Suzanne J. Bohan 12-5-13
Valouis Shay
Mr. Grath
Director , NEPA Compliance and Review Program
Permiting Program
EPA Regional 8 Supervisor
Office of Ecosystems Protection and Remediation

Dear Public Servants,

I am once again wrtitng in response to the proposed Dewey-Burdock ISL uranium project outside of Edgemont, South Dakota.

Some of the information enclosed does not directly deal with this project but is sent to demonstrate that these companies, when forced can clean water to safer levels. This should be a requirement for all, not matter the cost to them. Our water supplies are dwindling and it is your job to protect the public from this attack.

Please note the information enclosed dealing with the state of Wyoming.Where the mining is allowed and water levels continue to decline at great rates. The Madison that more and more of the population inWyoming are depending on is the same aquifer that Powertech is asking 551 gallons per minute, for 20 years or more.The state line is invisable, and many cities in the state of South Dakota depend on it as well. Are you POSITIVE that this aquifer system can handle this? Are you POSITIVE that this contamination will remain in the same place forever? (Not just your own life time.)

If you aren't POSITIVE don't give them any permits. The state of Wyoming has already jeopardized our only source of water. We are only human, it is just a guessing game unless you look at the notes of different geologists that say this can't be contained and will travel. Powertech has stated it will move. You need a lot more proof of what would happen, years past our life times.

Please go to the DENR website in South Dakota and listen to the hearings, that have now been postponed. They are waiting for you, the blame has to be somewhere and they live here.

We are now very aware of the past and present contamination that is due to uranium mining in this area, mitigation measures should at least be taken to stop this from going into the tributaries, then down into the Cheyenne.(Isn't this against the law? The Clean Water Act? And another law dealing with the poor and your responsibility to protect it, this reservation just happens to the poorest place in the United States.) Please note the test result from the cow taken in the area. (hot) How many people are eating these and who? Isn't that your responsibility also?

The United States is dilluting the Japan nuclear incident, thank God for the computer. Uranium mining needs to become a thing of the past, due to the facts of its safety issues at the beginning and end. The spent fuel at the operating power reactors use only 1%, 99% buried, while the enrichment level is at 2% almost 3 times natural uranium. Why aren't we recycling?

Thank you for your time, please notify the public in the local newspaper as to when your meeting is with the town of Edgemont, according to what Mark Hollenbeck the project manager told the press.

Terri Baker

Terri Baker
cc:/NRC

SANDSTONE FORMATION

An analogy of sandstone would be a bowl full of marbles, each marble would represent an individual grain of sand. Then one would add a binding material which would form crystals around the individual grains. In our case the binding material is predominately calcium carbonate. The uranium and other minerals precipitated out onto the surface of the grains and then was held in place by the calcium carbonate binder. To release these minerals a leaching agent is required which dissolves the calcium carbonate allowing the minerals to be released into the water. The proposed agent is carbonic acid which is produced by adding carbon dioxide to water. Oxygen (hydrogen peroxide) is also added to keep the minerals in solution once they are released from the grains. This solution (lixiviant) will be injected into the sandstone under pressure resulting in a three dimensional teardrop shaped cone with the small end at the recovery well. All of the sandstone in this cone will experience dissolution of the binder. No data is provided characterizing the changes in flow caused by this disturbance of the formation, however one should assume increased flow rates. No data is provided characterizing the effect of the solutions on flow rates through existing fracture zones or the possibility of opening of new paths between aquifers.

Drop in U.S. underground water levels has accelerated -USGS

By Environment Correspondent Deborah Zabarenko

WASHINGTON | Mon May 20, 2013 6:55pm EDT

May 20 (Reuters) - Water levels in U.S. aquifers, the vast underground storage areas tapped for agriculture, energy and human consumption, between 2000 and 2008 dropped at a rate that was almost three times as great as any time during the 20th century, U.S. officials said on Monday.

The accelerated decline in the subterranean reservoirs is due to a combination of factors, most of them linked to rising population in the United States, according to Leonard Konikow, a research hydrologist at the U.S. Geological Survey.

The big rise in water use started in 1950, at the time of an economic boom and the spread of U.S. suburbs. However, the steep increase in water use and the drop in groundwater levels that followed World War 2 were eclipsed by the changes during the first years of the 21st century, the study showed.

As consumers, farms and industry used more water starting in 2000, aquifers were also affected by climate changes, with less rain and snow filtering underground to replenish what was being pumped out, Konikow said in a telephone interview from Reston, Virginia.

Depletion of groundwater can cause land to subside, cut yields from existing wells, and diminish the flow of water from springs and streams.

Agricultural irrigation is the biggest user of water from aquifers in the United States, though the energy industry, including oil and coal extraction, is also a big user.

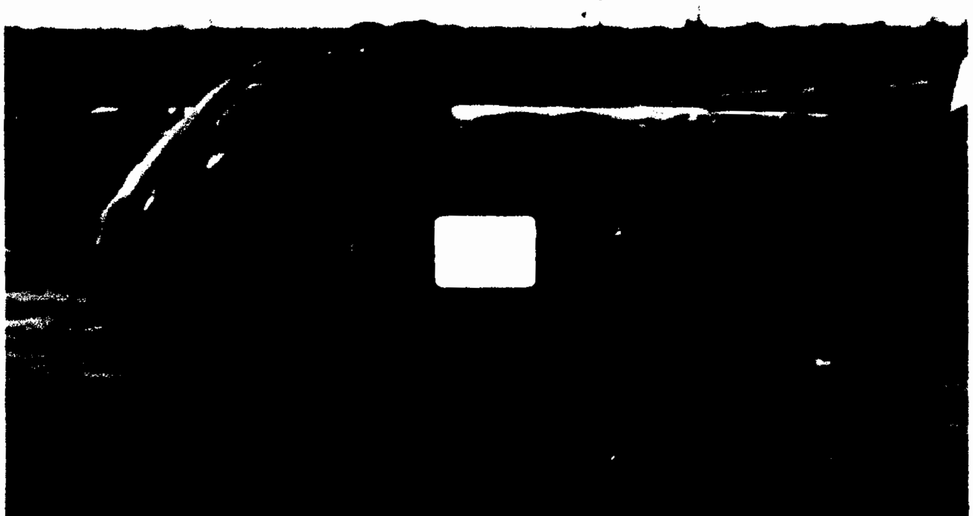
The USGS study looked at 40 different aquifers from 1900 through 2008 and found that the historical average of groundwater depletion - the amount the underground reservoirs lost each year - was 7.5 million acre-feet (9.2 cubic kilometers).

From 2000 to 2008, the average was 20.2 million acre-feet (25 cubic kilometers) a year. (An acre-foot is the volume of water needed to cover an acre to the depth of one foot.)

One of the best-known aquifers, the High Plains Aquifer, also known as the Oglala, had the highest levels of groundwater depletion starting in the

More oil and gas drillers turn to water recycling

AP By RAMIT PLUSHNICK-MASTI
11 hours ago



MIDLAND, Texas (AP) — When the rain stopped falling in Texas, the prairie grass yellowed, the soil cracked and oil drillers were confronted with a crisis. After years of easy access to cheap, plentiful water, the land they prized for its vast petroleum wealth was starting to dry up.

At first, the drought that took hold a few years ago seemed to threaten the economic boom that arose from hydraulic fracturing, a drilling method that uses huge amounts of high-pressure, chemical-laced water to free oil and natural gas trapped deep in underground rocks. But drillers have found a way to get by with much less water: They recycle it using systems that not long ago they may have eyed with suspicion.

"This was a dramatic change to the practices that the industry used for many, many years," said Paul Schlosberg, co-founder and chief financial officer of Water Rescue Services, the company that runs recycling services for Fasken Oil and Ranch in West Texas, which is now 90 percent toward its goal of not using any freshwater for fracturing, or "fracking," as it is commonly known.

Before the drought, "water was prevalent, it was cheap and it was taken for granted," he added.

Just a few years ago, many drillers suspected water recyclers were trying to sell an unproven idea designed to drain money from multimillion dollar businesses. Now the system is helping drillers use less freshwater and dispose of less wastewater. Recycling is rapidly becoming a popular and economic solution for a burgeoning industry.

The change is happening so swiftly that regulators are racing to keep up and in some cases taking steps to make it easier for drillers to recycle.

into injection wells deep underground.

Many companies, each using slightly different technology and methods, are offering ways of reusing that water. Some, like Schlosberg's Water Rescue Services, statically charge the water to allow particles of

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waste to separate and fall to the bottom. Those solids are taken to a landfill, leaving more than 95 percent of the water clean enough to be reused for fracking.

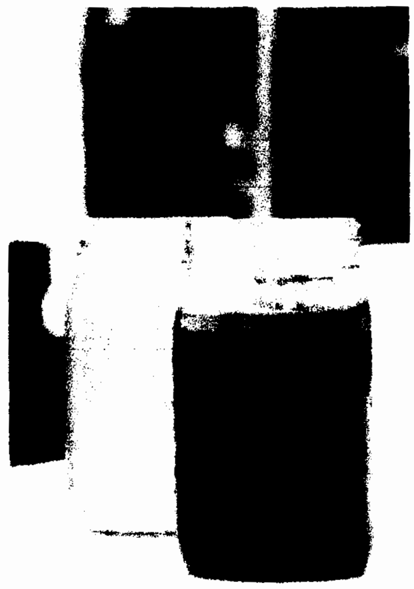
Other operators, such as Walton, Ky.-based Pure Stream, offer two technologies — one that cleans water so it can be reused in the oil patch and another more expensive system that renders it clean enough to be dumped into rivers and lakes or used in agriculture.

A worker looks over tanks holding waste water from hydraulic fracturing Sept. 24, 2013, in Midland, ...

Todd Ennenga, Pure Stream's vice president of business development, said interest in the technology has doubled in the past year alone.

Some others tout methods that leave behind no solid waste at all, eliminating the need to transport anything to a landfill. A few companies insist they can frack without any water.

"It's really taken off," Ennenga said of recycling. Two years ago, he said, most operators were still vetting the different systems. These days, they have a plan and are saying, "We need to do this right now."



A jar holding waste water from hydraulic fracturing, right, sits beside a jar of recycled water at a ...

In Texas, the fracking boom began around 2009, just as the state fell into years of drought. Especially hard-hit were South and West Texas, where rock formations have proven to be rich sources of oil and gas. Residents who were told to cut back on lawn watering and car washing grumbled about drillers hogging water supplies.

Similar issues have arisen in arid parts of Wyoming, North Dakota, New Mexico and Colorado.

Farther east, states such as Pennsylvania, Ohio and West Virginia, face different issues. There, water is relatively plentiful but disposal of wastewater has been bureaucratically difficult and expensive, while the sites that can collect it are scarce.

States are scrambling to draft regulations for the new recycling systems.

In Texas, requests for recycling permits rose from fewer than two a year in 2011 to 30 approved applications in fiscal year 2012. So the Texas Railroad Commission, the agency that oversees oil and gas operations, revamped the rules in March, eliminating the need for drillers to get a permit if they recycle on their own lease or on a third-party's property.

Commission spokeswoman Ramona Nye said in an email that the new rules are designed to "help operators enhance their water conservation efforts" and encourage recycling.

Large hoses go from one hydraulic fracturing drill site to another as horses graze in the field Sept ...

In Ohio, disposing of drilling wastewater has hit some obstacles. Activity at a deep injection well near Youngstown was tied to one in a series of earthquakes, and a former officer of the firm that ran the operation has been indicted in connection with a separate dumping incident that allegedly violated the Clean Water Act. That led to a temporary moratorium on disposal sites in that region, stricter rules and an EPA review.

Pennsylvania, meanwhile, has few dumping sites, and operators once paid large sums to haul wastewater to Ohio. Recycling has now become cheaper, and transports to Ohio have dwindled.

Back in Texas, Fasken Oil and Ranch believes it solved many of its early problems with the containment pools, tanks, pipelines and trailers. Within six months, the company expects to reach its goal of using no freshwater in its fracking operations — a feat made possible by combining recycled water with briny water drawn from an aquifer and treated.

Then Fasken will start applying the same methods at drilling sites in South Texas and New Mexico, Manager Jimmy Davis said.

"We face the same problems," Davis said. "There's not an abundance of freshwater."

—

Associated Press writer Julie Carr Smyth contributed to this report from Columbus, Ohio.

A jar holding waste water from hydraulic fracturing is held up to the light at a recycling site in M ...

—

Plushnick-Masti can be reached on Twitter at https://twitter.com/RamitMastiAP

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Health care law could be liability for Democrats
WEST PALM BEACH, Fla. (AP) — Rep. Patrick Murphy had been a cautious defender of President Barack Obama's health care law for much of the last year, telling constituents in his swing-voting district that the far-from-perfect
Associated Press

UN expects 'the worst' in Philippines typhoon disaster
Tacloban (Philippines) (AFP) - The UN warned it expected "the worst" in the typhoon disaster that devastated the Philippines, saying one town alone may have more than 10,000 dead, adding even more urgency to rescue operations underway Tuesday. The Manila government has declared a
AFP 11 mins ago

Dow Jones average reaches another record high
NEW YORK (AP) — The Dow Jones industrial average rose to another all-time high on Wall Street Monday.
Associated Press

Wet roads turn icy as temperatures dip into 20s
As snow moves out of the area, falling temperatures are causing wet, untreated roads to freeze Monday night into Tuesday.
WLS - Chicago 17 mins ago

Simply the best: Champions Classic has 4 of top 5
CHICAGO (AP) — Every year, Tom Izzo subjects his Michigan State team to a non-conference schedule only a masochist could love.
Associated Press

Apple, Samsung to face off in court again on patents
A jury trial opens Tuesday to reconsider damages awarded last year in the case stemming from Apple's allegation that its South Korean rival illegally copied technology from the iPhone and iPad. The new trial became necessary after a judge cut some $450 million from a damage award of more than $1...
AFP

Anti-Obamacare group entices students with models and a boozy party
Generation Opportunity is throwing parties to urge young people not to enroll in Obamacare exchanges.
Yahoo News

California company recalls salads, wraps on E. coli fear
By Dan Whitcomb LOS ANGELES (Reuters) - A California company is recalling more than 180,000 pounds of prepackaged salads and sandwich wraps containing chicken and ham following an outbreak of E. coli-related illnesses
Reuters

Morocco unveils scheme to recognise illegal immigrants
Sale (Morocco) (AFP) - Morocco has unveiled details of an "exceptional operation" to give official papers to some of its 25,000-40,000 illegal immigrants from sub-Saharan Africa, many of whom hope to reach Europe. "The exceptional operation to regularise the situation of foreigners residing...
AFP 25 mins ago

VEGOILS-Market factors to watch Nov 12
The following factors are likely to influence Malaysian palm oil futures and other vegetable oil markets. FUNDAMENTALS * Malaysian palm oil futures inched up on Monday, snapping four straight days of losses ...
Reuters

Harding County

Sioux Ranger District
News Release

For Immediate Release
Date: September 24, 2013

Contact: Marna Daley, (406) 587-6703

Slumping Road is Closed in North Cave Hills

Camp Crook, SD... The Custer National Forest has closed a portion of Forest Road #3123 in the North Cave Hills because of road slumping caused by the excessive rainfall that occurred on September 7 – 8, 2013.

The public safety closure begins at the junction of Forest Roads #3120 (Riley Pass Road) and #3123 (near Sediment Pond 4) and extends to the top of the hill where a gate is already in place. In addition to the road slump, the hillside below the road is saturated and unstable creating additional concerns for public safety.

The Forest will continue monitoring area conditions to re-open the road as soon as safely possible. Please call the Sioux Ranger District in Camp Crook at (605) 797-4432 for information.

- FS -

Ken Steinken
Writers on the Range

Back to:
November 10, 2013

A uranium mining proposal that's larded with snake oil

- «
- 1 of 1 images
- »

I step into an elevator and push the button; the car descends the equivalent of 23 stories in 30 seconds. When survey team members and I step out, we enter Jewel Cave, the third-longest cave in the world.

Since 2005, I've helped to survey unmapped areas of this subterranean labyrinth on the edge of South Dakota's Black Hills. The experience has taught me a lot about what lies beneath the earth's surface.

Solid as a rock — that's how most of us think of our planet. But my underground exploration has shown me that the earth is anything but solid. It's almost impossible, for instance, to predict what a cave passage will or will not connect to deep underground.

That's one reason why the British Columbia-based Powertech Corp. proposal for an in-situ uranium mine in southwestern South Dakota is a bad idea. Here's the Reader's Digest version of the mining process. In-situ is Latin for in-place, so the uranium is "mined" where it is found, underground. Powertech plans to drill into the uranium-bearing rock, then pump in fluids that cause the uranium to bind with the liquid.

That liquid, composed mostly of water, moves through the pervious rock layer. Additional wells would be placed in the direction that the liquid is expected to travel, and the liquid, now carrying uranium, gets pumped out. The uranium is then extracted from the liquid and turned into yellowcake, which is later refined.

Exposure to radioactive uranium, of course, is not good for human health. Conventional mining leaves behind piles of radioactive waste rock. Open-pit mining stirs up radioactive dust, which can travel great distances in the wind.

Powertech project manager Mark Hollenbeck, a chemical engineer and a local rancher, claims in-situ mining is safer and more environmentally friendly than conventional mining. He calls it "arthroscopic." One could argue that keeping the rock and dust underground is safer.

But there are potential problems underground. The water that's pumped below comes from local aquifers. Powertech's permit calls for taking 3 million gallons of water every day from this semi-arid area, which has recurring cycles of drought.

"The proposed water usage is absurd," says Clean Water Alliance spokesperson Rebecca Leas.

After the uranium has been removed from the liquid, the excess, which now contains toxic heavy metals and radiation, is pumped back into the ground or sprayed on the surface. "This is a form of mining that always contaminates, and it's done right in the water supply," says environmental attorney Bruce Ellison of Rapid City, S.D.

Of course, the mining company says that the layers of rock above and below the uranium-bearing strata are impervious, as dense as if they formed a triple-sealed, underground storage tank. How could anything leak out of solid rock?

Then I think of Jewel Cave and its 166 miles of passages snaking underneath only six square miles of land, and the memory shoots holes through the "solid rock" idea. It makes me wonder how Powertech can claim that radioactive liquids won't get into the aquifers where drinking water comes from.

I'm well aware that different strata of rock have different characteristics and that some are denser than others. But even if a rock layer has been virtually impenetrable in the past, there is no guarantee that it will continue to be so in the future.

Our planet is neither solid nor is its current form permanent. It's in a constant state of flux. It is subject to internal and external forces. Groundwater and gravity team up to exploit and penetrate the tiniest crack or weakness in an "impenetrable" rock layer. The wells that Powertech drills will also connect previously separated layers of rock, providing a way for radioactive water to get where it's not supposed to go. The history of in-situ uranium mines in Wyoming, Nebraska and Texas shows that this is exactly what happens.

The problem is that humans looking to turn a profit make ridiculous promises that distort or ignore science, history and common sense. Remember the Deepwater Horizon oil rig that British Petroleum claimed could not fail, or the West, Texas, fertilizer plant that couldn't explode, or the earthquake-proof Fukushima nuclear power plant that continues to spew radioactivity today?

When dealing with the forces of nature, there are no 100 percent ironclad guarantees. Anyone who offers such rock solid assurances is merely peddling snake oil and should not be trusted.

Ken Steinken is a contributor to Writers on the Range a service of High Country News (hcn.org). He writes about nature and the environment in Rapid City, S.D.

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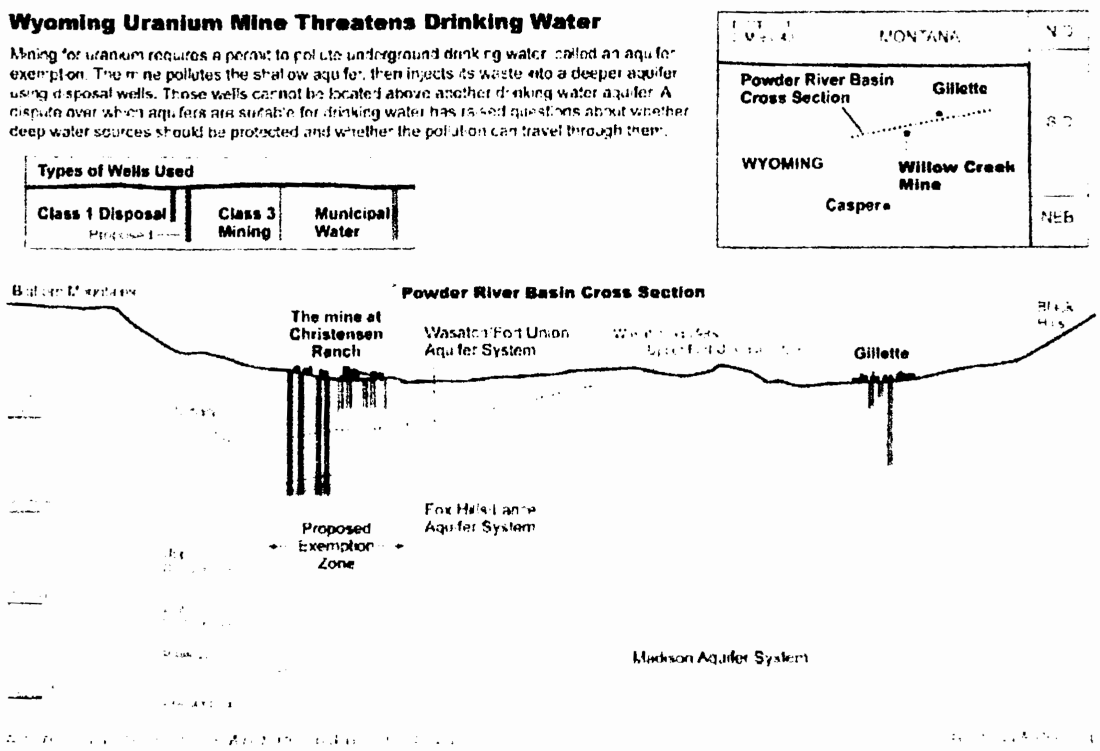
Injection Wells
The Hidden Risks of Pumping Waste Underground

Graphic: Uranium Mining at a Wyoming Ranch

A battle over uranium mining at Christensen Ranch, a remote 35,000-acre tract in Wyoming, could shape decisions nationwide as mining surges in drought-stricken areas. Below see how uranium mining at the Wyoming ranch could affect drinking water resources. | Related story »



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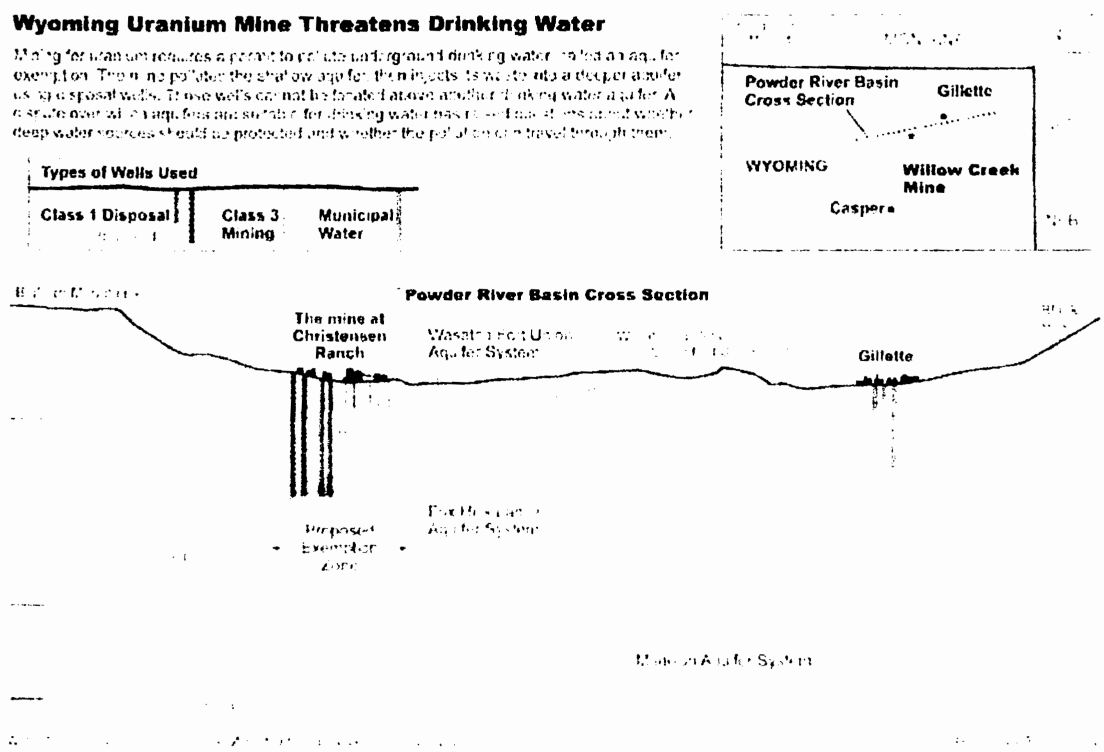
Graphic: Uranium Mining at a Wyoming Ranch

A battle over uranium mining at Christensen Ranch, a remote 35,000-acre tract in Wyoming, could shape decisions nationwide as mining surges in drought-stricken areas. Below see how uranium mining at the Wyoming ranch could affect drinking water resources. | Related story »



Safeguard the public interest

Christesen Ranch Started in 1978

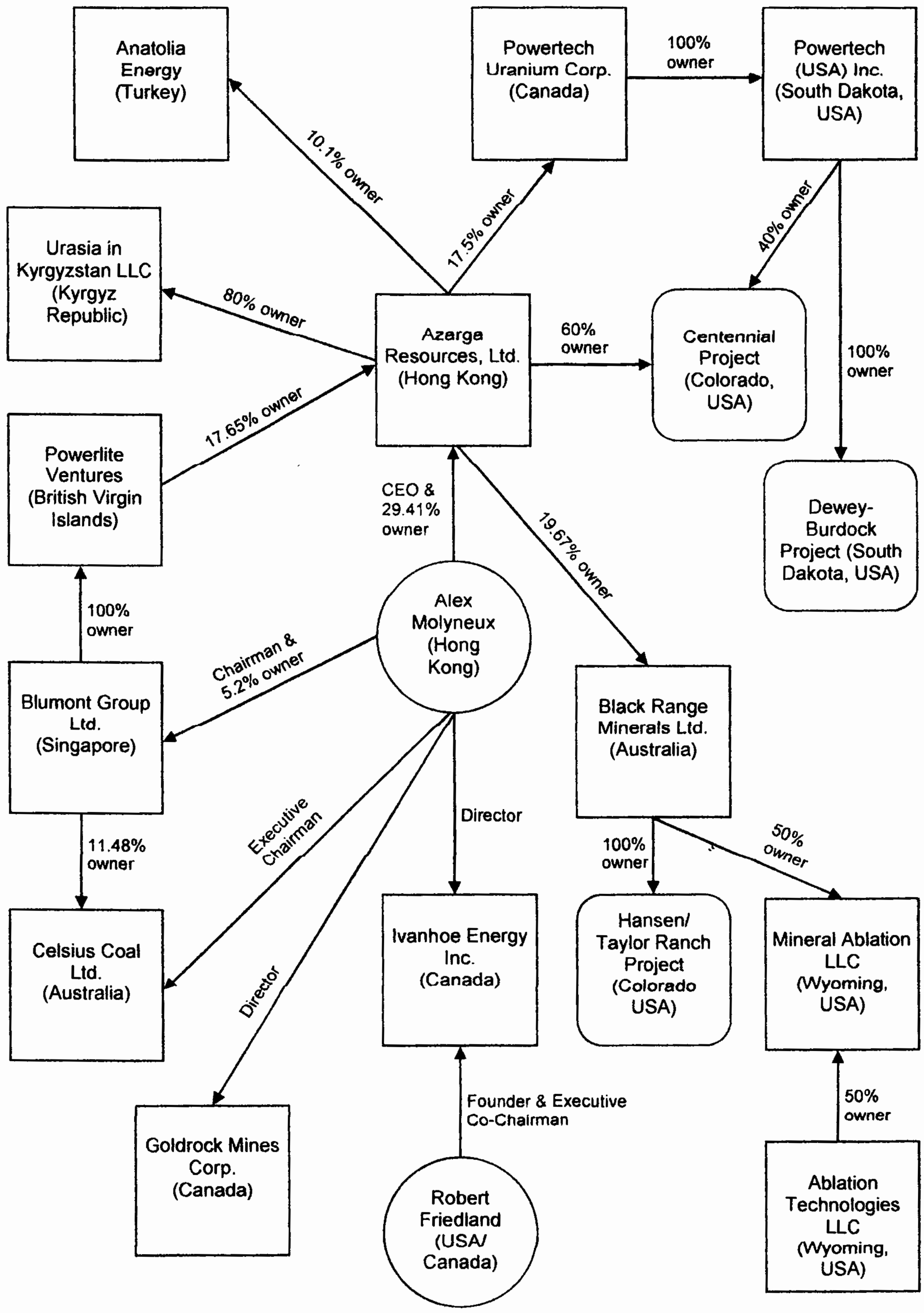
TABLE 7.2

CITY OF GILLETTE SOURCE WATER PRODUCTION 1978 – 2007

Year	Wasatch Formation Wells [1]		Ft. Union Formation Wells		Fox Hills Formation Wells		Madison Formation Wells [2]		Total Production
	(MG)	% of Total	(MG)	% of Total	(MG)	% of Total	(MG)	% of Total	(MG)
1978	82.1	13%	393.6	62%	156.1	25%	-	-	631.8
1979	172.0	21%	479.3	58%	172.0	21%	-	-	823.4
1980	172.0	19%	499.2	56%	227.8	25%	-	-	899.0
1981	116.3	9%	477.4	38%	141.4	11%	505.7	41%	1,240.8
1982	-	-	266.5	28%	233.6	25%	445.4	47%	945.6
1983	-	-	270.5	23%	266.9	22%	654.3	55%	1,191.6
1984	-	-	306.6	26%	163.6	14%	691.5	60%	1,161.7
1985	-	-	481.0	36%	114.0	9%	734.1	55%	1,329.1
1986	-	-	427.2	35%	23.5	2%	778.1	63%	1,228.8
1987	-	-	359.4	33%	19.9	2%	703.8	65%	1,083.1
1988	-	-	321.0	24%	100.7	8%	918.2	69%	1,339.9
1989	-	-	270.5	22%	293.3	24%	653.0	54%	1,216.7
1990	-	-	336.0	27%	219.0	18%	682.7	55%	1,237.6
1991	-	-	298.5	24%	242.1	20%	681.0	56%	1,221.6
1992	-	-	220.9	17%	176.1	14%	897.1	69%	1,294.1
1993	-	-	259.7	23%	67.8	6%	782.0	70%	1,109.5
1994	-	-	264.9	19%	217.3	16%	910.1	65%	1,392.4
1995	-	-	295.8	24%	143.9	12%	775.0	64%	1,214.7
1996	-	-	259.3	22%	143.9	12%	775.1	66%	1,178.3
1997	-	-	260.8	21%	109.0	9%	883.4	70%	1,253.2
1998	-	-	424.8	30%	25.4	2%	957.9	68%	1,408.1
1999	-	-	417.1	30%	25.9	2%	961.0	68%	1,404.0
2000	-	-	397.4	23%	59.3	3%	1,259.1	73%	1,715.8
2001	-	-	351.7	18%	62.7	3%	1,534.3	79%	1,948.6
2002	-	-	355.6	22%	60.7	4%	1,191.5	74%	1,607.8
2003	-	-	310.7	18%	50.2	3%	1,337.9	79%	1,738.8
2004	-	-	373.7	22%	71.2	6%	1,247.7	73%	1,692.2
2005	-	-	410.7	22%	57.3	3%	1,418.0	75%	1,886.0
2006	-	-	394.5	22%	71.1	4%	1,296.7	74%	1,762.3
2007	-	-	355.8	22%	59.9	4%	1,228.9	75%	1,644.6
Average				351.3		125.9		922.4	1,326.7
Min. %				17%		2%		41%	
Max. %				62%		25%		79%	
Avg. %				28%		11%		65%	

Notes:
[1] Wasatch Formation Wells Taken Off Line in 1981.
[2] Madison Formation Wells Placed On Line in 1982.
[3] 2004 Formation Production through August.

Alexander Molyneux's holdings and directorships as of October 2013



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S Form 153, January 2005 (See Reverse)

Burdock project could potentially impact waters of the U.S. ...sdiction, such as Pass and Beaver Creeks and ephemeral ... indicated by the United States Army Corps of Engineers ...ction 404 permits for the discharge of dredged and fill material ...ds. The Draft EIS explains that siting wellfields within ...utaries upstream of jurisdictional wetlands may require the ...ore construction activities (e.g., drilling wells, laying pipeline, ...ACE may be required to conduct additional environmental ...CWA Section 404 permits associated with the project. We recommend including more ... information in the Final EIS such as the status of the USACE permitting process for the Dewey-Burdock project, specific acreages of wetlands that could be impacte and identification of mitigation for impacts, including riparian/wetlands that may be banked or enhanced.

NO permit?

EPA's Rating and Recommendations US CORP 605-224-8531

Consistent with Section 309 of the CAA, it is the EPA's responsibility to provide an independent reviev and evaluation of the potential environmental impacts of this project. Based on the procedures the EPA uses to evaluate the adequacy of the information and the potential environmental impacts of the proposed action, the EPA is rating this Draft EIS as Environmental Concerns – Insufficient Information (EC-2). The "EC" rating indicates that the EPA review has identified environmental impacts that need t be avoided in order to fully protect the environment. The "2" rating indicates that the EPA review has identified a need for additional information, data, analysis or discussion in the Final EIS in order for the EPA to fully assess environmental impacts from the proposed project. A full description of the EPA's rating system is enclosed.

We hope that our comments will assist you in further reducing environmental impacts of this project. We appreciate the opportunity to review and comment on the Draft EIS. If we may provide further explanation of our comments, please contact me at 303-312-6925, or your staff may contact Ken Distler at 303-312-6043.

Sincerely,

for Suzanne J. Bohan
Director, NEPA Compliance and Review Program
Office of Ecosystems Protection and Remediation

Enclosure: EPA's Rating System Criteria

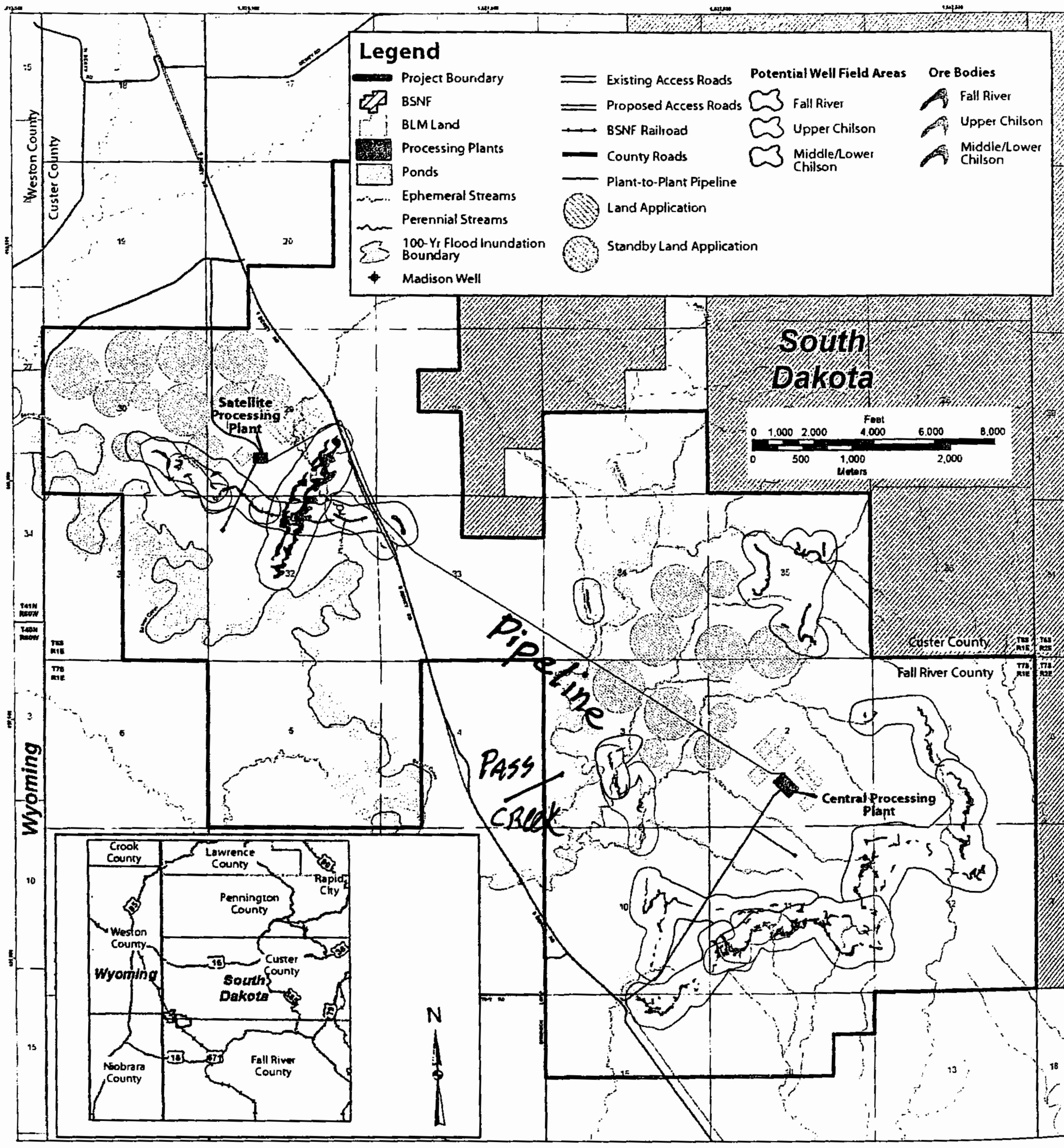


Figure 3.5-3. Map Showing Modeled 100-Year Flood Inundation Boundary of Stream Channels Within the Proposed Dewey-Burdock ISR Project Area.
Source: Modified From Powertech (2011).

suitable for cold water marginal fish life propagation rather than warm water fish life propagation (SDDENR, 2008). Both Beaver Creek and Pass Creek are classified as having the beneficial uses of fish and wildlife propagation, recreation, stock watering, and irrigation near the project site. Beaver Creek is also classified as having the beneficial uses of coldwater marginal fish life propagation and limited contact recreation near the project site (SDDENR, 2008). These creeks, however, are not classified as having the beneficial use of domestic waters.

by CHARLES E. DONNELLY, jr.

I visited the old Triangle mines area near Burdock Sat-urday afternoon . . . now operated by Mines Development

look like gopher hole. This second pit will require th moval of 787,000 cubic yards of earth.

* * *

I remarked rather ruefully that with all the water ing into that area and the size of the new pit to be du it would be a shame to fill that in too when complet Phil set my mind at ease. This new pit, he said, will filled again, but will be allowed to fill with water, c a tremendous body of water some 130 feet deep, and fi 20 feet from ground level. It will be deep enough fo fishing, Phil said, and boy what a place for scuba it will be.

Edgemont Herald Tribune - Editorial January 26, 196

by CHARLES E. DONNELLY, jr.

I visited the old Triangle mines area near Burdock Saturday afternoon . . . now operated by Mines Development, Inc., . . . and saw a fantastic glacial-age sight that looked like a page out of "Journey To The Center Of The Earth."

* * *

This great man-made chasm is truly an impressive sight, beautiful yet somewhat frightening and disquieting to enter. The gigantic hole pierces the earth to a depth of about 130 feet with the sheer walls, blocking out the sun, showing in stark naked detail the work of centuries of evolution and stratification. The great seams of various type of earth, rock and mineral formation look like giant ribbons laced through the earth.

* * *

Like huge severed arteries, the water veins that plagued underground mining operations of the old Triangle mines, now lay exposed in the sheer cliffs extending skyward from the bottom of the pit. The freezing cold has formed huge icy clots on these water veins and has created some spectacular scenic spectacles, including several giant frozen waterfalls, a few of which we photographed and hope to have in the paper this week.

* * *

I stood at the bottom of this vast pit with Phil Peter, mining operations foreman, under an overhanging snag of rock richly colored with yellow uranium ore. An old metal drum served as a stove, belching oily smoke and flame, taking some of the bite out of the frosty air. Phil casually remarked that we were standing in part of one of the underground tunnels of the old mine.

* * *

As I understand it, and this may not be exactly accurate,

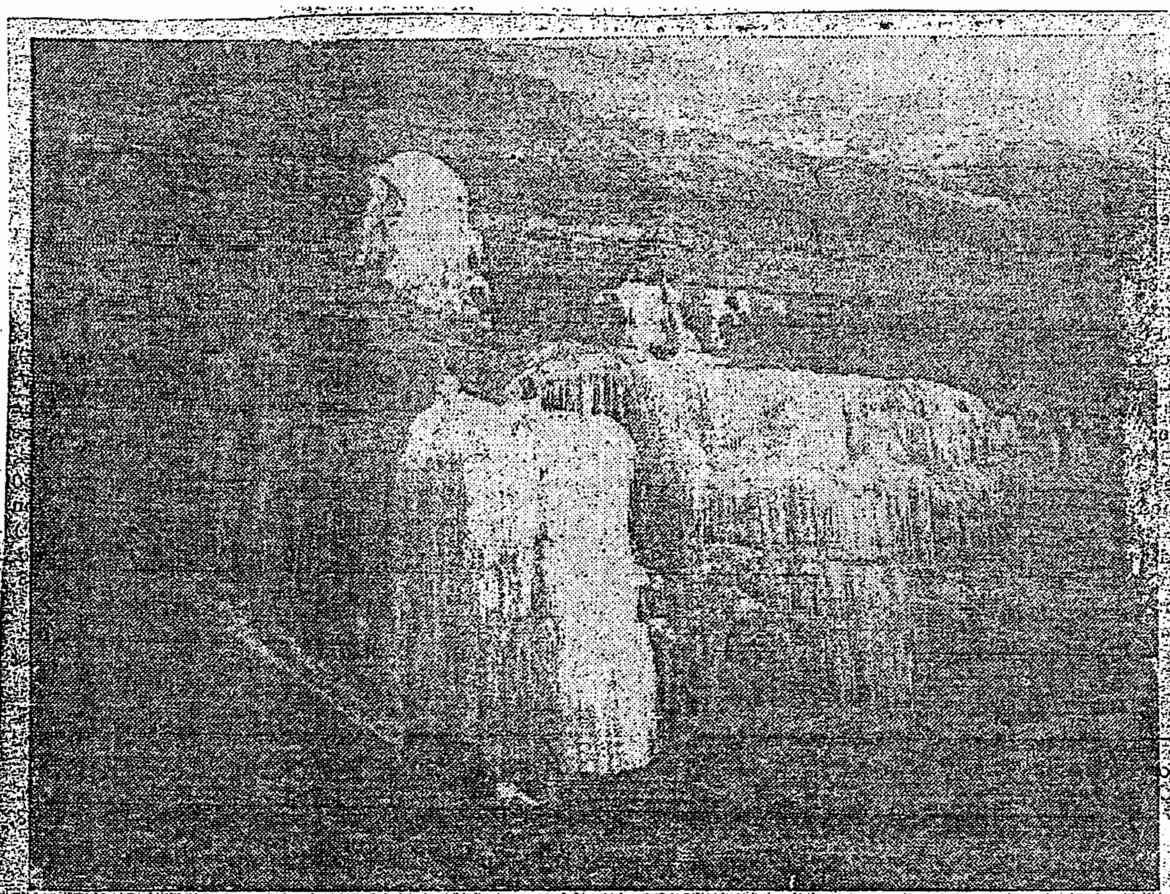
type of earth, rock and mineral formation look like g
ribbons laced through the earth.
* * *
Like huge severed arteries, the water veins that pl
underground mining operations of the old Triangle
now lay exposed in the sheer cliffs extending skyward
the bottom of the pit. The freezing cold has formed
icy clots on these water veins and has created some s
cular scenic spectacles

* * *

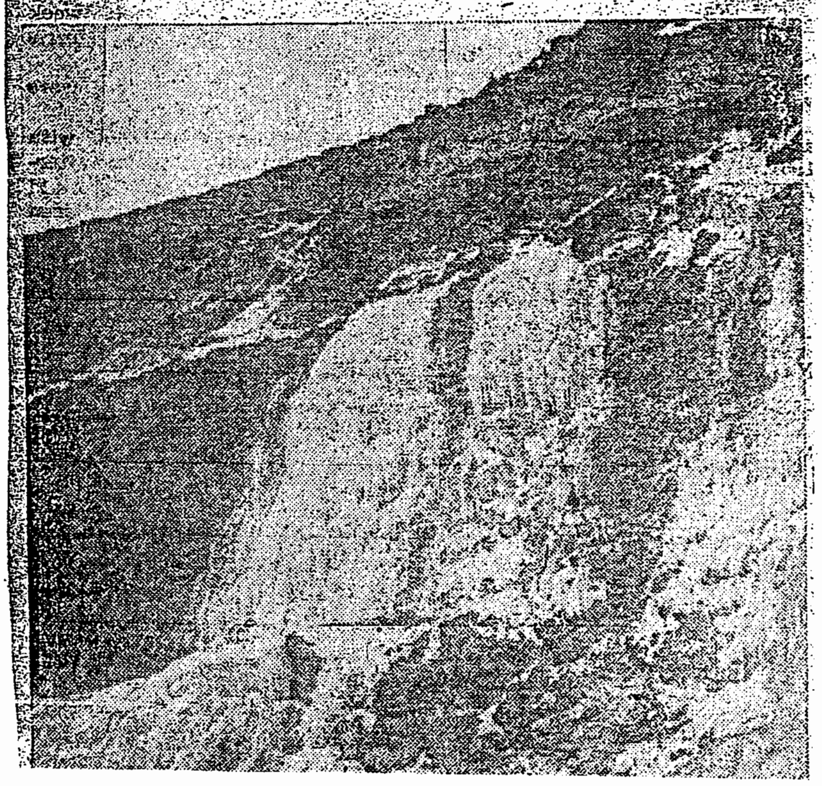
look like gopher hole. This second pit will require th
moval of 787,000 cubic yards of earth.

* * *

I remarked rather ruefully that with all the water
ing into that area and the size of the new pit to be du
it would be a shame to fill that in too when complet
Phil set my mind at ease. This new pit, he said, will
filled again, but will be allowed to fill with water, c
a tremendous body of water some 130 feet deep, and fi
20 feet from ground level. It will be deep enough fo
fishing, Phil said and "boy what a place for scuba
it will be."

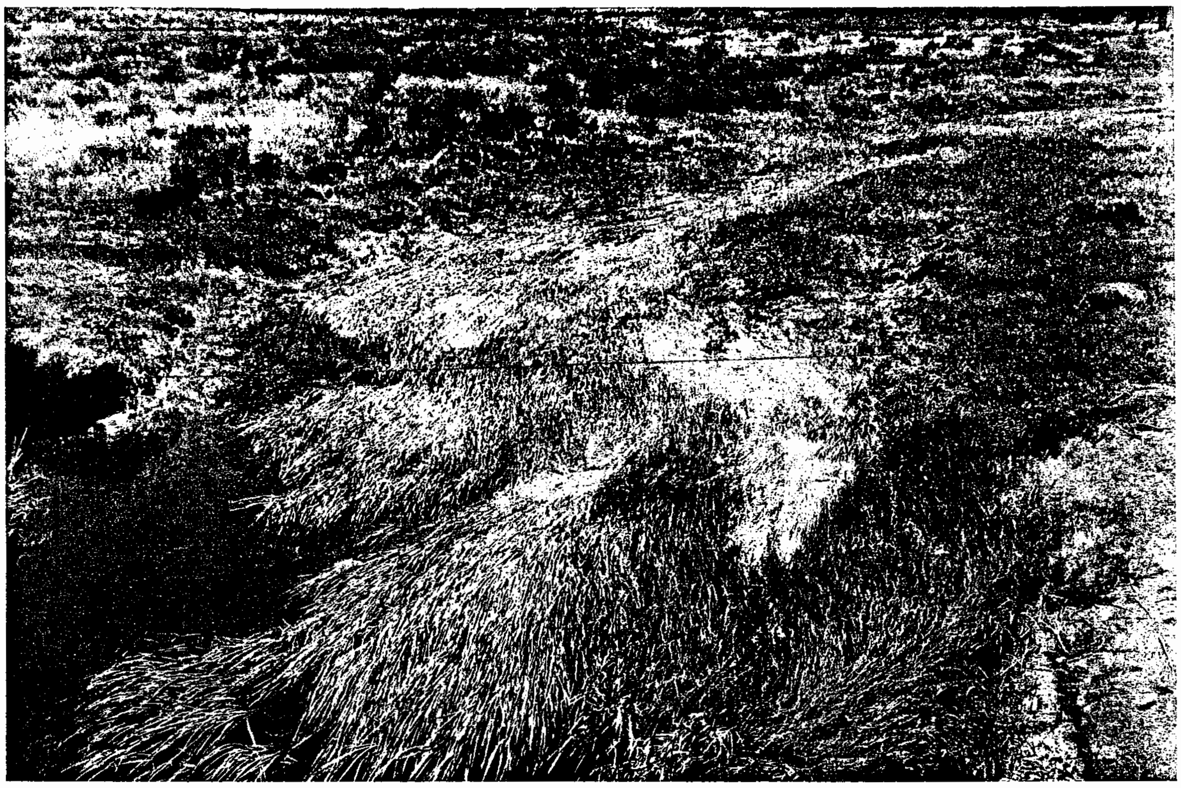


Beautiful frozen waterfalls adorn the sheer 130 foot walls of the new open pit uranium mine opened last fall by Mines Development, Inc., of Edgemont The open pit mining operation is near the end of the tunnel operations of the old Triangle mines northeast of Burdock which were dynamited with 25 cases of explosives after which some 339,000 cubic yards of earth were excavated to create the gigantic hole. The largest and most spectacular of the great waterfalls was hidden in the shadows of the setting sun and could not be photographed. These beautiful sights will not be seen by many . . . no visitors allowed and, within a few months, the hole will be filled again. For more about this man-made phenomena, see the column, "That Reminds Me" in this issue.



Herald - Tribune
January 26, 196

Flooding above and thru Dewey - Burdock Project



- Photo taken 7-10-13 - over 20ft wide
- Pass Creek - taken at the Southern end where Pass creek runs into Beaver Creek
- Flooding occurred above at Dewey the Town derailed 13 ~~de~~ cars - (Northern end)
- See enclosed Herald Tribune article

Derailment north (west) of Dewey
Photo by Gary Weishaupl

by Anne Cassens

At about 1:30 a.m. on July 8th, an Edgemont train crew operating Union Pacific engines approached the 496 mile marker just north past Dewey, SD, traveling at an estimated 45 mph, when they say what appeared to be water on the tracks. They immediately began slowing down. Seconds later a wall of water hit the train.

Very localized heavy rain had swept burned trees and other debris from the east into the area, washing out ballast below the tracks. Although Dewey had just around 0.7" of rain, there were places that had nearly 5" and this water was rushing toward its Beaver Creek drainage.

The crew managed to get the heavy engines through the stretch of damaged track, but some of the empty coal cars were not so lucky. A total of 37 cars derailed and 13 of those overturned. Crew members were Edgemont-based Shannon Clyde and CE Meyers. After the train came to a stop, the crew received a flash flood warning on the radio!!

Along a five mile stretch from Milemarker 496 to 501, there were several sections of rail suspended in the air, with all the ballast washed away. In just under 30 hours, railroad repair crews had the five mile piece repaired. How many days would this have taken 100 years ago?

Some of the gravel (ballast) washed into John Holmes' hay field west of the tracks.

Holmes reported that he went to look at the water at 5 a.m., "I was amazed to see the whole Line Creek Bottom covered with water. There was a big river running where there hadn't been any water all summer." He saw water twelve feet deep in his hayfield.

He also described the water speed at the damaged track area, "Up where the wreck occurred they said that the water was so swift that it washed the train eight feet sideways with the train still on the tracks. The water was over the tracks in numerous places."

Pubs.usgsgov/sir/2005/5160 /PDF/FTPART2.pdf for Brenda

Could, if injection in Minnelusa
Concerning Cascade Falls cause toxins in Cascade?

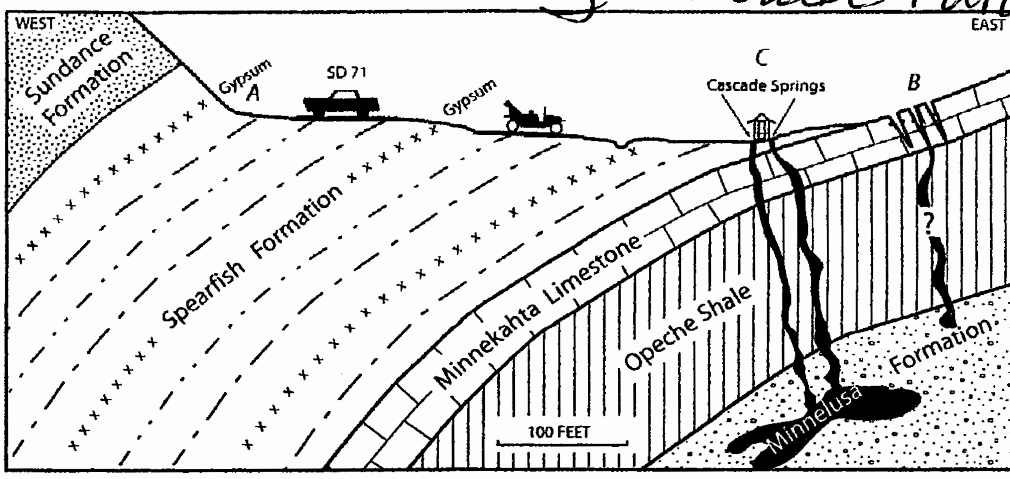


Figure 14. Cross section through the area of the gazebo at Cascade Springs showing localities to be examined, and breccia pipes, believed to be former conduits for the springs, extending up from dissolution cavities in the Minnelusa Formation at depth. Fractured Minnekahta shown in figure 16 lies about 100 feet above the gazebo at locality B. Green shale of the Stockade Beaver Member of the Sundance Formation caps the Spearfish west of S.D. highway 71.

The other "pipe", about 150 feet to the west as noted by Hayes (1999), is characterized by a gypsum bed that is downwarped a few feet, and beds above and below are not affected.

The many veinlets represent a zone where much gypsum has been removed by solution and/or have been intruded into the surrounding rock from the parent bed by processes not fully understood. Broken beds of gypsum several feet thick merge laterally into gypsum-red bed breccia (fig. 15*C*) and veinlets. The impression is that the original bedded gypsum at this locality has been modified by solution removal, injection into veins, contortion by expansion, and brecciation. It is possible that much of the original mass of gypsum has been removed. Also, anhydrite, which may have been the original form of calcium sulfate, when converted to gypsum, may have expanded considerably to create the force for vein injection and bed crumpling. However, several beds at the northernmost end of the exposure along SD 71 were X-rayed and no anhydrite was found in veins or beds, only gypsum (John Johnson, USGS, pers. comm.).

B. Fractures ("pull apart") in the Minnekahta Limestone

Walk several hundred feet to the west along the highway and pass through an open gate before the parking lot at Cascade Springs and climb up the slope. Bedding in the Minnekahta wobbles a bit, but the dip averages about 20° to the southwest. Many large fractures (fig. 16 are found in a zone between 70 and 100 feet vertically above the base of the slope in an area about 150 feet long. The fractures are more than 10 feet deep in places, and probably extend the entire 40-foot thickness of the Minnekahta. They are as much as 10 feet wide and have various orientations, including N. 35° E., E.-W., N. 5 ° E., and N. 70 ° E., following prominent joint directions. There are three possible origins that might be considered for these structures: (1) subsidence due to solution of gypsum below, (2) gravity sliding on the soft sediments of the Opeche Shale, and (3) a combination of sliding and weakening of material below by solution. An initial impression is that these fractures are caused by tension due to downhill sliding. An interesting comparison with similar fractures in the Moenkopi Formation related to dissolution of salt at depth in the Holbrook basin (Epstein and Johnson, 2003) will be made. There are many small-scale structures, folds and faults, such as those described at mileage 4.5, that have been attributed to gravity sliding, believed to have occurred after erosion had exposed the surface of the Minnekahta (Epstein, 1958; Brobst and Epstein, 1963).


This problem
occurred in
May 2003

Liquid waste

2.1.1.1.6.2 Liquid Wastes

The applicant expects to generate liquid wastes during all phases of uranium recovery at the proposed Dewey-Burdock ISR Project. These wastes include well development and well test waters, storm water runoff, waste petroleum products and chemicals, sanitary wastewater, production bleed, process solutions and laboratory chemicals, plant washdown water, and restoration water. Process solutions include process bleed, elution and precipitation brines, and resin transfer wash. NRC classifies wastewater generated during or after the uranium extraction phase of site operations as byproduct material; however, storm water runoff, domestic sewage, waste petroleum, and hazardous waste are not byproduct material. Byproduct material does not meet the definition of solid waste in 40 CFR 261.4(a)(4) and therefore is not regulated as hazardous waste under Resource Conservation and Recovery Act (RCRA) regulations. Liquid byproduct material generated by the proposed Dewey-Burdock ISR Project will contain chemical and radiological constituents including uranium and radium (Powertech, 2011).

> These terms define the various types of solid and liquid wastes generated at the Dewey-Burdock ISR Project:
>
> **Liquid wastes**
>
> Liquid byproduct material: All liquid wastes resulting from the proposed action, except for sanitary wastewater and well development and testing wastewater
>
> Sanitary wastewater: Ordinary sanitary septic system wastewater; this wastewater is not hazardous waste and not byproduct material wastewater
>
> Well development and testing wastewaters: Wastewater produced during well development and pumping tests; this water is not hazardous waste or byproduct material and would not require treatment before disposal
>
> **Solid wastes**
>
> Solid byproduct material: All solid wastes resulting from the proposed action
>
> Nonhazardous solid waste: Solid waste that is not hazardous waste, including domestic/municipal wastes (trash), construction/demolition debris, septic solids, and radioactive facilities and equipment resulting from the proposed action that meet the criteria for unrestricted release specified in the NRC license (see NRC, 1993)
>
> Hazardous waste: RCRA or state-defined hazardous waste that is not byproduct material, and includes universal hazardous wastes

The applicant proposed deep Class V well injection, land application, or a combination of these processes for managing liquid byproduct material. The particular waste management option used will affect how wastes are treated and will determine the final disposal method. As described in SEIS Chapter 1, the proposed options require the applicant to obtain all applicable federal and South Dakota permits, in addition to an NRC license, before it operates the facility. Alternative wastewater disposal options are described in SEIS Section 2.1.1.2. However, the applicant did not propose using these alternative methods.

injection

The applicant's proposed deep Class V well injection disposal option involves drilling wells at the project site to dispose of liquid byproduct material. A typical deep injection well design is shown in Figure 2.1-11. The applicant submitted a permit application to EPA to construct four to eight UIC Class V deep injection wells to inject liquid byproduct material into the Minnelusa and Deadwood Formations; the application is currently under review (Powertech, 2011, Appendix 2.7-L). The first four of the proposed wells are detailed in the permit application. The depth from the ground surface to the disposal horizon for the 4 wells ranges from 492 to 1,076 m [1,615 to 3,530 ft] (Powertech, 2011, Appendix 2.7–L). For disposal using a UIC Class V well, an EPA permit, if granted, would prohibit injection of any material defined as hazardous waste as defined by RCRA regulations in 40 CFR 261.3. Additionally, if a license was granted, NRC would require the effluent pumped into deep injection wells to be treated and near Hot Springs in Fall River County. The closest earthquake to the proposed Dewey-Burdock site occurred January 5, 2004, with a recorded magnitude 2.8 with an epicenter located approximately 8 km [5 mi] north of the hamlet of Dewey in Custer County. The remaining 3 of the 14 earthquakes had epicenters located in southwestern, central, and eastern Fall River County.

Artificial Penetrations

According to the environmental report, there are 4,000 exploration drill holes representing historic exploration activities (Powertech, 2009a). The applicant has drilled approximately 115 exploration holes, including 20 monitoring wells in the project area. While the applicant cannot confirm that all historic borings were properly plugged and abandoned, the applicant has made commitments to ensure that unplugged drill holes will not impact human health or the environment during operations (Powertech, 2009b, 2011). In the technical report (Powertech, 2009b), the applicant stated that little evidence of unplugged boreholes has been observed given infrared photography data. However, an infrared map of a portion of the Burdock area shows an alkali pond area (Powertech, 2011). The applicant states unplugged borings appear to explain the presence of this pond area. No other pond areas or springs appear in infrared photography data of the Dewey-Burdock site. There is no other evidence indicating that previously unplugged borings are current groundwater flow pathways (Powertech, 2011).

3.5 Water Resources

3.5.1 Surface Waters

As described in GEIS Section 3.4.4.1, uranium deposits in Fall River and Custer Counties in southwestern South Dakota are present within the Beaver Creek and Angostura Reservoir watersheds (Figure 3.5-1). The proposed Dewey-Burdock ISR Project area lies within the Beaver Creek watershed and is drained by Beaver Creek, Pass Creek, and their tributaries (Powertech, 2009a). The Beaver Creek watershed covers an area of 3,522 km^2 [1,360 mi^2], excluding the Pass Creek subwatershed and lies within Weston, Niobrara, and Crook Counties in Wyoming and within Pennington, Custer, and Fall River Counties in South Dakota. The Pass Creek subwatershed comprises most of the east-southeast portion of the Beaver Creek watershed and covers an area of 596 km^2 [230 mi^2] within Custer, Fall River, and Pennington Counties in South Dakota and a very small portion of Weston County in Wyoming.

Beaver Creek, a perennial and shallow stream with ephemeral tributaries, flows northwest to southeast through the northwestern and western portions of the Dewey area (Figure 3.5-2). The average discharge rate for Beaver Creek, measured at Newcastle, Wyoming, is 0.34 m^3/s [12 ft^3/s] (stream gage 06392950; USGS, 2010). Pass Creek is dry for most of the year, except for short periods of high runoff following major storms (Powertech, 2009a). Pass Creek flows southerly through the central portion of the proposed project area and joins Beaver Creek southwest of the proposed project area. No permanent stream flow gages are stationed along Pass Creek. Beaver Creek and Pass Creek were not classified as domestic water supplies in beneficial uses of surface waters categorized by the State of South Dakota near the proposed area (SDDENR, 2008), although water from Beaver Creek is used for hay irrigation. Approximately 4 km [2.5 mi] south of the confluence of Beaver and Pass Creeks, Beaver Creek flows into the Cheyenne River (Figure 3.5-2). The average flow of the Cheyenne River at Edgemont, South Dakota, is 1.1 m^3/s [39 ft^3/s] (stream gage 06395000; USGS, 2010).

See Flood picture

Overlying the Precambrian-age rocks is the Deadwood aquifer, which is contained within the Deadwood Formation and is used primarily near outcrop areas. Regionally, the Precambrian-age rocks act as an underlying confining unit to the Deadwood aquifer, and the Whitewood and Winnipeg Formations, where present, act as overlying semiconfining units (Strobel and others, 1999). Where the Whitewood and Winnipeg Formations are absent, the Deadwood aquifer is in contact with the overlying Englewood Formation, which is considered similar in hydrologic characteristics to the lower Madison Limestone.

The Madison aquifer generally occurs within the karstic upper part of the Madison Limestone, where numerous fractures and solution openings have created extensive secondary porosity and permeability. The entire Madison Limestone and Englewood Formation were included in the delineation of the Madison aquifer for this study. Thus, in this report, outcrops of the Madison Limestone and Englewood Formation (fig. 5) are referred to as the outcrop of the Madison Limestone for simplicity. The Madison aquifer receives recharge from streamflow losses and precipitation on the outcrop. Low-permeability layers in the lower part of the Minnelusa Formation generally act as an upper confining unit to the Madison aquifer. However, collapse related to karst features in the top of the Madison Limestone and fracturing related to the Black Hills uplift may have reduced the effectiveness of the overlying confining unit in some locations.

The Minnelusa aquifer occurs within layers of sandstone, dolomite, and anhydrite in the lower portion of the Minnelusa upper portion. Shales in the lower portion of the Minnelusa Formation act as confining layers to the underlying Madison aquifer; however, the extent of hydraulic separation between the two aquifers varies greatly between locations and is not well defined. Collapse breccia associated with dissolution of interbedded anhydrite in the Minnelusa Formation may enhance secondary porosity to the aquifer (Long and others, 1999). The Minnelusa aquifer receives substantial recharge from streamflow losses and precipitation on the outcrop. Streamflow recharge to the Minnelusa aquifer generally is less than to the Madison aquifer because much streamflow is lost to the Madison aquifer before reaching the outcrop of the Minnelusa Formation. The Minnelusa aquifer is confined by the overlying Opeche Shale.

The Madison and Minnelusa aquifers are distinctly different aquifers, but are connected hydraulically in some areas. Many of the artesian springs have been interpreted as originating at least partially from upward leakage from the Madison aquifer; however, the overlying Minnelusa aquifer and other aquifers probably contribute to artesian springflow in many locations. Although the confining layers in the lower parts of the Madison and Minnelusa aquifers generally do not transmit water at a high rate, their capacity to store water could influence how these aquifers respond to stress (Long and Putnam, 2002).

The Minnekahta aquifer, which overlies the Opeche Shale, is contained within the Minnekahta Limestone. The Minnekahta aquifer typically is very permeable, but well yields can be limited by the small aquifer

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USGS Ground Water Investigations 03-4049
See figure 5 page 5
See fractures, faults

percent recharges the Madison and Minnelusa aquifers. Springflow was estimated as 219 ft^3/s, of which 94 percent originates from the Madison and Minnelusa aquifers. Well withdrawals were estimated as 40 ft^3/s, of which 70 percent is withdrawn from the Madison and Minnelusa aquifers. Ground-water outflow from the study area was estimated as 89 ft^3/s, of which 65 percent occurs in the Madison and Minnelusa aquifers. Artesian springflow is the single largest discharge component for the Madison and Minnelusa aquifers, and accounts for 38 percent of the total discharge from these aquifers.

Large outcrops of the Madison Limestone and Minnelusa Formation occur in the Black Hills of Wyoming and were included in estimating recharge to the Madison and Minnelusa aquifers. Recharge to these aquifers for water years 1931-98 in South Dakota and Wyoming averaged about 344 ft^3/s. Annual recharge rates were highly variable (fig. 7) and ranged from about 62 ft^3/s in 1936 to about 847 ft^3/s in 1995.

Guide book to the Geol. of the BLACK HILLS S. Dakota –
Lufkin, Redden, Lisenbee, Loomis 2009 (Mus. copy?)

Dakota Sandstone (his name for the main aquifer) underlay most of the state, and giving the approximate depth required for wells to reach this aquifer.

The main aquifers of the Black Hills are the sandstones of the Inyan Kara Group (which include the Fall River and Lakota Formations), Minnelusa Formation, Deadwood Formation, and the cavernous rocks of the Pahasapa (Madison) Limestone. Figure 3.1 shows a general cross section across the Black Hills and how these aquifer units crop out at higher elevations where they are recharged by rainfall and surface waters. The higher elevations where water enters the aquifers provide a gravity or hydrostatic head which causes the ground water to move to lower elevations, provided that the aquifer unit is overlain by an *aquaclude,* or an impermeable rock unit. The movement of water is very slow in sandstones (as little as a few feet per year), but in cavernous carbonate rocks or breccia zones in other rocks, it can travel much faster. For example, wells in the Pahasapa Limestone may have yields of several hundred gallons per minute, in contrast to wells in sandstone that typically yield tens of gallons of water per minute.

From Figure 3.1, it is obvious that water wells drilled outside of the Cretaceous Hogback reach the various aquifer units at different depths, with the shallowest being the Lakota-Fall River sandstones of the Inyan Kara Group. All of the aquifer units exposed in the Black Hills, however, do not extend as a blanket across the state. The Pahasapa and Deadwood Formations, for example, pinch out due to unconformities on the south side of the dome and also farther to the east.

Although you would assume that the water should go down the outcrop slope of the aquifer, this is not always true in small areas. For example, where Boxelder Creek disappears in sinkholes in the Pahasapa Limestone (the Madison aquifer) northwest of Rapid City, dye added to the water was recovered in wells drilled into this formation in Rapid City in the Rapid Creek drainage basin. This indicates that the water moved laterally but down slope to the lower elevation of the cavernous Pahasapa below Rapid City.

It is possible to tell the source of ground water from its chemistry and also its temperature. For example, "cold" water in the municipal wells at Edgemont is too hot to comfortably shower in during the hot summer months, and the water contains very small amounts of trace elements such as Li and Cs. The latter elements are not harmful, but their source is from the Precambrian rocks which lie at greater depths than the Minnelusa Formation, which is the aquifer tapped by Edgemont wells. Obviously, some water has moved upward from the "basement" rocks. Precambrian schists and granite are not good primary aquifers where they are unweathered, but deep weathering and fracturing of these rocks occurred before the younger Deadwood Formation was deposited across the weathered zone.

The Deadwood thins and, in fact, is generally absent (as are lower Paleozoic rocks in the Edgemont/Hot Springs area), which permits some water from the Precambrian weathered zone and along fractures to move upward into the Minnelusa and Pahasapa. This "deeper" water is also warmer, so one can understand how the town of Hot Springs got its name.

Some aquifers also "leak" water to overlying aquifers. When the southern part of the Black Hills was mapped in detail during the uranium mining in the 1950s, U.S. Geological Survey geologists noted many *breccia pipes* exposed up the slope of the Black Hills dome. It was recognized that these pipes were due to solution of deeper, buried soluble rocks (largely gypsum). The breccia pipes permitted the transfer of water from deeper aquifers to shallow aquifers when erosion produced topography similar to the present. This upward transfer of water occurs at Cascade Springs, a few miles south of Hot Springs, where large springs emerge in the Opeche Formation. However, the chemistry of the water and included sediment indicate that the water is also moving through the Minnelusa Formation, but comes from the deeper Pahasapa *aquifer* (Hayes, 1999), so the leaking process is still taking place. Many of these breccia pipes have apparently resulted from solution of thick gypsum beds in the Minnelusa, while others likely may result from solution of carbonate rocks such as the Pahasapa Limestone.

Ground water in the fresh Precambrian rocks is largely stored in alluvium below the drainages where it also enters cracks, fractures, and fault zones in the Precambrian rocks. In the southern Black Hills, low-dipping sills of granite or pegmatite commonly act as aquacludes and trap water below the sills. Wells are generally shallow and have limited yields of only a few gallons per minute.

This brief summary of the hydrology clearly indicates that the source area for much of the ground water recovered in wells around the Black Hills and throughout much of the state is the surface water of the Black Hills. Thus, it is absolutely imperative not to contaminate that water source! This relationship is generally recognized and has led to much stricter requirements for septic systems throughout the Black Hills as the population increases and more homes are built within the area.

7.0 PRECAMBRIAN ROCKS

The central Precambrian core consists largely of complexly folded and refolded metamorphic rocks derived from sedimentary rocks, pillow basalts, volcaniclastic rocks, tuff, and metagabbro sills and dikes. These core rocks range in age from >2.5 Ga to about 1.86 Ga (Redden et al., 1990). Granitic intrusions are about 2.6 and 1.71 Ga in age. Hence, both Archean and Proterozoic rocks are present. The younger Proterozoic Harney Peak Granite is described in detail in a following section and more extensively in Redden and DeWitt (2008).

Metamorphism

The Precambrian rocks have experienced two separate episodes of metamorphism. The first, a *regional metamorphic event*, affected all of the rocks older than the Harney Peak Granite (~1.7 Ga). It produced a general north-northwest-trending foliation (cleavage or schistosity) which can be seen in slate, phyllite, and schist in much of the central and northern Black Hills. Where the Harney Peak Granite was later intruded in the southern Black Hills, however, another dominantly *thermal metamorphism* was superimposed on the earlier metamorphosed rocks. These rocks were distended by emplacement of the granite, and locally a younger schistosity developed which is more or less peripheral to the main granite mass. New garnet, staurolite, andalusite, and sillimanite isograds have been mapped on the general northerly side of the granite, but are concealed by the Phanerozoic rocks elsewhere.

Archean Rocks

Two small areas of *Archean* rocks which are partly covered by younger Phanerozoic rocks are located north of Nemo along Little Elk Creek and in the Bear Mountain area about 10 miles west of Harney Peak (Figure 4.1).

Little Elk Creek Area

The small area of Little Elk Granite consists of somewhat gneissic augen granite dated at ~2.55 Ga (Gosselin et al., 1988). However, geophysical data indicate the Little Elk Granite underlies a roughly circular area east of Nemo which is about 7 miles across and extends as far east as the

1320 E. Lake Bluff Blvd.
Shorewood, WI 53211

January 9, 2013

Cindy Bladey, Chief
Rules, Announcements, and Directives Branch (RADB)
Office of Administration
Mail Stop: TWB–05– B01M
U.S. Nuclear Regulatory Commission
Washington, DC 20555– 0001

Dear Ms. Bladey:

Speaking as a frequent visitor and occasional part-time resident of the southern Black Hills, I have several concerns and questions about impact of the proposed Dewey-Burdock project on local and regional water supplies.

1. The use of Class V wells is obviously an attempt to evade state laws prohibiting Class I disposal wells. I have discussed this with NRC and EPA officials, and it is clear that the only reason these disposal wells are classified as Class V is because Class I wells are not allowed under South Dakota law. If the people of South Dakota want to allow Class I wells, they can change the law; otherwise, Powertech should be required to obey both the letter and the spirit of the law, rather than circumventing it by changing terminology.

2. The EPA's only regulatory involvement here is to model and monitor the quality of water placed in the disposal wells. They do not model or monitor depletion of aquifers, apart from requiring that some water be removed from the upper (Inyan Kara) aquifer to keep the pressure gradient low enough to prevent migration of contaminated water beyond the proposed containment zone.

It is up to the state to ensure that the aquifers are not irreparably depleted. The SEIS says the aquifers will recharge "over time" or "with time." It is not at all clear to what extent the aquifers will be depleted and how long it will take to recharge them. What is the basis for the statement that the aquifers will be recharged ever, much less "with time"? What time span does the model suggest? What happens when annual precipitation is less than 10 inches for several years in a row? The SIES asserts that the aquifers are sealed off from one another by layers of impermeable shale. That being the case, how does water ever make its way back into the aquifer? It doesn't.

Water that would otherwise be available for domestic and livestock use will be removed from the lower (Madison) aquifer and pumped into the Inyan Kara aquifer, thereby partially depleting the Madison in an attempt to bring the contaminated post-project Inyan Kara aquifer up to some water quality standard. The more contaminated the Inyan Kara, the more water must be removed from the Madison. If the assertion that these are sealed aquifers is correct, then natural recharge of the Madison is not possible.

3. Class V wells are not allowed to contain hazardous material. It is not clear to me how the liquid waste will rendered sufficiently free of uranium, radium, selenium, and arsenic to be deemed not hazardous. If the EPA issues permits for Class V disposal wells, that agency is thereby asserting that the "liquid waste" is free of uranium, radium, selenium, and arsenic (among other toxins). That being the case, it is not clear to me why this purportedly unpolluted water must be placed in a disposal well. One person told me the only reason for "liquid waste" disposal is to keep the pressure gradient sufficiently low to prevent the water from moving outside the impact zone. Another told me that this "liquid waste" from uranium ISU would normally be classified as hazardous waste. The reason that term isn't used in this instance is because Class V wells are not permitted for disposal of hazardous waste. (Are you starting to see a pattern here?) Is it "liquid waste" or water? If it is water, then why does it matter if some leaks outside the impact zone? If is it clean, usable water, why not pump it back into the Madison aquifer? And if it is water, then ask Powertech and NRC officials if they would drink that water every day for the next 15 years.

4. If the water in these aquifers is drawn down to a level that cannot recharge themselves in a reasonable amount of time, or ever, what is the remedy? The SEIS says Powertech will provide landowners with new wells or water supplies. What water source will those wells tap? Will Powertech truck in water for domestic use and livestock? For how many years? If/when Powertech declares bankruptcy and leaves, who will pay for a remedy?

5. If Powertech and regulators opt for surface disposal of the "liquid waste," then the EPA has no role in regulating the quality of that water. The state would be responsible for monitoring the effects of spraying the liquid waste directly onto the ground surface. What will prevent arsenic and radioactive materials from running off into alluvial and shallow groundwater? What is the remedy offered if the "liquid waste" is actually "liquid waste" and not unpolluted water? Is the state indemnified against the costs of such remedy? How?

6. The hazardous waste renamed "liquid waste" so that it can be disposed of in Class V wells will be injected both above and below the Madison aquifer. With a major geologic fault only a mile distant from the project impact zone and the law of gravity not yet repealed, it would appear that this project can easily render both the Inyan Kara and the Madison aquifers unusable. Is that worth 84 jobs?

Thank you for your attention to this matter. Water is life. Water is life. Water is life.

Linea Sundstrom
Linea.sundstrom@gmail.com
(414) 963-0288

cc: Representative Charles Hoffman, Chair, SD House Agriculture and Natural Resources Committee; Senator Shantel Krebs, Chair, SD Senate Agriculture and Natural Resources Committee

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coincident with Page Springs and may act as a highly permeable conduit for the flow of groundwater to the springs.

Aquifers and Aquifer Properties

Most rock units in the study area contain some water-bearing zones. However, structural deformation has reduced the continuity of saturated units across the study area. Groundwater systems of the study area are more complex than is indicated by the fairly simple layering of the rocks that contain the groundwater systems. The complexity is because of variations in stratigraphy, lithology, and, geologic structure (Bills and others, 2007). The Redwall-Muav aquifer, the Coconino multiple aquifer system (Coconino aquifer), and the basin-fill aquifers are the primary aquifers in the study area. The Quaternary alluvial aquifers and the Payson granite are local aquifers that are hydraulically connected to the regional groundwater system. Other local aquifers are in the alluvium, volcanic rocks, the Kaibab Formation, the Coconino Sandstone, the Supai Group, and Proterozoic rocks and often are hydraulically disconnected from each other and from the regional aquifer system. These local isolated aquifers generally are small and thus are unsuitable as long-term water supplies; however, these aquifers are used extensively to meet local water demands. These local disconnected aquifers are taken into consideration in the regional groundwater-flow system because groundwater that discharges from the local aquifers can percolate downward to the underlying regional aquifer system. The Redwall-Muav aquifer and the Coconino aquifer are the primary regional aquifers on the Colorado Plateau in the study area (Cooley and others, 1969; Cooley, 1976). The Redwall-Muav aquifer and the Coconino aquifer have southeast-northwest trending groundwater divides that are coincident with or near the Mogollon Rim and divide the regional groundwater-flow system into parts that flow northward toward the Colorado and Little Colorado Rivers and southward toward the Verde and Salt Rivers.

The Coconino aquifer comprises the Kaibab Formation, the Coconino Sandstone, the Schnebly Hill Formation, and the Upper Supai Formation (Bills and others, 2000). Although the Kaibab Formation typically is unsaturated, except for perched zones and north of the Little Colorado River, the formation provides a conduit for infiltration and percolation of precipitation and surface water (Bills and others, 2000; Wilkinson, 2000). The Coconino aquifer is the primary aquifer in the Little Colorado River watershed, but is only locally saturated west of the Mesa Butte Fault. The Redwall-Muav aquifer underlies the Coconino aquifer and comprises the Redwall, Naco, Temple Butte, and Muav Limestones. North of the Verde River and Big Chino Wash, the Martin Formation and Tapeats Sandstone underlie the Redwall Limestone and are considered part of the Redwall-Muav aquifer (Owen-Joyce and Bell, 1983). The Redwall-Muav aquifer is the primary aquifer in the Cataract Creek watershed. The basin-fill aquifers are the primary aquifers in the Chino Valleys and Verde Valley, and Tonto Creek Basin.

Knowledge of the hydrologic properties of the geologic units that constitute the regional and local aquifers in the study area is important information for conceptualizing and simulating the movement of groundwater. Aquifer properties include hydraulic conductivity, transmissivity, specific storage, and specific yield. Formation lithology, fracture development, and dissolution influence the magnitude and preferential orientation of these properties. One method that is commonly used to obtain hydraulic property estimates is aquifer tests. During an aquifer test, a well is pumped for several hours or longer while yield (volume per time) and change in water level (drawdown) in the pumped well and adjacent monitoring wells are recorded. The combined measurements of pumping and drawdown can then be used to estimate aquifer properties. The derived aquifer properties can then be used to help determine aquifer properties for a numerical groundwater-flow model.

Aquifer tests are costly and do not always provide representative results. Thus, specific-capacity values, which are more readily available, are commonly used to estimate transmissivity. Specific capacity is computed by dividing well yield by drawdown at the pumped well. Specific-capacity values are representative of aquifer properties only near the pumped well. Transmissivity can be estimated by using empirical equations that convert specific-capacity data into a transmissivity value (Theis and others, 1963; Driscoll, 1986; Razack and Huntley, 1991; and Mace, 1997). Several authors have reported specific-capacity values for the study area (Schwalen, 1967; Owen-Joyce and Bell, 1983; Navarro, 2002). A summary of specific-capacity values is presented by Blasch and others (2006) for comparison of values among water-bearing units in the upper and middle Verde River watershed.

Proterozoic Basement

In general, the Proterozoic crystalline rocks do not store or transmit substantial amounts of water and form the underlying confining bed for the Redwall-Muav, Coconino, and basin-fill aquifers. Only in a few areas with major fracturing is water found in quantities sufficient for withdrawal. One of these areas is near Payson, where the Proterozoic rock, known as the Payson granite or Payson shelf, is the primary aquifer that is exposed in more than a 128-mi^2 area. Here, Tertiary faulting has created substantial secondary permeability (Parker and others, 2005) and storage. Based on numerous aquifer tests throughout the area, transmissivity ranges from 40 to 2,270 ft^2/d and is greatest where wells are associated with major fracture systems (Southwest Groundwater Consultants, Inc., 1998). Discharge from Proterozoic rocks is low compared to the Redwall-Muav and Coconino aquifers (Flora, 2004).

- AMS-05: 123.7 for 303 monitored days, projected to 149 mrem/yr
- AMS-06: 88.0, for 164 monitored days projected to 196 mrem/yr
- AMS-07: 145.3 for 303 monitored days, projected to 175 mrem/yr
- AMS-BKG: 167.8 for 303 monitored days, projected to 202 mrem/yr

Excluding the result at AMS-02, the range of exposure rates (114 to 202 mrem/yr) and average (165 mrem/yr) is similar to average worldwide exposures to natural radiation sources comprised of comic radiation, cosmogenic radionuclides, and external terrestrial radiation reported in the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) Report to the General Assembly, Sources and Effects of Ionizing Radiation, Annex. The typical ranges of average worldwide exposures reported in this reference document are to 60 to160 mrem/yr.

10.0 FOOD SAMPLING

To determine baseline radionuclide concentrations in local food, Powertech collected three tissue samples (one of liver [DBAT-03], two of meat [DBAT-01, DBAT-02]) from a locally grazing cow on June 25, 2008. The samples were analyzed for natural uranium, radium-226, lead-210, and polonium-210. The results are listed in Table 10-1.

For the majority of analytes, the reported concentrations are at or below LLDs that, in turn, exceed the LLDs recommended in RG 4.14. This is evident for all reported concentrations of natural uranium, radium-226 and polonium-210 in Sample DBAT-01, and lead-210 in all three samples. There are only three cases where radionuclide concentrations exceed LLDs. Radium-226 concentrations are 0.003 and 0.06 pCi/g in Samples DBAT-01 and DBAT-02. The concentration of polonium-210 in Sample DBAT-03 is 0.02 pCi/g.

11.0 SUMMARY AND CONCLUSIONS

The results of the Dewey-Burdock baseline field investigation documented herein indicate the following:

- Baseline gamma-ray count rates have been obtained across the permit area. Twenty-five percent of the count rates were lower than 11,395 cpm. Seventy-five percent of the count rates were below 14,437 cpm. Three distinct populations of gamma-ray count rates were observed: an anomalous 600-acre portion of the main permit area, the main permit area itself, and the surface mine area. Considered individually, each has non-parametric count-rate distributions.
- Elevated levels of radioactivity, as characterized by gamma readings greater than 17,945 cpm in the main permit area and 20,270 cpm in the surface mine area, occur in the