Ohio Environmental Protection Agency

John R. Kasich, Governor
Mary Taylor, Lt. Governor
Craig W. Butler, Director

October 3, 2017

Re: Buckeye Brine
Permit – Long Term
Application and Support
Underground Injection Control
Coshocton County
OHS031350001

Mr. Steve Mobley, President
Buckeye Brine, LLC
2630 Exposition, Suite 117
Austin, TX 78703

Subject: Class I UIC Permit to Operate Applications – Notice of Deficiency
Buckeye Brine, LLC
23986 Airport Road
Coshocton, Ohio 43812

Dear Mr. Mobley:

Ohio EPA's Underground Injection Control (UIC) Unit has completed its initial review of all submittals related to the Class I Non-Hazardous permit applications submitted by Buckeye Brine LLC (Buckeye Brine) on June 1, 2017 (with appropriate permit application fees of $3,000 per well). Currently, Buckeye Brine operates three (3) UIC Class II brine disposal wells at its Keene Township, Coshocton County, Ohio Facility. The current wells permitted by Ohio Department of Natural Resources (ODNR) UIC Section are API #34031271770000, API #34031271780000, and API #34031272410000. Citing declining oil and gas activity in the region and a need for an environmentally sound method for disposing of non-hazardous waste waters as the reason, Buckeye Brine's applications propose to convert its Wells #1 (**API #34031271770000)** and #3 (**API #34031272410000)** to Class I Non-Hazardous disposal wells while Buckeye Brine Well #2 will remain as permitted with ODNR.

The following serves to summarize comments the UIC Unit has compiled during its initial review of the applications.

Section I – Volume 1

Table 1 of the applications summarizes the requirements of the UIC permit to operate applications which reflect the applications rules of Ohio Administrative Code (OAC) Rules 3745-34-12, 3745-34-13, and 3745-34-15. Table 1 should be amended to include specific location of the information required by the application, specific to the precise section(s) and page(s).

Table 1

- Application #1 and #3 should have its own separate table. The applications contain only a table for Well #1.

- Each well must have its own individual latitude and longitude, not the coordinates of the centroid of the facility.

- Table 1 cites attachments that do not exist (i.e. Attachment III C.5).

- Page 31 of Table 1 indicates Well Operating Procedures are located in Attachment III.C.1. Attachment III.C.1 is the Plugging and Abandonment Plan.

Expertise
Appendix II Section 1 of the application asks for a statement of the relative expertise of the owner of a proposed Class I injection well per OAC Rule 3745-34-13 (A). Buckeye Brine provided a statement that they had no expertise but believe the Class II wells they operate are operated at very similar standards to Class I wells. Please include a brief discussion of the credentials of third party service contractors who participated in the well installation, who compiled the permit applications and who oversee the routine well testing.

Financial Assurance
Buckeye Brine has not provided financial assurance but has provided justification for not doing so at this time. Buckeye Brine has indicated it would provide financial assurance after UIC Class I permit issuance. At no time would Ohio EPA grant a permit to operate that allows operation of a Class I injection well until the appropriate financial assurance for the injection wells has been established and approved, in writing, by the Director of Ohio EPA.

The Buckeye Brine applications do contain financial statements that indicate Buckeye Brine has the resources to cover the closure cost estimate of Well #1 which is $178,000. This does not cover the cost estimate of $183,000 estimated for Well #3 nor does it cover post-closure cost estimates (which were not evaluated and will be addressed separately later in this summary). The aggregate of all expected costs associated with both closure and post-closure should be represented in all financial statements indicating Buckeye Brine has adequate financial resources for these potential expenditures. With this, and per OAC Rule 3745-34-13 (H), Ohio EPA could accept these documents as "other materials acceptable to the Director" at this phase in the permit application review.

Chemical Data
Appendix 1 Section 9 of the application and OAC Rule 3745-34-12 (E)(12) asks that the applicant state the chemical composition and physical properties of the fluids planned for injection. Buckeye Brine indicates that it cannot provide this data being that it plans to accept 3rd party generated wastes. Please provided more of a general profile of the expected waste stream.

Formation Sampling:

- Appendix III (per rule OAC Rule 3745-34-15) Section 1 asks for the results of the formation testing program that "includes all of the following":

Laboratory testing results:

i. Cores for permeability;
ii. Cores for compatibility;
iii. Cores for porosity;
iv. Analysis of formation water; and
v. Descriptive core analysis and sieve analysis.

The data from the formation testing program including the analysis of the chemical, physical and radiological characteristics of and other information on the receiving formation is also to be included.

BB doesn't provide this data as it was never collected on its wells. Buckeye Brine should explore any and all available data on wells drilled within the Area of Review or further, to determine if data exists to supplement the applications.

Section II Geology

- Geologic expertise section dated May 1, 1017. Please correct date.

- Figure II. B. 7. 01. Doesn't show all artificial penetrations per the requirements of OAC Rule 3745-34-13 (D)(3).

- Page 58, The Mt. Simon top is nearly 100 feet lower in Well #1 than in Well #3. This change in a lateral wellhead distance of 921 feet implies a structural event of sorts, possibly faulting. The applications acknowledge "it is a value out of line" with the relatively flat stratigraphy in Ohio. The applications also indicate that no downhole deviation survey were recorded, but deviation surveys were taken through the intermediate hole. Please describe "intermediate hole". The applications and associated figures indicate only a conductor hole, surface casing hole, and the long string/production hole.

- Buckeye Brine has described the offset Mt. Simon tops as a possible "Growth Fault". Please expand.

- Figure II.B.8.05 should be revised to include formation tops referenced to Kelly bushing and provide surface elevation of both wells including total depths.

Seismic

- No formations/horizons between the Gull River/ Pre-Cambrian basement identified. Please revise to include per OAC Rule 3745-34-40 (E)(6).

- Discussion of "Airport Dome" feature. The applications indicate some faulting is apparent but doesn't appear to extend beyond the Mt. Simon Formation into the Rome Formation. OAC Rule 3745-34-13 F (3) requires that the application include a determination that the geology of the area can be described confidently and that limits of waste fate and transportation can be accurately predicted using models. Buckeye Brine's applications don't clearly make that determination. If faulting from the underlying Pre-Cambrian structure extends into the Mt. Simon as the applications indicate, accurately modeling this portion of the injection zone could be questionable if fault communication exists.

- On July 31, 2017, Buckeye Brine provided Ohio EPA with a CD copy of the raw field data. Please provide four (4) additional copies that will be included with the four (4) applications that will go to ODNR for review.

Section III Construction

- Are the referenced depths from Kelly bushing? What is surface elevation? This information should be on all schematics.

- The cement ticket for Well #1 indicates the 11 ¾" surface casing was set at 882 feet. The well schematic of Figure III.A. indicates surface casing was set at 894 feet. Please explain/correct the discrepancy. The 8 5/8" long string casing cement ticket and schematic match (5,898 feet).

- Long string centralizers. The applications indicate centralizers were placed on the bottom 10 joints of the Well #1 and #3 casings. No centralizers were placed on the 5,000+ feet of casing above that?

- III.A.3.a. of the application for Well #3 indicates the original long string casing was installed to 5,950 feet. The applications document that at some point in the operational life of the Class II well, the long string casing parted making 5,912 feet the new bottom of the continuous casing length where there then is a 50-foot gap to the top of the casing "fish" (5,962 feet) and the bottom of the fish is at 6,048 feet. These depths are according to the well schematic (Figure III.A.). This same figure indicates the original long string casing was set at 6,015 feet. However, page 2 of the application indicates the original casing set point was 5,950 feet. If the fish is 86-foot long, with a 50-foot gap from the continuous casing that would imply the casing was originally set at 6,036 feet. Cement ticket shows 6,015 feet. Please make the necessary corrections and resubmit.

- The construction data for Well #1 indicates that cement was not brought to the top 906' of the long string casing due to problems during cement job. Ohio EPA will not permit operation of a Class I well without the casing cemented to surface to ensure protection of Underground Sources of Drinking Water (USDW) per OAC Rule 3745-34-07 A.

- The construction data for Well #3, as discussed earlier, documents a bottom hole casing construction failure. Ohio EPA requests a full explanation of how this may have

occurred including assurance that the inability to have a secure casing shoe at the bottom of the long string casing will not compromise the well's ability to contain wastes within the intended intervals.

- Prior to a well receiving authorization to inject, Ohio EPA would require demonstrations of mechanical integrity per OAC Rule 3745-34-34. This would include, at a minimum, an annular pressure test (APT), a radioactive tracer (RAT) survey, and a temperature survey. This testing would require a workplan be submitted for Ohio EPA approval. At the current time, and per Buckeye Brine representatives, the casing fish doesn't prohibit the passing of logging tools through the compromised section. Should that change, Ohio EPA would require remedial action should a Class I permit to operate be granted.

- The well schematic of Well #3 indicates the long string casing is 24# casing. Page 2 of the construction section narrative indicates 32# casing. Please make the necessary corrections.

- Please provide Well #1 surface casing cement bond log. The Well #1 long string casing cement bond log was provided. The log shows one pass with a 1,000-psi applied to the casing. If other passes, i.e. a zero-pressure pass was conducted, please provide a copy of the log(s).

- Please provide cement bond logs for Well #3. None located in the application.

- Per OAC Rule 3745-34-15 (I), please confirm the applications contain all logs or other related data related to demonstrations of mechanical integrity testing.

- Page 12 of Section III indicates the Well #1 casing was set at 5,898 feet. Please correct.

- Section III.A.10. indicates there are cement bond logs and RAT logs in Appendix 3. Ohio EPA can't locate these logs for either application.

- Section III.A.9. discusses the lack of cores and native formation fluids as required by OAC Rule 3745-34-15 (A). The applications indicate that the operational history suggests there is sufficient porosity and permeability. The applications don't appear to address potential waste compatibility with what would be the receiving formations. Please address.

- Figure III.A of the Well #1 application indicates the bottom of the packer is at 5,826 feet. But Figure III.B of the Well #1 application indicates the bottom is at 5,819 feet.

- Figure III.B of the Well #3 application indicates the packer is set at 5,924.64 feet below Kelly bushing.

- Section III.B.9. OAC Rule 3745-34-15 (J) requires a plan for monitoring the lowermost USDW near the injection well(s). Buckeye Brine has proposed a 3" monitoring well to the base of the USDW (330 feet). Understanding the applications contain a preliminary plan that will be later refined should a Class I permit to operate be issued, the applications should be revised to include a general location map of a proposed monitoring well placement that would also show ground water flow direction with a piezometric water table contour map. Buckeye Brine should include a general list of parameters to be analyzed including major markers/analytes that would be indicative of the expected waste stream.

- The applications should be more specific with regard to the cement used in the well construction/s. This includes discussion/disclosure of type/blends/additives used in lead, intermediate and tail slurries. The cement tickets aren't included in the paper applications.

- Attachment III.B.2 Corrosion Monitoring Plan. Buckeye Brine needs to be more specific as to the individual corrosion coupons it proposes to use. Any well material that could be exposed to waste fluids must be represented.

- Buckeye Brine has proposed to plumb the corrosion monitoring rack in the way that the coupons will be exposed to 8-14 gallons per minute (3-5 feet per second in a 1-inch pipe). This rate is significantly lower than the expected operational rates. Section 2.0 of the proposed plan indicates high flow rates can contribute to erosion and low rates (less than 2 feet per second) can accelerate corrosion and biological fouling. Please provide any available supporting documentation that the proposed 8-14 gallons per minute/3-5 feet per second is the optimum rate in obtaining the most representative corrosion monitoring sample without compromising the coupon.

- Attachment III.B.3 – Please provide all Well #1 tracer logs available. Please provided any formal reports that supplement these logs including any written field procedures that may be available.

- Waste Analysis Plan – Section 2 of the plan indicates that the generator of a waste stream is the entity legally obligated to characterize its wastes prior to disposal by a third-party (i.e. Buckeye Brine). Although Ohio EPA doesn't dispute this, but should Class I UIC permits to operate be granted, Buckeye Brine would ultimately be responsible for characterizing the waste stream prior to injection through re-sampling.

- Section 5 of the plan indicates that the only radioactive wastes that Buckeye Brine would accept would be NORM and TENORM. Please provide a range (in pCi/L) of concentrations that Buckeye Brine would expect to take in.

- Section 7.1 of the plan indicates there may be situations where Buckeye Brine will accept un-manifested waste shipments. Please explain further.

- Section 9 of the plan indicates that non-TSCA PCB's greater than 35 ppm will not be accepted. Please explain how 35 ppm was selected.

- Attachment III.C.1 Plugging and Abandonment Plan should be revised to include, at a minimum, a continuous cement plug from below the lowermost USDW to surface. The bottom and middle plugs as proposed are adequate.

- Applications should be amended to include a Post-Closure Monitoring Plan. i.e. Post injection period modeling, USDW sampling results, etc.

Section IV Reservoir Mechanics

Section IV.1 indicates the Well #1 packer is set at 5,833 feet below ground surface. The well schematic provided suggests otherwise. Please revise as necessary.

Section IV.1 indicates the injection interval is defined as the interval between the base of the packer assembly to total well depth. OAC Rule 3745-34-01 (KK) defines the injection interval as the area in which direct fluid emplacement occurs. Therefore, the bottom of the long string casing is the top of the injection interval in Well #1. In Well #3, due to the downhole casing issue, the bottom of the 8 and 5/8-inch continuous casing (indicated to be 5,912 feet) would be the top of the injection interval. Please revise applications accordingly.

IV.1 indicates a cement plug in the bottom of Well #1. Please elaborate. This was not mentioned in Section III.A.2 where construction is defined. If the well was plugged back, schematics should be revised accordingly. 7,305 feet listed as total drilled depth in Table 1.

IV.4 Despite 50,000,000+ gallons more fluid (32%) has been injection into Well #1, Well #3's bottom hole pressure has increased 34 psi compared to 9 psi at Well #1. This would suggest the operation of Well #1, and most likely, Well #2 have influenced bottom hole pressures in Well #3. If 34 psi is the known current pressure increase in Well #3, that pressure would be expected to increase to some degree over the 5-year modeled period. Table IV.5 should be re-evaluated to address this. The table should also be updated to account for the 38 to 45 psi modeled increase cited in Section IV.6.4.

Modeling inputs account for the 1.2 specific gravity of the connate fluid but do not account for potential injectate with lighter gravities that may have higher diffusion and dispersion rates. Please address.

Section V Area of Review

Maps

OAC Rule 3745-34-12 (E) (13) 1" = 400' Map:

- Buckeye Brine elected to delineate a two (2) mile radius surrounding the Buckeye Brine facility as the Area of Review (AOR). 2 miles was chosen "as a measure of safety" per Section V of the permit applications. Ohio EPA has no objections with the chosen

radius, however, the map appears to be missing several key components. Please revise the maps to include all required information before certification by an Ohio registered surveyor.

This would include providing a legend that identifies all features required by rule. The items highlighted in red are those that Ohio EPA believes hasn't been properly addressed and incorporated.

a. The facility.
b. Each of the facility's intake and discharge structures.
c. The proposed injection wells.
d. Each of the facility's hazardous waste treatment, storage or disposal facilities.
e. Solid waste disposal areas at the facility.
f. Each well where fluids from the facility are injected underground.
g. All wells permitted to inject fluids underground. (do Class V wells exist?)
h. Active, closed, and temporarily abandoned oil and gas wells.
i. Those wells, springs, and other surface water bodies, and drinking water wells listed in public records or otherwise known to the applicant including the drinking water source protection area for all public water supply wells identified.
j. If the well is currently or is proposed to be located within the excavations and workings of an active mine, the map shall include all the following:
    i. The location of the mine.
    ii. The name of the mine.
    iii. The name of the person operating the mine.
k. If the well is currently or is proposed to be located within the excavations and workings of an abandoned mine, the map shall include all the following:
    i. The location of the mine.
    ii. Where known, the name of the mine.
    iii. Where known, the dates the mine operated.

<u>OAC Rule 3745-34-13 D map requirements</u>.

- All the following features within the AOR are required on a map (scale optional) (not required to be certified by Ohio registered surveyor):
    i. The location of all known wells that penetrate the injection zone within the injection well's area of review;
    ii. Actively producing oil and gas wells;
    iii. Active, temporarily abandoned, and abandoned injection wells;
    iv. Abandoned oil and gas wells including non-producing wells and boreholes;
    v. Surface bodies of water;
    vi. Springs;
    vii. Mines (surface and subsurface);
    viii. Quarries;
    ix. Water wells;
    x. Other pertinent surface features including residences and roads; and
    xi. Seismic areas and faults, if known or suspected; and

xii. Boundaries of the facility.

- Similar to the 1" = 400' map, the map should include a legend including all features listed above.

Conclusion
Ohio EPA requests that Buckeye Brine address these comments within forty-five (45) days of the date of this transmittal. An adequate response will allow Ohio EPA to forward copies of the applications to Ohio Department of Natural Resources (ODNR) for its divisions' respective reviews pursuant to Ohio Revised Code Chapter 6111.044.

Should you have any questions, please contact me at (614) 644-3556 or via email at jess.stottsberry@epa.ohio.gov .

Sincerely,

Jess Stottsberry
UIC Unit Geologist
Division of Drinking and Ground Waters

cc: Andrew Adgate, UIC Program Administrator, ODNR
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