BEFORE THE ARKANSAS POLLUTION CONTROL AND ECOLOGY COMMISSION

IN THE MATTER OF REQUEST BY HALLIBURTON ENERGY SERVICES, INC. TO INITIATE RULEMAKING TO AMEND REGULATION NO. 2	))))	**DOCKET NO. 16-003-R**

HALLIBURTON ENERGY SERVICES, INC.'S
RESPONSIVE SUMMARY

Petitioner, Halliburton Energy Services, Inc. ("HESI"), for its Responsive Summary to the public comments received regarding the above-captioned third-party rule making, states:

1. On July 22, 2016, the Arkansas Pollution Control and Ecology Commission ("APCEC" or "the Commission") granted HESI's Petition to Initiate Third-Party Rulemaking to Amend Regulation No. 2, the Regulation Establishing Water Quality Standards for Surface Waters of the State of Arkansas. Notice of the rulemaking and a public hearing was published in the *Arkansas Democrat-Gazette* on August 1, 2016, and August 2, 2016. A public hearing was held on September 27, 2016, in Magnet Cove, Arkansas. No public comments were made at the hearing. The public comment period ended on October 11, 2016. Two written comments were received.

2. HESI's responses submitted pursuant to APCEC Regulation Nos. 8.811 and 8.815 to the two written comments are attached hereto at "Attachment A".

Respectfully submitted

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By _____
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CERTIFICATE OF SERVICE

I hereby certify that on this 8th day of December, I served a copy of the foregoing Response to Comments on the following by United States Mail, first class postage prepaid:

Michael McAlister
Acting Chief Counsel, Legal Division
Arkansas Department of Environmental Quality
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North Little Rock, AR 72118

_____
Michael B. Heister

Attachment A

Halliburton Energy Services, Inc. (HESI) Responses to Technical Comments on: Several Documents associated with the 3rd Party Request Submitted by Halliburton Energy Services Inc.: APC&E Commission Docket #16-003-R

These responses to comments are being provided to the Arkansas Pollution Control & Ecology Commission (the Commission) and the Arkansas Department of Environmental Quality (ADEQ) by Halliburton Energy Services, Inc. (HESI). HESI is responding to comments received from the Arkansas Department of Health (ADH) and the U.S. Environmental Protection Agency (EPA) regarding several documents submitted by HESI in support of a temporary water quality standards modification associated with an Environmental Improvement Project (EIP) for the Dresser Industries-Magcobar Former Mine Site. Temporary water quality standards modifications are proposed for Chamberlain Creek, Cove Creek, Lucinda Creek, Reyburn Creek, Rusher Creek, Scull Creek, and Clearwater Lake. These were the only comments submitted to ADEQ during the public comment period regarding HESI's 3rd Party Rulemaking.

Responses to ADH Comments Received by HESI in September 2016

1. In the long term, reclamation of the former mine site is supportive of maintaining water quality in the Ouachita River which is utilized as a drinking water source for four public water systems. The four public water systems are: the Kimzey Regional Water District, the Malvern Waterworks, the Arkadelphia Waterworks, and the Camden Waterworks. Together these four public water systems provide drinking water to approximately 65,000 Arkansans. Once reclaimed, re-vegetation of the site and other improvements should improve water quality entering the Ouachita River.

   Response: *ADH's comment is noted. HESI agrees that remediation of the site should result in water quality improvement.*

2. Cove Creek discharges into the Ouachita River in close proximity to the Kimzey Regional Water District intake structure. While the potential for back mixing appears to be minimal, the ADH nevertheless asks that secondary drinking water standards criteria concerning minerals be applied to Cove Creek and this is consistent with the proposed rulemaking.

   Response: *ADH's comment is noted.*

3. Chloride concentrations are of particular concern with regards to drinking water systems efforts to control corrosion. Corrosion concerns occur at much lower levels than the secondary drinking water standard of 250 mg/liter for chlorides. While it appears that adequate dilution of chlorides will occur in Cove Creek and then in the Ouachita River, the ADH requests that discharges from the mine site be designed such that lower flow and continuous discharge protocols are favored over higher flow and periodic discharges. This should serve to minimize minerals concentration variations seen by downstream water users and thus facilitate consistency in drinking water treatment.

   Response*: Discharge from the site water treatment system (WTS) from 2003 through 2012 was by a Hydrographically Controlled Release (HCR). This approach will continue in order to meet the criteria set forth in Consent Administrative Order (CAO) LIS 16-043. The HCR allows greater WTS discharge to Cove Creek when its flows are high and lower discharge when its flows are low. This approach is necessary in order to remove the amount of water from the mine pit lake necessary to draw down the pit lake surface*

and maintain a decreased elevation such that overflow does not occur (i.e., the total annual water withdrawal from the pit lake by the WTS must equal or exceed the amount of precipitation falling on the pit lake surface and its contributing drainage basin). In addition, the HCR provides more consistent minerals concentrations to Cove Creek than would occur if a constant WTS discharge were maintained. Under a constant discharge scenario, minerals concentrations in Cove Creek would be low when its flow is high due to dilution, and would be high when its flows are low because less dilution would occur.

Responses to EPA Comments Received by HESI in September 2016

Several comments have page numbers following the comment to indicate where in the document this item was discussed. The page numbers reflect the page counted by Adobe Acrobat, rather than the page number listed in the document, for the site-related documents posted on ADEQ's web site:

https://www.adeq.state.ar.us/regs/drafts/3rdParty/reg02/16-003-R/

As a preliminary matter, HESI notes that many of the EPA's comments pertain to prior investigations and analyses that are not properly before the Commission as part of this third-party rulemaking. HESI is nevertheless responding to ensure that EPA understands the regulatory history of the site and the process that eventually resulted in ADEQ's approval of the EIP.

General Questions/Comments for the Halliburton Energy Services, Inc. Environmental Improvement Project

1. How will achievement of downstream criteria, particularly in Cove Creek, be ensured? In Cove Creek the 2000-2012 data demonstrates exceedances of several criteria with the maximum values measured in the creek. Will the discharge be limited to a certain amount of flow to ensure that the criteria will be met? What fail safes are in place to alter the permit if downstream criteria are being exceeded?

   Response: *HESI assumes that EPA is referring to downstream criteria for dissolved minerals, as the proposed action before the Commission is approval of minerals criteria proposed as part of an EIP. Compliance with downstream criteria for other constituents of concern (COCs) will be addressed through the remediation process detailed in the Remedial Action Decision Document (RADD) approved by ADEQ in May 2016. The water treatment system resumed treatment operations per the new CAO LIS 16-043 as of mid-August 2016. This CAO implements the same minerals criteria on a temporary basis that are proposed through the EIP.*

   As discussed in the response to ADH Comment 3, the discharge into Chamberlain Creek used a HCR approach between 2003 and 2012; the discharge was subject to the following criteria per the previous CAO LIS 03-061 (effective May 27, 2003): 60 mg/L for chloride, 860 mg/L for sulfate, and 1,600 mg/L for total dissolved solids (TDS). Based on ADEQ's routine monitoring data, there were no exceedances of the CAO-based criteria during that time frame.

   Monitoring to ensure compliance with the proposed criteria is occurring and will continue to be performed throughout the EIP in accordance with the effectiveness monitoring plan (EMP) required by the RADD, which will be prepared after Commission approval of the

EIP. The new HCR is following the same discharge protocols as were successfully followed with the 2003-2012 HCR except that the critical flows are now based on lower minerals criteria of the EIP and CAO LIS 16-043. If monitoring performed as part of the EMP or separate monitoring by ADEQ indicates that the proposed minerals criteria are not being met in Cove Creek, the HCR will be adjusted accordingly to address any exceedances.

2. Whole effluent toxicity (WET) tests downstream of the current water treatment facility have demonstrated toxicity in Chamberlain Creek and at times in Cove Creek, even when toxicity isn't seen in the discharge of the plant. Some of this toxicity is likely due to elements of acid rock drainage (ARD) originating from additional seepage that is not currently being treated by the water treatment facility, but may be captured with the new French drain. After remediation work begins, will toxicity still be monitored downstream on Chamberlain and Cove Creek to assure that the remediation plan is addressing this toxicity from seepage? If toxicity is still found, what steps will be taken to determine the source of the toxicity (i.e. metals vs. pH vs. minerals) and address remediation of this source of toxicity?

   Response: *The French drain system will be designed to capture the surface water runoff, acidic seepage, and shallow groundwater that are believed to be the sources contributing to downstream toxicity. The purpose of the remedial actions detailed in the RADD is to address water quality (including toxicity) downstream of the site. If other toxicity sources are indicated during the EIP, remedial actions to address the newly identified sources will be developed and proposed, per Section 11.0 of the RADD, which states:*

   > *"If compliance, or progress toward compliance, to include obtaining the necessary access agreements and/or institutional controls, is not demonstrated, the RADD may be modified so that additional remedial alternatives can be considered, evaluated, and implemented in a reasonable time frame.*
   >
   > *The Responsible Party shall investigate, as appropriate, technologies that become commercially available to facilitate the identification and consideration of additional remedial alternatives to affect permanent control, abatement, prevention, treatment or containment of releases and threatened releases at the site."*

   Chronic WET testing will continue to be performed at Outfall 001 per the requirements of NPDES Permit No. AR0049794. Additionally, chronic toxicity tests are included in the baseline monitoring program planned for 2017, one during low-flow conditions and one during high-flow conditions. The toxicity tests will evaluate toxicity in Chamberlain Creek just upstream of its confluence with Cove Creek and in Cove Creek just downstream from the Chamberlain Creek inflow.

   The EMP will specify the types of toxicity testing and other biological sampling events that will be performed throughout the duration of the project. However, as specified in the RADD (Section 11.1.4), the EMP will include, at a minimum, biological sampling at the following locations once every 5 years: Lucinda Creek (upstream of its confluence with Cove Creek), Chamberlain Creek, Cove Creek (downstream of its confluence of Chamberlain Creek), Reyburn Creek (downstream of the confluences of drainages from

tailings ponds and Clearwater Lake), and Stone Quarry Creek (downstream of the drainages from the tailings ponds).

3. Will toxicity tests be performed for Lucinda Creek, Reyburn Creek, Rusher Creek, Scull Creek, and Clearwater Lake once remediation work has begun?

   Response: *Please see the response to EPA Comment 2.*

4. It appears from the Remedial Action Decision Document (RADD), in the Effectiveness Monitoring Program section, that the remediation plan can be altered if progress towards compliance isn't occurring and new remediation activities need to be considered. Is there a schedule for periodic evaluation of the progress of the remediation and for investigation into new technology to treat minerals? Is there a number of years estimated to see effects of some of the non-point source remediation activities such as revegetation

   Response: *It is correct that the RADD allows for adapting the approach to address water quality and toxicity (please see Section 11.0 of the RADD and the response to EPA Comment 2). With regard to the EIP and the schedule for evaluating progress toward meeting water quality criteria for dissolved minerals, Section 7.2 of the EIP NOI states the following:*

   > *"HESI proposes that ADEQ, EPA, and HESI confer annually by video conference or meeting to evaluate the status of the project. Such conferences/meetings would commence approximately one year from EPA's approval of the EIP and would continue to the end of the EIP. In addition, HESI will provide an annual written update on remediation activities to ADEQ and EPA approximately 2 weeks prior to each annual discussion."*

   HESI believes that the above-referenced annual meetings will serve as periodic evaluations of the progress towards compliance once remediation activities have been completed.

   It is unknown at this time when the effects of nonpoint source remediation activities will be observed. The EMP will provide a framework for documenting that the implemented remedies are achieving progress toward compliance with downstream water quality standards.

5. Is there any concern that the pH of the sludge ponds will drop? Could the pH drop to a level that would potentially make ARD constituents soluble again? (pg. 223)

   Response: *HESI infers that this comment, and those below through EPA Comment 15, pertain to Appendix A, Site Investigation (SI) Report. Page 223 references the Settling Ponds, not the Sludge Ponds. This nomenclature is explained in Section 3.5 of the SI Report (p. 75 of the .pdf file). Per the SI Report, the Sludge Impoundments consist of two sets of three impoundments (the Settling Ponds and the Sludge Ponds). The Settling Ponds are located on natural subgrade near the southwest spoil piles. The Settling Ponds perennially contain water and sludge from former treatment operations is present on the pond bottoms. The Sludge Ponds are located on top of the southwest spoil piles and also contain treatment sludge, but are dry.*

Given EPA's page reference, HESI infers that this comment refers to the Settling Ponds. While it is possible that the pH of the waters contained in the Settling Ponds could decrease to the point that metals in the alkaline sediment in the bottom of the ponds may become more susceptible to mobilization, this does not comprise a major concern from a site-wide perspective. A reduction in water pH would be due to runoff of ARD from adjacent mine spoil piles. At the time the SI was conducted (2000-200 time frame), such runoff had been occurring for several decades and the Settling Pond waters were still near-neutral in terms of pH. Since that time, natural recovery of the spoil piles has continued, with further oxidation and revegetation of the spoil pile surfaces which would tend to reduce ARD production. Smaller amounts of ARD from the spoil piles would, in turn, reduce the likelihood of acidifying the Settling Pond water to the point that metals would be mobilized from the pond sediment. Measurement of the pH of the Settling Pond water will be undertaken as part of the EMP to assess the extent to which the water may have been acidified.

If EPA's comment is instead referring to the Sludge Ponds, HESI is developing a design to cover the former ponds with soil, with run-on and runoff controls, to reduce risks to terrestrial receptors. This closure method is not expected to result in a pH reduction that could increase the mobility of metals in the dried sludge.

6. In determining the risk presented by metals in the aquatic sediments, was the risk of benthic organisms taking up metals and then the metals bioaccumulating in the food chain considered? (pg. 258)

   Response: *In the Baseline Ecological Risk Assessment (BERA; Appendix B of the SI Report), the diet of the mammalian riparian receptor (raccoon) is a generalized diet assumed to include 50% benthic macroinvertebrates and 50% small fish. Risks (hazard quotients [HQs]) to the raccoon were derived relative to no observed adverse effects level (NOAEL) and lowest observed adverse effects level (LOAEL) and are presented in Table 7-7 of the BERA. Thus, in determining the risk presented by metals in the aquatic sediments, the risk of benthic organisms taking up metals and then the metals bioaccumulating in the food chain was considered.*

7. What is the risk of metals becoming soluble again from the sediments? Is there a pH threshold that would allow these metals to enter into solution again? (pg. 258)

   Response: *HESI infers that this comment refers to sediment in streams proximal to the site. Though the risk of solubilizing metals from sediment exists, it is expected to be small given that the site is undergoing natural recovery and the amount of ARD produced by the site is decreasing. One caveat is that ARD production may temporarily increase during remedial construction activities, potentially increasing the possibility that metals could be mobilized from stream sediment. However, such ARD will be addressed through the use of best management practices during construction, limiting the amount of ARD that could enter the site streams.*

8. For fish sampling associated with future monitoring, it would be useful to quantify the number of fish caught per unit effort so that sampling at the various locations can be compared. For some locations in the past it appeared that much larger areas were sampled at one site location compared to another.

Response: *Future fish sampling events will include a comparison of the total abundance across sampling locations by calculating fish caught per unit effort (CPUE). The length of the stream reach sampled is 40 times the average width of the stream per standard methodology; therefore the area sampled for each stream will vary according to the size (width) of the stream.*

9. Streams need to be clearly defined as either perennial or intermittent. In particular the site investigation (SI) switches back and forth between calling Lucinda Creek an intermittent and a perennial stream (pg. 415)

   Response: *EPA's comment is noted. During the SI, Cove Creek and Lucinda Creek below Lucinda Lake were perennial and other site streams (Chamberlain Creek, Rusher Creek, Scull Creek, Reyburn Creek, and Stone Quarry Creek) were intermittent.*

10. Where did the Region 6 screening level value for sulfate come from? Is there a document that specifies this value? Was this screening level set for aquatic life or for human health? (pg. 436)

    Response: *The value for sulfate is an old aquatic life protection screening value that was supported by EPA with an earlier use attainability analysis (UAA) that was approved by ADEQ and EPA (Holly Creek – Alcoa). The value is still found in Regulation 2.511. FTN Associates cited it as a Region 6 Screening level value in its May 2002 Proposed Approach for the Interim Management of the Discharge of Treated Pit Lake Water, which was submitted to ADEQ's Permit Division and ultimately approved by ADEQ and implemented in CAO LIS-03-061.*

11. In several instances it appears that discussion about the precipitate that has been created from pulling the metals out of solution is separated from the discussion about the risk posed by the sediments to the aquatic species. In some instances the precipitate exceeds the no effect concentration (NEC) while the sediment does not. Given this, how does the presence of the precipitate factor into how the health of the streams was evaluated? Was is assumed that the precipitate was not bioavailable, and if so, why? Also, at what pH would the metals in the precipitate become bioavailable? (pg. 470)

    Response: *The precipitate was not always present nor prevalent during the sampling for the BERA. Though some precipitate was observed in the site streams during the 2000-2001 SI, more pronounced precipitate formation was observed in Chamberlain and Cove creeks after the WTS began discharging treated water to Chamberlain Creek in June 2003 (see p. 469 of the .pdf file). The more pronounced precipitate formation was found to result from mixing of the near-neutral, treated water and acidic, metal-bearing groundwater entering Chamberlain Creek. Follow-up monitoring was conducted soon after the more pronounced precipitate formation was observed. Concentration data from the precipitate were collected to evaluate against effects thresholds. There were no assumptions about bioavailability as the precipitate formation was temporally variable (i.e., precipitate was typically present during quiescent, low-flow conditions but absent during high-flow conditions).*

    HESI implemented response actions to reduce the precipitate formation, including extension of the WTS discharge line by approximately 1,000 feet downstream on Chamberlain Creek and collection of shallow groundwater in the upper Chamberlain

Creek basin, in late 2005. The collected shallow groundwater is pumped to the pit lake for treatment by the WTS.

12. How were the physical impacts of the precipitate on the benthic organisms considered in the risk assessment? (pg. 470)

    Response: *The physical impacts of the precipitate in streams in the site vicinity were not considered in the BERA. Implementation of the RADD is expected to further reduce the presence and quantity of precipitate in the site streams.*

13. EPA is concerned that manganese was not retained as a contaminant of potential concern (COPC) for sediments, as in many creeks its hazard quotient (HQ) was between 1 and 1.5. When this value was rounded, the justification given for not retaining it as a COPC was that the HQ was not greater than 1, even though it was when the value was not rounded. (pg. 507) This occurs with a few other parameters as well.

    Response: *Computed HQs for manganese, and some other metals, in several site streams were between 1 and 1.49. Rounding to the nearest integer for HQ calculations is a common practice in risk assessment and it was also stated in the approved BERA that this approach would be taken. While there is no clear guidance on this practice, the questions asked in the risk characterization are relative to a single digit —is the HQ less than or greater than 1— thus it is logical to derive HQs to a similar level of significant figures.*

14. Is there an upper limit of hardness tolerance in aquatic species? (pg. 523)

    Response: *Hardness is a function of calcium and magnesium. We are not aware of any data that suggest hardness presents a toxicity issue at the calcium and magnesium levels encountered at the site.*

15. In Table 7-3, there appears to be many more values that exceed the lower benchmark value than are actually noted in this table. (pg. 559)

    Response: *As pointed out by this comment, there are some values that exceed the lower benchmark but are not shaded in Table 7-3. These include two values for arsenic (MFG Max Background and Tigre-1 sed), four values for beryllium (Cove pool 10, Cove pool 10 dup, Covepool4, and Chm 2.5 ppt), one value for copper (Weston Max Background), one value for nickel (Weston Max Background), and two values for zinc (Weston Max Background and Cove pool 10), which is an oversight. These table cells should have been shaded green. In addition, the cobalt value for Covepool 4 should have been shaded green instead of red because only the lower benchmark was exceeded.*

Questions/Comments for Draft Feasibility Study Report Dresser Industries-Magcobar Mine Site, Hot Spring County, Arkansas, August 20, 2009 (Appendix B)

16. The report states that "Recovery of affected streams is anticipated to be nearly immediate when the pH is controlled." EPA believes this is an overstatement of how quickly the streams will recover and the impact the streams will still experience from elevated minerals and metals that will remain partially elevated even after pH control. (pg. 20)

Response: *EPA's comment is noted.*

17. It is unclear from the report how the cost estimate for Alternative 2 was calculated as $6,910,000. The report states that alternative 2 assumes a periodic cost of $1,000,000 every 5 years, beginning in year 15 and that the life span of the water treatment system (WTS) is 100 years. 100 yrs-15 yrs = 85 yrs /5 yrs = 17. At a minimum this cost should be $17,000,000 just for periodic cost. What other factors are in this equation that makes this cost estimate so much less than 17 million dollars? (pg. 133)

    Response: *Per EPA guidance,[1] the cost estimates presented in the FS Report were calculated as present values. Present value analysis is a method to evaluate expenditures (capital, annual O&M, and periodic) which occur over different time periods. This standard methodology allows for cost comparisons of different remedial alternatives on the basis of a single cost figure for each alternative. This single number, referred to as the present value, is the amount needed to be set aside at the initial point in time to assure that funds will be available in the future as they are needed, assuming certain economic conditions. An interest rate of 7 percent was used in the present value analyses. Thus, the present value for Alternative 2 of $6,910,000 is the amount of money that would need to be invested at the beginning of the project, at an interest rate of 7 percent, to complete the initial construction (capital cost) and to implement O&M and periodic costs for 100 years. Since a return of 7 percent is assumed, the total amount invested at the beginning of the project is less than if no return is assumed (0 percent interest). See Appendix B of the FS Report (pp. 174-176 of the .pdf file).*

18. Why wasn't an alternative that considered upgraded source control without pit treatment considered in the alternatives analysis (a combination of alternative 3 and 5 rather than alternative 5 just expanding on alternative 4)? (pg. 150)

    Response: *This comment appears to ask why wasn't there an alternative that consisted of continued WTS operation (not pit neutralization) coupled with extensive source control. The extensive source control envisioned as part of Alternative 5 was intended to provide a means for eliminating ongoing water treatment. It would consist of physically relocating most of the spoil to a new repository location to the west (downgradient) of the mine pit lake. The spoil would be amended with lime to limit acid generation as the spoil is placed in the repository. Overall, it was estimated that approximately 14 million cubic yards of spoil would require excavation and transport to the repository location (pp. 107 and 108 of the .pdf file). The conceptual footprint and configuration of the repository is shown on p. 215 of the .pdf file. This spoil pile alternative was developed and considered because it would minimize or eliminate further ARD drainage to the mine pit lake. As discussed under Alternative 5, the WTS would continue operation during and after relocation of the spoil to the repository (p. 107 of the .pdf file). The upper layer of the mine pit lake would be neutralized with lime and, since further ARD drainage to it would be minimized or eliminated, WTS operation would cease when treatment was no longer needed and the pit lake water could be discharged without treatment. Thus, continued WTS operation and extensive source control were considered together in the FS.*

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[1] A Guide to Developing and Documenting Cost Estimates during the Feasibility Study. EPA 540-R-00-002, OSWER9355.0-75. July 2000.

Questions/Comments for Remedial Action Decision Document, Dresser Industries-Magcobar Mine Site, Magnet Cove, Hot Spring County, Arkansas (Appendix C)

19. It is not clear that the improvement in the headwaters surface water quality will lead to sediment improvement without any direct remediation on the sediments. What processes are occurring in the sediments that would make the metals unavailable to the benthic organisms? Also, how long are the metals that are already present in the sediment expected to persist?

    Response: *As explained in the FS Report (e.g., p. 93 of the .pdf file), the site sediments were characterized as exhibiting low levels of risk (HQs <5) to environmental receptors. HESI and ADEQ agreed that removal of the sediment would destroy existing benthic communities, creating greater harm to the environment than leaving the sediment in place. The metals in the sediment will persist in perpetuity as they will not degrade or break down to other substances. However, it is expected that the concentrations of metals in sediment to which environmental receptors will be exposed will decrease through time by mixing with or becoming covered by sediment with lower metals concentrations that will originate from the site following remediation, given the relatively high gradient of the site streams and the corresponding tendency for sediment transport.*

20. SP3 spoil pile alternative (extensive regrading and revegetating) should potentially be thought of as a next step in the remediation process if monitoring demonstrates that initial actions are not sufficient to meet remediation goals (pg.33)

    Response: *Please see the response to EPA Comment 18. Extensive regrading and revegetation of the site spoil piles, as described in the FS Report, would have consisted of excavation, relocation, and lime amendment of most of the spoil. This spoil pile alternative was not selected by ADEQ as part of the site remedy and therefore is no longer under consideration.*

21. Reference sites should be included in the biological sampling plan (upstream of mine influence and potentially one off site) to act as a control while monitoring the progress of the remediation and so that any outside impacts unrelated to the remediation work at the site can be taken into account. (pg. 43)

    Response: *HESI anticipates the use of reference sites being a component of future sampling activities. The baseline sampling plan scheduled to be underway before the end of this year provides for water quality and biological sampling in up to four reference streams (to be selected in cooperation with ADEQ personnel) as well as in Basin Creek, a non-impacted stream upgradient of Chamberlain Creek that is also a tributary to Cove Creek, and in Cove Creek upstream of the site.*

22. What sort of monitoring will be performed to assure that no metals are leaching from sludge ponds and that contact by terrestrial receptors is prevented? Is there a monitoring plan to test the soil cover that will be placed over the sludge piles to make sure that no metals are leaching?

    Response: *Soil cover is the selected remedy in the ADEQ-approved RADD to prevent contact by terrestrial receptors with the sludge ponds and "will isolate the sludge from contact by terrestrial receptors, thus effectively eliminating the risk posed by the sludge to the environment in both the short-term and the long-term" (Section 7.1.5 of the*

RADD). The EMP (Section 11.0 of the RADD) will direct the monitoring and document the progress at the site and will include a section for each area of concern listed in Section 4 of the RADD (which includes the sludge ponds).

23. The current plan is designed for 100 years and involves active management, including active water treatment, to assure that the level of water in the pit is kept at a non-dangerous depth and that the water released from the pit is not toxic to wildlife. The plan does not seem to address a longer term solution, so what actions are anticipated after the hundred years that will assure that the pit lake and its water are not a risk to the environment?

    Response: *It is anticipated that the WTS will be operated in perpetuity, unless the pit lake water quality improves to the point that the WTS is no longer needed. The 100-year period was adopted in the FS report for the purposes of calculating present value costs for each of the remedial alternatives and exceeds the 30-year evaluation period that is often assumed for FS purposes.*

24. If Halliburton Energy Services, Inc. (HESI) isn't going to pay for new residents to be connected to the municipal water source, how is it assured that new residents will not drill into the ground water for a drinking water supply that may potentially be impacted by the mine site?

    Response: *HESI will pay the connection costs for future residents within the Municipal Supply Connection Area to be connected. For new residents, HESI intends to work with the Magnet Butterfield Water Association to (1) periodically monitor new development or changes in ownership of existing property in the affected area, (2) notify new residents of site conditions and potential risks, and (3) offer to connect such residents to a municipal water supply at no charge to the resident(s).*

    - What expense is the company responsible for in terms of adding new municipal water source connections? In the comments on the RADD HESI seems to imply they are not responsible for this cost, but the cost estimate is included in the feasibility study.

      Response: *HESI will pay the connection costs for future residents within the Municipal Supply Connection Area to be connected to a municipal water supply.*

25. Is there any enforcement power for the metals that do not have state criteria? Is there any enforcement power to assure that the remediation work is completed, aside from the NPDES permit for the water treatment facility?

    Response: *Enforcement power for attainment of water quality standards and completion of remediation work are embodied not only in NPDES Permit No. AR0049794 for the WTS, but also in Consent Administrative Order LIS 16-043 as well as the RADD, which were both executed in May 2016.*

26. Please include a description of how the physical presence of precipitates will be evaluated and how their impacts on benthic organisms will be minimized.

    Response: *HESI assumes that this comment refers to the formation of precipitate in Cove Creek downstream of the site. The presence of precipitate will be evaluated*

through field documentation during chemistry and biological community sampling performed as part of the EMP (see Section 11.0 of the RADD). It is expected that remediation activities implemented per the RADD will improve water quality such that the formation of precipitate will be significantly reduced or eliminated.

Questions/Comments for Seasonal Monitoring in Chamberlain and Cove Creeks, Per CAO LIS 03-061 Section B.3. December 9, 2005 (Appendix D)

27. Please make sure that monitoring data is appropriately described. For instance, one sentence states "The percent of total individuals as EPT was relatively constant across Cove Creek stations and decreased slightly during the monitoring period across all stations." This statement appears to be misleading as the percent of total individuals as EPT was about 65% in October 2003 and was about 18% in April 2005. A loss of approximately 45% is more than a slight decrease. (pg. 26, 28)

    Response: *EPA's comment is noted.*

28. Please also make sure that all information is accurately represented. In table 4.3, two metals, aluminum and manganese, are listed as having 0 permit violations. However, both of these metals are listed as report in the 2008 permit and do not have a limit, so listing them as having 0 violations is misleading. This is operating under the assumption that the 2008 permit contains the same limits as the previous permit. This should have an n/a since there was no limit in place that could be violated. In addition, both of these metals are still being discharged at concentrations that are quite high, even though the treatment has resulted in a large reduction in their concentrations (pg. 29)

    Response: *EPA's comment is noted.*

29. In Table 4.3, why is there no average pH or median pH values? (pg. 29)

    Response: *HESI has reviewed this 2005 summary report and cannot determine why these statistics for pH were omitted from Table 4.3. Future reports containing summary statistics will include average or median values as appropriate or will contain an explanation for potentially incomplete data sets.*

30. For Table 4.3, it appears that according to the 2008 permit TDS and sulfate both actually had permit violations. A previous version of the permit could not be located online, but according to the 2008 permit, sulfate values and TDS values are both in violation. The listed TDS limit is 212 mg/L for monthly average and for sulfate is 31 mg/L. Was another standard or permit value in place that made these values not in violation for the time period reported in this report?

    Response: *Please see the response to EPA Comment 1 regarding CAO LIS 03-061. CAO LIS 03-061 contained interim limits for chloride, sulfate, and TDS.*

31. For the biological monitoring results, please specify why particular taxa were excluded from the total taxa count. It appears that the highlighted taxa could potentially fit into another counted taxa, which is why they were excluded, but this is not clear from the footnote. (pg. 40)

Response: *It is correct that the highlighted taxa were excluded because they could potentially fit into another counted taxon. Future documents will include a more detailed explanation for this convention in the methods section.*

Questions/Comments for Appendix E: Historical Database

32. Even when the WTS was operating, aluminum concentrations, although reduced, were still very high and at times the pH was still below 6. What elements of the remediation plan will work to bring the aluminum and pH into ranges that are not harmful to aquatic life? What sort of fail safes are in place if the initial remediation plan is not sufficient?

    Response: *The remediation plan has control elements that were not in place when the WTS was operating earlier. All elements of the remediation plan are designed to reduce acidity entering the site streams, thereby resulting in pH increases and reduction of metal levels in the streams. These elements include continued operation of the WTS, consolidation of spoils within the Chamberlain Creek syncline where ARD in runoff and infiltration will flow to the pit lake for treatment, and capture of ARD outside of the syncline and directing the captured ARD to the WTS. Further, as discussed in the response to EPA Comment 2, the RADD includes provisions to evaluate additional remedial alternatives, as necessary. Finally, as discussed in the response to EPA Comment 4, annual meetings of EPA, ADEQ, and HESI will be held to discuss progress toward achieving the RADD water quality standards.*

33. Several concentrations are listed as less than concentrations rather than exact measurements, while exact measurements were attained during another monitoring season for concentrations below that less than threshold (ex: Lead at Scull Creek was measured at a maximum of 0.6 µg/L during the SI monitoring, but was measured at <40 µg/L during 2006 monitoring). Going forward, please make sure that the assessment methods utilized for the monitoring can detect the parameter in the range that is necessary to determine whether it is causing impairments to aquatic life.

    Response: *Only laboratory analytical methods that were developed and/or approved by EPA and ADEQ will be used on any future analyses of site environmental media. Use of these methods sometimes results in variable reporting limits due to the intermittent need to dilute samples because of high concentrations that, without dilution, would be beyond the measurement range of laboratory instruments.*

Questions/Comments for Halliburton Energy Services, Inc. Dresser Industries-Magcobar Former Mine Site Notice of Intent of an Environmental Improvement Project, October 29, 2014.

34. Currently the notice of intent (NOI) states that no direct remediation will be conducted to treat the elevated concentrations of minerals that are a result of the ARD from the Magcobar mine. It also implies that no work will be done to investigate new remediation techniques in the future that may assist in lowering minerals levels and may be more practical than reverse osmosis techniques. EPA would like to encourage the inclusion of consideration of new minerals treatment techniques over the course of the EIP so that minerals can potentially undergo remediation in the future.

    Response: *EPA's comment is noted. HESI will continue to evaluate new mineral reduction techniques throughout the EIP. Per Section 11.0 of the RADD:*

"The Responsible Party shall investigate, as appropriate, technologies that become commercially available to facilitate the identification and consideration of additional remedial alternatives to affect permanent control, abatement, prevention, treatment or containment of releases and threatened releases at the Site."

35. In several locations the temporary minerals criteria that are being proposed are much higher than the maximum concentration of that parameter that had been measured in that creek over the past 12 years. EPA would recommend dividing some of these creeks into upstream and downstream sections to designate different criteria for those area more impacted by the mine versus those less impacted by the mine. This seems to be appropriate for Scull Creek upstream and downstream of Clearwater Lake, Cove Creek upstream and downstream of Chamberlain Creek, and Reyburn Creek upstream and downstream of Scull Creek. Also for some creeks, such as Rusher and Lucinda, a lower criteria than 500 mg/L TDS and 250 mg/L sulfate seems more appropriate as these creeks are not demonstrating concentrations this high. If the higher minerals criteria are anticipated due to the construction effort associated with the remediation project than perhaps the higher standard can be applied just during the construction period and then reduced to a lower value after the regrading/revegetating is complete.

Creek Sampling Site	Proposed TDS Criteria (mg/L)	Max TDS from 2000-2012 (mg/L)	Proposed Sulfate Criteria (mg/L)	Max Sulfate from 2000-2012 (mg/L)
RUS-1W	500	220	250	140
RUS-1E	500	280	250	190
RUS-0	500	230	250	160
LUC-0	500	82	250	72
COV-5	500	72	250	16
COV-4	500	84	250	21
COV-3	500	640	250	440
COV-2	500	1500	250	1050
COV-1	500	793	250	538
SCL-1	500	570	250	430
SCL-0	500	94	250	63
CRL-4S (mean)	500	100	250	62
CRL-4B (mean)	500	120	250	67
CRL-1S (mean)	500	110	250	63
CRL-1B (mean)	500	110	250	66
REY-3	500	400	250	230
REY-2	500	240	250	150

Response: *HESI agrees that in some cases the proposed temporary minerals criteria are higher than maximum concentrations documented in that creek. HESI anticipates that minerals concentrations will increase significantly during remediation, particularly during earthwork activities, due to exposure of pyritic materials, and that these anticipated increases will persist for years; this was the basis for the EIP schedule continuing 6 to 7 years following active remediation activities (see Section 7.0 of the EIP NOI). However, the EIP NOI schedule is necessarily an estimate. HESI anticipates, based on experience at similar sites and similar remediation activities, that this proposed period for stabilization of disturbed/amended spoils will be sufficient. If this time frame is*

not sufficient to allow stabilization of downstream minerals levels, based on EMP data, HESI may propose an extension of the EIP to properly develop attainable downstream minerals concentrations.

The historical data do not necessarily predict where remediation (i.e., earth disturbing activities) will occur. HESI cannot predict the exact location or to what magnitude increases in minerals concentrations will be observed in response to remediation activities. Therefore, HESI respectfully does not propose to potentially limit or restrict remediation activities by dividing creeks into upstream and downstream sections with lower criteria for some sections.

However, as an ancillary issue resulting from EPA's comment, HESI agrees it would be helpful to identify in more detail the stream reaches to which the proposed criteria will apply. The specific stream reaches to which the proposed criteria apply are as follows:

- *Chamberlain Creek from its headwaters to its confluence with Cove Creek;*
- *Cove Creek from its confluence with Chamberlain Creek to its confluence with the Ouachita River;*
- *Lucinda Creek from its confluence with Rusher Creek to its confluence with Cove Creek;*
- *Rusher Creek from the confluence of the east and west forks to its confluence with Lucinda Creek;*
- *Scull Creek beginning approximately 350 feet upstream of Clearwater Lake to Clearwater Lake (including Clearwater Lake) and from Clearwater Lake dam to the confluence with Reyburn Creek; and*
- *Reyburn Creek from its headwaters to its confluence with Francois Creek.*

These specific reaches have been included in the proposed changes to Regulation No. 2 to narrow and refine where the proposed temporary criteria will apply.

For EPA's additional information, per CAO LIS 16-043, the following monitoring stations apply for each of these stream segments to document compliance with the proposed criteria for these reaches:

- *Chamberlain Creek at CHM-0,*
- *Cove Creek at COV-3,*
- *Lucinda Creek at LUC-0,*
- *Reyburn Creek at REY-2, and*
- *Rusher Creek at RUS-0.*

36. In several instances there are places where a maximum value is listed as less than a number and then an exact number is provided for the mean. This seems to imply that two different techniques were used to measure the concentration of this parameter over the years. Moving forward, as these streams continue to be monitored, a measurement technique that can provide an exact value rather than a less than value should be selected. Without an exact value, the effectiveness of the remediation cannot be

appropriately assessed.

Response: *Please see the response to EPA Comment 33. For the purpose of computing summary statistics, censored data (i.e., results that are below detection limits and therefore reported as "less than" values) are typically given a value according to a rule described in the text. Typical rules for assigning values to censored data include using the detection limit or one-half of the detection limit. Provided that detection limits are appropriate (i.e., less than the applicable water quality criterion or target level), censored data do not prevent assessment of the effectiveness of remediation. For all COCs tested under the EMP, detection limits will be at or below the level necessary to determine if RADD goals are being met.*

37. Is there any data for pH in Scull Creek? (pg. 39)

Response: *pH data for Scull Creek are provided on page 433 of Appendix E, Historical Database.*

38. Please explain why metals weren't assessed in Clearwater Lake? (pg. 40)

Response: *Metals data for Clearwater Lake are provided on pages 425 and 426 of Appendix E, Historical Database. These data were reviewed during the Site Investigation (see Appendix A of the EIP NOI, Section 5.4.1) and were determined to indicate ARD impacts to the lake (see the first paragraph on page 5-19 of the SI Report).*

39. Is there any pH data for Reyburn Creek? (pg. 41)

Response: *pH data for Reyburn Creek are provided on p. 427 of Appendix E, Historical Database.*

40. Are the bench sheets available for the WET testing that was performed? (pg. 42)

Response: *The WET testing referenced in Tables 3.8 and 3.9 was performed on samples collected by ADEQ and submitted to EPA's Houston laboratory. Reports provided by EPA's Houston laboratory do not include bench sheets.*

41. In Table 3.8, on November 3, 2008 there is no value for percent mortality, but it is still marked as significantly different. How is it known that the results were significantly different if the data values are unknown? (pg. 43)

Response: *The data tables of the original laboratory report only contained the asterisks indicating statistically significant differences. A review of the narrative text from the laboratory report showed that the mortality for both species was 100%.*

42. The language indicating significance is inappropriate for the toxicity data tables. It states "*Significantly different ($p \geq 0.95$) from control." If the p value was greater than or equal to 0.95, than these values would not be significantly different; the p value should be less than 0.05 to indicate a statistically significant difference. After speaking to the EPA Houston Lab it appears that they are determining significance by seeing if the data falls outside of the 95% confidence interval. This footnote should be corrected to appropriately indicate how significance was determined. (pg. 43)

Response: *EPA's comment is noted. Statistical significance is based on a statistical test that is appropriate for the characteristics of the data. It is not possible to capture in a single footnote how statistical significance is determined for all data because different data sets often require different statistical procedures. The original laboratory report must be consulted to determine the actual test used to determine statistical significance for any given test. HESI reproduced these data from a joint effort by EPA and ADEQ and is not, therefore, qualified or authorized to change the results. HESI agrees with the commenter that the reference to statistical significance should read, "Significantly different ($p<0.05$) from the control."*

43. In Table 3.9, please provide the bench sheets for the 3/23/2009 toxicity test. It is surprising that 47.5% mortality was not significantly different from the control. EPA would like to see the bench sheets to review the amount of variation between the samples and review the amount of mortality present in the controls. (pg. 43)

    Response: *Reports provided by EPA's Houston laboratory do not include bench sheets, nor do they include information that allows a review of variability among test replicates. Since the tests only involve a single sample, there is no variability among samples to review. However, the data table and narrative text in the laboratory report received from EPA for that sampling event do state that the value of 47.5% mortality was not statistically significant as compared to the control. The report provided a result for a t-test that showed the t-statistic as less than the critical t-value, which indicates that the result was not statistically significant. However, since the control had no mortality (and therefore its variance was equal to zero), it is unclear how a t-test could have been performed. FTN was unable to contact EPA staff to clarify the results at the time the results were received.*

44. In section 3.3.1, please state when this fish sampling was conducted.

    Response: *The first paragraph of Section 3.3 of the EIP NOI states that biological sampling was conducted in April 2012. Fish were sampled on April 25 and 26, 2012.*

45. Please provide the lab sheets for the WET testing results presented in Table 5.1. The discharge monitoring reports (DMR) data appendix only provides the lab sheets for the water chemistry data and not for the WET testing. (pg. 50)

    Response: *Reports prior to April 2008 were not scanned by the laboratory that performed the tests, but reports for tests from April 2008 through June 2012 were obtained. Many of the laboratory reports for tests performed from 2003 through 2008 were located on-site. The available laboratory reports are attached.*

46. During what years was the water treatment system operational? DMR values from Outfall 001 seem to indicate that it was operational from 2003 to 2012, but with various points of non-operation within that time frame. Please indicate when the plant was and was not operational and why operation was suspended during this time.

    Response: *The water treatment system was operational between July 2003 and June 2012 and has been operational since mid-August 2016. As discussed in the response to EPA Comment 1, Outfall 001 discharges using an HCR according to the flow rate in Cove Creek. In order to meet the water quality criteria in Cove Creek, discharge is*

adjusted (or discontinued) at times of lower flows in Cove Creek. Regarding months for which DMR data were not included in Table 5.1, Outfall 001 was not discharging due to low flow in Cove Creek for 10 months from July 2003 through June 2012. However, during the process of addressing this comment, two clarifications/corrections were identified and are shown in the table attached to these responses: (1) additional data from tests conducted during that period were discovered from DMR and laboratory records that were not included when originally developing Table 5.1 of the EIP NOI; and (2) the March 2005 result was one of three consecutive results resulting in toxicity to both organisms (due to a suspected pathogen; see Section 5.1 of the EIP NOI) and should not have been included in the original table. A revised table is attached and includes the lethal and sub-lethal no-observed-effect concentrations (NOECs) for each organism and the associated dissolved minerals values. Note that the additional WET testing results showed both lethal and sub-lethal NOECs of 100% effluent. When the minerals data associated with the additional tests are included in the proposed criteria calculations, using the same approach as was used in the EIP NOI, the new 95th percentile values are slightly higher (<10 mg/L) for both TDS and sulfate. HESI does not wish to amend the proposed criteria to reflect the less-stringent values.

47. Was any chronic WET testing performed? If so, what were these results? The 2008 permit indicates that WET testing for growth for fathead minnows and reproduction for Ceriodaphnia dubia were supposed to be conducted. Please provide the results from that testing. (pg. 50)

Response: *Table 5.1 showed the results of chronic WET testing performed according to the NPDES permit for the facility. The attached table and laboratory reports provide the results of chronic WET testing from July 2003 to June 2012, including the dates that were not included in Table 5.1 (see the response to EPA Comment 46).*

48. Please also provide the minerals, pH, and metals DMR data for all of the WET tests performed while the plant was operational. Please include this data for tests where toxicity was and was not present. (pg. 50)

Response: *The minerals values listed in Table 5.1 were measured from samples collected concurrently (or nearly so) with samples for WET testing. The DMR data reported for minerals, pH, and metals reflect averages and maximums from samples collected during each month. Table 5.1 in the EIP NOI and the attached table provide the measured minerals concentrations associated with the WET testing samples. DMR data for pH, metals, and minerals are available through EPA's ECHO database.*

49. Please justify why the secondary drinking water standards for TDS and sulfate are used as the criteria for Lucinda Creek, Rusher Creek, Scull Creek, Clearwater Lake, and Reyburn Creek when the most sensitive use is aquatic life. How are these criteria protective of aquatic life? (pg. 55)

Response: *Biological data collected during the site investigation (see Appendix A of the EIP NOI) were the basis for the statement on page 55 referring to aquatic life protection. The proposed criteria for minerals were determined to be protective of aquatic life during the SI. Use of secondary drinking water standards for minerals is also consistent with ADEQ's 303(d) assessment methodology for streams without site specific minerals standards when evaluating for aquatic life impairment. Aquatic life protection will continue to be evaluated through the EMP in accordance with the RADD.*

50. Please discuss what the anticipated time frame is for meeting metals and pH criteria.

Response: *The RADD provides the anticipated time frame for meeting metals and pH criteria. The EIP process, and the associated proposed temporary water quality criteria for dissolved minerals, is anticipated to last between 12 and 13 years (see Section 7.0 of the EIP NOI).*