EXHIBIT 1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
1595 Wynkoop Street
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Phone 800-227-8917
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DEC 0 3 2010

Ref: 8P-W-GW

Mr. Richard Blubaugh
Powertech (USA) Incorporated
5575 DTC Parkway, Suite 140
Greenwood Village, Colorado 80111

RE: Underground Injection Control (UIC) Program
UIC Class V Final Permit
Aquifer Recharge Injection Well
UIC Permit # CO51237-08412

Dear Mr. Blubaugh:

Enclosed is the Environmental Protection Agency Region 8 (EPA) Underground Injection Control (UIC) Class V Final Permit for the Class V injection well that will be used to reinject groundwater pumped from the Upper Fox Hills Formation back into the same formation from which it was pumped. The second public comment period ended December 24, 2009. The EPA received public comments during both public comment periods and both public hearings. The enclosed document entitled "Responsiveness Summary for the Underground Injection Control Class V Final Permit Decision for the Powertech (USA) Inc. Centennial Site" includes the EPA UIC Program's response to the comments that were directly related to this permitting action. All comments received by the EPA are included in a separate document that is part of the Administrative Record for this permit. This document also contains a summary of the changes in permit requirements from the draft to the final permit. The Statement of Basis for the Final Permit is also enclosed. This document includes a discussion of all the technical aspects upon which permit conditions are based.

The date the Final Permit was issued is DEC 0 3 2010. Because comments were received during the public comment period, the Final Permit will not become effective until JAN 0 3 2011, per Title 40 Code of Federal Regulations (40 CFR) Section 124.18, to provide a 30-day window for commenters to appeal the Final Permit decision. The procedures for appealing a Final Permit decision are outlined under 40 CFR Section 124.19, which is enclosed.

If you have any questions concerning the Final Permit, please call Valois Shea at 1-800-227-8917, extension 312-6276, or 303-312-6276.

Sincerely,

Stephen S. Tuber
Assistant Regional Administrator
Office of Partnerships and Regulatory Assistance

Enclosures: Final Permit
Responsiveness Summary
Statement of Basis
Title 40 Code of Federal Regulations Section 124.19

EXHIBIT 2

WESTERN MINING ACTION PROJECT

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July 24, 2009

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RE: Proposed Underground Injection Control Program (UIC) Permit (Permit Number: CO51237-08412).

Dear Ms. Shea,

Thank you for the opportunity to comment on your agency's proposal to issue an Underground Injection Control Program (UIC) Permit (Permit Number: CO51237-08412)[1] for Powertech (USA) Incorporated's proposed aquifer pump test in the Fox Hills Aquifer in Weld County, Colorado. As discussed herein, the draft permit cannot be issued as proposed. At a minimum, substantial additional information is required to demonstrate the ability of the permit applicant to protect underground sources of drinking water. This information includes additional baseline data on the water quality of both the injectate and the receiving water. In addition, the permit applicant should be required to demonstrate that the substantial historic exploration drilling in the area of the proposed permit will not result in contamination of adjacent aquifers, including underground sources of drinking water. Lastly, the EPA's permit processing exercise should be better coordinated with the required state permitting process for the proposed underground injection activities.

[1] We note that various permit numbers are used in various documents, making it unclear to the public as to which permit is under review. The Public Notice and Statement of Basis and Purpose show permit No. CO51237-08412, whereas the Draft Permit cites permit No. CO51237-08408. Still further, the text of the Draft Permit states that "[t]he EPA permit number the UIC Program Director ... has assigned to this permit is CO51237-08404." Draft Permit at 2. Lastly, the bottom margin of each page of the Draft Permit lists "Petroglyph Energy, Inc., UIC Class V Permit No. CO51221-00000." Thus, in various places, the EPA has listed no less than 4 different permit numbers in the materials. At a minimum, this is confusing to the public, and at worst, renders the public notice insufficient, and requires re-notice of the permit application to the public.

Regarding the Draft UIC Permit and the Statement of Basis for the permit, we make the following comments.

The statement of Basis and Purpose states that the permit will contain "no requirements for reinjectate sampling and analysis." Statement of Basis and Purpose at p. 6. However, the same document states that the applicant "will sample the stored groundwater and have it analyzed before reinjection occurs." Id. at 5. The draft permit should be revised to specifically require a full suite of water quality sampling prior to any injection into the aquifer. Such a sampling is necessary to ensure that the injectate does not present a threat to underground sources of drinking water or to the existing quality in the aquifer, as required by 40 CFR § 144.82(a). This sampling should include protection against such things as bacterial growth in the storage containers, as well as to assess the potential impacts to the aquifer and the existing uses of the affected ground water.

The need for sampling prior to injection raises additional issues related to the draft permit – namely the lack of a requisite analysis of the existing water quality in the aquifer. In fact, there appears to be a critical lack of information related to the existing water quality in the affected aquifer, including the water quality of the proposed injectate. Powertech states in its cover letter attached to the permit that "The water quality analysis displayed in attachment D was obtained from an existing well…located about 500 feet south of the pump test/proposed injection well, and completed in the same formation and interval." Cover letter at p. 3. The EPA must justify any decision to not require a more comprehensive characterization of not only the water proposed to be injected, but also the area of the aquifer proposed for injection. It appears that, as currently proposed, the agency is proposing to rely on a single sample from a single existing well located some 500 feet from the injection area to characterize the entire area of the aquifer from which the proposed injectate will be drawn and the area of the aquifer potentially impacted by the proposed reinjection activities. Review of the materials and discussion with agency personnel indicate that the withdrawn water proposed for injection will be drawn from the middle of a uranium ore-body – yet there does not appear to be any data demonstrating the quality of the water in the well from which the water will be drawn. Further, there is no data demonstrating that the water to be drawn and reinjected will not encounter oxidizing conditions as the pumping and reinjection occurs (for instance, flow from reduction zones into more oxidizing zones that could lead to iron hydroxide precipitation and well fouling). Should this occur, it could result in mobilization of additional contaminants in the aquifer, posing additional threats to underground sources of drinking water. In short, this existing data set is woefully inadequate. Should the data demonstrate that the quality of water proposed to be injected contains high levels of toxic or noxious chemicals, a Class I UIC permit may be appropriate to ensure protection of underground sources of drinking water. However, without this data, the EPA cannot make a reasoned analysis of the impacts of the proposed injection in order to fulfill its duty to protect underground sources of drinking water.

Notably, the additional information required of Powertech includes not only data on water quality of the aquifer and of the injectate, but also the geologic characteristics of the injection zone and the so-called confining strata. The EPA is authorized to require this information pursuant to 40 CFR § 144.27. Indeed, although drafted prior the finalization of the complete Class V regulatory program, the EPA's Statement of Basis and Purpose for the

agency's Underground Injection Control Regulations issued by the EPA's Office of Drinking Water (May, 1980; National UIC Program Docket Control Number D 01079) demonstrates the potential problems where injectate containing contaminants will be injected above or below an underground source of drinking water and the geologic information is lacking. This document states, at pages 13-14:

> [I]f the confining stratum which separates the injection zone from an overlying or underlying underground source of dirking water is either fractured or permeable, the fluids can migrate out of the receiving formation and into the protected region.
>
> For obvious reasons, there are no well construction standards which can address this problem of migration of fluids through this pathway. Consequently, the regulations propose two provisions to assure that fluids do not travel this pathway into underground drinking water. First, the regulations require that, prior to the issuance of a permit, the geologic characteristics of the injection zone and confining strata be reviewed. Data already available from the states can assist Directors in making these reviews. A permit should only be issued upon the Director's finding that the underground formations are sufficiently sound to contain fluids in the injection zone.
>
> Second, the regulations require that well injection pressure be controlled to prevent opening fractures in the confining strata or otherwise causing the rise of fluids into an overlying protected zone.

In this case, the EPA should require additional information regarding the geologic setting of the proposed injection activities. Based on this information, the EPA should consider and adopt restrictions on injection pressures in order to ensure protection of underground sources of drinking water.

Further demonstrating the lack of sufficient data is the statement on page 8 of the Statement of Basis and Purpose that the nearby domestic well "is completed deeper than the injection zone, and is probably in the B Sand of the Lower Fox Hills Formation...." This statement shows a lack of sufficient data to ensure protection of underground sources of drinking water. The conclusion is also supported by the statement on page 2 of the cover letter, where the applicant states, with regard to the nearby domestic well, "[t]he depth of the screened interval of the proposed injection well will be approximately 500 to 550 feet below the ground surface …. This well is much deeper than the zone of injection (620 feet), and is likely screened in the B-Sand of the Lower Fox Hills." However, the Well Construction and Test Report, State of Colorado, Office of the State Engineer, for this well indicates a Perforated Casing from 440 to 460 feet and from 520 to 560 feet (attached as exhibit 1). This demonstrates a lack of sufficient data and analysis to issue the permit at this time.

Overall, significant additional data is necessary for the EPA to fulfill its obligations under the federal Administrative Procedure Act (APA), which requires that the agency consider all information and make its decision based on a rational assessment of all relevant facts and circumstances. Absent full characterization of the injectate and the receiving aquifer and the

impacts on underground sources of drinking water, the EPA cannot effectively discharge this duty.

The Draft Permit states at page 7 that "[c]ompliance with this permit does not ... authorize ... any infringement of state or local law or regulations." Further, Powertech (USA) Inc.'s April 30, 2009 Request for Permit letter states that the Colorado Division of Reclamation Mining and Safety (DRMS) is the state agency "overseeing the project." However, there is no record of Powertech having any active application for any permit covering the activities proposed in the Class V Draft Permit. Indeed, Powertech has recently withdrawn an application that would have covered some of the relevant activities.

EPA should require Powertech to explain the relationship between the currently applied-for EPA permit and Colorado DRMS permit requirements for this same activity. As stated above, the Applicant does not at this time have any permit application in place before the DRMS, where the Applicant will be required to present substantial technical and baseline characterization evidence in order to obtain state authorization to conduct the proposed pump test. For instance, a letter dated March 31, 2009 from Mr. Allen C. Sorenson, Reclamation Specialist, DRMS to Mr. Richard Blubaugh, Powertech (USA) Uranium Inc., demonstrates the broad extent of the information that will be required as part of the state review. (attached as exhibit 2). This includes critical pieces of information related to the protection of the hydrologic balance and protection of water quality and quantity. Given the significant information that will be required in the state permit process, and the scant information currently available to EPA in the context of this UIC Class V permit (discussed herein) regarding the hydrologic balance and impacts on groundwater quality and quantity, the EPA should delay its permitting exercise to better coordinate with the DRMS in order to ensure that the EPA has sufficient evidence to draw rational conclusions with respect to the applicant's ability to comply with the SDWA and EPA regulations. Failure of the applicant to provide sufficient information to allow the EPA to draw such rational conclusions would violate the APA.

The DRMS also expresses its requirement that the Applicant provide the location information for all wells within two miles of the proposed operation, including not just Powertech wells but also any other wells historically drilled in the area. These old wells may indeed present significant problems with respect to protecting underground sources of drinking water. The EPA's 1980 Statement of Basis and Purpose (National UIC Program Docket Control Number D 01079) provides a clear description of the problem, at pages 14-15:

> One of the common ways by which fluids can enter an underground source of drinking water is by migration through improperly abandoned and improperly completed wells. This would occur if fluids moving laterally within an injection zone encountered an improperly abandoned or completed well, and, following the path of least resistance, flowed upward within the well until entering an overlying underground source of drinking water or overflowing onto the land surface. Because of the large number of wells drilled in the past, and because well operation and abandonment have not always benefitted from close regulatory scrutiny, contamination by this route can present a significant risk to public health.
>
> ...

> [In the case of a potential problem], however, the well operator would be expected to correct it. Correcting the problem could mean that the well operator would have to plug a faulty well at his/her expense.

In this case, the extent of the prior drilling in the area is highly significant. As demonstrated by the attached map prepared by Powertech and altered only with respect to identifying local roadways, and entitled "Topo and Drill Hole Location Map, Indian Springs and Centennial Uranium Projects", there are literally thousands of historic wells in the areas proposed by Powertech for in situ leach uranium mining, and many wells in the area proposed for injection under the Draft Permit. (Map attached as exhibit 3). In order to discharge its duties under the Safe Drinking Water Act and the APA, the EPA should require the applicant to provide information demonstrating that these wells have been properly abandoned in a manner that will not allow for communication between the injection area and the overlying underground source of drinking water.

The concerns with the previous abandonment of these wells are well documented. Indeed, documents suggest that many of these wells were not properly abandoned and could provide a conduit between the aquifers. For instance, a May 19, 2003 letter from Mark E. Hoffman, Project Manager for Exxon Mobil to Tony Waldron, DRMS, regarding reclamation activities at the Indian Springs Prospecting project (attached as exhibit 4 (with attachments)) states:

> Prospecting was conducted as described in three Notices of Intent to Conduct Prospecting Operations submitted to the Colorado Department of Natural Resources, Mined Land Reclamation Board, dated August 23, 1977, November 10, 1978, and October 27, 1980 (Attachment A). A total of 492 uranium exploration boreholes were drilled during this period.
> ...
> Mr. J.J. Faulhaber, of Alternative Energy, in an interoffice memo, dated May 28, 1985 (Attachment D) summarized borehole abandonment procedures and standards for the Project. Boreholes were abandoned with drilling mud consisting of varying viscosities from the bottom of the hole to ten feet below the ground surface. Cement plugs were installed from ten feet to the surface or two feet below the surface depending upon local cultivation practices.
>
> The borehole abandonment standards varied over the course of the Project, but the most stringent standards applied to the 1980 drilling program....
>
> The boreholes were drilled into the stratigraphic horizon that contains the Laramie-Fox Hills aquifer, a regional hydrogeologic unit that spans the base of the Laramie Formation and the top of the Fox Hills Formation. In a letter to Mr. Kenneth Holmes (Mobil), dated February 23, 1982 (Attachment E), Ms. Walker [Colorado Division of Mining] expressed concerns over the use of drilling mud in an interval of an aquifer, and the potential for contaminants in the Upper Laramie Formation to enter the Laramie-Fox Hills aquifer.

The interoffice memo referred to in this excerpt (exhibit 4, attachment D) also refers to well ab**a**ndonment procedures that were done in the 1970s, before Colorado legislation passed in the early 1980s (House Bill 1195) that required more substantial protections in drill hole abandonment procedures to protect groundwater. These documents refer to use of such materials "beet pulp" in the abandonment procedure in wells.

Other historic documents demonstrate that other companies drilled substantially more numbers of wells in the area in the 1970s and 1980s, including Rocky Mountain Energy, who reported to the State of Colorado in 1982 that it drilled some 2,142 holes in the area, including in the section proposed for the injection permit (attached as exhibit 5). There is little data on the abandonment procedures used in these wells, but one might assume they consisted of similar techniques that were standard at the time that gave rise to the State of Colorado's concerns with respect to aquifer communication and contamination with the Mobil project wells. In any case, the EPA should require the applicant to provide all information regarding these wells, any abandonment information, and require repair and proper closure prior to any injection authorization.

In addition, the applicant's own documents demonstrate that there have been problems encountered with abandonment procedures at historic drill holes. In an August 2007 Powertech (USA) Inc. "Activity Update" (attached as exhibit 6), the company recounts its experiences in discovering and attempting to repair broken well casings that appear to have been improperly abandoned in the first instance. As stated by the applicant:

> Some wells were broken off at ground surface during the intervening 20 plus years. We have attempted to locate wells with GPS system and hand digging. Some wells we could not locate this way and we used a backhoe to find the buried well. We gently raked 4 inches at a time searching for the casing. We did not break any wells with our backhoe. The photos found on some websites are actually jagged broken casings that were buried for 20 plus years.

Further, Powertech is on record in a letter dated October 16, 2007 from Mr. Richard Blubaugh, Powertech (USA) Inc. to Mr. Jim Woodward, www.powertechexposed.com (except attached as exhibit 7) overtly recognizing the problems associated with historic well abandonment procedures in defending assertions that it or its contractors were responsible for leaving open well casings:

> While these open well casings are on property owned by Powertech, these are not wells that were drilled by Powertech or its contractors. In fact, the wells left unprotected were drilled by previous exploratory efforts in the 1980s, and were uncovered by Powertech's geotechnical teams while in the process of locating each bore site.

In response to these local community concerns with respect to the potential failures of historic well abandonment, the applicant affirmatively committed to "ensuring that **all wells on its properties** meet state and local safety requirements and standards." We urge EPA to hold Powertech to its promised commitments to the local community and require the applicant to

submit this additional information of proper well abandonment as part of the permit review process, and before the grant of any such permit.

Overall, the SWDA and associated regulations provide that "no injection shall be authorized by permit or rule if it results in the movement of fluid containing any contaminant into Underground Sources of Drinking Water" 40 C.F.R. § 144.1(g). In order to ensure compliance with the SDWA and EPA regulations, the applicant must present significantly more detailed evidence with respect to the existence and potential cross-aquifer communication that may result from these historic wells, and require proper abandonment be completed prior to issuing a permit for injection. In fact, the applicant is on record as committing to However, as it currently stands, the record is insufficient to demonstrate that the applicant can achieve the protection of all USDW. As such, the strictures of the APA preclude the issuance of a permit in this case until the applicant can provide sufficient evidence demonstrating the ability to comply with applicable law.

Lastly, any permit issued should require complete reporting of water quality data encountered before, during, and after the pumping and injecting. While any approved pump test is ongoing, should any communication between aquifers be encountered, and the permit should include a provision for re-assessment of the viability of injection pursuant to the permit, as this new information would be critical to protecting underground sources of drinking water. Should such cross-communication be discovered, the existing permit should be suspended or voided pending additional review by the EPA.

Given the complexity of these issues, we continue to express a high level of concern with the proposed reinjection activities, and based on the current record urge the EPA to deny the proposed permit. At minimum, given the extensive amount of data and information that the EPA requires (as identified herein) in order to process the proposed permit for injection, we hereby request that the agency provide an additional public comment period to facilitate review of any amended Draft Permit or Statement of Basis and Purpose that may be forthcoming in the future. We understand that such additional review is not uncommon, and given the controversy surrounding the impacts associated with Powertech's proposed activities, is entirely appropriate. In addition, we are currently conducting ongoing research into such things as historic drilling records in the area, and reserve the right to supplement these comments should additional relevant information become available. Lastly, we hereby incorporate herein by reference all of the public comments submitted in this comment period, to the extent these comments address issues or detail facts or evidence not included herein.

We look forward to reviewing the EPA's responses to these comments, and please do not hesitate to contact me directly with any questions regarding these comments.

Sincerely,

/s/ Jeffrey C. Parsons

Jeffrey C. Parsons

Senior Attorney
Western Mining Action Project
On behalf of
Coloradoans Against Resource Destruction
Information Network for Responsible Mining

EXHIBIT 3

WESTERN MINING ACTION PROJECT

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December 24, 2009

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RE: Proposed Underground Injection Control Program (UIC) Permit (Permit Number: CO51237-08412).

Dear Ms. Shea:

Thank you for the opportunity to comment on your agency's proposal to issue an Underground Injection Control Program (UIC) Permit (Permit Number: CO51237-08412) for Powertech (USA) Incorporated's ("Powertech") proposed aquifer pump test in the Fox Hills Aquifer in Weld County, Colorado. As discussed in our comment letter submitted July 24, 2009 relating to the same permit application, the draft permit cannot be legally issued as proposed due to the lack of substantial additional information necessary to demonstrate the ability of the permit applicant to protect underground sources of drinking water. The points and issues raised in that July 24, 2009 letter, including attached exhibits, are expressly incorporated and adopted herein. For your convenience, the July 24, 2009 letter is attached (sans exhibits).

Unfortunately, despite the fact that some five months have elapsed since the submission of comments identifying the need for additional information, it appears that EPA has declined to request this information, review the same, or provide it to the public as part of this permitting exercise. This information includes additional baseline data on the water quality of both the injectate and the receiving water, and a demonstration that the documented substantial historic exploration drilling in the area of the proposed permit will not result in contamination of adjacent aquifers, including underground sources of drinking water. Lastly, the EPA must review any information obtained through any previous aquifer pump tests conducted in the area, as such data provides relevant information as to potential threats to local drinking water supplies. This is particularly true given the documents in the EPA record from Powertech (also submitted to the State of Colorado Division or Reclamation Mining and Safety) relying extensively on conclusions as to the protection of drinking water purported to have been derived by Powertech from data obtained in previous pump tests. Absent agency and public review of this same data and any reports derived therefrom, these assumptions are unsupported by the record, and thus

cannot form the basis of a conclusion by EPA that the draft permit will protect underground sources of drinking water.

As noted in the July 24, 2009 comment letter, the federal Administrative Procedure Act (APA) requires that the EPA consider all relevant information in making a determination on a permit such as that at issue here. Further, the Safe Drinking Water Act (SDWA), its implementing regulations, and the statement of basis and purpose developed in conjunction with the regulations, require the review of the information identified in the July 24, 2009 letter. This is particularly true in this case, given the documented existence of poorly or improperly abandoned historic drill holes in the vicinity of the proposed activities.

Through this letter, commenters again request that EPA conduct the required review of all necessary information to ensure the protection of underground sources of drinking water, as described herein and in the July 24, 2009 comment letter. Given the complexity of these issues, we continue to express a high level of concern with the proposed reinjection activities, and based on the current record urge the EPA to deny the proposed permit, as an award of a permit based on the current record would be in violation of the APA and SDWA.

We look forward to reviewing the EPA's responses to these comments, and please do not hesitate to contact me directly with any questions regarding these comments.

Sincerely,

/s/ Jeffrey C. Parsons

Jeffrey C. Parsons
Senior Attorney
Western Mining Action Project
On behalf of
Coloradoans Against Resource Destruction
Information Network for Responsible Mining
Environment Colorado

EXHIBIT 4

Responsiveness Summary for the
Underground Injection Control Class V Final Permit Decision
for the Powertech (USA) Inc. Centennial Site

Background

On April 30, 2009, the EPA received an Underground Injection Control (UIC) Class V permit application from Powertech (USA) Inc. to reinject groundwater pumped from the Upper Fox Hills Formation, A2 sandstone during an aquifer-pump test. The proposed injection well is located at the Centennial site in Weld County, Colorado, in the NE quarter of Section 33 in Township 10 North and Range 67 West. Powertech proposes conducting an aquifer-pump test at the site, which will involve pumping groundwater from the A2 sandstone within the Upper Fox Hills Formation. The groundwater will be stored temporarily in enclosed, above-ground, storage tanks. Powertech proposes reinjecting the stored groundwater back into the A2 sandstone using the same well that was used to pump the groundwater to the surface during the aquifer-pump test.

The purpose of the aquifer-pump test is to collect geologic and hydrologic information and other information about aquifer characteristics. Most importantly, the aquifer-pump test will seek to verify that the A2 sandstone is hydrologically isolated from other aquifers by impermeable confinement zones lying directly above and below it. Powertech plans to include this information in a UIC Class III permit application for the in-situ recovery of uranium that will be submitted to the EPA some time in the future. The EPA has not yet received a UIC Class III permit application from Powertech for the in-situ recovery of uranium at the Centennial site. The UIC Class V permit will allow only the reinjection of groundwater. The UIC Class V Final Permit does not authorize any injection activity for the purpose of uranium recovery.

The injection well is screened only within the A2 sandstone aquifer in the Upper Fox Hills Formation. The Laramie Formation overlies the Fox Hills Formation; therefore, the injection well intersects the Laramie Formation. The groundwater in the A2 sandstone contains concentrations of constituents regulated under the Safe Drinking Water Act (SDWA) that exceed drinking water standards. These constituents include uranium, antimony, and radium. The Laramie Formation contains aquifers that do not exceed the SDWA drinking water standards for uranium, antimony, and radium. The main purpose of the UIC Class V Permit is to protect the aquifers in the Laramie Formation from contamination during injection.

On June 15, 2009, the EPA issued a Class V UIC Draft Permit and published notice of this Draft Permit in *The Tribune* in Greeley. The public notice announced a public comment period and a public hearing for the Draft Permit. The EPA held a public hearing on July 20, 2009, in Greeley, Colorado. The public comment period for the Draft Permit began on June 19 and ended on July 24, 2009. The EPA received comments from the public on the draft permit during the public comment period and the public hearing. One of the comments received identified that multiple permit numbers were incorrectly used in the Draft Permit, and indicated that this was potentially confusing to the public. In response to this comment, the EPA issued a second Class V UIC Draft Permit with the corrected permit number. Public notice of the second

Draft Permit was published in *The Tribune* in Greeley on Friday, November 20. The public notice also announced a second public comment period and public hearing for the second Draft Permit. The EPA held the second public hearing on Monday, December 21, 2009 at the Nunn Community Center in Nunn, Colorado. The public comment period for the second Draft Permit began on November 20 and ended on December 24, 2009.

EPA's Final Permit Decision

EPA's Final Permit Decision is to issue the UIC Class V Permit to authorize the injection of A2 sandstone groundwater back into the A2 sandstone. The UIC Class V Final Permit contains several changes from the Draft permit to demonstrate the protection of underground sources of drinking water during injection. EPA has also obtained additional information from Powertech to address comments received from the public.

Changes to the Permit

EPA received public comments during both public comment periods and both public hearings. There were nine (9) main topics of comments related directly to this permitting action. This document contains summaries of significant and relevant comments and EPA's responses. All comments received by EPA are included in a separate document that is part of the Administrative Record for this permit. In response to issues raised in some of the comments received, the Class V UIC Final Permit contains the following changes from those proposed in the Draft Permit:

1. The Final Permit requires the permittee to submit to the EPA written documentation that the following requirements imposed by the Colorado Division of Reclamation, Mining, and Safety were fulfilled:

   i. cleaning of the storage tanks according to standard operating procedures;
   ii. the history of tank contents, including at least the most recent previous tank use event; and
   iii. sampling and analysis of rinse water collected from the storage tanks, after they have been cleaned.

   This requirement was added to the Final Permit in response to comments expressing a concern that the storage tank may have previously contained hazardous waste and could have the potential to contaminate the stored groundwater if they were not properly cleaned.

2. The permittee is required to collect samples of A2 sandstone groundwater from the proposed injection well prior to commencement of the aquifer test. The samples will be analyzed for Total Coliforms; Total Metals for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver; Volatile Organic Compounds; Semi-volatile Organic Compounds; and Total Petroleum Hydrocarbons. Analytical results will be submitted to EPA for review before injection is approved. This requirement was added to the Final

Permit to document the naturally-occurring concentrations of the listed constituents in the A2 sandstone at the location of the injection well.

3. The Final Permit requires the permittee to collect composite samples of stored A2 sandstone groundwater samples collected from both storage tanks. The samples will be analyzed for Total Coliforms; Total Metals for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver; Volatile Organic Compounds; Semi-volatile Organic Compounds; and Total Petroleum Hydrocarbons. The analytical results will be submitted to the EPA for review and approval before EPA authorizes reinjection of the stored groundwater back into the A2 sandstone. This requirement was added in response to concerns that the stored groundwater may be contaminated after being pumped to the surface during the aquifer-pump test and before reinjection.

4. The Final Permit establishes a Maximum Allowable Injection Pressure of zero at the well head. This requirement is included as a response to concerns that injection under pressure could result in A2 sandstone groundwater moving across a confinement zone into another underground source of drinking water.

5. The Final Permit includes new mechanical integrity test requirements appropriate for PVC-cased wells with no injection tubing. This requirement was changed because of the concern that the mechanical integrity test procedure in the Draft Permit does not work on wells with PVC casing and no injection tubing inside the well casing. Because the Maximum Allowable Injection Pressure is zero, the requirements for mechanical integrity tests on the injection well are no longer linked to the injection pressure.

Response to Comments

1. Comments related to the administrative procedures for the Draft Permit. The EPA received requests for an extension of the public comment period for the first Draft Permit to provide time for interested parties to submit information about closure procedures used for historic exploratory boreholes drilled at the Centennial Project site. There was also a concern that errors in the permit number in the first Draft Permit were potentially confusing to the public. Commenters also expressed concern that the public hearing for the first Draft Permit was held in a location that was too far away from the residents who lived near the proposed site for the injection activity.

EPA Response:

In response to the comments regarding potential public confusion, the EPA issued a second Draft Permit with the corrected permit number and offered a second public comment period. The EPA wanted to ensure that there was proper clarity on the Administrative Record and ample opportunity for the public to comment on this UIC Class V permitting action. EPA held a second public hearing for the second Draft Permit in Nunn, Colorado, closer to the site of the proposed injection activity.

2. Comments about concerns that the water quality of the groundwater pumped from the A2 sandstone could potentially be changed before the water is reinjected back into the A2 sandstone. Commenters expressed concern about the potential for changes in water quality from the following three ways: **A**) the storage tanks that will be used to store the groundwater on the ground surface before it is reinjected, **B**) bacteria, and **C**) increase in dissolved oxygen content of the groundwater that could result in the mobilization of uranium when the groundwater is reinjected back into the A2 sandstone.

A. Concerns related to potential changes in water quality resulting from previous use and improper cleaning of the storage tanks that will be used to store the A2 sandstone groundwater. Commenters expressed concern that the storage tanks may have been previously used to store hazardous materials that could contaminate the groundwater while it is being stored in the tanks, if the tanks are not properly cleaned. Other concerns related to the storage tanks include the adequacy of the standard operating procedures Powertech is proposing to use for tank cleaning, formation of rust inside the tanks, the growth of algae during storage, and changes in temperature of the stored groundwater.

EPA Response:

To demonstrate that the water quality of the stored groundwater is not degraded before it is reinjected, the UIC Class V Final Permit requires that the permittee collect composite samples of the stored groundwater from the storage tanks. The samples will be analyzed for Total Coliforms; Total Metals for the arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver; Volatile Organic Compounds; Semi-volatile Organic Compounds; and Total Petroleum Hydrocarbons. The analytical results will be submitted to the EPA for review to verify that the stored groundwater is not degraded before authorizing injection.

Powertech provided EPA with standard operating procedures (SOPs) for the cleaning and inspection of the storage tanks before the tanks are brought on the site where the aquifer-pump test will be conducted. This information is included in the Administrative Record for the Final Permit. Although the contract between Rain for Rent, the company supplying the storage tanks to Powertech, and Powertech includes a clause stating that the storage tanks may have contained hazardous waste in the past, most of the tank use is for the storage of clean water or groundwater from dewatering of construction sites. Rain for Rent has agreed to provide Powertech with tanks that were not used to store hazardous materials during the last use event, if available.

To verify that the storage tanks will not contaminate the A2 sandstone groundwater during storage, the Colorado Division of Reclamation, Mining, and Safety is requiring that Powertech verify cleaning SOPs have been followed, provide information about the substances the tanks were previously used to store, including at least the most recent tank use event, and analytical results of storage tank rinseate samples. The rinseate samples will be analyzed for total metals for the eight RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver), volatile organic compounds, semi-volatile organic compounds, and total petroleum hydrocarbons. The UIC Class V Final Permit will require that Powertech provide EPA with written documentation that these Colorado Division of Reclamation, Mining, and Safety requirements have been fulfilled.

The tanks that will be used to store the groundwater during and after the aquifer-pump test are closed tanks. The steel interior of the tanks will be rust resistant due to the nature of steel itself and the low oxygen content of the groundwater. Even if the formation of rust, which is oxidized iron, were to occur on the interior of the tank, it would not degrade the water quality of the water stored in the tank. Variation in temperature of the groundwater upon injection will not have a negative effect on water quality within the A2 aquifer, so there are no requirements in the Final Permit related to the temperature of the water. Powertech must keep the water in the tanks from freezing for practical considerations that are beyond the scope of this permit. It is rare for algal growth to occur without sunlight. The stored groundwater will be not be exposed to sunlight from the time it is pumped to the surface until it is reinjected. Algae that would grow under these conditions are not a water quality or human health concern under the Class V permit.

B. <u>Concerns related to bacterial contamination of the stored groundwater</u>. The second concern related to potential changes in water quality is that the groundwater may be exposed to sources of bacteria or may contain anaerobic bacterial populations that would increase during storage before reinjection occurs. Some commenters thought sodium hypochlorite bleach should be added to the tank to prevent bacterial growth.

EPA Response:

In response to the concerns expressed about bacterial contamination in comments received on the Draft Permit, the Final Permit requires the permittee to collect a composite sample of stored groundwater from the storage tanks and analyze the sample for Total Coliforms, just before the water is reinjected back into the A2 sandstone. The results will be submitted to the EPA for review, before the EPA issues authorization to reinject the stored water.

The reason Total Coliforms was selected as the analyte is because this analysis is used at drinking water treatment plants as an indicator for exposure to other sources of bacterial contaminants. It is important to distinguish between harmful, pathogenic bacteria, which cause diseases in humans, and nonpathogenic bacteria that do not cause diseases in humans. The microbiological constituents regulated under the Safe Drinking Water Act are pathogenic bacteria. The anaerobic bacteria referred to in the comment may be present within an aquifer under natural conditions and are not pathogenic. Coliforms are not usually pathogenic, but their presence in drinking water indicates the possible presence of pathogen.

The types of microbiological tests required for drinking water under the Safe Drinking Water Act include tests for Cryptosporidium, Giardia lamblia, Legionella, Heterotrophic Plate Count, Mycobacteria, Total Coliforms, Turbidity, and Viruses. These contaminants originate from sources that the groundwater will not be exposed to while being pumped from the aquifer-pump test well to the storage tanks, before being returned to the aquifer. The groundwater will not be exposed to dirty equipment and human hands, because it will be isolated within clean hoses and storage tanks from the time it leaves the aquifer-pump test well until it is reinjected into the aquifer.

If Total Coliforms are found to be present, then Powertech will be required to either perform more detailed bacteriologic analyses to determine if any regulated bacteria are present, or to disinfect the stored water. If regulated bacteria are present, the stored water will be

disinfected. After disinfection, a follow-up sample will be collected and analyzed for Total Coliforms.

The addition of a sodium hypochlorite as a disinfectant is not advisable unless necessary. Adding sodium hypochlorite to the groundwater adds the risk of forming disinfection by-products, which are regulated contaminants under the Safe Drinking Water Act. If sodium hypochlorite is used as a disinfectant, a neutralization procedure will be required before injection can occur.

C. <u>Concerns related to increased oxygen content of A2 sandstone groundwater as it is pumped to the surface during the aquifer-pump test</u>. The third concern related to potential changes in water quality is that an increase in dissolved oxygen could occur when the A2 sandstone groundwater is pumped to the surface and exposed to the atmosphere. The proposed injection well is screened within a uranium roll-front ore deposit in the A2 sandstone. Groundwater in confined aquifers has a very low oxygen content. When groundwater from the A2 sandstone is pumped to the surface, it will be exposed to atmospheric conditions, which are higher in oxygen than conditions present within the A2 sandstone groundwater. Uranium in a roll-front ore deposit is recovered by the injection of a highly oxidizing lixiviant solution. The uranium becomes dissolved in the lixiviant, which flows to production wells that pump the uranium-laden lixiviant to the surface for uranium recovery. Commenters familiar with this process are concerned that increasing the dissolved oxygen content of the A2 sandstone groundwater before reinjection would mobilize uranium and other associated constituents in the ore deposit surrounding the proposed injection well upon reinjection of the groundwater. Commenters also expressed concern that introducing oxygen into the ore body would start the decay process of uranium. There was also concern that injection would result in well fouling which would contaminate the groundwater.

EPA Response:
The low level of dissolved oxygen in the groundwater to be reinjected under the UIC Class V Final Permit will not result in mobilizing uranium in the subsurface, because the dissolved oxygen will be quickly overcome by the ambient reducing conditions of the aquifer once the groundwater is reinjected. The chemical components of the aquifer matrix contribute to these ambient reducing conditions. Two of these chemical components are iron and sulfur. The concentrations of iron and sulfur have been measured in the aquifer matrix from borehole samples collected at the proposed injection well location. Oxygen reacts readily with iron and sulfur and will preferentially combine with them over uranium. To verify that the dissolved oxygen present in the groundwater prior to reinjection would not result in mobilization of uranium upon reinjection, EPA directed Powertech to

1. provide calculations to demonstrate that the iron and sulfur present in the injection zone at the location of the proposed injection well will act as a preferred oxygen sink compared with uranium, and
2. provide a calculation on how far away from the injection well reinjected groundwater would travel before the dissolved oxygen in the groundwater is consumed by the iron and sulfur present.

The input parameters for the calculations include:

1. the estimated volume of groundwater that will be pumped to the surface during the aquifer pump test and reinjected,
2. the maximum amount of oxygen that could potentially become dissolved in the estimated volume of groundwater as it is exposed to atmospheric oxygen upon being pumped to the surface during the aquifer pump test, and
3. the concentrations of iron and sulfur analyzed from the sample of A2 sandstone at the location of the injection well.

Powertech's calculations demonstrated that any oxygen dissolved in the groundwater will preferentially react with iron and sulfur rather than uranium, and the concentrations of iron and sulfur present in the ore deposit will consume the amount of dissolved oxygen in the reinjected groundwater by the time the injectate has moved 2.5 feet from the injection well. EPA consulted with an expert in geochemistry at the US Geological Survey to confirm that Powertech's assumptions and calculations were correct.

The mobilization of uranium during in-situ leaching recovery is accomplished by the injection of a highly oxidizing lixiviant. A very strong oxidizer is needed to overcome the natural reducing condition of the aquifer from the injection well to the recovery well. Flow of the oxidizer in the subsurface must be maintained by a combination of injection pressure at the injection wells and pumping at the recovery wells in order to maintain mobilization of the uranium. Under the UIC Class V Final Permit the groundwater will be injected at zero injection pressure at the injection wellhead.

EPA consulted with the US Geological Survey uranium group to address the comment about oxygen initiating radioactive decay in the uranium ore body. Oxygen is not material to the initiation of radioactive decay. Radioactive decay of naturally occurring uranium isotopes uranium-238, -235 and -234 is a time dependent process: the half-life of these decay processes are 4.47 billion years (U-238), 704 million years (U-235) and 245,500 years (U-234). What *is* oxygen dependent is the mobility of uranium in groundwater. In more oxygenated environments, uranium is a mobile species and becomes more highly concentrated in groundwater, and with increasingly reducing conditions uranium is fixed in various mineral species such as uraninite, lowering its concentration in groundwater.

Well fouling refers to a build-up of minerals precipitating on a well screen over time. It is a common problem with all types of wells. Well fouling does not create a water quality problem; it is more of an issue for flow of water into the aquifer for injection wells or out of the aquifer for water supply wells. Well fouling will not be an issue for the short duration of the proposed aquifer-pump test.

3. Comments related to concerns about the communication between aquifers resulting from the improper closure of historic exploration boreholes. Commenters raised the issue of historical documents related to uranium exploration drilling that include information on plugging and abandonment of exploration drill holes in the vicinity of the proposed injection well. These documents raise questions concerning the potential for leakage between the Upper Fox Hills Formation and the overlying Laramie Formation. Since the primary purpose of the UIC Class V Permit is to prevent the contamination of the Laramie Formation groundwater, commenters

stated that the EPA should review these documents before issuing the Class V Final Permit. One comment also raised concerns that the proposed aquifer-pump test and subsequent injection activity might create the potential for contaminants from the Upper Laramie Formation to enter the Laramie-Fox Hills aquifer.

EPA Response:

The EPA has determined that the results of the aquifer-pump test will provide more definitive information about the integrity of the confinement zones above and below the A2 sandstone than the plugging and abandonment information for the historic exploration drill holes. The basic question that needs to be addressed is: "Has the integrity of the confinement zones been compromised by the presence and closure methods of the historic exploration boreholes?" The Statement of Basis for the UIC Class V Final Permit provides a detailed discussion of the aquifer-pump test procedure and explains why the results are a more effective means to answering this question than examination of these historical records for the purpose of issuing the Class V Final Permit.

The permit requires Powertech to provide EPA with the results of the aquifer-pump test before any subsequent injection is authorized. The test results will serve as an indicator of the integrity of the confinement zones. The aquifer-pump test results will indicate if there are any breaches in the confinement zones above and below the proposed injection zone caused either by natural discontinuities in the confinement zones, improperly constructed or abandoned wells that penetrate the confinement zones, or improperly abandoned historic exploration bore holes that penetrate the confinement zones. The aquifer-pump test will include the measurement of water levels in observation wells completed in the same aquifer as the aquifer-pump test well, in this case the A2 sandstone. The test will also include the measurement of water levels in observation wells completed in aquifers above and below the aquifer being pumped.

Monitoring changes in water levels in observation wells completed in the same aquifer as the pumping well can determine if there are any discontinuities in the confinement zones above or below the aquifer. The water level in observation wells completed in aquifers above and below the pumped aquifer should not show any change in water level during the aquifer-pump test, if the confinement zones are impermeable. If the water level in one of these observation wells should decrease, it would be an indication that water is being pulled from the aquifer through a breach in the confinement zone, into the aquifer being pumped.

Injection activity under the Class V permit will be of short duration; the injectate is not expected to travel more than 50 feet from the injection well, and the groundwater will not be injected under pressure. Given these conditions, EPA has determined that the aquifer-pump test results will provide information adequate for evaluating the integrity of the confinement zones surrounding the proposed injection well.

The proposed aquifer-pump test and subsequent injection activity will not create the potential for contaminants from the Upper Laramie Formation to enter the Laramie-Fox Hills aquifer. All wells related to this aquifer-pump test are cemented through the Laramie Formation, except for the wells that are screened within the sandstone within the Laramie Formation. The

wells screened in the Laramie Formation sandstone do not penetrate the confinement zone separating the Laramie and Fox Hills Formations.

4. Comments related to the concern that the EPA has obtained insufficient information to issue a final permit that is protective of underground sources of drinking water. There were several comments requesting that EPA obtain more information before making a decision on the final permit. Commenters believe that the EPA should acquire more information about: **A**) the extent of the area within the A2 sandstone aquifer expected to be affected by the injection activity, **B**) the water quality of the A2 sandstone aquifer and the injectate, **C**) the geology of the injection interval confinement zones, **D**) the location of screened intervals in a private drinking water well, which is located one mile away from the proposed injection well, relative to the elevation of the injection formation, and **E**) the previous aquifer tests Powertech has conducted at the Centennial site. Commenters questioned whether the groundwater flow was characterized in the area (included in part **F** of this section).

A. Area of aquifer expected to be affected by the injection operation. Several commenters asked about the extent of the effect of injection within the Upper Fox Hills Formation.

EPA Response:

The vertical extent of injection is expected to be contained within the A2 sandstone aquifer. There are confinement zones of impermeable shales that will isolate the injection activity to the A2 sandstone. One of the purposes of the aquifer-pump test is to verify that the A2 sandstone is hydrologically isolated from other aquifers.

Powertech provided a report included in the Administrative Record that the injectate is expected to travel less than 50 feet away from the injection well (see page 5 of the Petrotek report). Petrotek based this conclusion on the anticipated volume of injectate and the volume of open space within the A2 sandstone available for groundwater to flow through. A more detailed description of Petrotek's process for determination is included in the Statement of Basis for the UIC Class V Final Permit.

One factor that affects how far the injectate will travel from the injection well is the volume of fluids to be injected. In the Class V permit application, Powertech estimated that 200,000 gallons of groundwater would be pumped from the A2 sandstone during the aquifer-pump test. Since that time, Powertech has had opportunity for additional observation of the aquifer properties. More recent estimations indicate that 43,200 gallons will be pumped from the A2 sandstone during the aquifer-pump test.

B. Comments related to the potential of insufficient sampling and characterization of aquifer water quality. Some commenters believe that additional water quality characterization is needed to demonstrate protection of underground sources of drinking water during injection. This information would include additional baseline data on the water quality of both the injectate and the receiving formation and discrete vertical samples collected throughout the entire thickness of the receiving aquifer to develop an accurate characterization of the water quality in the area affected by the aquifer-pump test and injection.

EPA Response:

The UIC Class V Permit has been changed to require that groundwater samples be collected from the pumping well and analyzed for Total Coliforms; Total Metals for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver; Volatile Organic compounds; Semi-volatile Organic Compounds; and Total Petroleum Hydrocarbons. The analytical results will be submitted to the EPA. The analytical results from these samples will be used for comparison with the results of the injectate analysis discussed in Section 2A.

The water quality within the A2 sandstone varies due to the presence of uranium ore bodies, because the groundwater within the ore bodies shows elevated levels of uranium, radium, radon, and other associated constituents. It is true that the uranium ore bodies may not extend the full vertical thickness of the A2 sandstone. Figure 1 shows the A2 sandstone portions of logs from wells PW1, MM1, MU1, and MUU1 located in Section 33, Township 10 North, Range 67

West. Well PW1 is the proposed injection well. Wells MM1, MU1, and MUU1 are the nearest wells to PW1 intersecting the A2 sandstone. The green line is the measurement of gamma radiation with depth along the well bore. The location of the uranium ore bodies corresponds to the high gamma values. The high gamma line does not extend through the entire thickness of the A2, therefore, it can be concluded that the uranium ore body does not extend through the entire thickness of the A2 sandstone. There may be some slight variation in water quality within the A2 sandstone in the 1- to 5-foot intervals above and below the uranium ore body. However, it is not possible to collect samples from discreet vertical (e.g., 1 foot) intervals within the A2 sandstone to analyze for variation in water quality, because there are no confining zones to vertically isolate the water within the ore body from the water above and below it.

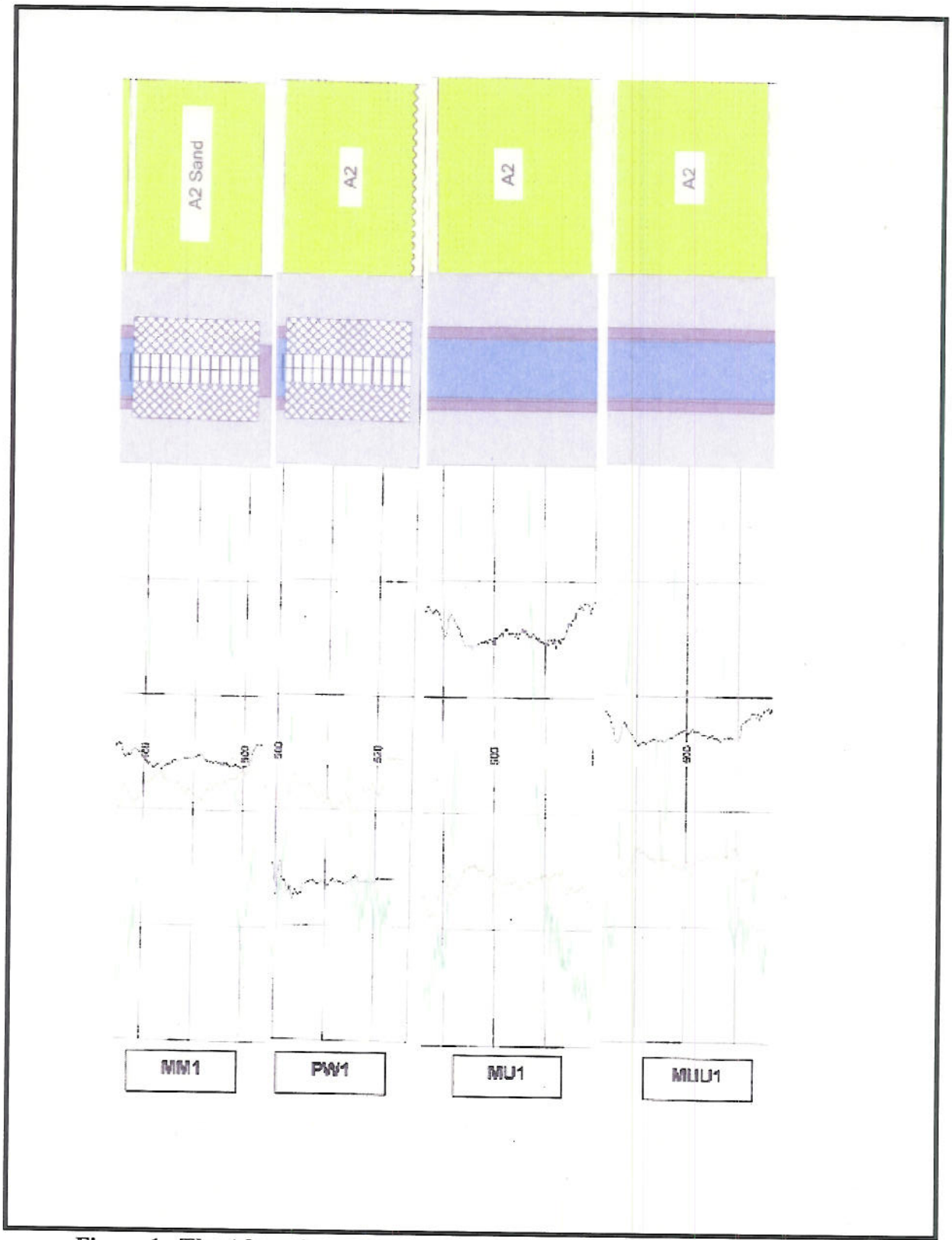

Figure 1. The A2 sandstone portions of the well logs for wells MM1, PW1, MU1, and MUU1 showing the gamma measurements as green lines.

C. Comments related to insufficient geologic documentation of overlying confinement zone. Commenters stated that the permit application did not contain geologic well logs from the proposed injection area to support the contention that an impervious and continuous confining layer of mudstone separates the injection zone from the overlying Laramie aquifer with its higher-quality water. There was also concern expressed that not enough information is available as to which aquifers exist in the area, as well as the depths of these aquifers.

EPA Response:

Powertech provided EPA with site-specific geologic information in the form of a geologic cross section based on exploratory borehole logs through Section 33, Township 10 North, Range 67 West. The cross section demonstrates that there are confining zones above and below the proposed injection zone. The cross-section also identifies the aquifers in the Laramie and Upper Fox Hills Formations and the depths of these aquifers.

One of the purposes of the aquifer-pump test is to test the integrity of the confinement zones above and below the A2 sandstone of the Upper Fox Hills Formation. The Final Class V Permit includes a requirement that the injection will be conducted under zero injection pressure at the wellhead. Because the proposed injection activities will be conducted at zero pressure, even if historic boreholes have compromised the integrity of the confinement zone, the injection pressure will not induce the migration of injectate into the Laramie Formation or the underlying WE sandstone unit that is not already occurring under existing conditions. Examination of the potentiometric[1] surfaces of the Laramie Formation aquifer, the A2, and the WE sandstone aquifers in the immediate area of the injection well show that their elevations are distinctively different. The difference in elevations of potentiometric surfaces of aquifer is evidence that the aquifers are not hydrologically connected across their confinement zones. The difference in elevations of the potentiometric surfaces of Laramie and Upper Fox Hills Formation aquifers is enough to support the hypothesis that the integrity of confining units above and below the A2 sandstone is adequate to contain the injectate. This hypothesis will be tested by the aquifer-pump test.

D. The Tarbett domestic well. Commenters were concerned about the non-definitive nature of the statement in the Statement of Basis for the Draft Permit referring to the Tarbett domestic well. The well was described as the nearby domestic well that "is completed deeper than the injection zone, and is probably in the B Sand of the Lower Fox Hills Formation...." Commenters were concerned that the statement shows a lack of sufficient data to ensure protection of underground sources of drinking water.

EPA Response:

The Tarbett well is located up-dip and up-gradient of the proposed injection well. The Tarbett well and the proposed injection well are located on the western flank of the Cheyenne Basin where the regional dip of the geologic strata is eastward toward the central axis of the Cheyenne Basin.

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[1] The potentiometric surface of a confined aquifer is the elevation to which the water level rises within a well bore completed within the aquifer. The groundwater within a confined aquifer is under pressure, because of the confined condition of the aquifer. It is this pressure that causes the groundwater to rise above the top of the aquifer in the well bore.

The fact that the Tarbett well is located up-gradient of the proposed injection well means that groundwater flows away from the Tarbett well toward the injection well. The injectate would have to flow uphill for a mile to reach the location of the Tarbett well. This information was evidence enough for EPA to determine that the Tarbett well will not be affected by the proposed reinjection activity for the purposes of developing Class V Permit requirements.

In response to these comments, EPA is clarifying the effect of the dipping geologic strata. Powertech provided a more detailed geologic cross section for Sections 32 and 33 of Township 10 North, Range 67 West, based on exploration borehole logs, in order to illustrate the effect of the dip of the geologic strata in the area. Figure 2a is a portion of the geologic cross section including both the Tarbett well and the proposed injection well. The surface trend of the geologic cross–section across Sections 32 and 33 is shown in Figure 2b. The footage of the Tarbett drinking water well is superimposed on the cross section based on the well location indicated on the driller's log. The location of the well screens based on the Tarbett well log are labeled in figure 2a.

The Tarbett well is located up-dip of the proposed injection well, which means that the local geologic formations are intersected by the Tarbett well at a higher elevation than where the same formations are intersected by the injection well. According to the site-specific geologic cross section provided by Powertech, the A2 sandstone (the injection zone) is intersected in the Tarbett well at an approximate depth of 380 to 410 feet below the ground surface. The A2 sandstone is intersected in the injection well at the depth of 500 to 550 feet below ground surface. According to the Tarbett well report the well is screened at two depths: 440 to 460 feet and from 520 to 560. These two screened intervals are deeper than the injection zone interval, which is intersected at 380 to 410 feet below the ground surface; therefore, the portion of the sentence on page 8 of the Statement of Basis and Purpose stating that the nearby domestic well "is completed deeper than the injection zone, ..." is correct.

The rest of the sentence states that the Tarbett well is probably completed in the B Sand of the Lower Fox Hills Formation. This statement is based on the information provided by Powertech and is also a correct statement. As demonstrated by the footage of the Tarbett well being superimposed on the cross section developed by Powertech, the screened interval from 520 to 560 appears to be in the B sandstone of the Lower Fox Hills Formation. The Tarbett well also is screened interval at 440 to 460 feet, which is within the A3/4 sandstone that is stratigraphically below the A2 sandstone unit.

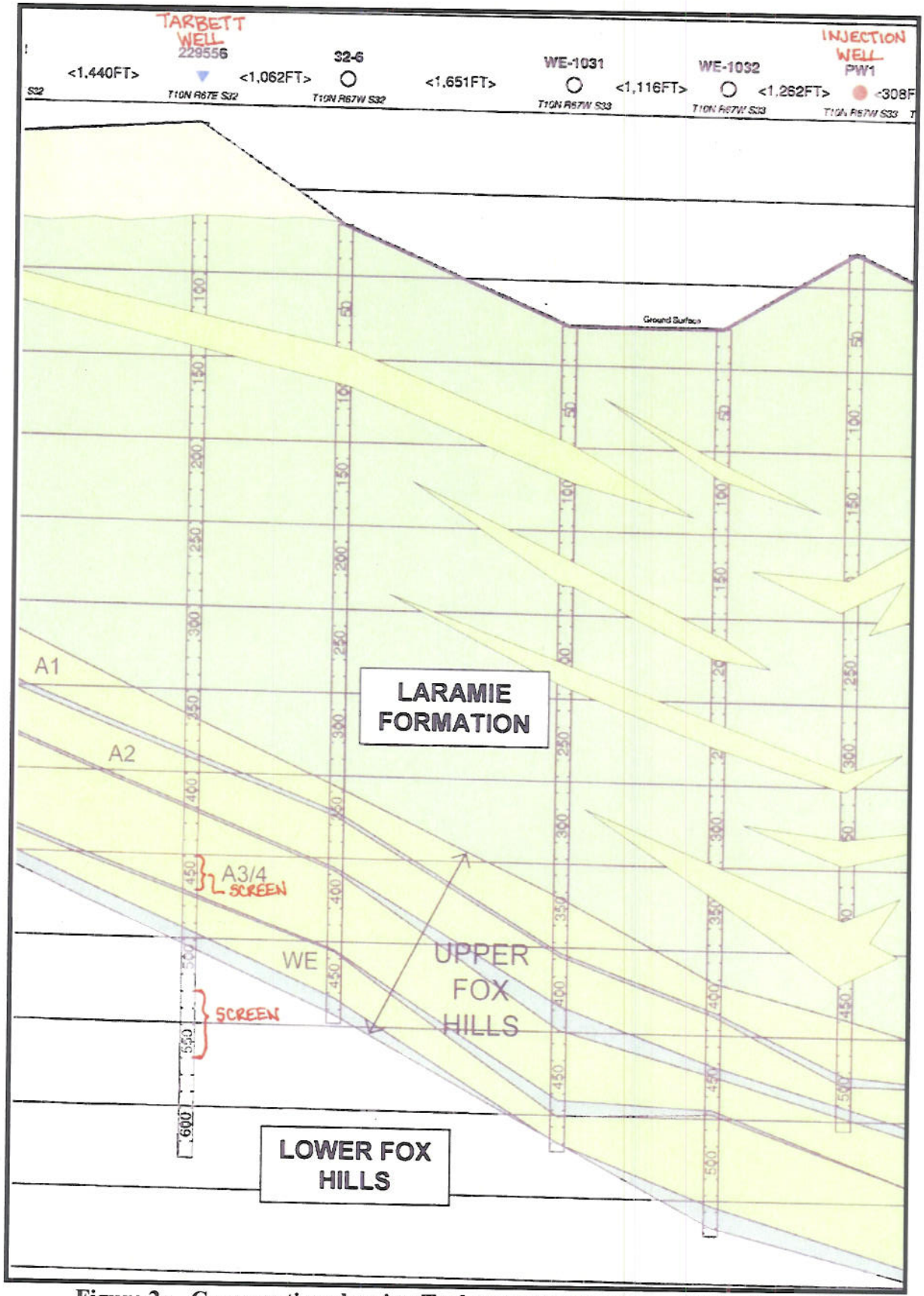

Figure 2a. Cross section showing Tarbett well and proposed injection well.

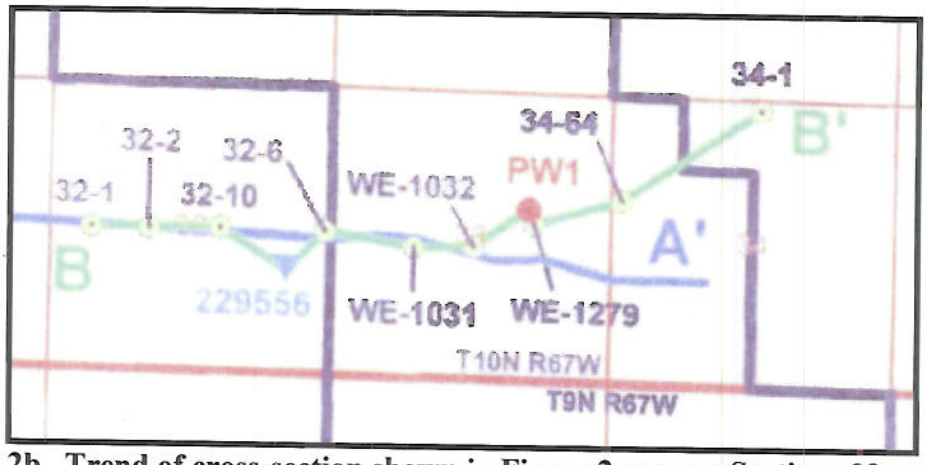

Figure 2b. Trend of cross-section shown in Figure 2a across Sections 32 and 33, Township 10 North, Range 67 West.

E. <u>Information from the two previous aquifer-pump tests conducted at the Centennial Site</u>. Commenters stated that EPA should review the results from the two previous pump tests that Powertech conducted at the Centennial site before issuing a permit to reinject the groundwater back into the A2 sandstone.

EPA Response:

EPA does not need the information from the two previous aquifer-pump tests that Powertech has conducted at the proposed Centennial mine site in order to develop permit requirements that are protective of underground sources of drinking water during the proposed injection activity. As discussed in Section 4A, the area of impact from the proposed injection activity is expected to extend less than 50 feet away from the injection well. The first aquifer-pump test was conducted in the SE quarter of Section 9 in Township 9 North, Range 67 West, more than two miles south of the proposed injection activity.

The second pump test was conducted in the SE quarter of Section 33, Township 10 North, Range 67 West. Figure 3 shows the location of these pump test wells in relation to the wells for the proposed pump test. The pumping well for the second pump test, IS-003T, is located 500 feet away from the proposed injection well (PW1). Observation well IS-003T used during the second pump test is located 15 feet to the north of IS-003T and 485 feet south of the proposed injection well. Both of these wells are completed in the A2 sandstone.

The information these two prior pump tests would provide is verification that the confining zones above and below the A2 sandstone hydrologically isolate the A2 sandstone from other aquifers. As discussed above in Section 4C, EPA has adequate evidence to believe that the confining zones above and below the A2 sandstone isolate it hydrologically from other aquifers. The proposed aquifer-pump test will provide information that is more directly applicable to the proposed injection activity than the previous aquifer-pump tests. Both the Draft and Final Permits require that the results of the proposed aquifer-pump test be submitted to EPA for review before EPA authorizes injection of the stored groundwater back into the A2 sandstone.

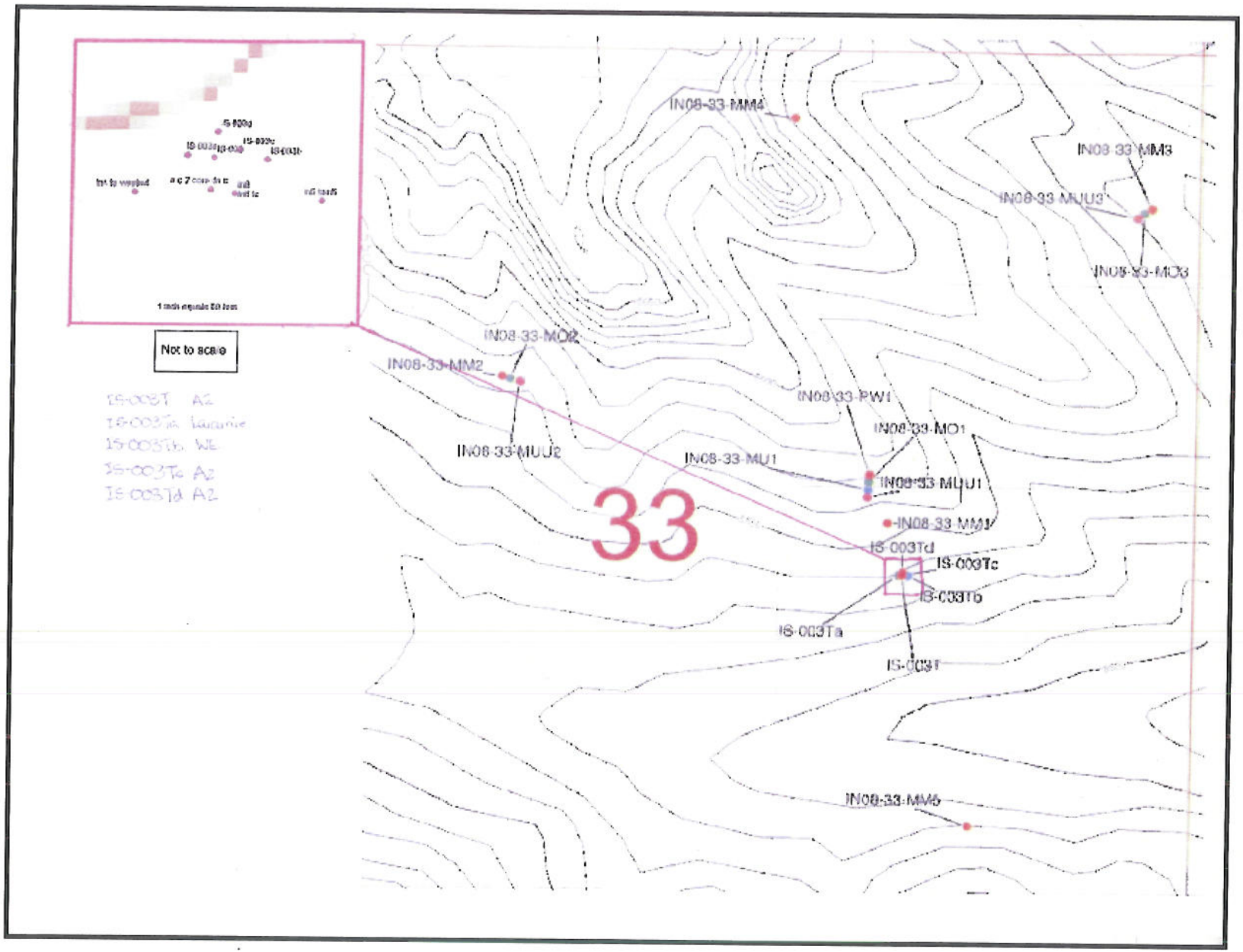

Figure 3. Location of pumping and observation wells for first aquifer test conducted in Section 33, Township 10 North, Range 67 West, in relation to pumping wells for second aquifer pump test.

F. <u>Information about groundwater flow</u>. Because Powertech is conducting the aquifer-pump test to gather information about the A2 sandstone aquifer, commenters questioned whether there is information available for current groundwater flow. The concern is that after the groundwater is reinjected, there would not be a way of calculating its rate or direction of movement after reinjection.

EPA Response:

There is enough information on the record to indicate that the groundwater flows to the south at this injection site. A general idea of direction of groundwater flows can be inferred from the direction of the dip of the aquifer in which it is contained. This general estimate is further supported by observing water levels in monitoring completed in the aquifer in question. Once a monitoring well is completed in a confined aquifer, the water pressure in the aquifer causes the water level to rise in the well column to a level in equilibrium with the aquifer water pressure (known as the potentiometric surface, see page 11). Powertech has measured the water levels observed in several monitoring wells. Contour maps of these water levels are included in the Petrotek report included in the Administrative Record. The water surface elevation decreases in the direction of groundwater flow. The direction of groundwater flow within the A2 sandstone in Section 33 is to the south. (This southerly direction of dip and groundwater flow is a local variation from the regional easterly dip and groundwater flow direction imposed by the regional structure of the Cheyenne Basin.)

5. Many commenters expressed the concerns that the aquifer-pump test and the reinjection activities are risky procedures and pose a threat of contamination to the Fox Hills Formation aquifers, regional aquifers, and the private drinking water wells in the area.

EPA Response:

The proposed aquifer-pump test will not contaminate any aquifers. An aquifer-pump test is common practice for site characterization studies, a standard procedure for determining aquifer characteristics, and is not a high-risk procedure. During an aquifer-pump, groundwater is pulled toward the pumping well. If there is a breach in a confinement zone for the pumped aquifer, groundwater is pulled into the aquifer being pumped. In the case of the proposed aquifer-pump test, the groundwater that does not meet drinking water standards is in the aquifer being pumped. If there are any breaches in the confinement zones for the A2 sandstone, cleaner water will be pulled into it by the pumping well.

EPA routinely authorizes injection related to aquifer-pump tests by rule. In this instance, EPA decided to require a permit because the injection well passes through the Laramie Formation, which must be protected from contamination from injection activities. The permit requirements that protect the Laramie Formation aquifers during injection are the construction requirements for the injection well that ensure the well itself has not caused a breach in the confinement zone between the Laramie and Fox Hills Formations. The permit requires mechanical integrity tests to ensure that the construction requirements for the injection well are in compliance with the permit. An additional protective requirement is that the results of the aquifer-pump test be submitted to EPA for review. EPA will review the aquifer-pump test

results to be sure the test has properly characterized the confinement zones near the injection well, before issuing the authorization to reinject the groundwater.

6. Commenters questioned why the EPA did not require as much information as the Colorado Division of Reclamation, Mining, and Safety for Powertech's proposal to dispose of the A2 sandstone groundwater in an infiltration pond.

EPA Response:

Powertech's application to the Colorado Division of Reclamation, Mining, and Safety (DRMS) was for a different method of disposal than the application before the EPA for Class V underground injection. The application before the DRMS proposed the construction and use of an infiltration pond as a method of returning the A2 sandstone aquifer-pump test groundwater to the subsurface. The infiltration pond was proposed as a modification to the existing Notice of Intent to Conduct Prospecting that Powertech currently has on file with the DRMS. The DRMS responded to the proposal with a list of additional information that Powertech would need to provide in order to be able to use the infiltration pond. With the infiltration pond, the A2 sandstone groundwater, which has concentrations of uranium, antimony, and radium that exceed drinking water standards, would percolate downward through the Laramie Formation. The Laramie Formation aquifers have lower concentrations of uranium, antimony, and radium than the A2 sandstone groundwater. The DRMS needed the additional information in order to evaluate the effect that infiltration of A2 sandstone groundwater into the subsurface would have on aquifer water quality within the Laramie Formation aquifers.

Because Powertech's proposal to reinject the A2 sandstone groundwater via a Class V injection into the source aquifer bypasses the Laramie Formation, EPA did not need information about groundwater mixing or the flow path of infiltration through the Laramie Formation from the infiltration pond. In the case of the infiltration pond, the groundwater percolating downward into the Laramie Formation would move horizontally along less permeable strata of the Laramie Formation, instead of moving directly back into the A2 sandstone. The DRMS's concerns about the impacts to the hydrologic balance are addressed by Powertech's proposal to reinject the A2 sandstone back into the same well that will be used to pump the groundwater to the subsurface. The hydrologic balance is preserved by the reinjection proposal.

7. Comments related to permit requirements. The EPA received specific comments on the following permit requirements: **A**) mechanical integrity test requirements for the proposed injection well, **B**) well construction, **C**) the maximum allowable injection pressure, **D**) additional water quality sampling, **E**) provisions if a breach in confinement zones are detected during the aquifer-pump test, and **F**) use of sub-chronic and lethal standards.

A. <u>Concerns about the mechanical integrity test requirements in the permit</u>. EPA received a comment expressing the concern that the mechanical integrity test requirements in the Draft Permit were not compatible with the well construction design parameters used for the proposed injection well.

EPA Response:

The mechanical integrity test requirements in the Draft Permit included a standard tubing-casing annulus pressure test to demonstrate internal mechanical integrity and a cement bond log to demonstrate external mechanical integrity. The standard tubing-casing annulus pressure test is appropriate for injection wells that have injection tubing inside the well casing and an open annular space between the injection tubing and the well casing. The proposed injection well does not have injection tubing within the well casing. The cement bond log, which is designed to test the bond of the cement filling the annulus between the outside of the well casing and the borehole wall, is not useful for well that do not have metal casing.

The mechanical integrity test requirements have been changed to requirements that are compatible with PVC-cased wells. The internal mechanical integrity test will consist of a pressure test conducted on the well casing. Because the permit is requiring that the maximum injection pressure is zero, the internal mechanical integrity test pressure is no longer linked to the value of the injection pressure. EPA has determined that to demonstrate internal mechanical integrity for the proposed injection activity, a pressure of 100 psi should be held for 15 minutes with less than 10 % pressure loss. This requirement is established pursuant to regulation 40 CFR 146.8 (b)(2) covering casing pressure tests. The external mechanical integrity well test requirements have been replaced with the requirements to demonstrate mechanical integrity by means of cementing records indicating that the total volume of open space between the well casing and the borehole wall is filled with cement with no voids. This requirement is established according to 40 CFR 146.8 (c)(3) for Class III injection wells. This regulation was used because there are no mechanical integrity testing regulations for Class V wells, and the construction of this Class V well is similar to that of a typical Class III well. (A copy of the full text of regulation 40 CFR 146.8 is included in Appendix A.)

B. <u>Comment on well construction requirements in permit</u>. One commenter posed the question as to whether proper well construction procedures were followed and questioned how that could be verified.

EPA Response:

The Colorado State Engineer has requirements for well construction and the use of certified well installers. The Colorado State Engineer also has a permitting process for injection wells that includes construction requirements; however, the State Engineer's permit does not authorize any injection activity. The EPA often uses the Colorado State Engineer requirements in UIC Class V permits for injection wells located in Colorado. Powertech provided reports to the Colorado State Engineer's office on well construction and testing. The EPA has reviewed copies of these reports. If improper well construction techniques have compromised the mechanical integrity of the proposed injection well to the point that a conduit for fluid movement through the confinement zone has been formed, the aquifer-pump test will detect the presence of these conduits. Section 3 and the Statement of Basis contain explanations of the aquifer-pump test procedures and how breaches in confinement zones are identified.

C. Comments Regarding Maximum Allowable Injection Pressure. Commenters asked whether the Class V permit would allow reinjection under pressure, what potential impact that may have on the potential for excursions, and how excursions would be monitored?

EPA Response:

In the Draft Permit, EPA stated that it would establish a maximum injection in the authorization to inject document that would be issued after EPA had reviewed the mechanical integrity test results and the aquifer-pump test results that determined the pressure required for injection. However, Powetech has already determined, based on aquifer characteristics, that injection can occur under a vacuum. Therefore, the Final Class V permit allows a maximum injection pressure of zero at the wellhead. A pump will be used to move the stored groundwater from the storage tanks to the wellhead. At the wellhead, the groundwater will be gravity fed into the injection well.

There will be no excursions from the injection activity under this Class V permit. Excursions are related to the in-situ recovery process for uranium. Under a UIC Class III permit, a lixiviant is injected to mobilize uranium. An excursion occurs when some constituents of the lixiviant are detected at the monitoring well ring that surrounds the in-situ recovery wellfield. There will be no injection of lixiviant and no uranium recovery authorized under this Class V Permit.

D. Comments on Water Quality Sampling Requirements. Commenters expressed concern that the Draft Permit did not include water quality sampling requirements for the injectate before reinjection.

EPA Response:

The UIC Class V Final Permit requires sampling of groundwater and the injectate as discussed in Sections 2 and 4 of this document.

E. Comment Regarding Provisions for Breach of Confinement. One commenter stated that there should be provisions in the permit for any breach in confinement zones detected during the aquifer-pump test. The commenter stated that while any approved pump test is ongoing, if there is communication between aquifers, the permit should include a provision for re-assessment of the permit, as this new information would be critical to protecting underground sources of drinking water. The commenter felt that if such cross-communication is discovered, the existing permit should be suspended or voided pending additional review by the EPA.

EPA Response:

The UIC Class V Final Permit includes the requirement that Powertech provide the results of the aquifer-pump test to EPA for review. EPA will review the aquifer-pump test results to determine if there are any indications of a breach in a confinement zone for the injection formation. If the aquifer-pump test identifies that there is a breach in the integrity of a confinement zone, then migration of groundwater from one aquifer to another is already occurring across the confinement zone. The likelihood of that being the case is small, because the difference in potentiometric surfaces and water quality indicate that there is no intermingling of the groundwater in the individual aquifers within the Laramie and Fox Hills Formation. Even

if the aquifer-pump test identifies a breach in a confinement zone, as long as injection into the Class V well is not under pressure, the proposed injection activity will not result in any movement of groundwater across a confinement zone that is not already occurring under present conditions. As stated above, the Final Class V Permit limits the maximum allowable injection pressure to be zero at the wellhead.

If a breach in confinement is indicated by the aquifer–pump test results, the authorization to inject will require additional monitoring requirement during injection, as deemed necessary by the EPA. Additional monitoring requirements may include monitoring of the aquifer-pump test observation wells during the reinjection of the A2 sandstone groundwater, or closer monitoring of the injection activity, such as the rate at which the injectate is delivered to the injection well.

F. Standards applicable to UIC permits. One commenter stated that EPA should consider sub-chronic and lethal discharge standards.

EPA Response:

The UIC Program is authorized under the Safe Drinking Water Act, and uses the primary drinking water standards, also called Maximum Contaminant Limits (MCLs) as permit limits. MCLs are more protective than sub-chronic standards. The MCL is considered protective for a lifetime of exposure (about 70 years using the approach of the EPA Drinking Water Program). The Drinking Water Program does not have sub-chronic standards. However, a sub-chronic standard would be considered protective for about 10% of a lifetime (about 7 years).

8. Commenters questioned whether industry is allowed more input into the permitting processes than the public.

EPA Response:

EPA is committed to its duty to provide adequate notice and comment opportunities to the public. The EPA regulations under 40 CFR part 124 describe the public review process for an Underground Injection Control permitting action. The EPA followed these regulations for this Class V permitting action and in addition, provided a second public comment period and second public hearing based on concerns from the public. During these comment periods, the entire administrative record is open for review by the public.

9. Miscellaneous comments. These comments include topics such as **A**) another public comment period for the public to review changes in the requirements from the Draft to the Final Permit, **B**) the potential for air contamination, **C**) discrepancies in the Administrative Record, **D**) questions about requirements for the previous two pump tests Powertech has conducted at the Centennial site, and **E**) the effect of swelling soils on the injection well integrity.

A. Public review process for changes from the Draft to the Final Permit. EPA received the comment that at a minimum, given the extensive amount of data and information that the EPA requires in order to process the proposed permit for injection, we hereby request that the agency provide an additional public comment period to facilitate review of any amended Draft Permit or Statement of Basis and Purpose that may be forthcoming in the future.

EPA Response:

According to EPA regulations that govern the public participation requirements related to permit issuance (40 CFR Part 124), a public comment period is required for denial or issuance of a Draft Class V Permit, but not for changes in the Statement of Basis and/or changes to a Draft Class V Permit, before it is issued as a Final Class V Permit (A copy of 40 CFR 124.17 Response to Comments is included in Appendix A of this document.) The changes that EPA has made to the Class V permit requirements from Draft to the Final version have been discussed earlier in this document.

These changes were made in response to public comments received during the public comment period and the public hearing. An explanation of the reasons for these changes are included in this responsiveness summary document, rather than the Statement of Basis in accordance with the regulations found under 40 CFR Part 124.

B. Concerns about Air Contamination.

Comment: What if there is air contamination from the area? What health risks are associated with this?

EPA response:

There will be no potential for air contamination related to this aquifer-pump test and reinjection activity. The groundwater being pumped to the surface during the aquifer-pump test will be contained within hoses, pipes, and storage tanks, until it is reinjected. The groundwater from the A2 sandstone may be above drinking water standards for uranium, antimony, and radon, but these concentrations are not high enough to have a negative impact on air.

C. Discrepancy between SOB and the Draft Permit.

i. Sampling and analysis of injectate.

Comment:

The Draft Permit and Statement of Basis contradict each other with respect to sampling and analysis of the injectate before injection. The Statement of Basis indicates that Powertech will sample the stored groundwater and have it analyzed before injection occurs. However, the Draft Permit explicitly does not require sampling and analysis.

EPA Response:

The statement of basis is correct in stating that the draft permit did not require sampling and analysis of injectate. At the time the permit application was submitted, Powertech was voluntarily planning to sample and analyze the stored groundwater prior to injection, and submit the results to EPA for record keeping purposes. At the time the Draft Permit was issued, EPA had determined that no sampling and analytical requirements were necessary for the injectate and the injection zone in order to protect underground sources of drinking water. The information about Powertech's sampling and analysis of the injectate was included in the Statement of Basis to inform the public of the fact that Powertech was going to perform voluntary sampling and analysis and provide this information to EPA.

ii. Statement that the storage tanks would be steam cleaned.

Comment:

The Statement of Basis for the Draft Permit mentions that the storage tanks will be steam-cleaned, but there is no reference to steam cleaning in Powertech's SOP.

EPA Response:

The use of the term "steam cleaning" in the Statement of Basis was not accurate. When EPA and Powertech were discussing the tank cleaning procedures, the term "steam cleaning" was used. EPA used this term in the Statement of Basis for the Draft Permit with the understanding that it was accurate. However, when Powertech provided additional details about the tank cleaning procedure, the minimum temperature for the pressurized water wash was stated to be 180°F, which is below the temperature range for steam.

D. Was EPA approval required for the previous pump tests that Powertech has conducted?

Comments:

Powertech Uranium Corporation has done at least two pump tests without prior EPA approval. Should EPA permitting have been done before they did these previous tests? Have they already reinjected fluids into our drinking water aquifer?

EPA Response:

Powertech's first two pump tests did not involve any injection activity regulated by EPA. Powertech's activities during the previous pump tests were regulated by the DRMS and the Colorado Department of Public Health and Environment, Water Quality Control Division.

E. Effect of swelling soils on well integrity.

Comment:

What sort of soil stability reports is Powertech required to produce to guarantee the fact that the concrete lining of their well will not be cracked or broken from soil shifts? What third party will generate the report through physical inspection?

EPA Response:

Powertech is not required to produce soil stability reports to the EPA. The swelling clays that occur in Colorado soils expand in the presence of water and contract while drying out. They pose a problem to surface structures that exert a loading pressure on the ground surface, when the swelling and shrinking occur at different rates under the surface structure foundation. Because a well is more of a subsurface structure than a surface structure, it is not affected in the same way by shrinking and swelling soils. The Colorado State Engineer's regulations for surface casing construction requirements are designed to protect the well structure through the soil and other layers of unconsolidated ground materials. Bentonite is a type of clay that experiences the largest amount of volume change during wetting and drying cycles. Bentonite is actually used in the annular space between the well casing and the borehole above the screened section of the well in some well construction designs, because it swells and creates a seal above the sand pack around the well screen.