

McDermott, Steve

To: Bergman, Tom
Subject: FW: Written Comment re Draft MLRB Rules regarding CO HB 08-1161, In Situ leach mining-Fortune

To: Colorado Mined Land Reclamation Board, Attn: Irene Stanton
1313 Sherman Street, Room 215, Denver, CO 80203
Irene.Stanton@state.co.us

From Irene Fortune

Dear Ms. Stanton,

Please find below my written comment on Draft MLRB Rules regarding CO HB08-1161.

I'm a retired chemist with almost 30 years experience in many aspects of highly hazardous chemical manufacturing, including assessing risks involved in proposed new chemical processes. Further, I advised my Fortune 500 employer on chemical regulatory compliance for six years. I hope to live in Loveland for many more years and I'm concerned that widespread health effects due to unsafe groundwater will affect the vitality of the region, not to mention the high risk of direct negative effects to the people who live closer to the proposed mining site.

I have reviewed the Act that was HB08-1161, and "The Basic Standards for Ground Water" to which HB08-1161 refers. **I have two comments regarding:**

Page 7 – HB08-1161 Section 5, paragraph (5)(a) "The Board ... may deny a permit for in situ leach mining operations based on scientific or technical uncertainty about the feasibility of reclamation..." I submit that permits for in situ leach mining should be denied because the mining process will change the forum of the ore, from gigantic sedentary insoluble rock layers into tiny particles, and the "tailings" returned underground will be much more soluble and more apt to diffuse with groundwater flow into surrounding properties. Technically, once the ore has been "leached" it will not be possible to restore ground water to premining baseline water.

And

Page 10 – HB08-1161 Section 7, paragraphs (8)(a) and (b), referencing water quality standard(s) that are to be met during mining and reclamation. Having stated that the standard in Section 5, paragraph (a) will not be met, reclamation enforcement will rest on paragraph (b) or "Tables 1 -4 in Basic Standards for Ground Water". I am concerned that this document provides ample avenues for reinterpretation and will become the route by which Powertech overpowers Colorado's regulatory budget and persuades the state to relax the reclamation standard, since, once mining is underway, the Act does not allow the permit to be revoked unless the state can prove a pattern of willful violations.

Further, the damage will be done. No human powers exist to return the ore to the prior stable state. The Reclamation Board may charge fines and truck in water for household and livestock but for a steadily expanding region surrounding the proposed site near Ault, little else can be done at this point to protect human health and well-being – radioactive and hazardous minerals will have been freed from their age-old frozen state and will be let loose into the environment. The question becomes, what recourse will increasingly endangered neighbors seek? Powertech is Canadian. Our US court system is unlikely to reach them. But the state of Colorado will continue to be here. Our state has enough challenges already. I don't want us to bring anymore upon ourselves. Don't let this issue become a matter of reclamation in the first place.

Comment #1 – technical uncertainty about the feasibility of reclamation

Summary:

My concern lies with the uranium and the impurities in the acid-digested ore that is slated to be returned underground. It is not cost effective to recover 100.0% uranium, some will remain unextracted. After the extraction step, minerals with proven health effects will have been broken free of the ages-old rock formation to flow wherever water may take them. They will become available to enter the groundwater because the vastly reduced particle size and lower chemical stability of the minerals returned to the ground will result in higher water solubility than in their premined state.

The strong acid used to extract uranium from the impure ore will break the strong, stable, covalent chemical bonds that comprise the water-insoluble ore at a molecular level. Once broken, these high-activation-energy bonds can not be reformed except by another act of nature similar to what formed the ore in the first place. When impurities are returned underground after uranium has been extracted, merely settling the impurities on top of rock layers will leave pools of fine particles containing lead, radium, thorium, unrecovered uranium or other hazardous minerals held in place by gravity

only and at risk of diffusing whenever water flows – including initial water used to return the tailings underground. Neither can the slurry be left to dry on the surface after uranium has been extracted, due to the inhalation hazards that these mineral impurities present.

Details:

1. The ore of interest to Powertech likely contains uranium oxide, uranium phosphide, uranium silicate and/or partially oxidized uranium phosphide as well as variable amounts of lead, radium, thorium, and rare earth metals in various oxidized forms.¹ Naturally-occurring inorganic compounds do not exist as discrete molecules, eg uranium dioxide or UO₂, but as matrices, or multi-dimensional connected series of something like -U-O-U-P-O-Th-O-U-P-Pb-O-² in all directions, forming “particle sizes” larger than Weld County farm fields – three-dimensional farm fields.
The dashes “U-O” indicate strong covalent bonds, formed ages ago when the ore was formed by geologic conditions of intense pressure and heat over long periods of time. This oxide and phosphide matrix form is insoluble in water. If water should trickle past the surface of this rock, at worst, a glacially slow process of erosion will occur. The presence of neutral or slightly basic groundwater provides no energy capable of breaking the covalent bonds.
2. The strong acid used to extract uranium from the ore slurry brought to the surface will break the covalent oxide and phosphide bonds, replacing the oxide/phosphide matrix with dissolved mineral salts via relatively weak ionic bonds. Mineral salts will include unextracted uranium but also with thorium, lead, radium and other naturally occurring mineral impurities.
3. After uranium extraction, the resultant slurry might be left in surface ponds or it might be returned underground. Surface ponds present an obvious problem. The water would evaporate and fine dust containing mineral impurities would be distributed by the strong winds that are characteristic of this region.
4. Depositing the impurities underground represents temporary disposal at best. Powertech describes following the slurry with a sodium bicarbonate solution to deposit the re-solidified mineral carbonate salts onto remaining rock surfaces. What Powertech cannot do is apply intense heat and pressure for the time necessary to re-form the covalent oxide bonds, so that lead, radium, thorium, etc can chemically “re-attach” to the rock and return to the water-insoluble state in which it currently exists. Instead, a thick layer of fine powder, containing minute particles of uranium, lead, radium and thorium carbonate salts will be left to simply lay on top the rock surface, ready to be swept along with any subsequent water flow – not to mention gravity flow of the water used to return slurry underground in the first place.

¹ Hawley’s Condensed Chemical Dictionary, eleventh edition. N. Irving Sax and Richard J. Lewis, Sr, Van Nostrand Reinhold, ©1987 p 1207

² O – Oxygen, P – Phosphorous, Pb – Lead, Th – Thorium, U - Uranium

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Comment #2: Flexibility for re-interpretation allowed in “Basic Standards for Ground Water”

Summary:

Having established that returning to premining levels in not possible, I would expect Powertech to express intent to comply with Section 7, paragraph (8)(b). I’m concerned that this reference is the route through which Colorado will be pressured to relax water quality standards, due to the way HB08-1161 and the Basic Standards for Ground Water³ are written.

Details:

Since I previously advised a large multinational chemical manufacturer on regulatory compliance, it’s easy to read the Standards with the interests of Powertech in mind and begin finding avenues for reinterpretation in the above document.

Within the Basic Standards for Ground Water, only Sections 41.5 and 41.6 are automatically applicable to any ground waters of the state. Section 41.5 allows the development of site-specific standards while 41.6 allows flexibility in determining the point of compliance. Table A, page 6 in Section 41.5 does not include a maximum limit for uranium, nor a total radioactivity limit. Section 41.5, point 1.b. states “For all other radioactive materials... they shall be maintained at the lowest practical level.” I submit that the lowest practical level is going to shift higher after in situ leach mining has occurred and Colorado will be pressured not to fine Powertech but instead to relax standards in order to allow the company to show “compliance” in the interest of the economy and jobs.

Tables 1 – 4, referenced in HB08-1161, Section 7 paragraph (8)(b), are in Section 41.7 which allows classification by “any interested person, including a regulated entity or a person who may be affected by ground water quality”

Table 1 contains the radiological limits and is specific to Domestic Water Supply with some of the same maximum contaminant levels found in Fort Collins and Loveland municipal water supply annual reports to customers. Powertech

may argue that no groundwater across the state would be expected to meet the same standards as the treated and filtered product of a municipal water facility! It may be that analysis of groundwater at the proposed leaching mine site already does not meet one or more of these contaminant levels. Regardless the severability clause in Section 41.8, this may be held as grounds to develop site specific standards.

³Colorado Department of Public Health and Environment, Water Quality Control Commission, 5 CCR 1002-41, The Basic Standards for Ground Water”, last amended on October 13, 2009. Several internet searches led me to this document. I believe this is the correct reference for the Tables 1 through 4 referenced in HB08-1161, page 10, Section 7, paragraph (8)(b).

Irene Fortune