Clarification of Hydrologic Analysis Approach
Supplement to BLM Responses to ADEC Comments on 3rd Draft Feasibility Study
Red Devil Mine, Alaska

Based on the October 13, 2015 comment resolution conference call between ADEC, EPA, BLM and E & E, concerns associated with the Draft Final Feasibility Study for the Red Devil Mine site (August 2015) were raised by the ADEC Solid Waste Division. The concerns mainly focused on the design of the proposed repository and the HELP modeling presented in the FS. These concerns include:

- Anchorage vs Bethel precipitation data as input to model.
- Average Concentration vs UCL.
- Model runs should be done with and without a liner.
- 100-year vs 50-year simulation.
- Multiple model runs are needed.
- Repository side slope - effect of steep slope on cap infiltration rate that impacts volume of leachate.
- Liner-Liner comparison as prescribed process for establishing a liner that's different than prescribed in ADEC regulations for contaminated material landfills.
- Use of HDPE vs. PVC
- Model did not consider head/leachate during repository construction.
- Monofill #2: requested additional performance/test information for use of concrete cloth.

The intent of this correspondence is to offer addition clarification and/or justification associated with the methods and selection of features associated with the repository that has been developed for the FS. It should be noted that the document is a feasibility study and not a full remedial design. It is not the intent of this document to provide specifications and drawings that are suitable for constructing the repository.

Item 1: Anchorage versus Bethel precipitation data as input to model.

The HELP model has standard preset precipitation data for a number of cities with Anchorage being one of them. It was noted in our initial response to comments that the Red Devil site receives approximately 0.8 inches precipitation than Anchorage (18.8 versus 18.0). Over a five acre area (approximate area of the repository) this equates to approximately 21,710 gallons of additional precipitation that will fall onto the repository or roughly a 4.3% increase. With the HELP model estimating that approximately 90,000 gallons of leachate being generated using the proposed cover system, this would equate to an additional 3,900 gallons of leachate being generated. While it is acknowledge that this is a simplistic approach, this difference between Anchorage and Bethel precipitation data does not cause a significant difference nor would it cause the repository alternatives to be evaluated in a different way.

Item 2: Average Concentration vs UCL.

The BLM believes that the use of 95% UCL on the mean values to represent concentrations of COCs in the repository contents is unrealistic and overly conservative for use the hydrogeologic model.

Item 3: Model runs should be done with and without a liner.

As noted in ADEC SWD comments, a single HELP model run was performed, which did not include a bottom liner. Based on the model inputs used, the HELP model predicted that approximately 90,000 gallons of leachate would be generated. Additionally, it was determined that the concentrations of arsenic, antimony and mercury in the leachate that would reach the groundwater table would be less than MCLs. If a HELP model run using a bottom liner was performed, the volume of leachate that leaves the

repository would be significantly reduced; however, the results of COC concentrations that reach the groundwater table would not change. For the purposes of evaluating the performance of a lined versus unlined repository, the HELP model results, with the exception of volume of leachate generated, would be essentially the same. For the purposes of evaluating a lined versus an unlined repository, an additional HELP model run would not alter the evaluation presented in the FS.

Item 4: 100-year vs 50-year simulation.

In the FS, it is assumed that 30 years of operations and maintenance would be required for the repository. In order to be conservative, 50-years was selected for the model run. If during the design phase, it is necessary to model the repository assuming a 100 year time period, then that value can be used.

Additionally, it should be noted that the HELP model run assumed 10 holes per acre, which represents a fair to poor installation. Provided thorough QA/QC procedures are developed and adhered to, the volume of leachate that was predicted is very conservative and the actual volume of leachate generated would be less.

Item 5: Multiple model runs are needed.

During a detailed design, multiple HELP model runs would be prudent to optimize the design of the repository features. However, for the purpose of an FS, the refinement of the design features to achieve the level of a detailed design is not warranted. A basic, conceptual design for a repository was developed for the FS, and the HELP was used to determine whether this conceptual design would be protective of groundwater. While multiple model runs would support further refinements to the repository alternative, it does not alter the individual nor the comparative analysis of alternatives.

Item 6: Repository side slope - effect of steep slope on cap infiltration rate that impacts volume of leachate.

BLM agrees with the ADEC SWD that a steeper slope will increase the runoff rate, which reduces the amount of leachate generation. For the FS, an average slope between the side walls and top was used. The ADEC SWD expects repository designs to model each individual area that has a different slope, which is reasonable expectation for the engineering design stage. If during the design, the engineer determines that the slopes are too great or that the contaminant concentrations are not meeting with the RAOs developed by the FS, then design changes would be warranted. If slopes are problematic, they can be reduced, the repository footprint expanded, and another HELP model run could be performed to determine compliance with the groundwater RAOs.

With regard to the cover, the FS proposes a 60-mil PVC liner. However, it may be necessary to either increase the thickness of the liner (i.e., upgrade to 90 or 120 mil), change to HDPE, or install a double liner system. Should a double liner system be installed, a drainage layer between each liner would be necessary. The drainage layer would be designed to drain to the uncontaminated water (e.g., hasn't come into contact with the repository contents) to the SMA with a downgradient flow away from the repository.

While liner upgrades would increase the alternative cost, there is a cost contingency built in to each alternative that could absorb the increased cost. Additionally, the cost increase would equally affect each alternative that has a repository as a component of the remedy. Therefore, the evaluation of alternatives would not be altered.

Items 7 and 8: Liner-Liner comparison as prescribed process for establishing a liner that's different than prescribed in ADEC regulations for contaminated material landfills, and Use of HDPE vs. PVC.

During the design process, the final cover system will be developed. Should the design engineers develop a cover system that varies from the ADEC regulation, they will need to develop the appropriate

justification or liner-liner comparison. For the FS, a simplistic cover system was developed and modeled with the results predicting that a simple 60-mil PVC liner would be effective in meeting RAOs. As described above, changes to what is presented in the FS will probably occur given that the information presented in the FS is not a design nor is it suitable to be used for construction.

Item 9: Model did not consider head/leachate during repository construction.

The HELP model run was performed without a bottom liner; therefore, the potential head on a liner was not calculated. It should be noted that the HELP model is a method to perform water balance calculations within a landfill or repository. While Alternatives 3C and 3D have a liner incorporated as a component of the system, the need to perform head calculations is beyond the scope of alternatives evaluation in a FS. As discussed in our response to Item 6 above, the design engineer will be responsible for evaluating and specifying the bottom liner so that it is functional and meets appropriate industry standards. While head calculations during the design phase would be important if a bottom liner is part of the remedy, the refinement associated with performing these calculations would not alter the individual or comparative evaluations of the alternatives in the FS.

Item 10: Monofill #2: requested additional performance/test information for use of concrete cloth.

E & E has contacted several vendors of concrete cloth for additional performance and test information. This information will be distributed to ADEC prior to publication of the final FS.