determine whether the water that has been analyzed derives from the aquifer in the Mahogany Zone, or from the aquifer in the sandstone layer a few tens of feet beneath the Mahogany. *Id.* Because the Application does not contain data related to water quality of the aquifer in the zone immediately beneath the proposed mine site, DWQ is not justified in its conclusion that ground water quality in the area of the mine will not be impacted. In any case, there is nothing in the record to suggest that the ground water beneath the mine contains petrochemicals or other contaminants that would be discharged from the mine and therefore that would not be adversely impacted by the operation of the mine.

Because the permit fails to require Red Leaf to accurately describe the geology and hydrology of the mine site as required in R317-6-6.3(E) & (K) and R317-6-6.4, and to incorporate and explain the results of the 2013 seep and spring inventory, and because DWQ's assumptions regarding possible impacts of the mine area based on an inaccurate characterization of ground water beneath the mine, the agency's action is arbitrary and capricious and a violation of the law.

**The Permit Fails to Demonstrate that the Discharge Can be Properly Controlled.**

The permit does not require complete and accurate information to show that the discharge can be controlled as required by R317-6-6.3(G) and R317-6-6.4. While the company claims that the mine operation will be a zero-discharge operation, Application at 11, that claim is based on the assumption that the EPS will be constructed with an "impermeable liner," *id.* at 4, and that

"water will not enter the hydrocarbon recovery zone of the capsules." *Id.* at 8. However, the company's own analysis shows that there will be a rate of seepage through the BAS layer of 1,683 gallons per year for a reclaimed capsule, and 73,772 gallons per year for a non-vegetated one. Lips at 7. Of critical importance is that the company performed this analysis assuming that there would be a uniform conductivity of $1x10^{-7}$ cm/sec across the entire surface of the capsule. However, if there are defects or cracks in the BAS layer, as discussed above, the seepage of water into the capsule will be several orders of magnitude higher than modeled. *Id.*

Further, seepage through the BAS is likely to be greater than the 1,683 gallons per year figure derived by the 30-year modeling conducted by the company for three reasons. First, the modeling failed to take into account the amount of time that it will take to completely saturate the overlying material. *Id.* This could take up to 10-15 years, and because the 30-year model failed to factor in this significant element, any results derived from that model are skewed. *Id.* Second, the model does not take into account the company's plans to regrade the top surface of the EPS. *See* Application at 8. As noted above, the long-term differential settling that is likely to occur will necessarily increase the amount of water that will penetrate the capsule. *Id*; *see also* Kuipers at 7. Third, the modeling also does not factor in the amount of time that will be necessary to establish vegetation at the mine site.

DWQ previously recognized the deficiencies of the modeling, and on February 12, 2012, requested that the company conduct modeling that would: 1) consider long-term performance of the capsule; 2) evaluate the time it would take to reach field capacity; and, 3) evaluate performance of the upper layer where the covering had been removed by erosion. Completeness Review, attached as Exhibit D. Rather than comply with DWQ's request, Red Leaf submitted a technical memorandum that completely fails to address the long-term management of the spent shale, the performance of the bottom BAS, the potential discharge from the EPS, and the point at which the lower portion of the EPS will reach field capacity. *See* Bayer Technical Memorandum; *see also* Lips at 8. Further, rather than requiring the company to submit this modeling as part of its Application, DWQ allows Red Leaf to submit a plan on how it intends to conduct such a study 90 days before beginning its testing and permits the company to wait until the theoretical application for a revised permit before requiring Red Leaf to submit this data. Because DWQ is improperly allowing the company to perform the evaluation after the EPS is constructed rather than requiring the company to provide complete and accurate information that shows that the discharge can be controlled, as required by R317-6-6.3(G) and R317-6-6.4, and because it is improperly denying the public a meaningful opportunity to comment on the company's plan to obtain such information, as required by R317-6-5, DWQ's action is arbitrary, capricious and a violation of the law.

**The Permit Fails to Require Red Leaf to Monitor Ground Water in the Area of the Mine.**

Given that Red Leaf has never constructed its proposed capsules, there is no basis in the record for DWQ to conclude "that construction of the EPS capsule as presented in Red Leaf's ground water discharge application will not degrade beneficial uses of ground water." SOB at 7. This is especially true given the admission in the previous sentence that "[t]he issuance of this permit is part of an evaluation phase that will be used to test assumptions and factors related to ground water protection, capsule performance and site conditions that are still not completely

known." *Id.* DWQ assumes that the BAS liner will remain intact after being subjected to extreme heat over an extended period of time. As outlined in detail above, there is no justification for this assumption. Further, DWQ is also unjustified in its assumption that there is an "unlikely possibility that the capsule would cause a discharge of contaminants to the subsurface," as a basis for concluding that monitoring ground water "would not provide useful information to evaluate Red Leaf's compliance with the Ground Water Quality Protection Regulations." SOB at 7.

Because the Application does not contain complete and accurate information showing that the discharge can be controlled and will not migrate into or adversely affect the quality of waters of the state, as required by R317-6-6.3(G) and R317-6-6.4, the company must conduct monitoring to determine the impact of the mine on ground water resources. Additionally, the ground water permit makes the incorrect statement that "[g]round water monitoring is not feasible at the site due to the impermeability of the shales that underlie it." Permit at 2.

While Red Leaf recognized that a continuous sandstone layer exists under the project area a few tens of feet below the mine, the company did not complete monitor wells that would allow for the sampling and analysis of the water quality in this aquifer. Lips at 9. Because of that, the company must be required to install new monitor wells that will adequately establish baseline conditions of the ground water in this aquifer as required by R317-6-6.3(I) and R317-6-6.4. *Id.* Further, DWQ must require that these wells continue to function as monitoring wells once mining operations begin. Lips at 2, 9-11.

Because the company identified eight springs down gradient from the well, DWQ must require the company to explain the significance of these springs, where the water is coming from and whether these waters can be impacted by Red Leaf's operation. *Id.* Further, once mining operations begin, the company must be required to monitor these springs to determine whether they will be impacted from the mine as required by R317-6-6.3(I) and R317-6-6.4. *Id.* While DWQ recognizes the uncertainties associated with the EPS, SOB at 7, DWQ fails to require the company to submit a sampling and monitoring plan as required by the Ground Water Quality Protection regulations and instead allows the company to submit a sampling and analysis plan at some point in the future. Permit at 6. This action both violates the requirements of R317-6-6.3(G) & (I) and R317-6-6.4, and deprives the public of the opportunity to meaningfully comment on this plan as provided for in R317-6-5 and is therefore arbitrary and capricious and a violation of the law.

**The Permit Does Not Contain a Closure and Post-Closure Management Plan as Required by R317-6-6.3(S).**

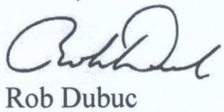
DWQ fails to require the inclusion of a Closure and Post-Closure Management Plan in the permit as required by the Ground Water Quality Protection regulations. *See* R317-6-6.3(S) and R317-6-6.4. Therefore there are no provisions for operational shut-down and subsequent drain-down and handling of petroleum containing liquids. Such a management plan is especially important in the case of an unplanned mine closure. Kuipers at 6. Various state and federal agencies require that an interim or emergency fluid management plan be part of reclamation and closure plans at mines. *Id.* If Red Leaf were to abandon the site during operations, it is likely

that the State of Utah would have to dispose of significant quantities of process solutions containing deleterious materials. *Id.* Because there is no mention of a closure or post-closure plan in either the Application or the Permit, DWQ's failure to address this deficiency was arbitrary and capricious and a violation of the law.

**Conclusion**

Thank you for the opportunity to comment on this Draft Permit. As always, we very much appreciate your willingness to consider our input and to work with us towards improving Utah's ground water quality.

Yours,



Rob Dubuc
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WESTERN RESOURCE
ADVOCATES

September 27, 2013 *Sent via email and hand delivery*

Mark Novak
Ground Water Section
Utah Division of Water Quality
195 North 1950 West
P.O. Box 144870
Salt Lake City, UT 84114-4870

*RE: Red Leaf Southwest # 1 Mine, Ground Water Discharge Permit No. UGW470002*

Mr. Novak:

Thank you for the opportunity to comment on the draft for Ground Water Discharge Permit No. UGW470002. These comments are submitted on behalf of Living Rivers, Grand Canyon Trust, Utah Chapter of Sierra Club, Southern Utah Wilderness Alliance, and Great Old Broads for Wilderness (Collectively Living Rivers).

Initially, we would like to credit Red Leaf Resources, Inc. (Red Leaf), for its efforts to quantify the extent of ground water resources in the area of the mine. Although these efforts fall short of what is needed, the company's actions show a willingness to respond to concerns raised previously in the Division of Oil, Gas and Mining permitting process. Additionally, Red Leaf has shown its willingness to monitor for possible leakage outside the Early Production System (EPS); and while these efforts fall short of what is needed, they are at least a step in the right direction. Unfortunately, the Division of Water Quality's (DWQ) approach to permitting oil shale and tar sands development undermines any attempts by Red Leaf to verify whether or not the EcoShale capsule design will perform according to the company's expectations. Rather than recognize this proposal for what it is – a first-generation proof-of-concept design requiring verification of its results – DWQ marginalizes numerous reports of ground water at the mine site that could be impacted by this operation and waves off attempts by the company to verify possible impacts from this prototype. Further, rather than treating this permit as a stand-alone operation and requiring the company to show that construction and testing of the EPS would not be harmful to ground water, DWQ treats this as the first part of a much larger, commercial-scale permit and defers many of the regulatory reporting requirements until some indefinite point in the future when the company will supposedly proceed with an application for modification of this permit. However, as there is no guarantee that the company will seek modification of this permit and therefore meet these regulatory requirements, those mandates must be part of the present permit.

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In a situation, such as this, it is imperative that DWQ recognize that one of the primary functions for constructing and testing the EPS is to determine whether the design of the capsule will perform as expected. For that reason, verifying the results of that testing is of critical importance. In order to determine whether or not, for instance, the design of the EPS will prevent release of contaminants into the environment, DWQ must require the company to undertake a stringent monitoring regimen as a critical part of this permit. Inexplicably, in this draft permit DWQ actually takes several steps backwards from what the company has proposed by requiring less, rather than more, monitoring of the capsule performance.

In order to comply with the law, DWQ is obligated to issue a permit that requires the company to conduct sufficiently rigorous sampling and analysis monitoring of the performance of the EPS to ensure protection of ground water, R317-6-6.3(I) and R317-6-6.4, to perform timely and thorough analysis of both the toxic characteristics of the spent shale within the EPS and the discharge rate emanating from the EPS, R317-6-6.3(F) and R317-6-6.4, to provide complete and accurate descriptions of the geology and hydrology in the area of the mine, R317-6-6.3(E) & (K) and R317-6-6.4, and to provide whatever information is required to show that any possible discharges from the EPS will be protective of waters of the state. R317-6-6.3(G) and R317-6-6.4. Further, DWQ may not treat the present proposal as part of some larger, commercial-scale operation that is not before the agency at this time, but must instead make a permitting decision on the company's request to permit the EPS. With that in mind, if DWQ chooses to issue a permit for the EPS, it must require the company to both conduct sufficient monitoring to determine whether or not the EPS has the potential to harm ground water and require the company to report the results of that monitoring on a timely basis.

**The Permit Must Contain a Detailed Sampling and Analysis Monitoring Plan for the Testing of Spent Shale.**

In its Statement of Basis, DWQ admits that some hydrocarbon product will remain in the capsule after heating and that this product will likely adhere to rock fragments and the metal collection plan. SOB at 3. Pursuant to R317-6-6.3(F), Red Leaf is required to identify the characteristics of its effluent or leachate. In order to accomplish this, the company has briefly outlined a plan for the sampling and analysis of spent shale taken from within the EPS following cooling of the capsule. Application at 6. Rather than requiring the company to finalize the sampling and analysis plan as part of its permit application, DWQ has chosen to defer this regulatory requirement until some indefinite point in the future. SOB at 3; Permit at 6. By taking this approach, DWQ has chosen to ignore the plain language intent of R317-6-6.3(F) and R317-6-6.4, under which it is necessary to determine whether the spent shale has the potential to cause contamination to local ground water. Instead, DWQ has tied the requirement to report the testing of this material to Red Leaf's theoretical modification of the permit at some indefinite future date. This approach by DWQ violates the requirements outlined in R317-6-6.3 and R317-6-6.4, deprives the public of the opportunity under R317-6-6.5 to meaningfully comment on how the company intends to meet this regulatory obligation, and completely sidesteps the agency's legal duty to treat this as a single and stand alone project with potential to impact ground water.

In approaching matters in this fashion, the agency has failed to account for the distinct possibility that Red Leaf – for any number of reasons – may choose to forego modification of the permit. Under the current permit provisions, the company would only be obligated to submit a plan for testing the spent shale 90 days before it intends to conduct the testing and would not be obligated to report the results of that testing unless the company decides to move forward with commercial production. Permit at 6. The same is true of the company's evaluation of the upper Bentonite Amended Shale (BAS) liner performance and the hydrologic properties of the spent shale as discussed in detail below. None of these results is required to be reported to DWQ unless and until the company seeks modification of its permit. However, this information is critical to determining to what extent the EPS could contaminate ground water. There is no justification for DWQ to waive these requirements until some uncertain future date. The Ground Water Quality Protection regulations require this information to be included as part of the application and incorporated into the current – rather than for some possible future – permit.

Further, DWQ is only requiring that the company conduct Synthetic Precipitation Leaching Procedure (SPLP) testing of these materials. Permit at 6. Because the SPLP uses a 20:1 liquid to solid ratio, the results of the test are a highly dilute leachate. Kuipers at 6, attached as Exhibit A.[1] Therefore, the appropriate test is the Meteoric Water Mobility Procedure (MWMP) which provides for the column percolation extraction of mine rock in order to determine the potential for dissolution and mobility of constituents by meteoric water. *Id.* The extract is then used to determine the final pH and release of certain constituents of the test sample under laboratory conditions. *Id.* In addition, the Toxic Characteristic Leaching Procedure (TCLP) method may also be appropriate for testing the spent shale. *Id.* Because the TCLP is designed to determine the mobility of both organic and inorganic analytes, this test may provide essential information in a setting where the identification of gasoline and diesel organics is critical. *Id*; *see also* Permit at 6. Ultimately, a full suite of tests including the SPLP, the MWMP and the TCLP should be performed on the spent shale.

Because there is no valid reason for DWQ's decision to waive the requirement that the company submit a sampling and analysis plan as required by R317-6-6.3(F) as part of its application and to defer such a submission until some uncertain future date, and because DWQ is not requiring Red Leaf to conduct an appropriate suite of testing on the spent shale, the agency's action is arbitrary and capricious and a violation of the law.

**The Permit Must Contain Provisions Requiring Rigorous Sampling and Analysis Monitoring of Liquid Buildup Within the Capsule.**

It is also a violation of the law for DWQ to brush aside Red Leaf's offer to conduct more extensive monitoring of liquid build-up on the top of the BAS near the collection drain trough on the steel floor. Application at 6. This monitoring would involve the collection of liquids in both the monitoring pipes and trench sumps on a weekly basis for a period of up to 2 months following their installation and thereafter on a monthly basis. *Id.* at 6-7. When liquids are detected in the monitoring pipes or trench sump, that detection would trigger resumption of weekly monitoring until four consecutive weeks have passed without liquid accumulation. *Id.*

[1] The Kuipers Report references the Red Leaf Notice of Intent to Commence Large Mining Operation, attached as Exhibit B.

The company then goes on to suggest that semi-annual sampling would replace monthly monitoring when six months have passed without additional liquid accumulation. *Id.*

Rather than requiring this level of monitoring of the discharge, DWQ is content to have the company monitor the drains leading from these points on a semi-annual basis beginning six months after shutdown. SOB at 8. Further, instead of having Red Leaf submit a complete monitoring plan of this discharge as required in R317-6-6.3(I), and evaluating that plan as part of the draft permit as required by R317-6-6.4, DWQ intends to allow the company to forego this requirement until some unnamed date in the future. In addition to illegally sidestepping the requirement to outline a thorough monitoring plan as part of this permit, DWQ is also depriving the public of an opportunity to meaningfully comment on this plan as provided for in R317-6-5. Because there is no valid reason for DWQ's decision to waive this requirement until some uncertain future date, the agency's action is arbitrary and capricious and a violation of the law.

**The Permit Must Contain Provisions for Monitoring for Liquids Beneath the EPS Capsule.**

The permit does not require complete and accurate information that shows that the discharge can be controlled as required by R317-6-6.3(G) and R317-6-6.4. While the company proposed to conduct additional monitoring in the trenches for product and heating pipes beneath the capsule, Application at 43, DWQ is of the opinion that such monitoring is of no value in this situation. As noted by the company, the analysis of water samples from these locations would provide an indication of any possible discharge of petrochemicals from the capsules. *Id.*

There are several reasons why monitoring beneath the capsule is critical. First, in spite of the fact that no information is presented to the public on the viability of the metal sheet design or any quality assurance/quality control measures which would be used to ensure the proper installation of this equipment, DWQ assumes that the metal sheet designed to collect the fluids and prevent seepage below the sheet will work as advertised. However, the metal sheet pan collection system is novel to this process and it is highly likely that the metal sheet will be affected by the heating and pressurization process, as well as by the weight and settling of the material. Kuipers at 4. These forces will cause warping and weld failures that will result in the sheet allowing solution to pass through the sheet and result in increased reliance on the BAS liner to capture and prevent solution discharge. *Id.*

Second, the stability of the backing walls and the integrity of the BAS liner are likely to be adversely affected by the heat and pressure generated within the capsules during the retorting process. *Id.* Other cover systems such as geomembrane liners and composite liners have been shown to be highly susceptible to conditions such as heating, which has resulted in significant degradation of liner integrity over time. *Id.* Liner integrity could also be affected by conditions such as the pressure and associated solution contact in the form of retort steam and liquid products. *Id.* Further wetting and drying of BAS liners can result in material shrinkage and desiccation. *Id.* Potential chemical alteration by mechanisms such as ion exchange can degrade the liner and compromise the integrity of the BAS. *Id.* If any of these conditions compromise the BAS liner, both the stability of the EPS and the ability of the liner system to prevent discharge would be adversely affected and it is highly likely that the result would be the release of contaminants from the capsule. *Id.* While the company claims that the BAS liner will have a

uniform hydraulic conductivity of 1x10-7 cm/sec across the entire surface of the capsule, if the permeability is not uniform because there are defects or cracks in the BAS layer, the seepage of water into the processed ore zone and from within the capsule to the exterior would be several orders of magnitude higher than modeled. Lips at 7, attached as Exhibit C.

Third, while the EPS is being proposed as a zero-discharge operation that will contain primary and secondary containment, Application at 10, only the primary BAS system offers containment and no secondary systems, such as a drainage and capture network below the BAS, have been proposed. Kuipers at 5; Lips at 10-11. Given the likelihood of failure of the BAS, DWQ should only issue a permit for the EPS if it is constructed on a liner system that incorporates a leak detection system, such as a geomembrane liner overlain by a geogrid draining to a collection point. *Id.*

Fourth, while the Application states that this is a zero-discharge operation, as noted in detail below the seepage analysis conducted by Red Leaf shows that a significant amount of water from precipitation will infiltrate through the upper BAS layer and, in all probability, through the bottom EPS layer. Lips at 7-9.

Fifth, there is the potential for differential settling over a longer period of time – years versus months – than is predicted. Kuipers at 5. This differential settling would mean that some areas of the capsule would settle more than others, *id.*, and that this settling would likely result in significant gaps in the upper BAS layer that would allow moisture from precipitation to enter the capsule relatively unimpeded. Lips at 7. Because the settling may occur over an extended period of time – in excess of five years and possibly as many as 25 years, *id.* – DWQ must account for the possibility that the resulting settling of the pile will make long-term effectiveness of the containment questionable and short-term reclamation of the surface difficult. *Id.* at 7.

Because there is a strong possibility that the BAS liner will fail due to heat and pressure, that the metal sheet could fail to perform as expected, and that differential settling will make the long-term effectiveness of the containment questionable thus allowing a significant amount of precipitation to infiltrate through the upper – and ultimately lower – BAS layers, and because DWQ is not requiring the company to construct the EPS on a liner system that incorporates a leak detection system, the agency's action is arbitrary, capricious and a violation of the law.

**The Permit Must Require Red Leaf to Excavate the Decommissioned Capsule to Verify Performance of the BAS Layer and Other Critical Components and Must Require the Company to Report the Results of its BAS Testing on a Timely Basis.**

In its Application, the company has stated that it is considering alternative design and construction methods for the bottom, side and cover BAS layers. Application at 32. However, the total lack of monitoring on the capsule exterior required in the DWQ permit will not allow the agency to determine whether the BAS layer remains intact across the majority of the capsule surface. As the company admits, "[n]o direct post operational evaluation or monitoring of the basal BAS layer will be performed." Application at 34. This is a fatal flaw in the company's plan and the resulting permit. While the company is appropriately proposing to construct a prototype of sufficient scale, in order to examine the impacts that the retort process has on the

BAS layer and other critical components such as the metal sheet, the company must excavate into the decommissioned capsule. Kuipers at 4. Without such excavation, there is no way for the company or DWQ to properly evaluate the results of the testing process. *Id.* Because DWQ is not requiring Red Leaf to excavate into the capsule in order to account for the performance of both alternative designs on the bottom and sides of the EPS and critical capsule components, there is no way for DWQ to verify whether the EPS will perform as expected as required by R317-6-6.3(G) and R317-6-6.4. Therefore DWQ's action is arbitrary, capricious and a violation of the law.

**The Application Fails to Accurately Characterize the Geology and Hydrology in the Area of the Mine.**

First, while Red Leaf's Application documents the presence of ground water in the wells drilled at the mine site and emanating from nearby springs, the company does not provide, and DWQ does not require, complete and accurate descriptions of these systems as required by the Ground Water Quality Protection regulations. *See* R317-6-6.3(E) & (K) and R317-6-6.4. For instance, while the Application indicates that there are layers containing ground water immediately below the mine site, the Application fails to properly document those aquifers. Lips at 4. Specifically, the Application notes the presence of an aquifer as close as 20 feet below the proposed mining operation, but fails to contain an adequately document such things as the quality of the water, the thickness of the aquifer, the direction of flow, porosity, hydraulic conductivity and flow systems characteristics. *Id.* at 5.

Second, while the Application contains a brief description of the October 2012 seep and spring survey, it completely fails to incorporate any of the information contained in the Supplemental Inventory conducted in May 2013. This omission is significant because the 2013 inventory corrected many of the conclusions drawn from the 2012 inventory, noting that "several areas marked as potential seeps were verified to be springs[,]…that seeps inventoried in October 2012 should now be classified as springs in May 2013[, and that] some of the smaller, previously identified individual springs were, in fact, larger springs that were part of gaining/losing systems." 2013 Inventory at 6. Rather than seriously considering the information contained in the 2013 Inventory, DWQ dismissed this information out of hand concluding that "no distinctly new seeps and springs were found in the May 2013 survey" and that the discharge of one of the springs identified in 2012 "appeared slightly higher in May 2013." SOB at 5.

The fact is that the 2013 Inventory documented two springs that showed appreciable amounts of water – .42 gallons per minute permit in one case, and .52 gallons per minute in another – and showed that all of the springs have less than 3,000 mg/l of total dissolved solids and therefore qualify for protection as Class II Drinking Water Quality Ground Water under the regulations. Lips at 5; *see also* R317-6-3.5 The 2013 Inventory also documented surface flow of up to 3,900 feet which supports vegetation and wildlife. Lips at 5; *see also* 2013 Inventory at 9-12.

The question left unanswered by both the Application and the SOB is what constitutes the source of the water that feeds these springs and what is the significance of the finding that eight individual springs exist down gradient of the mine site. Specifically, the question of whether

those springs could be impacted by the mine must be answered. In spite of that, the Application does not contain any geologic and hydrologic descriptions of the aquifers from which these springs emanate, or the ground water flow direction and aquifer materials. Lips at 5; R317-6-6.3(E). Rather than require Red Leaf to resubmit the Application in order to properly account for the new information regarding ground water that could be impacted by the mining operation, DWQ merely includes the information in its public notice and makes passing reference to it in the SOB. SOB at 5.

Third, there is no basis for the statement in the Application and the inventories that "[a]lluvial deposits are minimal in the RLR parcels and are insufficient to meet the state definition of an aquifer." Application at 17. Alluvium is not a condition necessary for the occurrence of ground water, as seen in the fact that there are many productive bedrock aquifers. Additionally, the importance of recharge to bedrock is emphasized in other sections of the Application, where the Douglas Creek outcrop is identified as an important zone of recharge. Finally, the assertion that alluvial deposits are insufficient and the assertion that marlstone is too impermeable to conduct significant ground water is contradicted by evidence in the record that notes that the B Groove, which is described in the Application as marlstone, is described as a productive aquifer in certain locations.

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Because the permit fails to require Red Leaf to accurately describe the geology and hydrology of the mine site as required in R317-6-6.3(E) & (K) and R317-6-6.4, and to incorporate and explain the results of the 2013 seep and spring inventory, and because DWQ's assumptions regarding possible impacts of the mine area based on an inaccurate characterization of ground water beneath the mine, the agency's action is arbitrary and capricious and a violation of the law.

**The Permit Fails to Demonstrate that the Discharge Can be Properly Controlled.**

The permit does not require complete and accurate information to show that the discharge can be controlled as required by R317-6-6.3(G) and R317-6-6.4. While the company claims that the mine operation will be a zero-discharge operation, Application at 11, that claim is based on the assumption that the EPS will be constructed with an "impermeable liner," *id.* at 4, and that

"water will not enter the hydrocarbon recovery zone of the capsules." *Id.* at 8. However, the company's own analysis shows that there will be a rate of seepage through the BAS layer of 1,683 gallons per year for a reclaimed capsule, and 73,772 gallons per year for a non-vegetated one. Lips at 7. Of critical importance is that the company performed this analysis assuming that there would be a uniform conductivity of $1x10^{-7}$ cm/sec across the entire surface of the capsule. However, if there are defects or cracks in the BAS layer, as discussed above, the seepage of water into the capsule will be several orders of magnitude higher than modeled. *Id.*

Further, seepage through the BAS is likely to be greater than the 1,683 gallons per year figure derived by the 30-year modeling conducted by the company for three reasons. First, the modeling failed to take into account the amount of time that it will take to completely saturate the overlying material. *Id.* This could take up to 10-15 years, and because the 30-year model failed to factor in this significant element, any results derived from that model are skewed. *Id.* Second, the model does not take into account the company's plans to regrade the top surface of the EPS. *See* Application at 8. As noted above, the long-term differential settling that is likely to occur will necessarily increase the amount of water that will penetrate the capsule. *Id*; *see also* Kuipers at 7. Third, the modeling also does not factor in the amount of time that will be necessary to establish vegetation at the mine site.

DWQ previously recognized the deficiencies of the modeling, and on February 12, 2012, requested that the company conduct modeling that would: 1) consider long-term performance of the capsule; 2) evaluate the time it would take to reach field capacity; and, 3) evaluate performance of the upper layer where the covering had been removed by erosion. Completeness Review, attached as Exhibit D. Rather than comply with DWQ's request, Red Leaf submitted a technical memorandum that completely fails to address the long-term management of the spent shale, the performance of the bottom BAS, the potential discharge from the EPS, and the point at which the lower portion of the EPS will reach field capacity. *See* Bayer Technical Memorandum; *see also* Lips at 8. Further, rather than requiring the company to submit this modeling as part of its Application, DWQ allows Red Leaf to submit a plan on how it intends to conduct such a study 90 days before beginning its testing and permits the company to wait until the theoretical application for a revised permit before requiring Red Leaf to submit this data. Because DWQ is improperly allowing the company to perform the evaluation after the EPS is constructed rather than requiring the company to provide complete and accurate information that shows that the discharge can be controlled, as required by R317-6-6.3(G) and R317-6-6.4, and because it is improperly denying the public a meaningful opportunity to comment on the company's plan to obtain such information, as required by R317-6-5, DWQ's action is arbitrary, capricious and a violation of the law.

**The Permit Fails to Require Red Leaf to Monitor Ground Water in the Area of the Mine.**

Given that Red Leaf has never constructed its proposed capsules, there is no basis in the record for DWQ to conclude "that construction of the EPS capsule as presented in Red Leaf's ground water discharge application will not degrade beneficial uses of ground water." SOB at 7. This is especially true given the admission in the previous sentence that "[t]he issuance of this permit is part of an evaluation phase that will be used to test assumptions and factors related to ground water protection, capsule performance and site conditions that are still not completely

known." *Id.* DWQ assumes that the BAS liner will remain intact after being subjected to extreme heat over an extended period of time. As outlined in detail above, there is no justification for this assumption. Further, DWQ is also unjustified in its assumption that there is an "unlikely possibility that the capsule would cause a discharge of contaminants to the subsurface," as a basis for concluding that monitoring ground water "would not provide useful information to evaluate Red Leaf's compliance with the Ground Water Quality Protection Regulations." SOB at 7.

Because the Application does not contain complete and accurate information showing that the discharge can be controlled and will not migrate into or adversely affect the quality of waters of the state, as required by R317-6-6.3(G) and R317-6-6.4, the company must conduct monitoring to determine the impact of the mine on ground water resources. Additionally, the ground water permit makes the incorrect statement that "[g]round water monitoring is not feasible at the site due to the impermeability of the shales that underlie it." Permit at 2.

While Red Leaf recognized that a continuous sandstone layer exists under the project area a few tens of feet below the mine, the company did not complete monitor wells that would allow for the sampling and analysis of the water quality in this aquifer. Lips at 9. Because of that, the company must be required to install new monitor wells that will adequately establish baseline conditions of the ground water in this aquifer as required by R317-6-6.3(I) and R317-6-6.4. *Id.* Further, DWQ must require that these wells continue to function as monitoring wells once mining operations begin. Lips at 2, 9-11.

Because the company identified eight springs down gradient from the well, DWQ must require the company to explain the significance of these springs, where the water is coming from and whether these waters can be impacted by Red Leaf's operation. *Id.* Further, once mining operations begin, the company must be required to monitor these springs to determine whether they will be impacted from the mine as required by R317-6-6.3(I) and R317-6-6.4. *Id.* While DWQ recognizes the uncertainties associated with the EPS, SOB at 7, DWQ fails to require the company to submit a sampling and monitoring plan as required by the Ground Water Quality Protection regulations and instead allows the company to submit a sampling and analysis plan at some point in the future. Permit at 6. This action both violates the requirements of R317-6-6.3(G) & (I) and R317-6-6.4, and deprives the public of the opportunity to meaningfully comment on this plan as provided for in R317-6-5 and is therefore arbitrary and capricious and a violation of the law.

**The Permit Does Not Contain a Closure and Post-Closure Management Plan as Required by R317-6-6.3(S).**

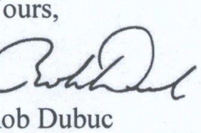
DWQ fails to require the inclusion of a Closure and Post-Closure Management Plan in the permit as required by the Ground Water Quality Protection regulations. *See* R317-6-6.3(S) and R317-6-6.4. Therefore there are no provisions for operational shut-down and subsequent drain-down and handling of petroleum containing liquids. Such a management plan is especially important in the case of an unplanned mine closure. Kuipers at 6. Various state and federal agencies require that an interim or emergency fluid management plan be part of reclamation and closure plans at mines. *Id.* If Red Leaf were to abandon the site during operations, it is likely

that the State of Utah would have to dispose of significant quantities of process solutions containing deleterious materials. *Id.* Because there is no mention of a closure or post-closure plan in either the Application or the Permit, DWQ's failure to address this deficiency was arbitrary and capricious and a violation of the law.

**Conclusion**

Thank you for the opportunity to comment on this Draft Permit. As always, we very much appreciate your willingness to consider our input and to work with us towards improving Utah's ground water quality.

Yours,



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# Exhibit A

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September 23, 2013

Rob Dubuc
Western Resource Advocates
150 South 600 East, Suite 2A
Salt Lake City, Utah 84102

Re: Expert Report, Red Leaf Resources – Seep Ridge Block, Southwest # 1 Mine

Dear Mr. Dubuc:

This letter constitutes my expert report in connection with Red Leaf Resources' proposal to mine and process oil shale before the Utah Department of Environmental Quality, Division of Water Quality (DWQ).

## INTRODUCTION

The focus of this report is my analysis of Red Leaf Resources' proposal to conduct oil shale retort operations. After reviewing the evidence in my possession, I have concluded that:

(1) Red Leaf Resources' proposed capsule technology has significant risk of both technical and economical failure;
(2) This results in a high likelihood that the containment system will not operate or function as intended or result in zero discharge and discharges to the environment are likely to occur;
(3) In the event discharges occur, there is a high likelihood that they will contain deleterious constituents and potentially result in water quality violations, and;
(4) There is a high likelihood of project failure and proponent bankruptcy and therefore it is important that there be an interim (emergency) closure plan to address a worst-case maximum cost situation where the operator abandons the site and uncontrolled discharges must be addressed by the regulatory agencies.

## BACKGROUND

I have a B.S. in Mineral Process Engineering from Montana College of Mineral Science and Technology (1983). I am a Professional Engineer (PE Mining/Minerals) currently registered in the states of Montana and Colorado. I have more than 30 years of professional experience in the mining industry and mining environmental compliance. A full resume is attached.

I worked in the mining industry from 1983 to 1996 in a successive series of positions ranging from shift foreman to mill superintendent, and corporate analyst to project manager. I was involved during that time in a number of positions involving mineral process technology research and design as well as prototype implementation

Since 1996, I have been the principal of J Kuipers Engineering, reformed as Kuipers & Associates, LLC in 2003, with offices in Wisdom and Bozeman, Montana. Kuipers & Associates provides engineering consulting and other technical services to a variety of clients including local, state, federal and tribal government and non-government public interest organizations. Kuipers & Associates specializes in hardrock mine permitting, operations, reclamation and closure. We have a particular emphasis on mine site characterization, toxic release response planning including the use of source controls as well as wastewater management and treatment, as well as associated cost estimation and financial assurance. I am the principal consulting engineer.

During my career I have been directly involved in the design, construction and operation of more than a dozen mine sites using reclamation covers and mining associated wastewater treatment plants. Additionally, I have reviewed or participated in the design and implementation of reclamation covers and water treatment plans at numerous other mine sites in the western U.S. and Canada. I have also conducted several surveys of mining industry reclamation practices, including source controls (e.g., removals, engineered covers, groundwater diversions) and water treatment requirements, and have authored papers and taught courses on the application of source controls and water treatment and associated cost estimation. Further information together with a list of all my publications during the last 10 years is listed in my attached resume.

Since 2003, I have provided consultant services to the U.S. EPA on the topic of source controls, wastewater treatment and cost estimation. Specifically, from 2003 to 2005 I developed EPA's Draft Hardrock Mine Cleanup Financial Assurance Cost Estimation Guide and from 2006 to present have provided training on hardrock mine reclamation and closure cost estimation to most of the EPA regions and to the country of Chile on EPA's behalf. Since 2010, I have provided assistance to EPA on cost estimation guidance and policy concerning rulemaking for financial assurances for potential release of contaminants at hardrock mines and mineral processing facilities.

## FACTS AND DATA CONSIDERED

To prepare this report, I reviewed the revised Ground Water Discharge Permit Application (Ground Water Application or Application) received by the Utah Division of Water Quality (DWQ) in June, 2013, in addition to documents cited elsewhere and described in the References section of this declaration.

### SITE INFORMATION

The EcoshaleTM In-Capsule Technology (hereinafter referenced as "capsule") approach proposed for the project is a new method for the extraction of petroleum containing liquids from oil shale. The capsule method in some respects is comparable to heap leaching for gold or

copper versus traditionally more energy intensive milling processes. Similarly, the capsule approach would utilize sized material placed in a Bentonite Amended Soil (BAS) lined facility (JBR, 2013 p. 4)[1] rather than more intensive milling and retorting processes employed in the past and at present in oil shale producing regions such as Estonia. The oil shale capsule approach would then seal the pile and apply heat in order for the pile to act as a retort and mobilize the contained petroleum. Capsules would be located within mined areas and be stacked two high and would be reclaimed by standard techniques following cooling and settling of the capsules.

For the purposes of the Ground Water Application, Red Leaf is proposing construction of a 3/4 scale prototype, which the company refers to as the Early Production System (EPS). According to the Application (JBR, 2013 p. 5), the EPS is designed to standards believed necessary to confirm proofs of concept for the key design components of the Ecoshale capsule, including the bedding material for piping, insulation effectiveness, heat delivery and product recovery manifold effectiveness, BAS thickness, construction procedures, capsule dimensions, and capsule containment effectiveness, especially roof performance during capsule settling.

## ANALYSIS

### Capsule Stability

The stability analysis performed for Red Leaf was a "preliminary analysis" conducted by Norwest (Norwest, 2011b p. 1)[2], and in general all materials that have been reviewed do not appear to contain the level of site-specific technical analysis which should be required of the project proponent in the Ground Water Application. A preliminary analysis uses professional judgment rather than site-specific data and generally relies upon the project proponent to conduct detailed final analysis using site-specific data to verify the results of preliminary analysis. Similarly, model parameters used were assumed and apparently based on experience with similar materials and literature review (Norwest, 2011a p. 2)[3] rather than site-specific materials information which would provide much more reliable data. It is not uncommon for plans to require significant changes to the foundation and containment designs over successive design generations to account for site-specific conditions when they are based on preliminary analysis. In order to provide for confident data and analysis the Norwest analysis should have contained more detailed and final analysis based on borings and materials analysis from a variety of samples representative of the actual site conditions.

The BAS and insulating gravel units were not included in the preliminary backing wall stability analysis (Norwest, 2011a p. 2) and should be considered in a more detailed analysis using site-specific data. The BAS and insulating gravel units represent potential weak layers in the design. According to the proponent's consultant, the intact strength of the bedrock foundation and risk of planar bedding failures through weak layers would affect the stability of the backing walls and

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[1] (JBR, 2013) Utah Ground Water Discharge Permit Application for Red Leaf Resources, Inc., Southwest #1 Project, JBR Environmental Consultants, Inc., June, 2013.

[2] (Norwest, 2011b) Reclamation Cover Performance Monitoring, Red Leaf Resources, Norwest Corporation, November 7, 2011.

[3] (Norwest, 2011a) Stacked Capsule Backing Wall Stability Analysis, Michael Graham, Norwest Corporation to Shawn Packard, Red Leaf Resources, April 21, 2011.

impact the integrity of the BAS liner and should be further investigated and include lab testing of actual site materials (Norwest, 2011a p. 4). Planar failures result when a discontinuity dips out of a slope surface such as that of the BAS and insulating gravel layer. For this reason, the information in the NOI should have contained additional investigations related to the site-specific materials to be used in creating the BAS and insulating gravel units and their properties and the BAS and insulating gravel units should have been included in the stability analysis.

The stability of the backing walls and the integrity of the BAS liner will be adversely affected by the heat and pressure generated within the capsules during the retorting process and should be evaluated during the EPS testing (Norwest, 2011a p. 4). While no comparable design has been methodically tested for performance under similar conditions, other cover systems such as geomembrane liners and composite liners using soil and geomembrane systems have been shown to be highly susceptible to conditions such as heat resulting in significant degradation of liner integrity over time.[4] Liner integrity would similarly likely be affected by other conditions such as the pressure and associated solution contact in the form of retort steam and liquid products. Wetting and drying of BAS liners can result in material shrinkage and desiccation. Potential chemical alteration by mechanisms such as ion exchange could degrade the liner and compromise the integrity of the BAS. If the BAS materials are compromised by any of these processes, the stability of the capsules as well as the integrity of the liner system to prevent discharge would be adversely affected and it is highly likely that this would result in a release of deleterious materials.

While the company is appropriately proposing to construct a prototype EPS at a significant scale, it is not proposing to excavate into the decommissioned EPS capsule in order to examine the impacts that the heating process will have on the BAS materials and on such critical components as the metal sheet that the company plans to use to collect fluids. Without such excavation and examination of the potential degradation of the buffer and liner system and examination of its integrity relative to the EPS test conditions, there is no way for the company or regulatory agencies to properly evaluate the results of the testing process.

**Process Solution and Post-Retort Draindown and Leachate Collection**

A metal sheet, referred to as the oil collection pan, is proposed above the BAS to collect fluids and prevent seepage together with collection pipes (JBR, 2013 p. 28), however no information is presented to the public as to the viability of the metal liner design and collection pipe system or quality assurance/quality control measures to ensure their proper installation, all of which have been shown to be highly important in heap leach and other similar designs. The metal sheet pan collection approach is novel to the proposed capsule process and has not been used elsewhere to my knowledge. It is highly likely that the metal sheet will be affected by the heating and pressurization process as well as the weight and settling of the material and will cause warping and weld failures in the metal sheet which will result in the sheet allowing solution to pass through the sheet and in turn result in increased reliance on the BAS liner to accomplish capture and to prevent solution discharge.

[4] (Koerner, 2011) Koerner, R., Hsuanj, Y., Koerner, G., Geomembrane Lifetime Prediction: Unexposed and Exposed Conditions, Geosynthetic Institute GRI White Paper #6, Updated February 8, 2011.

According to the Bureau of Land Management (FPEIS p. 4-31 to 4-32)[5] common impacts from oil shale development include "Spent shale piles and mine tailings that might be sources of contamination for salts, metals, and hydrocarbons for both surface and groundwater" and (DPEIS p. 4-32) "Degradation of groundwater…from contributions of residual hydrocarbons or chemicals from retorted zones after recovery operations have ceased; and, from spent shales replaced in either surface or underground mines." Based on this information the proponent has not adequately identified the spent shale as a potential source of deleterious materials and as a result has not emphasized the proper management of these materials either during operations, in the event of unanticipated closure, during the solution draindown period, or post reclamation. Given the high likelihood for capsule liner failure as previously described, there is an equally high risk that any solution which escapes from the capsule will contain deleterious constituents.

The operation is proposed as a zero-discharge operation that will include primary and secondary containment (JBR, 2013 p. 10). However, other than the primary BAS system no additional secondary containment such as a drainage and capture network below the BAS has been proposed for the EPS. Given the potential likelihood of failure of the BAS, a true zero-discharge design would incorporate an additional redundant liner and leak detection system, such as a geomembrane liner overlain by a geogrid draining to a collection point. In addition, at least one if not more downgradient groundwater monitoring wells should be included in the EPS proposal as an additional measure of BAS system containment.

The proposal relies on "proprietary fabrications" to address BAS seal function (JBR, 2013 p. 30). In a heated and pressurized retort environment this is problematic given the high likelihood of failure that liner seals have exhibited in other similar designs under less onerous conditions. Considerable effort has been required to successfully design and construct liner seals in heap leach processing and other applications which are relatively mundane in comparison to the requirements which will be placed on liner seals in a heated and pressurized retort environment. The liner seals proposed for the capsule design which consists of a pressurized and heated retort application represent a specific design area in this novel approach where there is a high likelihood of failure which would be likely to result in discharge of retort solutions containing deleterious constituents.

Further, there is a significant potential for differential settling within the capsule which would occur over a longer term (e.g. years versus months) than is predicted. Differential settling would result in some areas of the pile settling more than others and is common in similar instances where large amounts of settling relative to the overall material height have been constructed. The EPS proposal will allow for evaluation of settling however the time period over which it may occur could be in excess of five years and take place for potentially 25 years or more.

**Post-Closure Sampling**

According to the draft public notice version of the Statement of Basis, Red Leaf will be required to obtain representative samples of spent shale, including hydrocarbons, and analyzed by the

[5] (FPEIS, 2012) Final Programmatic Environmental Impact Statement and Possible Land Use Plan Amendments for Allocation of Oil Shale and Tar Sands Resources on Lands Administered by the Bureau of Land Management in Colorado, Utah and Wyoming, U.S. Department of the Interior, Bureau of Land Management, November 2012.

SPLP method. It is widely recognized that the SPLP method (ASTM D6234-98, EPA Method 1312, Standard Test Method for Shake Extraction of Mining Waste by the Synthetic Precipitation Leaching Procedure (SPLP)), which uses a 20:1 liquid to solid ratio, results in a highly dilute leachate. A more appropriate alternative method would be to use the MWMP method (ASTM-E2242-12a, Standard Test Method for Column Percolation Extraction of Mine Rock by the Meteoric Water Mobility Procedure (MWMP)). This test method provides a procedure for the column percolation extraction of mine rock in order to determine the potential for dissolution and mobility of certain constituents by meteoric water. This test method is intended as a means for obtaining an extract from mine rock samples. The extract may be used to estimate the final pH and release of certain constituents of the test sample under the laboratory conditions described in this test method. In addition, testing by the TCLP method (EPA Method 13, Toxic Characteristic Leaching Procedure (TCLP)) may also be appropriate. The TCLP method is used to determine if a waste is hazardous under RCRA. It is intended to simulate municipal landfill containing organic wastes. The TCLP is designed to determine the mobility of both organic and inorganic analytes present in liquid, solid, and multiphasic wastes.

Due to the undefined nature of the spent shale oil in terms of regulatory jurisdiction (e.g. RCRA applicability) we recommend that testing be performed on representative samples using SPLP, MWMP and TCLP methods. In addition it is important that separate samples representative of various areas and depths of the EPS be sampled and individually analyzed to determine variability within the EPS. A single representative sample of the EPS would not be representative of the capacity of various parts of the pile to contain and leach significant contaminants.

**Closure and Post Closure Management Plan**

No provisions for operational shut-down and subsequent drain-down and handling of petroleum containing liquids are contained in reclamation and closure information provided in the Application. This is especially important in the case of an unplanned mine closure. The inclusion of interim fluid management, also referred to as emergency fluid management, is an integral reclamation and closure task common to mine sites recognized by the Office of Surface Mining, Bureau of Land Management, Forest Service and states such as Nevada and Montana. The typical tasks required include management of process solutions upon operator bankruptcy resulting in the abandonment of the site to prevent discharge of those solutions, and involves the cost of manpower, equipment and materials involved in the management of those materials for a minimum of six months and in some cases three years or more.

In the event Red Leaf Resources were to abandon the site during operations it is likely that the State of Utah would have to manage significant quantities of in-process solutions as well as immediate draindown solutions from the capsules. It is also likely that the State would eventually have to dispose of significant quantities of process solutions containing deleterious materials. Both of these tasks could result in significant cost to Utah taxpayers if the interim water management and fluid draindown tasks are not addressed in the reclamation and closure plan and associated costs are not covered by a bond for these activities.

## CONCLUSIONS

Based on my review the following conclusions can be reached concerning the risks presented by the proposed capsule technology: (1) The new technology has only been demonstrated at a pilot scale and is technically and economically unproven as a commercially viable technology; (2) Given the history of similar endeavors in the mining and oil/gas industry it is highly likely that the project will prove to be uneconomic and could cease operations within 2-3 years of start-up or otherwise during the expected course of operations; (3) Given similar technological developments it is likely that initial efforts to capture and contain liquid petroleum containing products will not be successful as it is highly likely that unexpected forces will be exerted in terms of liquid head or saturation within the pile resulting in the additional potential for loss of liquid products containing deleterious materials outside the capsule, and; (4) The degree to which the retorting process might result in deformation or reaction with the capsule materials as well as the resulting settling of the pile makes long-term effectiveness of the containment questionable and short-term reclamation of the surface of the capsule difficult due to highly uneven surfaces requiring significant regrading to accomplish positive drainage off the top surface of the reclaimed capsules.

The capsule proposal is without precedence from an engineering standpoint and therefore has inherent risks. It is not known how a three-foot thick bentonite liner will perform under the proposed conditions. We know how a six or twelve inch liner used for heap leaching or municipal waste disposal (e.g. landfill) might behave under much less rigorous conditions and know that failures are typically very site or incident specific. This means reliance on preliminary analysis rather than site-specific data is likely to lead to underestimation of failures, and that processes which exert more demands, such as those involving heat and pressure, would be more likely to result in failures. How a three-foot thick liner used in retort conditions with heat and pressure might behave in terms of fluid containment over the short or long-term, is as much dependent on the oil and gas retorting process, which is also novel in this case, as it is on the novel liner itself in this specific application.

My best professional judgment is that because this is a novel concept involving significant chemical and physical demands upon the proposed BAS containment system there is a high likelihood there will be significant failures resulting in release of deleterious materials. And while construction of the Early Production System could answer many of those questions, the company does not propose to take the necessary step of doing post-decommissioning excavation of the capsule and require installation and monitoring of a secondary leachate collection system in order to allow for direct examination in order to determine how the BAS liner has performed. Without this essential step, there is no assurance that the BAS liner integrity, metal sheet design, seal designs, and post-operation settlement of the EPS will perform to similar expectations in a commercial application. In addition site-specific data should be gathered and used to evaluate stability and other aspects of the proposed design.

If you have any questions or require additional information, please do not hesitate to contact me at (406) 689-3464.

Sincerely yours,

James R. Kuipers, P.E.
Principal Consulting Engineer
Kuipers & Associates LLC

Attachment: Resume

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## SUMMARY OF EXPERIENCE

Over 30 years experience in mining and environmental process engineering design, operations management, regulatory compliance, waste remediation, reclamation and closure, and financial assurance. Over 15 years experience providing technical assistance to public interest groups and tribal, local, state and federal governments on technical aspects of mining and environmental issues.

## EDUCATION

Montana College of Mineral Science and Technology, B.S. Mineral Process Engineering, 1983.

## PROFESSIONAL REGISTRATION

Professional Engineer (PE Mining/Minerals): Colorado (No. 30262), Montana (No. 7809 & Corp. No. 197)

## PROFESSIONAL EXPERIENCE

1996 to Present **Kuipers & Associates/J. Kuipers Engineering, Butte, MT.**

- *ABN AMRO Bank, Netherlands*: Consulting Engineer, confidential mine evaluation.
- *Amigos Bravos, Taos, NM*: Consulting Engineer, Molycorp Questa Mine, technical review committee and working group member in reclamation and closure/closeout permitting and bonding process.
- *Anaconda Deer Lodge County, MT*: Consulting Engineer/Project Manager, Anaconda Superfund Site, provide technical services related to institutional controls, property conveyance and redevelopment, property and facility operation and maintenance, review of regulatory documents, renewable energy development , air and water monitoring and other tasks related to county involvement in Superfund activities.
- *Bannock Technologies, Pocatello, ID*: Consulting Engineer, Shoshone Bannock Tribe mining oversight project studies.
- *Blackfoot Legacy, Lincoln, MT:* Consulting Engineer, McDonald Project, review of project feasibility and environmental issues.
- *Border Ecology Project, Santa Fe, NM:* Consulting Engineer, Cananea Project (Mexico), consulting engineer mine reclamation and closure planning.
- *Cabinet Resource Group, Noxon, MT*: Consulting Engineer, Rock Creek Project, review of proposed tailing impoundment.
- *Clark Fork River Technical Advisory Committee, Missoula, MT*: Technical Advisor, Clark Fork River and Milltown Reservoir Operable Units, Upper Clark Fork Basin Superfund Sites.

- *Center for Science in Public Participation, Bozeman, MT:* See separate description below.

- *Citizens' Technical Environmental Committee, Butte, MT:* Technical Advisor, Butte-Silver Bow Site Operable Units, Upper Clark Fork Basin Superfund Sites.

- *Cottonwood Resource Council, Big Timber, MT:* Consulting Engineer, Lodestar Mine and Mill, review of operating and MPDES permits, financial assurance and operations data.

- *Earthjustice, Bozeman, MT:* Consulting Engineer, Montanore and Rock Creek Projects permitting process.

- *Earthworks, Washington, D.C.:* Project Manager and co-author, Water Quality Predictions and NEPA/EIS Studies.

- *Environmental Defender Law Center, Bozeman, MT*: Expert Witness and Consulting Engineer, Boliden Promel, Chile arsenic waste disposal.

- *Gila Resources Information Project, Silver City, NM:* Consulting Engineer, Phelps Dodge Chino, Cobre and Tyrone Mines, reclamation and closure/closeout permitting and bonding process.

- *Great Basin Mine Watch, Reno, NV:* Expert Witness and Consulting Engineer, various NV projects, permitting and reclamation and closure/closeout permitting and bonding process.

- *ICF International, Stafford, VA*: Consulting Engineer, 108(b) rulemaking technical support contract including financial assurance cost estimation model evaluations.

- *Johnson County, KS:* Consulting Engineer, Sunflower Limestone Mine reclamation plan and financial assurance.

- *Little Salmon Carmacks First Nation, Yukon Territory, Canada*: Expert Witness and Consulting Engineer, Carmacks Copper Project.

- *Montana Attorney Generals Office, Helena, MT:* Consulting Engineer, assist in defense of I-137 Open Pit Cyanide Mine Ban appeals.

- *Montana Department of Environmental Quality, Helena, MT*: General Contractor, Pony Mill Site Reclamation.

- *Montana Environmental Information Center, Helena, MT and National Wildlife Federation, Missoula, MT*: Expert Witness and Consulting Engineer, Golden Sunlight Mine, EIS Review and assist appeal of State operating permit.

- *Montana Environmental Information Center, Helena, MT*: Expert Witness, Bull Mountain Coal Mine appeal.

- *Montana Trout Unlimited, Missoula, MT*: Consulting Engineer, Trout Unlimited's Four Mines Campaign, review and provide technical assistance on McDonald, Crandon, New World and Rock Creek Mines.

- *Natural Resources Defense Council*, New York State: Consulting Engineer, review of Oil & Gas Draft EIS.

- *New Mexico Environmental Law Center, Santa Fe, NM*: Consulting Engineer, Oglebay Norton Mica Mine reclamation and financial assurance; New Mexico Environment Department Copper Rules Stakeholder Process.

- *Northern Plains Resource Council, Cottonwood Resource Council, Stillwater Protective Association, Billings. MT:* Consulting Engineer, Stillwater Mining Company Nye and East Boulder Mines, facilitate and perform technical aspects of Good Neighbor Agreement.

- *Northern Plains Resouce Council, Billings, MT; Wyoming Outdoor Council, Sheridan, WY:* Consulting Engineer, Montana Statewide and Wyoming Powder River Basin Coal Bed Methane EIS.

- *Northern Plains Resouce Council, Billings, MT:* Project Manager and co-author, Coal Bed Methane Produced Water Studies.

- *Northern Alaska Environmental Council, Fairbanks, AK:* Consulting Engineer, Pogo Mine NPDES permit negotiations.

- *Picuris Pueblo, Penasco, NM:* US Hill Mica Mine Reclamation Plan and financial assurance cost estimate and site reclamation project management.

- *Powder River Basin Resource Council, Sheridan, WY/Steven Adami, Buffalo, WY:* Expert Witness, Kennedy Oil IMADA POD appeals.

- *Rock Creek Alliance, Missoula, MT:* Expert Witness and Consulting Engineer, Rock Creek and Montanore Mines permitting.

- *Selkirk First Nation, Yukon Territory, Canada:* Expert Witness and Consulting Engineer, Minto Mine Project reclamation and closure and financial assurance.

- *Sheep Mountain Alliance, Telluride, CO*: Expert Witness and Consulting Engineer, Silver Bell Tailings remediation.

- *Shoshone-Paiute Tribes of the Duck Valley Reservation, NV:* Consulting Engineer, Rio Tinto Mine Reclamation and Closure.

- *Sierra Club and Mineral Policy Center:* Expert Witness, Cripple Creek and Victor Mining Company Clean Water Act case.

- *SKEO, Charlottesville, VA*: Consulting Engineer, 108(b) rulemaking technical support contract and EPA Region NEPA review and financial assurance support.

- *Southern Environmental Law Center, Charleston, SC*: Consulting Engineer, Haile Gold Mine permitting.

- *Systems Research and Applications Corporation, Fairfax, VA:* Consulting Engineer, mine cleanup and financial assurance guidelines subcontract to EPA.

- *Montana Trout Unlimited, Missoula, MT:* Consulting Engineer, I-147 initiative campaign.

- *Tohono O'odham Nation, San Xavier District, AZ:* Consulting Engineer, Mission Mine reclamation plan and financial assurance.

- *Trust for Public Lands, San Francisco, CA:* Consulting Engineer, Viceroy Castle Mountain Mine, evaluated pit backfill and reclamation alternatives for settlement agreement trust fund determination.

- *Walz and Associates, Albuquerque, NM:* Expert Witness and Consulting Engineer, assist in defense of New Mexico Environment Department and Mining and Minerals Division permitting and takings case (Manning v. NM).

- *Western Organization of Resource Councils, Billings, MT:* Oil and gas reclamation and financial assurance guide.

- *Western Resource Advocates, Salt Lake City, UT*: Expert Witness and Consulting Engineer, Red Leaf Resources oil shale project permitting.

1997 to 2005 **Center for Science in Public Participation, Bozeman, MT.**

- *Canadian Earthcare Society, Vancouver, BC*: Consulting Engineer, Brenda Mine, assist appeal of reclamation and closure permit.

- *CEE Bankwatch, Budapest, Hungary*: Consulting Engineer, Rosario Montana Mine (Romania), economic feasibility study of mine proposal.

- *Friends of the Similkameen, Hedley, BC*: Consulting Engineer, Candorado Mine, assist appeal of reclamation and closure permit.

- *Fort Belknap Tribal Council and Environment Department, Fort Belknap,MT*: Consulting Engineer, Zortman and Landusky Mines, Alternative Reclamation and Closure Plan, multiple accounts analysis working group member and technical advisor during supplemental environmental impact statement.

- *Guardians of the Rural Environment, Yarnell, AZ*: Consulting Engineer, Yarnell Project, EIS review and assist appeal of State operating permit.

- *Mineral Policy Center, Washington, D.C.*: Technical Advisor on general mining issues and Author of MPC Issue Paper.

- *National Wildlife Federation, Boulder, CO*: Consulting Engineer authoring report on Hardrock Mining Reclamation and Closure Bonding Practices in the Western United States.

- *Sakoagan Chippewa Tribes, Mole Lake Reservation, Wisconsin*. Consulting Engineer, Crandon Project, permitting process review.

1993 - 1995 **Denver Mineral Engineers, Inc., Littleton, CO.**

- Manager, Process Engineering Department.

- Manager, Mining and Environmental Wastewater Treatment Program

- *Arrowhead Industrial Water Co., San Jose, CA*: Project Manager, evaluation of reverse osmosis for mine wastewater treatment.

- *Barrick Goldstrike, USA, Elko, NV*: Project Engineer, engineering design, construction and installation of 1.5 M oz/year stainless steel electrowinning system.

- *Battle Mountain Gold, Co., Battle Mountain, NV*: Project Manager, evaluation, pilot testing, and preliminary feasibility study of wastewater treatment options for groundwater remediation of Fortitude Mine tailings area.

- *Commerce Group Corporation, Milwaukee, WI*: Project Manager, San Sebastian Gold Project, El Salvador.

- *Independence Mining Corp, Jerritt Canyon, NV*: Project Manager, technical evaluation and feasibility study of column flotation for beneficiation of refractory ores.

- *Kennecott Utah Copper, Bingham Canyon, UT*: Project Manager, design and construct stainless steel solvent extraction mixer settlers for prototype SX/EW plant.

- *Israeli Chemical Corp., Beersheeba, Israel*: Project Manager, evaluation of bromine as an alternative to cyanide gold leaching and prototype design.

- *Marston and Marston, St Louis, MO*: Project Manager, Kommunar Gold Mill Modernization Project, Kommunar, Siberia, Russia (CIS) and Suzak Polymetal Leach Circuit Evaluation and Feasibility Study, Kazakhstan (CIS).

- *Nevada Goldfields Mining Co., Denver, CO*: Project Manager, Nixon Fork Mine Preliminary Engineering Design and Feasibility Study, Concentrate Marketing Study, and environmental permitting studies.

- *Southern Pacific Railroad, Denver, CO*: Project Manager, design, construction and installation of dissolved air flotation wastewater treatment system.

1991 - 1992 **Western States Minerals Corp.**

- Project Manager, Northumberland Gold Mine, Round Mountain, NV.

- Corporate Senior Metallurgist, Wheat Ridge, CO. Engineering design and feasibility evaluations.

1986 - 1991 **Western Gold Exploration and Mining Co. (WESTGOLD)/Minorco**

- Corporate Senior Metallurgist / Project Manager, WESTGOLD, Golden, CO. Acquisitions and engineering design and feasibility evaluations, corporate acquisitions and business development group.

- Project Manager, Shamrock Resources (WESTGOLD Subs.), Reno, NV. Evaluation, engineering design and feasibility study, and prototype plant operation of refractory gold ore bioleaching technology program.

- Project Manager, Balmerton Mine, Ontario: Refractory gold ore bioleaching project and feasibility evaluation.

- Project Engineer, Johannesburg South Africa: Evaluation of Anglo American Corp. Pumpcell Technology.

- Mill Superintendent, Austin Gold Venture (WESTGOLD), Austin, NV.

- Shift Foreman, Inspiration Consolidated Copper Co, Globe, AZ.

1984 - 1985 **Canyonlands 21st Century Corporation**

- Director of Metallurgy, Blanding, UT. Project Manager, Jarbidge, NV.

1983 - 1984 **Cumberland Mining Corporation**

- Mill Superintendent / Head Metallurgist, Basin and Virginia City, MT.

1974 – 1980 **Huckaba Construction**

- Summer employment as Underground and Surface Miner, Millwright, Mill Operator, Fire Assayer, Whitehall and Cooke City, MT. Family owned small mining operation.

**PRESENTATIONS and PUBLICATIONS**

- *Financial Assurance Regulations and Cost Estimation at US Hardrock Mines,* U.S. Chile Mining Financial Assurance Seminar, US Office of Surface Mining and Environmental Protection agency and Chilean Ministry of Mining, Santiago, Chile, May 2012.

- *Mining Reclamation and Closure Regulations and Best Practices*, 2012 International Conference on Mining in Mindanao, Ateneo de Davao University, Davao City, Philippines, January 26-27, 2012.

- *Beyond the Global Acid Rock Drainage Guide,* Lake Superior Binational Program, Mining in the Lake Superior Basin Webinar Series, Environmental Impacts of Mining in the Lake Superior Basin, October 27, 2009

- *Characterizing, Predicting, and Modeling Water at Mine Sites,* California Environmental Protection Agency, California Water Board Training Academy, May 18 - 21, 2009

- *Mitigating Mining Impacts: Principles and Practices,* Lake Superior Binational Program, Mining in the Lake Superior Basin Webinar Series, Environmental Impacts of Mining in the Lake Superior Basin, March 24, 2009

- *Long-term Requirements & Financial Assurance at Superfund & Other Mine Sites*, Mine Design, Operations and Closure Conference, Fairmont Hot Springs, MT, April 2008.

- *The Effects of Coalbed Methane Production on Surface and Ground Water Resources*, Committee on Earth Resources, Board on Earth Sciences and Resources, National Research Council, Meeting on the Status of Data and Management Regarding the Effects of Coalbed Methane Production on Surface and Ground Water Resources, Denver, Colorado, April 2008.

- *Reclamation Planning and Financial Assurance Practice in the United States,* Kamchatka Mining Conference, Kamchatka Oblast People's Council of Deputies, the Committee on Ecology and Resource Management of Kamchatsky Krai, the Rosprirodnadzor Division of Kamchatka Oblast and Koryaksky Autonomous Okrug, the Division for Minerals Management for Kamchatka Krai, and the Kamchatka Oblast Council of the All-Russia Society for Nature Protection, Petropavlovsk-Kamchatsky, Russia, October 2007.

- *The Good Neighbour Agreement: A Proactive Approach to Water Management through Community Enforcement of Site-Specific Standards*, w Sarah Zuzulock, Greener Management International, Issue 53, Spring 2006, Greenleaf Publishing. 2007.

- *Sustainable Development at the Anaconda Superfund Site,* Mine Design, Operations and Closure Conference, Fairmont Hot Springs, MT, April 2007.

- *Comparison of Predicted and Actual Water Quality at Hardrock Mines: The reliability of predictions in Environmental Impact Statements* with A. Maest, K. MacHardy, G. Lawson. *Predicting Water Quality at Hardrock Mines: Methods and Models, Uncertainties, and State-of-the-Art* with A. Maest, Final Report Release December 2006.

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- *Predicted Versus Actual Water Quality at Hardrock Mine Sites: Effect of Inherent Geochemical and Hydrological Characteristics* with A. Maest, K. MacHardy, and G. Lawson at International Congress on Acid Rock Drainage (ICARD), March 2006, St. Louis, MS.

- *Oil, Gas and Coal Bed Methane Reclamation and Financial Assurance Guide*, with Kimberley MacHardy and Victoria Lynne, November 2005; 12th International Petroleum Environmental Conference, Houston, TX.

- *Approaches to Abandoned Mine Site Assessment and Remedy Selection in the U.S.,* NOAMI Workshop on Assessing Liabilities and Funding Options, November 2, 2005 Ottawa, Canada

- *Filling the Gaps: How to Improve Oil and Gas Reclamation and Reduce Taxpayer Liability*, Kuipers & Associates for Western Organization of Resource Councils, August 2005.

- *The Environmental Legacy of Mining in New Mexico*, Mining in New Mexico: The Environment, Water, Economics and Sustainable Development, New Mexico Bureau of Geology and Mineral Resources, Decision-Makers Field Conference 2005, L. Greer Price et al Editors.

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- *Evaluation of the NEPA Process for Estimating Water Quality Impacts at Hardrock Mine Sites* with A. Maest, K. MacHardy, G. Lawson, for Earthworks, presented at Society of Mining Engineers Annual Conference, Salt Lake City, UT, March 2005 and Mine Design, Operations and Closure Conference, Polson, MT, April 2005.

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- *Financial Assurance Guidelines for Hardrock Mine Cleanup*, Mine Design, Operations and Closure Conference, Polson, MT, April 2004.

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- *The Good Neighbor Agreement between Stillwater Mining Company and Northern Plains Resource Councils: An Example of Industry and Citizen Cooperation*, presented as a short course at Joint Engineers Conference, Helena, MT, November 2003.

- *Reclamation and Financial Assurance for Mines on or Impacting Tribal Land*, presented at U.S. EPA Workshop on Mining Impacted Native American Lands, Reno, NV, September 2003.

- *Reclamation and Financial Assurance from a Public Interest Perspective*, presented at U.S. Forest Service National Geofest, Park City, UT, September 2003.

- *U.S. State and Federal Policies on Financial Assurance Forms for Hardrock Mines,* presented at New Mexico Financial Assurance Forum, Santa Fe, NM, May 2003.

- *Public Interest Perspective on Land Application Disposal*, presented at Mine Design, Operations and Closure Conference, Polson, MT, April 2003.

- *Putting a Price on Pollution: Financial Assurance for Mine Reclamation and Closure*, Mineral Policy Center, Washington, D.C., March 2003.

- Testimony to the Subcommittee on Energy and Mineral Resources, Committee on Resources, U.S. House of Representatives, Hearing on "Availability of Bonds to Meet Federal Requirements for Mining, Oil and Gas Projects." Washington, D.C., July 23, 2002.

- *Mine Closure and Financial Assurance: Can the Mining Industry Afford It's Legacy?*, presented at Global Mining Initiative Conference, Toronto, Canada, May 2002.

- *The Role of the Center for Science in Public Participation in Mining Environmental Issues, with Perspective for Regulators and Industry*, presented at Canadian Institute of Mining and Metallurgical Engineers Conference, Vancouver, Canada, May 2002 and U.S. EPA Hardrock Mining Conference, Denver, Colorado, May 2002.

- *The Good Neighbor Agreement between Stillwater Mining Company and the Northern Plains Resource Councils: The Formation and Implementation of a New Approach to Addressing Environmental and Community Relations Issues,* presented at U.S. EPA Hardrock Mining Conference, Denver, Colorado, May 2002.

- *Underground Hard-Rock Mining: Subsidence and Hydrologic Environmental Impacts,* Center for Science in Public Participation, Bozeman, MT, February 2002. Co-authored with S. Blodgett.

- *Review of the Multiple Accounts Analysis Alternatives Evaluation Process Completed for the Reclamation of the Zortman and Landusky Mine Sites*; presented at National Association of Abandoned Mine Lands Annual Conference, Athens, Ohio, August 2001. Co-authored with S.C.Shaw, A.M. Robertson, W.C. Maehl and S. Haight.

- *Full Reclamation and Closure Plan, Phelps Dodge Tyrone Mine, Grant County, NM;* Gila Resources Information Project, Silver City, NM, July 2001. Co-authored with S. Blodgett.

- *Reclamation Bonding for Hardrock Metal Mines Workshop*; presented by CSP2 at Juneau and Fairbanks, AK, July 2001.

- *Full Reclamation and Closure Plan, Phelps Dodge Chino Mine, Grant County, NM;* Gila Resources Information Project, Silver City, NM, June 2001. Co-authored with S. Blodgett.

- *Reclamation Bonding in Montana;* Montana Environmental Information Center, Helena, MT, November 2000. Co-authored with S. Levit.

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- *Hardrock Mining Reclamation and Bonding Practices in the Western United States*: National Wildlife Federation, Boulder, CO, February 2000.

- *An Economic Evaluation of the McDonald Gold Project*; Blackfoot Legacy, Lincoln, MT, February 2000..

- *Restoring the Upper Clark Fork: Guidelines for Action*; Trout Unlimited, Missoula, MT, April 1999. Co-authored with D. Workman, B. Farling and P. Callahan.

- *Alternative Final Reclamation and Closure Plan, Zortman and Landusky Mines, MT:* Indian Law Resource Center, Helena, MT, January 1999.

- *Reclamation Bonding Regulations of Precious Metal Heap Leach Facilities in the Western United States:* Presented at the workshop on Closure, Remediation and Management of Precious Metals Heap Leach Facilities, University of Nevada, Reno, Jan 15, 1999.

- *Wastewater Treatment Methods for Base and Precious Metal Mines*: Public Education for Water Quality Project, Northern Plains Resource Council, Billings, MT, 1996.

- *Bacterial Leaching Pilot Study – Oxidation of a Refractory Gold Bearing High Arsenic Sulphide Concentrate:* Randol Gold Forum, Squaw Valley, 1990. Co-authored with J. Chapman, B. Marchant, R. Lawrence, R. Knopp.

- *Novel Aspects of Gold Recovery Using Column Flotation at Austin Gold Venture*: Gold and Silver Recovery Innovations, Phase IV Workshop, Randol International Ltd, Sacramento, CA, 1989.

# Exhibit B

# NOI

# Exhibit C

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September 26, 2013

Rob Dubuc
Western Resources Advocates
150 South 600 East, Suite 2A
Salt Lake City, Utah 84102

RE: Expert Report – Utah Ground Water Discharge Permit Application for Red Leaf Resources, Inc., Southwest #1 Project

Dear Mr. Dubuc:

This letter constitutes my expert report in connection with Red Leaf Resources' (Red Leaf) proposal to mine and process oil shale before the Utah Division of Water Quality (DWQ).

**EXECUTIVE SUMMARY**

The Application does not contain, and the permit does not require, a complete and accurate geologic and hydrologic description of the area as required under R317-6-6.3(E) or a complete and accurate description of the ground water most likely to be affected by the discharge as required under R317-6-6.3(K). The record contains at least four references to the presence of geologic units as shallow as 20 to 55 feet below the pits that potentially contain ground water; however, Red Leaf's drilling program failed to investigate or evaluate the occurrence of water in these zones that are likely to be affected by discharges. Red Leaf identified numerous springs in the vicinity of the mine that are discharging significant quantities of water. However, the Application does not provide, and DWQ has not required, information on the source of the ground water supporting these springs, the geologic and hydrologic connection to the proposed operations, or the potential that these water sources could be impacted. Furthermore, the Statement of Basis contains inaccurate assumptions regarding the ground water that occurs in aquifers immediately below the mine. This fundamental flaw renders the basis for issuing the permit invalid. Because of the incomplete and inaccurate geologic and hydrologic descriptions, and failure to identify ground water most likely to be affected by discharge, there is no supporting basis for assessing impacts to ground water.

The Application does not contain, and the permit does not require, complete and accurate information that shows that the discharge can be controlled and will not migrate into or adversely affect the quality of waters of the state as required under R317-6-6.3(G). The Application claims that the mine operation will be a "zero-discharge" operation. This claim is based on Red Leaf's assumption that the liner system is impermeable and that water will not enter the hydrocarbon

recovery zone of the capsules. However, Red Leaf's own analysis contradicts this claim and in fact demonstrates that significant quantities of water will infiltrate into the capsules. In spite of a request from the DWQ, Red Leaf failed to conduct additional analysis of the fate of this water or analyze the potential for leachate to be discharged from the bottom of the capsule. Until such time as Red Leaf is able to show through analysis of the performance of the Early Production System (EPS) that this will be a zero discharge operation, DWQ is unjustified in accepting Red Leaf's claims at face value.

The Application does not contain, and the permit does not require, a sampling and analysis monitoring plan as required under R317-6-6.3(I). While the Application contains the outline of a monitoring plan to potentially detect the occurrence of pollutant discharge, DWQ fails to include even these requirements in the draft permit. Instead, the agency instructs Red Leaf to submit a sampling and analysis plan at some point in the future. Most significantly, the permit fails to contain a description of compliance monitoring points, ground water monitoring to determine ground water flow direction and gradient, and the quality of ground water at the compliance points, or post-operational monitoring. In addition, the Application does not contain information on sampling of discharges and flow monitoring in order to determine the volume and chemistry of the discharge onto or below the surface of the ground as required under R317-6-6.3(L). Because of the uncertainty regarding Red Leaf's untested capsule design, and the documented presence of aquifers that are likely to be impacted, the EPS capsule should be constructed on a liner system that is both protective of waters of the state, and provides a reliable means of evaluating the performance of the capsule.

## 1.0 INTRODUCTION

### 1.1 Background

I am a Professional Geologist licensed in the States of Utah and Wyoming. In 1983, I received my Bachelor's degree from Western State College of Colorado with a double major in geology and physics. In 1990, I received my Master's Degree in geology from Colorado State University. Between 1983 and 1985, I was employed by the U.S. Geological Survey. During this time I participated in, researched, and co-authored several studies relating to ground water movement and landslides, as well as surface water flooding. Most of the investigations were on sites of recent flooding and landslide activity in central Utah.

Between 1985 and 1997, I was employed as a full-time consulting engineering geologist. During this time I conducted approximately 15 investigations for ground water contamination from mines, mills, smelters, tailings ponds, and other industrial facilities in Utah, Colorado, Nevada, and California. I participated in four separate seep and spring surveys for existing and proposed mines in Utah and Nevada, ranging in size between 2 and 50 square miles. I have supervised the installation of approximately 100 ground water monitoring wells using a variety of drilling methods and in a variety of geologic materials. I performed hydrology and hydraulics analyses and designed runoff control plans at numerous mine and industrial facilities in Utah and Nevada. I prepared geology, hydrology, and engineering components of mining and reclamation plans and ground

water discharge permits for 21 open-pit and underground mines, mill and concentrator sites, smelters, and tailings impoundments.

Between 1996 and 2006 I was an Adjunct Associate Professor in the Department of Geography at the University of Utah. I taught classes in geomorphology (including surface and ground water systems), environmental studies, climate change, and resource conservation and environmental management.

In the past 28 years, I have assisted in the preparation of geology, hydrology, and engineering portions of mining and reclamation plans at six coal mine facilities in Utah (Knight Mine, Star Point Mine, Soldier Canyon Mine, Sunnyside Mines, Horse Canyon Mine, and the Rilda Canyon Mine). I have also supported permitting activities at five non-coal mine facilities in Utah (Mercur Mine, Kennecott [mine, mill, smelter, and tailings pond], Carr Fork Mine, IS&R [mill site and tailings pond], and the Goldstrike Mine). In addition to permitting activities for the Division of Oil Gas and Mining, I have prepared permit applications for ground- and surface-water discharge.

In the past 16 years, I have provided permitting expertise in the areas of geology and surface and ground water quality and quantity for proposed mines, tailings ponds, dams, highways, coal ash landfills, and river diversions. These projects have involved review of Ground Water Discharge Permits, Coal Ash Landfill Permits, NEPA documents, 404 Permit Applications under the Clean Water Act, UPDES Permits, Federal Energy Regulatory Commission (FERC) Applications, and Utah Division of Oil, Gas and Mining and Reclamation Plans.

During my professional career, I have provided consulting services to federal, state, and local governmental agencies, private industry, and non-governmental organizations. I have prepared reports and provided expert testimony twice in Federal Court, at several hearings before the Utah Board of Oil Gas and Mining, and before an Administrative Law Judge in Division of Water Quality proceedings.

My Curriculum Vitae is found at Attachment A.

### 1.2 Facts and Data Considered

To prepare this report, I reviewed the Notice of Intention to Commence Large Mining Operations (NOI) submitted to the Utah Division of Oil, Gas and Mining (DOGM) by Red Leaf Resources, Inc. (Red Leaf) on September 6, 2011; the revised Utah Ground Water Discharge Permit Application (Application) submitted to the Utah Division of Water Quality (DWQ) in June, 2013; the Supplemental Seep and Spring Inventory (May, 2013); and the draft Statement of Basis (SOB) and Permit for this project. Additionally, I conducted a half-day reconnaissance of the proposed mine site and surrounding area on June 14, 2012, although my access was limited to viewing the property from public roads because the proposed mine site is private property posted no trespassing.

### 1.3 Geology of Proposed Mine Site

The Parachute Creek Member of the Green River Formation is the surface bedrock formation throughout the majority of Red Leaf parcels (Application, pg. 15 and Fig. 4). This member contains the Mahogany Zone from which the raw ore would be extracted (Application, pg. 15). Open-pit mining operations would extend up to a depth of 250 feet below the ground surface (NOI, Appendix N, pg., 8). The Douglas Creek Member of the Green River Formation directly underlies the Parachute Creek Member and is about 50 feet below the Mahogany Zone (Application, Fig. 5).

## 2.0 INCOMPLETE AND INACCURATE DESCRIPTION OF GEOLOGY AND HYDROLOGY

The Utah Ground Water Quality Protection Rules require that an application for a ground water discharge permit contain geologic and hydrologic descriptions including aquifers, ground water flow direction, ground water quality, aquifer material, and well logs (R317-6-6.3 (E)). In addition the rules require a description of the ground water most likely to be affected by the discharge, including water quality information of the receiving ground water prior to discharge, a description of the aquifer in which the ground water occurs, the depth to the ground water, the saturated thickness, flow direction, porosity, hydraulic conductivity, and flow systems characteristics (R317-6-6.3 (K)). Red Leaf's Application does not contain, and the permit does not require, this information. The Application documents the presence of ground water in wells and nearby springs, however, the scant information in the Application fails to provide complete and accurate descriptions required by the Ground Water Protection Rules.

### 2.1 Incomplete and Inaccurate Description of Ground Water Beneath the Project Area

Sandstone layers in the lower portions of the Parachute Creek Member or the upper portions of the Douglas Creek Member are the layers likely containing ground water immediately below the mine site and would be the first to be impacted by the mining and retorted operations. The Application contains numerous references to the Douglas Creek Member that contains layers of sandstone, or to porous rocks at depths as shallow as 20 to 55 feet below the Mahogany Zone, which indicates that the geologic units potentially containing ground water are close to the bottom of the pits. The Application must, therefore, contain information on aquifers in these layers.

The Application identifies the Douglas Creek at a depth of approximately 55 feet below the Mahogany Zone (Fig. 5). The Texaco Seep Ridge Unit #2 well, less than 2 miles west of the Red Leaf Leases reports the Douglas Creek Member 49 feet below the Mahogany (Application, pg. 13). The Application (Fig. 6) shows sandstone/mudstone in all six drill holes at depths between 20 and 60 feet below the Mahogany Zone. The NOI reports that the first porous unit

occurs approximately 50-100 feet below the Mahogany Zone in the Douglas Creek indicating the potential for groundwater in the area of the proposed mine (pg. 42).

The presence of a sandstone layer beneath the project area was confirmed in the fall of 2012 when Red Leaf installed six monitor wells to assess ground water conditions. The Application (pg. 24) states "[E]ach boring was drilled to the unnamed sandstone unit that occurs beneath the B Groove. This unit was selected because it is present beneath the entire project area…" Figure 8 shows that the wells were drilled to depths ranging between 20 and 55 feet below the Mahogany Zone, thus confirming that a continuous sandstone layer is present immediately beneath the zone to be mined.

Most importantly, the Application (pg. 24 and Fig. 8) notes that five of the six monitor wells encountered water in the lower part of the bore holes (one hole was not completed below the Mahogany Zone).

Having identified the presence of an aquifer as close as 20 feet below the proposed mining and retorting operations, the Application should, but does not, contain a description of this aquifer, including water quality information, the saturated thickness, flow direction, porosity, hydraulic conductivity, and flow systems characteristics[1].

## 2.2 Incomplete and Inaccurate Description of Springs the Project Area

The Application briefly discusses a seep and spring inventory that was conducted in Fall 2012 (pg. 23 and Appendix D). Surprisingly, the Application completely fails to incorporate any information from the Supplemental Seep and Spring Inventory conducted in May 2013. This omission is egregious because the May 2013 inventory in many ways corrected or provided critical information that was missing from the Fall 2012 inventory. For example, the May 2013 inventory noted in the, "several areas marked as potential seeps were verified to be springs[,]…that seeps inventoried in October 2012 should now be classified as springs in May 2013[, and that] some of the smaller, previously identified individual springs were, in fact, larger springs that were part of gaining/losing systems." (May 2013 Inventory, pg. 6).

In fact, the May 2013 inventory documented the presence of numerous springs in the vicinity of the proposed operation. Two of these springs show appreciable amounts of water – Klondike Canyon Spring-01 at 0.42 gallons per minute; Reservoir Canyon-01 at 0.52 gallons per minute – and all of the springs have less than 3,000 mg/l total dissolved solids thus qualifying for protection as Class II Drinking Water Quality Ground Water under the Ground Water Quality Protection Regulations. *See* R317-6-3.5. The springs identified in May 2013 flowed

[1] The Application does not contain the actual drill logs for the monitor wells installed in the Fall of 2012. Figure 8 in the Application shows only key marker beds (A-Groove, Mahogany Bed, and B-Groove) but does not show any lithology. The depth at which the sandstone was first encountered is not shown or discussed elsewhere in the Application. Thus, the top of this aquifer is closer to the bottom of the mining and retorting operations, but the Application does not identify how close.

intermittently at the surface for up to 3,900 feet, supported riparian vegetation, and showed evidence of wildlife use.

The May 2013 inventory failed to document the geologic occurrence for all but one of the springs; rather only noting that each was a spring that issued from "an interface between alluvium and the Parachute Creek Formation [sic].." In fact, three of the springs (Klondike Canyon Spring-01, Reservoir Canyon Spring-02, Reservoir Canyon Spring-03) are in areas mapped as the Douglas Creek Member of the Green River Formation on the geologic map in the Application (Fig. 4).

Regardless of this inaccurate information regarding the correct member of the Green River Formation, the Application does not contain any geologic and hydrologic descriptions of the aquifers from which these springs emit, or the ground water flow direction and aquifer materials. The question left unanswered by both the Application and the SOB is what constitutes the source of the water that feeds the springs noted in the May 2013 inventory, and what is the significance of the finding that eight individual springs exist down gradient of the mine site. Specifically, the question of whether those springs could be impacted by the mine must be answered. In contrast to this, the SOB fails to discuss or incorporate into the basis for the permit the results of the May 2013 inventory and completely mischaracterizes the importance of the findings, the extent of the water and the level of TDS emanating from the water sources (SOB, pg. 5).

### 2.3 Inaccurate Characterization of Ground Water Quality Beneath the Project Area

In the discussion of impacts of leachate being discharged from the capsule, the SOB states "Available information suggests that such leachate would have levels of dissolved contaminants that are comparable to or less than the existing ground water in the underlying rocks." (pg. 7) In essence, DWQ is saying that the basis for the permit is that it doesn't matter if the capsule discharges leachate, because of the poor water quality in the underlying aquifer. This justification for issuing a permit is fundamentally flawed because the water quality data in the Application do not represent the aquifer underlying the mining and retorting operations.

Red Leaf collected samples and analyzed ground water quality from the deep monitor wells (Application, pgs. 25-26). The results of the laboratory analyses indicated that these samples had high total dissolved solids (TDS values between 9,020 mg/l and 58,600 mg/l) and isotopic signatures representing long residence time.

The critical question is which aquifer does this high TDS water represent. Figure 8 of the Application shows the total depth of the monitor wells and information on how the wells were completed, including screened intervals, and zones that were backfilled with sand and bentonite. Sand backfill is extremely porous and will allow any water that flows into the bore hole to flow into the screened interval of the monitor well.

Examination of Figure 8 reveals that all of the deep wells were completed within either the screened interval and/or with sand pack that extended into the Mahogany Zone. Thus, the water samples that were collected and analyzed from these monitoring wells contain water that came from multiple geologic layers and their corresponding aquifers. Unfortunately, because of the way the monitor wells were completed, it is not possible to determine if the high TDS water was from an aquifer in the Mahogany Zone, or from the aquifer in the continuous sandstone layer that is present a few tens of feet below the Mahogany (see discussion above in Section 2.1).

Because Red Leaf did not complete the monitor wells in a manner that isolated the aquifer below the proposed mining and retorting operations, there is no basis for any statements regarding "[t]he existing ground water in the underlying rocks." (SOB, pg. 7). The Application contains no data that represents the water quality of the aquifer in the underlying rocks. Thus, DWQ is not justified in its comparison of water quality in the leachate to water quality that could be impacted – and this cannot be a basis for issuing the permit.

## 3.0 FAILURE TO DEMONSTRATE THAT DISCHARGE CAN BE CONTROLLED

The Application states that the mine operation is designed to be a zero-discharge operation (pg. 11). This claim is based on Red Leaf's assumption that the capsules will be constructed with an "impermeable liner" (pg. 4) and that "water will not enter the hydrocarbon recovery zone of the capsules" (pg. 8). The Application further states "the process capsules are designed to prevent both infiltration of precipitation-derived water into them and discharge of fluids from them" (pg. 11).

In fact, the seepage analysis conducted by Red Leaf contradicts this assumption and shows that a significant amount of water from precipitation will infiltrate through the upper BAS layer (Appendix K). Red Leaf ran several analyses, including a base case that assumes a vegetated cap as designed; and a case that assumes bare ground, i.e. no vegetation. The results identify a rate of seepage through the upper BAS layer of 1,683 gallons per year per capsule for a reclaimed capsule and 73,772 gallons per year for a non-vegetated capsule.

The analysis performed by the company assumes that there will be a uniform hydraulic conductivity of $1x10^{-7}$ cm/sec across the entire surface of the capsule. However, if the permeability isn't uniform because there are defects or cracks in the BAS layer, the seepage of meteoric water into the processed ore zone will be several orders of magnitude higher than modeled.

Further, the 1,683 gallons per year per capsule is the minimum amount of water that could seep through the BAS and this number is likely to be greater for three reasons. First, Red Leaf ran the model for 30 years and reported the average seepage for that time period. However, seepage in the first few years, in layers at depth would be very low to zero. It takes a few, perhaps up to 10-15 years for all the overlying material to reach field capacity and for equilibrium to be reached. At that point the seepage through the BAS would be fairly constant. The normal procedure for

reporting seepage results from the HELP model is to only report the values after equilibrium has been reached, not the average for the all the years. Thus, Red Leaf has skewed the results to show a lower seepage through the BAS.

Second, as stated in the Application (pg. 8), the reclaimed surfaces of the capsules will be regraded in order to reduce surface runoff and erosion. This will necessarily increase the amount of precipitation that will infiltrate into the ground and ultimately through the BAS. Red Leaf does not explain how this was accounted for in the HELP model.

Third, the base case assumes that the vegetation has been established. However, it may take a few years for this to occur, and in those years, infiltration will be significantly higher. Red Leaf does not explain how this was accounted for in the HELP model.

In my opinion, the water that infiltrates through the upper BAS layer will also infiltrate into and through the processed ore. Underlying the upper BAS layer will be 13 feet of gravel that Red Leaf has assumed to have a hydraulic conductivity of $1x10^{-1}$ cm/sec. Water will easily run through this layer into the processed ore. The processed ore is assumed to have a hydraulic conductivity of $1x10^{-4}$ cm/sec, so water will easily run through this material as well. There is no analysis in the record of the seepage of water into or through the processed ore, nor an evaluation of the seepage of water through the lower BAS layer.

Red Leaf has clearly demonstrated that the upper BAS layer is not impermeable and that a significant amount of meteoric water will flow through it. Given that the gravel layers and spent ore are several orders of magnitude more permeable, it is axiomatic that water will flow through these layers as well. Any water that accumulates at the base of the capsules will similarly flow through the lower BAS layer, because, like the upper BAS layer, it will not be impermeable.

DWQ recognized that the HELP modeling conducted by Red Leaf was inadequate to answer the questions of how much water will infiltrate into the capsules, and importantly, how much water will percolate through the spent ore and the lower BAS layer. On February 12, 2012, DWQ explicitly stated that the application should provide justification for several model inputs and additional HELP modeling that: 1) considered long term performance of the waste containment (longer than the 30 years evaluated by Red Leaf), 2) evaluated the time for the spent shale to reach field capacity, at which time it could possibly discharge leachate, and 3) evaluated scenarios where the upper BAS layer and capping materials have been removed by erosion.

Red Leaf failed to conduct the analysis that DWQ stated were necessary to address their concerns related to the long-term management of the spent shale. The Application contains no additional HELP modeling performed by Red Leaf. Apparently in an attempt to address these critical issues raised by DWQ, the Application contains a Technical Memorandum from Robert Bayer dated May 30, 2013 (Appendix L). However, this memorandum completely fails to address the long-term management of the spent shale, the performance of the bottom BAS, or discharge of leachate from the capsules. Furthermore, because of fatally flawed assumptions, the memorandum fails to even address its stated objective of determining the time necessary for the

lower part of the EPS capsule to reach field capacity, and thus provides no useful information regarding discharge of leachate from the capsule.

In my professional opinion, the performance of the capsule is one of the most critical issues regarding protection of ground water from the proposed Red Leaf operations. It is imperative that the Application provides a thorough and accurate evaluation of the potential for leachate to be discharged from the capsule. This evaluation can be accomplished with modeling that is conducted to the standard of practice for a project of this magnitude and complexity. The Application does not contain such modeling and evaluation, and DWQ has failed to follow through on their original requirement that it does. There is no justification for allowing Red Leaf to perform the modeling and evaluation after the EPS is constructed. As it stands, the Application does not contain, and the permit does not require, complete and accurate information that shows that the discharge can be controlled and will not migrate into or adversely affect the quality of waters of the state as required under R317-6-6.3(G).

## 4.0 INCOMPLETE SAMPLING AND MONITORING PLAN

### 4.1 Need for Ground Water Monitoring

Because the Application does not contain complete and accurate information showing that the discharge can be controlled and will not migrate into or adversely affect the quality of waters of the state, as required by R317-6-6.3(G), Red Leaf can and should conduct monitoring to determine the impact of the mine on ground water resources. Additionally, the ground water permit makes the incorrect statement that "[g]round water monitoring is not feasible at the site due to the impermeability of the shales that underlie it."

### 4.2 Need for a Sufficient Sampling and Analysis Plan

Red Leaf recognized during the drilling of the monitor wells that a continuous sandstone layer exists across the entire project area at a depth of a few tens of feet below the mine. Furthermore, they identified water in the bottom of the drill holes that extended into this layer. Unfortunately, Red Leaf did not complete the monitor wells in a manner that would allow for sampling and analysis of the water quality in this aquifer. Red Leaf should install new monitor wells that collect data that describe hydrologic descriptions including ground water flow direction, ground water quality, aquifer material, water quality information, the saturated thickness, porosity, hydraulic conductivity, and flow systems characteristics of this aquifer. Water quality monitoring in these wells should be used to establish baseline conditions and monitoring should continue as a permit condition.

In addition, because Red Leaf identified eight springs down gradient from the mine site and neither Red Leaf nor DWQ have made any attempt to explain the significance of these springs,

where the water is coming from and whether they can be impacted, Red Leaf should monitor these springs to determine whether they will be impacted by the mining operation.

The Application should contain a description of all compliance monitoring points, ground water monitoring to determine ground water flow direction and gradient, and the quality of ground water at the compliance points. These compliance monitoring points should be established and data collected before Red Leaf conducts any mining operations in order to establish background conditions. The Application should also contain a description of: 1) the installation, use and maintenance of monitoring devices; 2) monitoring of the vadose zone; 3) measures to prevent ground water contamination after the cessation of operation, including post- operational monitoring; 4) a description and justification of parameters to be monitored; and 5) quality assurance and control provisions for monitoring data.

DWQ recognizes that there are uncertainties related to the ground water protection, capsule performance, and site conditions (SOB, pg. 7). Give this uncertainty, it is incredulous that DWQ proposes to issue this permit without a Sampling and Analysis Plan. Rather, DWQ, without explanation or justification, only requires Red Leaf to submit a Sampling and Analysis Plan no later than the date that heating pipes in the capsule are shut down (Permit, pg. 6).

### 4.3 Need for Stringent Monitoring Requirements

The Permit Compliance Monitoring, Reporting Requirements, and Compliance Schedule are incomplete and insufficient to assess impacts from the proposed mining and retorting operation. The purpose of the monitoring and reporting should be to detect problems early and address them with prompt and appropriate actions. First, the monitoring schedule should be modified to reflect monitoring sooner than beginning six months after shutdown of the retorting operations. Second, the monitoring from the tunnels should be initially conducted bi-weekly (not bi-annually) until it is demonstrated that there is not discharge of leachate from the capsule. Third, monitoring reports should be submitted within 30 days of data collection and laboratory analysis, not semi-annually or annually after the shut down of heating. Fourth, the Permit makes several references to the term of the permit; however, the term of the permit is not established for this EPS capsule. Fifth, DWQ fails to state how any of the data submitted will be analyzed in order to guide decisions as to whether or not to cease operations of the EPS. For example, if monitoring shows that a discharge of leachate is occurring, what will DWQ do?

### 4.4 Need for Effective Ground Water Protection and Monitoring of Capsule Performance

The method of recovering hydrocarbons from oil shale described in the Application is a new concept that has never been demonstrated at the scale that Red Leaf proposes. Red Leaf has modified their original Ground Water Discharge Permit Application to only include one test capsule, called the EPS capsule. Among other stated objectives of the EPS, the purpose of this test capsule is to evaluate capsule containment effectiveness (Application, pg. 5). DWQ considers the evaluation of the capsule as the first reason for the basis for permit issuance -"The issuance of this permit is part of an evaluation phase that will be used to test assumptions and

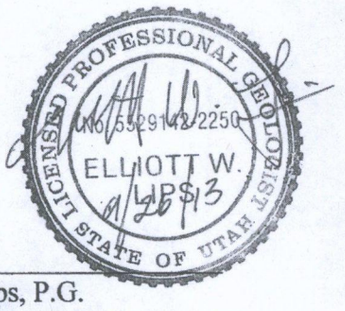
factors related to ground water protections, capsule performance and site conditions that are still not completely known." (SOB, pg. 7). Furthermore, the Permit states, "Red Leaf intends to use this EPS capsule to evaluate design features related to waste containment." (Permit, pg. 2). In plain language, neither Red Leaf or DWQ knows if the capsule design, particularly the BAS will contain leachate, and if not, what the impacts to ground water will be.

Given this uncertainty, along with the documented presence of ground water immediately beneath the proposed mine, the numerous springs down gradient of the mine, and Red Leaf's modeling results that show that the BAS is not impermeable, it is imperative that this EPS capsule be constructed on a liner system that can effectively contain any leachate that does discharge. DWQ should only issue a permit for this EPS capsule if it is constructed on a liner system that consists of an HDPE (or equivalent) liner and a leak detection and leachate recovery system between the capsule and the HDPE liner. A liner system of this type will provide the best available technology for protecting waters of the state.

In addition, the presence of leachate with this type of liner system will be detected in a time period that will allow DWQ to make informed decisions before permitting the full-sale operation that Red Leaf proposes. While monitoring of ground water in wells and in nearby down-gradient springs is necessary, the time that might be required for leachate to reach these source may be long enough that DWQ would, if no contamination were detected, incorrectly assume that no leachate was being discharged. However, the response time for detecting discharge of leachate could be reduced to a few days or weeks with the use of a HDPE and leak detection and leachate recovery system.

In my professional opinion, the uncertainty regarding this untested capsule design, and the documented presence of aquifers that are likely to be impacted, requires that the EPS capsule be constructed on a liner system that is both protective of waters of the state, and provides a reliable means of evaluating the performance of the capsule.

Sincerely,




Elliott W. Lips, P.G.
Principal Engineering Geologist
**Great Basin Earth Science, Inc.**

Attachment A – Curriculum Vitae

**ATTACHMENT A**

**Elliott W. Lips**
**Curriculum Vitae**

# CURRICULUM VITAE

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## SUMMARY OF EXPERIENCE

Mr. Lips is a licensed professional geologist with 30 years experience in engineering geology and geomorphology in the western United States. He has conducted research, consulted, taught university classes, and provided expert witness testimony on surface and ground water impacts, geologic hazards, engineering geology, dam evaluations, mine reclamation and permitting, Earth surface processes, and environmental studies. Mr. Lips is currently the Principal Engineering Geologist of Great Basin Earth Science, Inc.

## ACADEMIC AND PROFESSIONAL QUALIFICATIONS

Ph.D. A.B.D., Geography, University of Utah, Salt Lake City, Utah
M.S., Geology, Colorado State University, Fort Collins, Colorado, 1990
Graduate courses in Engineering, University of California, Berkeley, 1984-1985
B.A., Geology and Physics, Western State College, Gunnison, Colorado, 1983
Registered Professional Geologist, State of Wyoming No. 1489
Licensed Professional Geologist, State of Utah No. 5529142-2250
Member, Geologic Peer Review Board, Morgan County, Utah, 2008-present

## PROFESSIONAL HISTORY

*Great Basin Earth Science, Inc., Principal Engineering Geologist, 1995 - Present*
Responsible for all aspects of providing consulting services for geologic hazard evaluations including faults, landslides, floods, debris flows, and rockfalls; surface and ground water investigations; stream characterization and restoration evaluations; geologic/seismic dam safety evaluations; and paleoenvironmental reconstructions.

*University of Utah, Adjunct Associate Professor, 1999 - 2006; Adj. Assist. Professor, 1996 - 1999*
Responsibilities include developing curriculum and teaching courses on geomorphology and surficial processes, geologic hazards, climate change, environmental studies, and natural resource management.

*AGRA Earth & Environmental, Engineering Geologist, 1992 - 1995*
Project manager for engineering geologic and geologic hazard investigations. Projects were for existing, proposed, and reclaimed mines, proposed subdivisions, utility corridors, commercial developments, and dams.

*JBR Consultants Group, Engineering Geologist, 1985 - 1992*
Project manager for engineering geologic investigations and mine permitting and reclamation projects throughout the western United States. Directed data collection and analysis, and prepared technical reports and permitting documents for new developments, proposed and existing mining operations, and for abandoned mines.

*U.S. Geological Survey, Geologist, 1983 - 1985*
Conducted research on landslides, floods, and debris flows in the western U.S. (primarily in central Utah); prepared publications on processes, recent events, methods of evaluations, and methods of risk assessment.

## REPRESENTATIVE RESEARCH AND CONSULTING EXPERIENCE

### *Geologic Hazards Evaluations*

Landslide Vulnerability Assessment, Project Impact, Salt Lake City, Utah: Served as chair of committee of geologists and engineers and was lead author of final report to Salt Lake City. Project consisted of conducting investigations and assessing the vulnerability for all property within the limits of Salt Lake City that could be impacted by landslides. In addition, lifelines entering the city, which if damaged or destroyed by landslides, would potentially result in loss of life and/or serious economic impact to the residents of the city, were considered.

Geologic Hazards Identification and Evaluation, Draper, Utah: Conducted evaluation of geologic hazards at two sites for a proposed salt storage facility in the Traverse Mountains, Draper, Utah. Hazards evaluated included landslides, debris flows, rock falls and surface fault rupture.

Landslide and Debris-Flow Hazard Evaluation, Central Utah: Evaluated the potential for debris flows and debris floods for a 30-mile portion of the Wasatch Front. Evaluated and rated more than 90 canyons in the project area for their potential to generate an event that could impact residential communities. Conducted reconnaissance of landslides and debris flows throughout central Utah during the period of high landslide activity in 1984. Provided reports to the Utah Geological Survey on conditions of landslides and debris flows that posed hazards, and provided 24-hour emergency assistance to City and County personnel by identifying and evaluating landslides, debris flows and flood hazards.

Geologic Hazards Evaluations, Utah and Wyoming: Evaluated site conditions at approximately 30 individual residential lots and proposed subdivisions (up to 3000 acres in size) to assess geologic hazards including seismic hazards, surface and ground-water impacts, landslides, and collapsible soils. Reports have been prepared in support of obtaining approval for septic drain fields, building permits, and subdivision approval.

***Erosion and Sedimentation Evaluations***

Sediment Yield Evaluation, Grants, New Mexico: Determined erosion rates, soil loss, and sediment yield from an 8,000-acre area disturbed by open-pit uranium mining. Developed a site-specific model that considered soil loss contributions from sheetwash, rill, gully, and stream-bank erosional processes. Sediment yield was evaluated for existing, post-reclamation, and pre-mining conditions at eight locations where drainages exited the mine site. The model results were tested by comparing the estimated sediment yield to the measured sediment accumulation in a downstream reservoir.

Erosion and Sediment Transport Investigation, Central Utah: Performed field measurements in ephemeral channels to document bank erosion, deposition, and impacts from past mining activities. Measured and mapped erosion features on disturbed slopes and mine waste piles, and evaluated their potential as sediment source contributors to the watershed drainage network. Calculated expected erosion rates and volumes, and modeled sediment transported in the stream channels. Assessed historic downstream deposition of tailings material.

***Stream Channel and Floodplain Restoration Designs***

Stream Channel Stability Evaluations and Design, Salina, Utah: Conducted an evaluation of two stream channels at a reclaimed mine site that had been damaged by high-runoff events. Channel stability was evaluated by considering the geomorphic setting, previous channel designs, stable upstream reaches, and examples from the literature. Prepared designs for reconstruction of the channels incorporating a series of buried grade control structures. Provided assistance in permitting the design and developed a program for construction supervision.

Stream Channel and Floodplain Evaluations and Design, Salt Lake City, Utah: Conducted an evaluation of existing hydrology on a 200-acre portion of the Jordan River Floodplain. Surface water features were surveyed and quantified; ground water flow was modeled based on data obtained from shallow bore holes. Designs were prepared for channels that would transfer surface water to dry parts of the floodplain in order to enhance shallow ground water available to plants. The project goals were to reestablish native floodplain vegetation to provide habitat for migratory birds. Channels were also designed to convey runoff from an adjacent site to the project area.

River Restoration, Carbon County, Utah: Designed a realignment and restoration of a 1,500-foot reach of the Price River that had been impacted by coal mining. Reviewed peak flows for various return-interval events, evaluated geomorphic stability, flow hydraulics, sediment transport, aesthetics, wildlife habitat, and costs to develop designs for river and floodplain restoration. Developed several conceptual design alternatives for client review and rated each alternative based on effectiveness, costs, long-term stability, maintenance requirements, permit considerations, and constructability.

***Surface and Ground Water Investigations***

Investigation of Lake Flooding, Southern Utah: Conducted an evaluation of the cause of recent flooding on property adjacent to Quichapa Lake. Investigations consisted of evaluation of aerial photographs, topographic maps, records of historic floods, climate records, vegetation, and playa sediments. Site investigations included flood boundary mapping and surveying, inspection of hydraulic control structures and channel geomorphic features, collection of tree sections for dating, and collection of sediment cores in order to determine cause of flooding and history of flooding in the lake basin.

Investigation of Flood Sources, Central Utah: Conducted an evaluation of the cause of recent flooding on property adjacent to the Sevier River. Investigations consisted of evaluation of aerial photographs, topographic maps, records of historic floods, and determining flood magnitudes and recurrence intervals. Site investigations included floodplain mapping and surveying, aerial reconnaissance during flood events, and inspection of hydraulic control structures in order to determine source of flooding.

Investigation of Potential Sources of Seepage, Great Salt Lake Beach, Utah: Conducted an evaluation of seepage and beach saturation in a complex industrial and hydrogeologic setting. Investigation consisted of reviewing reports of previous investigations, conducting field investigations and surveys, conducting finite element seepage modeling of ground-water flow, and investigating surface-water management of nearby water sources.

Runoff and Sediment Control Plans, Utah and Nevada: Performed the hydrology and hydraulics analyses and designed integrated runoff control plans at numerous mine and industrial facilities ranging in size to 300 acres. Determined runoff volumes, peak flows, and sediment yield. Plans were developed that would: direct upgradient runoff from undisturbed watersheds through the sites; control runoff generated on the sites and prevent it from mixing with the undisturbed area runoff; minimize the potential for on-site runoff to contact pollutants; direct perennial seepage water through the sites; and provide treatment for site runoff prior to its leaving the sites. Structures designed as part of these runoff control networks include earth-lined channels, riprap channels, biodegradable erosion control channel protection, water bars, drop structures, culverted road crossings, synthetic lined channels, spillways, and sedimentation ponds.

***Regulatory Evaluations/Project Reviews***

Building Permit Review, Northern Utah: Served as a member of the Morgan County Geologic Peer Review Board for purpose of reviewing geologic and geotechnical engineering reports submitted by applicants for building permits. Conducted public meetings, performed site inspections, and prepared written comments for Morgan County on several proposed residential developments.

Environmental Impact Statement Review, Northern Utah: Conducted a review of a Draft EIS prepared by the Army Corps of Engineers for a proposed 5,000-acre expansion of a tailings impoundment. Key technical issues were potential impacts to surface and ground water, adjacent wetlands, and the Great Salt Lake. An extensive summary report was prepared identifying specific items that needed clarification and/or additional information.

Environmental Assessment Review, Southern Utah: Conducted a review of an Environmental Assessment prepared by the BLM for a proposed chaining project on public and private land. Evaluated the geologic and hydrologic investigations conducted to support the impact assessment from sedimentation and erosion.

Hydropower Project Permitting Review, Western Colorado: Conducted reviews of the Draft and Final EIS, the Army Corps of Engineers 404 permit application, and supporting technical documents for the proposed AB Lateral Hydropower Project. The proposed project would divert about 900 cfs from the Gunnison River to the Uncompahgre River. Evaluated the impacts to the Uncompahgre River and prepared detailed technical comments on potential changes to stream geomorphology from bed scour and bank erosion.

Dam Permit Application Review, Central Utah: Conducted a review of a Federal Energy Regulatory Commission (FERC) application for a proposed dam and hydroelectric power plant on the Fremont River, near Capitol Reef National Park. Prepared comments on the adequacy of the geologic, geotechnical engineering, and hydrologic investigations conducted as part of the application package, and potential impacts to the river within the park.

Mine Permit Application Review, Southern Utah: Conducted several reviews over a three-year period of mine permit applications submitted to the Utah Division of Oil, Gas and Mining (DOGM) for a proposed coal mine on the Kaiparowits Plateau. The hydrology and geology sections of the permit application were evaluated, written comments were prepared, and expert testimony was provided on the adequacy of the baseline investigations, probable hydrologic consequences, monitoring plans, and impacts to surface and ground water.

Highway Design and Construction Review, Central Utah: Conducted reviews of design drawings, and construction specifications during a three-year period of highway construction for U.S. 189 in Provo Canyon, Utah. The geologic and hydrologic components of the project were evaluated for their compliance with NEPA and the Clean Water Act. Engineering geologic components of the project were evaluated, with emphasis on slope stability of hillslopes, cuts for the roadway, impacts to the Provo River, and mitigative measures. Prepared numerous written documents based on site inspections, surveys, data analysis, and interpretation.

Mine Permit Application Review, Central Utah: Conducted several reviews over a seven-year period of mine permit applications submitted to the Utah Division of Oil, Gas and Mining (DOGM) for a proposed coal mine along the Book Cliffs. The hydrology and geology sections of the permit application were evaluated, written comments were prepared, and expert testimony was provided on the adequacy of the baseline investigations, probable hydrologic consequences, monitoring plans, and impacts to surface and ground water.

Mine Permit Application Review, Southern Utah: Conducted review of a mine permit application submitted to the Utah Division of Oil, Gas and Mining (DOGM) for a proposed strip coal mine near Alton. The hydrology and geology sections of the permit application were evaluated, written comments were prepared, and expert testimony was provided on the adequacy of the baseline investigations, probable hydrologic consequences, monitoring plans, impacts to surface and ground water, and alluvial valley floor determinations.

Mine Permit Application Review, Eastern Utah: Conducted review of a mine permit application submitted to the Utah Division of Oil, Gas and Mining (DOGM) for a proposed tar sand mine in the Uintah Basin. The hydrology and geology sections of the permit application were evaluated, written comments were prepared, and expert testimony was provided on the adequacy of the baseline investigations, monitoring plans, impacts to surface and ground water, and reclamation.

Coal Power Plant Permitting Review, Southern Nevada: Conducted a review of ground water discharge permit, NEPA document, and landfill permit application for a coal power plant in southern Nevada. The hydrology, engineering, and geology sections of the documents were evaluated and written comments and testimony were provided on ground water contamination from evaporation ponds and the landfill.

***Dams and Water Infrastructure***

Engineering Geologic Investigations – Existing Dams, Utah: Conducted investigations at 13 existing high-hazard earthen dams for various water user associations in compliance with Utah Statutes and Administrative Rules for Dam Safety. Investigations have included preparing maps of surface and bedrock geology including landslides and faults; drilling, logging, and sampling test holes in existing dams and abutments; installation and monitoring of piezometers; evaluating liquefaction susceptibility; developing earthquake design parameters from both deterministic and probabilistic methods; and preparation of maps, cross-sections, logs, and reports.

Engineering Geologic Investigations – Monks Hollow Dam Site, Wasatch, County, Utah: Conducted investigation at the site of a proposed concrete arch dam on the Diamond Fork River for the Central Utah Water Conservancy District. Investigations included review of Bureau of Reclamation geologic and seismic reports and design drawings; inspection of exploratory tunnels in abutments, mapping surficial geology and faults, evaluating fault activity, and preparation of presentations and summary report.

Engineering Geologic Investigations – Water Storage Tank, Draper, Utah: Conducted geologic hazards investigations at three sites for a proposed 2.3 million gallon water storage tank in the Traverse Mountains. Hazards evaluated included landslides, debris flows, rock falls and surface fault rupture. Test pits and trenches were excavated, geologic logs were prepared of subsurface geology, landslide and fault activity was evaluated, and reports were prepared and summarized in a presentation to the Draper City Council.

Engineering Geology and Geologic Hazards Evaluations – Canal Enclosure, Utah County, Utah: Project consisted of evaluating engineering geology and geologic hazards for a proposed 22-mile long, 144-inch diameter pipeline along the base of the Wasatch Mountains. Hazards evaluated included landslides, debris-flows, surface-fault rupture, and rock fall. Soil properties were characterized from test hole, test pit, and trench logs according to surficial geologic units. Test holes were drilled, logged, and sampled in a one-mile wide landslide in order to assess landslide characteristics and activity. Active faults were mapped from aerial photographs, and potential rock-fall areas were delineated from field surveys. Results were summarized in a report and presentations were made to the Water Users Association.

***Slope Stability Modeling and Remedial Design***

Landslide Analyses and Remediation, Central Utah: Conducted three separate analyses of recent landslides that occurred on a pipeline right-of-way, a reclaimed mine, and an active mine. Projects including detailed mapping of landslide features, conducting seismic profiles, installing borings and piezometers, collecting samples, conducting laboratory testing, and conducting computer stability analysis. Based on the analyses, remediation designs were developed to increase stability by controlling surface and shallow ground water, and regrading the landslides to stable configurations.

Sediment Pond Stability Evaluation, Salina, Utah: Conducted stability analysis and prepared hydraulic designs for an earth embankment of a sediment pond. Stability was evaluated for full-reservoir and rapid-drawdown conditions under static and pseudo-static scenarios. Based on these analyses, a new embankment was designed and a report was prepared including construction drawings for the embankment as well as for the primary and secondary spillway structures.

***Seismic Hazard Evaluations***

Liquefaction Analysis, Wasatch Front, Utah: Evaluated liquefaction potential for four sites along the Wasatch Front. Factors considered were presence and depth of liquefiable layer of loose sand identified from blow counts in previous geotechnical borings, depth of ground water, and horizontal acceleration of gravity resulting from an earthquake on nearby faults. Probability of liquefaction for specified periods of time, and the amount of settlement that would result was estimated at each site.

Fault Rupture Investigations, Western United States: Conducted aerial photo interpretation, low sun-angle aerial reconnaissance, drill log and core examination, topographic and stream channel profiling, and trench logging as part of investigations of normal and accommodation faults in Arizona, Montana, Nevada, and Utah. Have participated in, or directed, approximately 20 individual surface fault rupture investigations for projects ranging from single-family lots and commercial/industrial facilities to 50-acre subdivisions.

***Paleoenvironmental Reconstruction***

Investigation of Paleolakes, Central Utah: Conducted an investigation to document the presence of lacustrine ecosystems in the southern Bonneville Basin during the Paleoindian period. Sediments were retrieved from deep bore holes in four present day playas and sub basins of Lake Bonneville. Chronological control was established based on radiocarbon analysis. Paleoenvironmental conditions within the region were derived from analysis of biological and geochemical indicators preserved in the sediments.

Paleoenvironmental Reconstruction, Southeastern Wyoming: Conducted investigations to reconstruct paleoenvironmental conditions for the Snowy Range and Carbon Basin during the late Pleistocene and the Holocene. Sediment cores were retrieved from five modern lakes and sediments were analyzed for sedimentological, biological, geochemical, and isotopic indicators of past climate and environmental conditions. Chronological control was established based on radiocarbon analysis.

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# Exhibit D

M/047/0103
cc: Leslie
Tom

State of Utah
GARY R. HERBERT
*Governor*

GREG BELL
*Lieutenant Governor*

Department of
Environmental Quality

Amanda Smith
*Executive Director*

DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
*Director*



Rec'd
2/13/2012

February 10, 2012

Mr. Robert J. Bayer, P.G.
JBR Environmental Consultants, Inc.
8160 Highland Drive
Sandy, Utah 84093

Dear Mr. Bayer:

Subject: Completeness Review Comments and Request for Information
Red Leaf Resources, Inc. Ground Water Discharge Permit Application

The Division of Water Quality (DWQ) has completed a review of the Ground Water Discharge Permit Application for the Red Leaf Resources (Red Leaf) Southwest #1 Project, which we received on December 21, 2011. The application is for a proposed oil shale mining and hydrocarbon extraction project at the Red Leaf SITLA lease site located approximately 55 miles south of Vernal in Uintah County, Utah. The proposal involves mining and crushing oil shale, and constructing "capsules" using the crushed shale and overburden, along with bentonite-amended shale (BAS) liners, to provide an in-situ no-discharge structure for thermal hydrocarbon extraction, and subsequent in-place reclamation. Based on our review, we have the following comments.

**Spent Shale Management**

Analysis of spent shale from a pilot test of Red Leaf's capsule retort technology using the Synthetic Precipitation Leaching Procedure (SPLP) suggests that natural precipitation coming into contact with the spent shale would dissolve minimal amounts of contaminants at concentrations below Utah ground water quality standards. One exception is antimony, which was slightly above the ground water quality standard. The SPLP results indicated a pH of 10, which suggests that water from precipitation exposed to the spent shale could generate leachate with high pH. Red Leaf has not provided information to indicate that the potential for the spent shale to generate high-pH leachate will diminish over time. Because high-pH leachate has the potential to harm beneficial uses of surface and ground water, the spent shale must be managed in a way to prevent the potential release of high pH leachate to surface or ground water.

Under Red Leaf's plans for mining and reclamation, it would take a considerable amount of time for precipitation to accumulate and react with buried spent shale in quantities large enough to affect ground water resources. Therefore, DWQ's concerns are related to long-term management of the spent shale. Following are several deficiencies we have identified in the Red Leaf ground water discharge permit application dated December 20, 2011.

Comment 1: Red Leaf asserts that the upper layer of BAS to be installed on top of the stacked shale and an insulating layer in a capsule will retain a 1 x $10^{-7}$ cm/sec saturated hydraulic conductivity after the shale is heated and undergoes compaction of nearly 40 feet in the capsule. Red Leaf should either provide a field demonstration that the hydraulic conductivity will not be adversely affected by capsule compaction, or provide additional modeling results using higher hydraulic conductivity values that might be expected post-compaction to show that surface and ground water quality will be protected after reclamation.

Comment 2: The application should provide a more complete justification for the input parameters and climate data used in the HELP model to assure that the values chosen are appropriate for this site. In particular, the justification should address the values chosen for hydraulic conductivity of the upper BAS layer, as mentioned above, the initial moisture content of the various model layers, and the climate data chosen for the growing season and precipitation. There should also be a statement of limitations inherent to the HELP model. Also, Red Leaf only ran the model for thirty years, while DWQ is interested in long-term performance of the waste containment. In particular, Red Leaf should estimate the time it would take for the spent shale in an upper, "Tier 2" capsule to reach field capacity, at which point it could possibly discharge leachate. The estimate should be done for two scenarios, one in which the upper BAS layer and capping materials are intact; and another scenario where they have been removed by erosion. Model input parameters and limitations should be explained as with the HELP modeling described above.

Comment 3: Surface drainage off of the reclaimed capsules could potentially come into contact with the spent shale as the upper cap and BAS layer erode over time. Red Leaf's plans for reclamation include collecting some of this water in ponds within the mine pit, and other streams would discharge to the regional surface drainage. Red leaf should demonstrate how this planned drainage will be protective of surface and ground water resources in the long term, in case the water becomes alkaline due to contact with the spent shale.

**Capsule Engineering Comments**

Comment 1: The second to last sentence at the bottom of page 5 states: *The permeability of the BAS layer will be 10 x $10^{-07}$ cm/sec or less.* This is incorrect and should be 1.0 x $10^{-07}$ cm/sec or less.

Comment 2: Sheets 1 and 2 of Figure 7 (Capsule Life Cycle Sections) are drawn to scale and show the knuckles and sides of the capsules. However, it would be appreciated if dimensions were placed on the drawings for the knuckles (slope, thickness of ore, thickness of overburden, etc.).

Comment 3: The following statement is made in Section 11.6 (Process Wall Penetrations): *Proprietary fabrications have been designed and will be installed to enable BAS protection from heating.* Although these fabrications may be proprietary, the information is still required for our engineering review and can be marked "confidential" to ensure that DWQ does not make the proprietary information available to the public.

Comment 4: The following statement is made in Section 11.13.2.1. (Shale): *The ANSYS "multi-linear elasticity" model was used to approximate consolidation properties of rubblized shale at varying temperatures.* Please provide the entire report and model with all input parameters so we can review them.

Comment 5: Sections 11.13.2.2. (Gravel) and11.13.2.3 (BAS) reference a Drucker-Prager plasticity model. Please provide the entire report and model with all input parameters so we can review them.

Comment 6: Section 12.2. (Bottom Liner Fill) of the Construction Quality Control Plan states that BAS will be placed and bladed to a maximum loose lift thickness of 18 inches. Although 20 feet by 40 feet test pads will be constructed using BAS manufactured on site, we have never seen a clay liner constructed with an 18-inch loose lift thickness. Typically, the loose lift thickness is between 8 and 12 inches.

Comment 7: Section 12.3. (Side Liner) indicates that the test pad will be constructed without the gravel side liner. However, a test pad should be built just as it would be with the actual construction, which would mean construction of the BAS with the gravel side liner.

Comment 8: Based on the SPLP results, potential leachate generated by percolation of precipitation through the spent shale could have a high pH. Please provide information that addresses potential adverse effects of high pH leachate on the BAS bottom liner.

We realize that some of the information we are requesting may be proprietary or business confidential. Please indicate when requested information is proprietary or business confidential so we can keep this information separate from the publicly accessed files.

If you have any questions about the Spent Shale Management comments, please contact Mark Novak at (801) 536-4358 or mnovak@utah.gov. For questions on the Capsule Engineering comments, please contact Woodrow Campbell at (801) 536-4353 or wwcampbell@utah.gov.

Sincerely,

Robert J. Herbert

Rob Herbert, P.G., Manager
Ground Water Protection Section

RFH/WWC/MTN:

cc: Laura Nelson, Red Leaf Resources
Paul Baker, DOGM
Scott Hacking, Tri-County District Engineer
Tri-County Health Department
Sonja Wallace, SITLA

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