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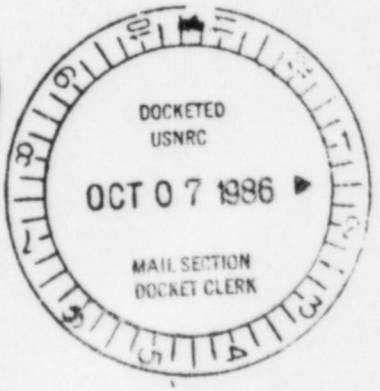
Western Division

818 Taughenbaugh Boulevard
Rifle, Colorado 81650-2730
Phone: 303-625-2445

October 6, 1986



Mr. R. Dale Smith, Director
Uranium Recovery Field Office
Region IV
U.S. NUCLEAR REGULATORY COMMISSION
P.O. Box 25325
Denver, Colorado 80225

Dear Mr. Smith:

Enclosed please find two reports prepared, respectively, by Dr. Charbeneau, Dr. Ledbetter, and Dr. Liljestrand at the University of Texas, and Dr. Humenick of the University of Wyoming, further demonstrating that sufficient groundwater restoration has occurred at the Collins Draw project. We have also forwarded these reports to the Wyoming Department of Environmental Quality to support our view that BPT requirements have been met and that we can move toward final surface reclamation and license termination. In this regard, we have requested a meeting with Randy Wood and his technical staff to discuss these points.

We will keep you informed of developments in this matter. In the interim, if you have any questions or comments on the status of the Collins Draw Project, please do give me a call.

Very truly yours,

Gary D. Aho

Gary D. Aho
Manager-Western Division

GDA:ms
Enclosures

Addl Info

87-017

DEPARTMENT OF CIVIL ENGINEERING
UNIVERSITY STATION, BOX 3295

THE UNIVERSITY OF WYOMING
COLLEGE OF ENGINEERING
LARAMIE, WYOMING 82071

Truman E. Louderback
Cleveland-Cliffs
818 Taughenbaugh Boulevard
Rifle, CO 81650-2730

October 1, 1986

Dear Mr. Louderback:

At your request I have reviewed the report by Dr. Charbeneau and his coworkers, and have responded to the specific questions you posed in your letter of September 10 ,1986. I also have provided a brief discussion of what I believe to be pertinant to your specific problem and the general problem of ground water restoration at uranium solution mining sites.

1. "Are the analyses, assumption, and conclusions contained in Dr. Charbeneau's technical report reasonable?"

After taking some time to review the report entitled Environmental Report on the Collins Draw Project Campbell County, Wyoming (dated June 30, 1986 and submitted to the NRC and the Wyoming DEQ) which contains Dr. Charbeneau's report, I have concluded that the work and conclusions contained therein are sound. In arriving at conclusions, the work was based on conservative estimates which would lead to "worst case" predictions. Of particular importance was the assumption that no retardation would occur regarding heavy elements such as uraniurn, selenium, and arsenic during migration under norman ground water flow outside the mining zone. Research performed by myself and coworkers over the past several years has indicated that heavy elements have adsorptive propreties with respect to surrounding strata which slow down the movement of these heavy elements with respect to ground water velocity. Thus, the predictions of down-gradient, heavy-element concentrations as estimated by Dr. Charbeneau may be much higher that what would actually be realized. Further, there is the possibility of natural stabilization of these heavy elements with time under conditions of normal reducing environments. Because the time scale for migration of heavy elements for very short distances is very long at the Collins Draw site, the possibility of natural stabilization is enhanced.

2. "Based on the information contained in the Environmental Report and the technical report do you concur with the Dr. Charbeneau's recommendation that no further restoration activities be pursued at the Collins Draw site?"

Based on the information provided in the above report I would agree which this conclusion. However, I would agree for other reasons also.

We have been performing research in the area of ground water restoration at uranium solution mining sites continuously for more than eight years. It is my opinion that, as a general rule, it is impossible to restore a solution mine zone to baseline water quality using any engineered process within a time frame of several years. There are several reasons for this which include the fact that material has been removed from the mine zoned which contributed to the natural ground water quality, the fact that very long periods of time are required for reequilibration and stabilization to occur between the ground water and the surroundings; the idea that once stabilization has occurred, equilibrium will be established at a different set of ground water concentrations, and the fact that not enough basic research and development of restoration technology has been done related to uranium solution mining to provide reliable and proven restoration methods.

If uranium solution mining is allowed to be practiced commercially, at this time I believe that restoration criteria should be based on mine zone restoration that will protect and maintain ground water quality at the boundaries of the mine property for a period of time between 50 and 100 years. This concept can be implimented using existing information and modeling techniques related to the transport of contaminants of interest such as heavy elements and other lixivient components.

Finally, it is my opinion that Cleveland-Cliffs has spent a significant amount of time and resources to attempt to restore the Collins Draw site. Besides the fact that the affected zone is very small, further restoration work may take an exceedingly long period of time. This is discusssed further, below.

3. "Do you believe it would be practicable and beneficial to conduct additional restoration with reverse osmosis and/or to inject a reductant such as hydrogen sulfide into the production zone?"

The answer to this question is based on what can and can not be predicted at this time. The use of reverse osmosis alone probably will not be successful in any reasonable time period. It is quite certain that if return water from an R/O unit contained even small amounts of oxygen, more heavy elements would be released from the surrounding strata thus defeating or greatly delaying the removal of these contaminants from the ground water. If the reinjected water was maintained at a reducing ORP(oxidation -reduction potential), or if ground water sweep (sweep with water outside the mine zone which is reducing) was practiced, the amount of water and time required to achieve significant restoration would be large. This conclusion is based on recent work performed by our research group where we studied the transport of heavy elements from a mined ore under anaerobic ground water conditions. We found that simple hydraulic sweep of heavy elements (uranium, selenium, molybdenum, vanadium, and arsenic) contained in the pore fluid was not sufficient to lower the local ground water concentration of heavy elements rapidly. It was found that these heavy elements apparently are adsorbed in some form on the surrounding solid surfaces and are released slowly based on equilibrium and kinetic relationships. This phenomena can be modeled using a computer simulation that will probably show that an unreasonable amount of time and expense will be required for significant reduction in ground water contaminants

for this small mine zone.

What is uncertain at this time is whether or not the introduction of a powerful reducing agent into the mine zone will stabilize the heavy elements in the area quickly and economically. To my knowledge there is no established technology for this technique currently practiced or cited in the literature. It is possible that there is proprietary work which has been performed by private companies related to this idea. However this information, if it exists, is not available to me.

I hope the above comments are of use to you.

Sincerely,

MJ Humenick

Dr. Michael J. Humenick
Professor

COLLEGE OF ENGINEERING

THE UNIVERSITY OF TEXAS AT AUSTIN

Department of Civil Engineering · Austin, Texas 78712-1076
Environmental and Water Resources Engineering · (512) 471-5602

19 September 1986

Truman E. Louderback
Cleveland-Cliffs
818 Taughenbaugh Boulevard
Rifle, Colorado 81650-2730

Dear Truman:

We wanted to thank you for sending us a copy of the letter dated August 27, 1986 from the Wyoming Department of Environmental Quality. We do not agree with the suggestion that injection of a reductant is an application of best practicable technology. The following comments will outline our reasons for this belief.

To date, we are aware of four sites operated by three different companies where a reductant has been injected. These sites are located in Texas and New Mexico. For only one of the sites could the injection be considered successful in that the heavy metal concentrations showed a decrease. In all other cases there was no significant change in metal concentrations, even after production water showed a considerable decrease in the redox potential (Eh).

There are a number of potential problems associated with injection of a reductant which should be noted. First, one is introducing sulfides into the aquifer which will be mobile with the potential for migration off-site. Second, other metals, notably Fe and Mn, are soluble in a reducing environment and one could expect their concentrations to rise to the extent where they might be considered a problem. In addition, with injection of hydrogen sulfide as a reductant, the pH will decrease which again increases the mobility of metals within the aquifer. Also, with decreased pH's, the solubility of many of the metal hydroxides is increased. In addition, if the sulfides are oxidized the resulting sulfates can act as complexing agents increasing the mobility of the metals. Finally, there are tremendous health risks associated with the handling of hydrogen sulfide and the reductants would in no way influence the mobility of ammonia.

In summary, the technology of injection of reductants is not proven. There are many potential problems associated with such an injection and the result could lead to a worsening of aquifer water quality rather than an improvement. As a general rule we believe the less one has to modify the chemistry of the orebody and surroundings the more likely it is to return to its natural reducing state without creating other unanticipated water quality concerns.

I hope that these comments are helpful.

Sincerely yours,

Randall J. Charbeneau
Associate Professor

Howard M. Liljestrand
Associate Professor