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From: Buffalo River <buffalowatershed@gmail.com>
Sent: Thursday, December 15, 2016 5:01 PM
To: drillingstudyquestions
Subject: 20161215-Gordon-Watkins
Attachments: BRWA Drilling Report Questions.pdf

Please find the attached Word document, and included below, questions regarding the Harbor C&H drilling study, submitted on behalf of Buffalo River Watershed Alliance.

Thank you
Gordon Watkins

Buffalo River Watershed Alliance
buffaloriveralliance.org

**Questions regarding Harbor Environmental Drilling Report
from Buffalo River Watershed Alliance**

Submitted electronically to drillingstudyquestions@adeq.state.ar.us

December 15, 2016

Field Notes

Questions-

1) Were the notes described as “*Field notes transcribed by Thomas Huetter, P.G., Harbor Environmental*” originally taken by Thomas Huetter?

2) Why were the original notes in their original form not produced in addition to the transcribed notes?

3) Will those original notes be made available to the public?

QA/QC

Question -Were split samples pulled and chain-of custody procedures followed in accordance with the workplan? If not, why?

The Hubbard report references problems with “undersized core sample boxes” and stated “*The drilling method employed during this investigation consisted of a rotosonic drill rig without a high speed rotation implement used for typical rock coring. This limitation resulted in poor rock core quality, preventing the calculation of Rock Quality Determination (RQD) as proposed.*”. Both of these limitations would seem to be completely avoidable oversights given the considerable planning and expense devoted to this project.

Questions –

1) Were the core samples transferred to appropriately sized boxes suitable for long term storage and possible future analysis? If not, why?

2) Did ADEQ or Harbor foresee problems with preserving integrity of the core samples by using oversized boxes and the lack of a “high speed rotation implement”?

3) How does the lack of a Rock Quality Determination, representing a deviation from the Workplan, affect the overall study?

4) Was there sufficient material/water in all samples to split according to Workplan ?

5) What evidence can you cite that there were no irregularities or confusion in the collection, labeling and handling of soil, leachate or groundwater samples?

Cementing

Huetter's transcribed notes state that the driller pumped 225 gallons of cement on 9/23 (1550 entry) and that on 9/26 (1423) the borehole was grouted to the surface with an additional 50 gallons, a total of 275 gallons. This does not agree with the report. The report at Page 8 states

“ Due to fracture zones encountered in the subsurface, the borehole took more grout than calculated for its volume (see boring log in Appendix B). Borehole volume was estimated at 23.6 cubic feet (176 gallons). Total estimated grout placed in the borehole was approximately 280 gallons.”

Either 280 gallons or 275 gallons exceed the wellbore volume estimate of 176 gallons by just under 50% - indicative of a relatively large void. However, there is little discussion of this void in the Harbor report and Hubbard's report, in Table 1 repeatedly states, *“No voids noted during drilling”*.

It is possible that the grout thief zone, which resulted in difficulty grouting above 25-ft on 9/23, is related to the lost circulation zone noted at 25-ft (Harbor boring log) and/or that noted between 28 and 38-ft (Hubbard Rock Core (and overburden) Boring Log). It is also possible that this fracture or

void could extend beneath the ponds. It is concerning that this potentially serious matter is not more thoroughly discussed in the report.

Questions -

- 1) Why is there a discrepancy regarding the presence of a void or voids?**
- 2) Why does this feature appear to be glossed over in the report and why is there not a more thorough discussion or explanation of this apparently significant karst feature which could possibly extend beneath the ponds?**
- 3) How does the depth of 25' bgs at the borehole site correlate to the depth of the bottom of the waste ponds (ie: if the fracture or void extended beneath the ponds, how far below the bottom of the ponds would it be?).**

Heutter's notes and others indicate difficulty cementing above 25 ft bgs on Friday, Sept 23 due to the presence of a "void". However, when the crew resumed work on Monday, Sept 26 the depth to cement was noted as 12' bgs. There was no explanation of this discrepancy provided in the Harbor report. No mention whatsoever of this difficulty in cementing the hole is included in Hubbard's report, perhaps because, according to Heutter's notes, Hubbard left the site at 1307 (1:07 pm) on 9/23, before geophysical logging and cementing commenced.

Questions –

- 1) Explain the discrepancy between the 9/23 and 9/26 measurements to depth of cement.**
- 2) Explain the significance of the void encountered at approximately 25' bgs.**
- 3) Why did the Hubbard report make no mention of this potentially significant geological feature?**

4) Why did Tai Hubbard, the official, independent observer, leave the site during geophysical logging and cementing?

Inconsistencies

Hubbard notes numerous occurrences of karst development throughout the bore hole (see Hubbard Rock Discontinuity Data Sheet), the surficial material (to 16-ft) is described as highly decomposed, but throughout the well to at least 112-ft Hubbard describes rock units as moderately decomposed – providing evidence of karst development throughout the boring. Hubbard further notes that at 23.5-ft and at 27.5-ft the rock character is highly decomposed (hde) and that there are calcite and clay infills (CAL/cl) and that these features are associated with joints (which are fractures)

However, the Harbor Report notes on page 7 (bold emphasis added):

*“Weathered and fractured, fossiliferous gray to buff limestone was encountered from 20 to 28.5 feet. The driller reported potable drilling water loss in this zone. Competent, fossiliferous gray limestone (consistent with the Boone Formation), with some minor fracturing and bedding planes was encountered at 28.5 feet bgs, which generally extended to the TD of 120 feet bgs. Zones of increased fracturing were encountered around 70 feet and 90 feet bgs; however, **no Karst features such as dissolution features were encountered.**”*

The neutron logs indicate that in the interval 25-ft to 38-ft, there are two zones of reduced count rate – one at 26-ft and one at 31-ft – possibly indicating an area that could be karsted and could be a fluid conduit – consistent with the fluid loss observations and the later grouting issues.

Question -Why is there a lack of complete concordance and coverage among the Harbor Report text, the Harbor Report boring log, the Geophysical logs, Hydrogeology's boring log and Huetter's transcribed notes? Which is correct?

The hand-written log produced by Harbor does not agree with Table 1 in Tai Hubbard's report. Specifically, the Drilling Notes which Hubbard represents as having been made by the driller are very sketchy and do not reflect the extensive annotations of the presence of fractures noted on the Harbor graphic log nor does Hubbard's report refer to any circumstances of fluid loss (see Huetter's notes at page 6). Table 1 in Hubbard's report also ignores the descriptions of limestone fracturing and decomposition that are present in the Rock Core (and overburden) Boring Log. In addition, the Rock Core (and overburden) Boring Log clearly states, "*Driller indicated loss of drilling water circulation between 28 and 38'.*" This is not reflected in Huetter's transcribed notes. Likewise, Hubbard notes, "*Driller indicated water circulation loss and heavy rig vibration during specific intervals on Run 14 and 15.*" This is not noted in Huetter's transcribed notes. Loss of water circulation can be a serious problem, and given the thrust of this investigation (i.e. looking for subsurface fluid conduits) would seem to have been a much more noteworthy event.

Questions –

- 1) Why is there not discussion in the Harbor report of lost circulation zones that are described in Hubbard's report?**
- 2) Explain the significance of water circulation loss.**
- 3) How do you explain the lack of concordance between Harbor and Hubbard's reports?**

Drilling Water

Chlorinated municipal drinking water was injected into the borehole during the drilling process. Chlorine and other chemicals are used specifically to eliminate E. coli and other contaminants. E. coli was one of the analytes being examined. VOA and residual chlorine analysis of the municipal water was reportedly done to rule out its interference with the sampling results.

However, there are two drilled wells located on the site which provide untreated, potable water to the swine operation. At least one of these wells has been repeatedly tested as part of the BCRET study. Presumably the other well has been tested and approved by the Arkansas Department of Health, providing a known analysis of each well.

Questions:

- 1) Why did the use of chlorinated municipal water not compromise the validity of sample results, E. coli in particular?**
- 2) Why was treated municipal water used when non-chlorinated well water was available on-site?**
- 3) Due to their reactive nature does VOA and residual chlorine analysis provide definitive evidence of the presence or absence these compounds? Please explain.**

There is little information provided of the amount of water utilized during drilling. The sole mention of water volume used in the hole appears to be on page 1 of 2 of Boring Log B-1 which simply states “*Total approx. 750 gallons potable water added.*” There is no mention of the amount returned, only photos of the containment drums. A mass balance calculation comparing the amount of water injected and the amount returned would

reveal the presence of fractures, voids or other possible conduits and would provide important data.

Questions –

1(Why doesn't the report provide a mass balance calculation of the amount of drilling water used? Please provide data on the amount of drilling water injected and the amount of water returned.

2) Why does Tai Hubbard, a hydrogeological specialist, not discuss fluid behavior in the borehole as it relates to his geologic observations and instead focus solely on the rock?

Laboratory Analysis

The interpretive work largely relies on comparisons to background values and hog waste lagoon values for individual parameters to the values of those parameters obtained from the study site soils, leachates and waters. The study does not incorporate any form of dilution analysis --- the most likely scenario – in which escaping hog waste infiltrates uncontaminated soils and mixes with uncontaminated groundwater – which would be consistent with the goals of the study of “Assessing potential subsurface impact from the waste storage ponds.” (Harbor Report – page 1)

Table 5-4 - Summary of Hog Waste Pond Analytical Results shows the values for zinc and manganese as being many times the regulatory limit normally applied to land application of municipal sewage sludge. It appears that the units for these analytes are incorrect.

The background data used was limited in scope. Specifically, the background data relied upon were those in the *National Geochemical Survey – Database and Documentation* USGS OF-2001-1001 for soils, and groundwater data presented in Leidy, V.A. and Morris, E.E., 1990, *Hydrogeology and Quality of Ground Water in the Boone Formation and Cotter Dolomite in Karst Terrain of Northwestern Boone County, Arkansas*, USGS for soil leachate and groundwater (described as the “ambient study”). Both of these data sets have a limited number of observations. The USGS data set for soils is limited to six locations in Newton County. The Leidy and Morris study is limited to 17 samples in Newton County and reflects conditions at these locations 26 years prior to sampling of the C&H groundwater. The Leidy and Morris study breaks out data as “wet season” and “dry season” samples, but Harbor appears to lump all of the Leidy and Morris data together regardless of its season of collection. Furthermore, Leidy and Morris do not assert that the groundwater data they present is pristine. They simply say that it does not exceed U.S. EPA primary or secondary maximum contaminant levels (as of 1990).

There was a workplan change from analysis of Nitrates to Total Nitrogen. While it would have been far better to have concurrent analytical data for ammonia, nitrate, nitrite and total N, only Ammonia (N) and Total Nitrogen are reported. The nitrogen system is complex and susceptible to atmospheric oxidation (ammonia transformed to nitrite and then nitrate).

Questions –

- 1)What precautions were taken to limit oxidation of water and leachate samples when sampling for Total Nitrogen?**
- 2) Why was there a change from Nitrates to Total Nitrogen.**
- 3) Who was the geochemist at Harbor who reviewed the water and leachate chemistry data? What, specifically, is this person’s experience with geochemistry?**

4) Does Harbor assert that the Leidy and Morris data reflects uncontaminated groundwater in Newton County, AR? If so, please provide justification for this assertion.

5) Is Harbor aware of data sets beyond those used by Harbor as geochemical background values to interpret the geochemical data for soils, leachates and groundwater? If so, please identify.

6) How does Harbor justify reaching conclusions regarding the presence or absence of hog waste contamination solely on the basis of individual comparisons of the concentrations of parameters to “background” values and hog waste pond values?

7) Why was the on-site groundwater well not sampled and analyzed so that current on-site groundwater could be included in the comparisons?

8) Did Harbor do any form of analysis of how groundwater composition would be altered by the addition of hog lagoon waste to background groundwater?

9) How were pond samples collected? Were they composited? Were they representative of the entire water column in both ponds? Why were pond samples analyzed in July but the results not made available until drilling commenced?

10) Is all of the data contained in Table 5-4 - Summary of Hog Waste Pond Analytical Results accurate? If not please explain

Thank you for the opportunity to present these questions. We look forward to a thorough and complete response.

Gordon Watkins, President

Buffalo River Watershed Alliance

