

**Wyoming Outdoor Council**

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Jim Ruby, Executive Secretary
Environmental Quality Council

John Wagner, Administrator
Wyoming DEQ/WQD
Herschler Building – 4W
122 West 25th Street
Cheyenne, WY 82002

RE: Wyoming Department Of Environmental Quality, Water Quality Division's
Proposed Chapter 24, Wyoming Water Quality Rules and Regulations

Wyoming Outdoor Council's comments on Carbon Capture and Sequestration regulations

Dear Mr. Wagner:

The Wyoming Outdoor Council herewith presents its comments on Chapter 24, Wyoming Water Quality Rules and Regulations and further requests. We appreciate this opportunity to make comments.

For its comments on the proposed Chapter 24, Wyoming Outdoor Council presents the following:

**Bonding And Financial Assurance Regulations are Essential
For Carbon Sequestration to be Effective**

1. We note that the Wyoming legislature has now passed, in 2010, Enrolled Act 26, which provides that regulations for bonding of carbon storage (CS) sites are to be promulgated by the DEQ, and requires the passage of regulations governing the following [passed as amendments to W. S. 35-11-313(f)]:

(vi) Requirements for bonding and financial assurance for geologic sequestration facilities and geologic sequestration sites including:

(A) Procedures to establish the type and amount of the bond or financial assurance instrument to assure that the operator faithfully performs all requirements of this chapter, complies with all rules and regulations and provides adequate financial resources to pay

for mitigation or reclamation costs that the state may incur as a result of any default by the permit holder, provided that, any insurance instruments submitted for financial assurance purposes shall include the state of Wyoming as an additional insured, which inclusion shall not be deemed a waiver of sovereign immunity;

(B) Annual or other periodic reporting by the permittee during geologic sequestration and reclamation activities to allow the administrator to confirm or adjust the amount or type of the bond or other financial assurance requirements consistent with the site, facility and operation specific risks and conditions;

(C) Procedures to require proof of compliance from any permittee ordered by the administrator to adjust a bond or other financial assurance, including procedures for permit suspension or termination procedures following notice and an opportunity for a hearing if adequate bonding or financial assurance cannot be demonstrated;

(D) Procedures for replacement of a bond or financial assurance instrument if notice of cancellation is provided or notice that the license to do business in Wyoming of the surety or insurance company issuing a bond or other financial assurance pursuant to this chapter is suspended or revoked;

(E) Procedures for the director to forfeit the bond or to make a claim against any insurance instrument providing financial assurance, including the right of the attorney general to bring suit to recover costs if the bond or financial assurance is inadequate, to pay for closure, mitigation, reclamation, measurement, monitoring, verification and pollution control, where recovery is deemed possible;

(F) Procedures, including public notice and a public hearing if requested, for the release of bonds or the termination of insurance instruments not less than ten (10) years after the date when all wells excluding monitoring wells have been appropriately plugged and abandoned, all subsurface operations and activities have ceased and all surface equipment and improvements have been removed or appropriately abandoned, or so long thereafter as necessary to obtain a completion and release certificate from the administrator certifying that plume stabilization as defined by rule has been achieved without the use of control equipment based on a minimum of three (3) consecutive years of monitoring data, and that the operator has completed site reclamation and all required monitoring and remediation sufficient to show that the carbon dioxide injected into the geologic sequestration site will not harm or present a risk to human health, safety or the environment, including drinking water supplies, consistent with the purposes of this chapter and the rules and regulations adopted by the council;

(G) Requirements for the operator to record an affidavit in the office of the county clerk of the county or counties in which a geologic sequestration site is located, which affidavit shall be reasonably calculated to alert a person researching the title of a particular tract that such tract is underlain by a site permitted for geologic sequestration.

(vii) Requirements for fees to be paid by all permittees of geologic sequestration sites and

facilities, which may include a per ton injection fee or a closure fee, during the period of injection of carbon dioxide and associated constituents into subsurface geologic formations in Wyoming, which fees shall be deposited in the geologic sequestration special revenue account created by W.S. 35-11-318 for use as provided therein.

Given this recent passage of legislation, it would not be responsible for the Environmental Quality Council to enact this carbon capture and sequestration (CCS) program without addressing this issue of financial responsibility. It would not be prudent for the Department of Environmental Quality to commence administering this CCS program until such financial responsibility regulations are in place. It is both necessary and proper that the Environmental Quality Council should defer and postpone any action on these regulations until the DEQ has come forward with regulations that have been reviewed by the Water and Waste Advisory Board. Financial responsibility and financial assurance regulations are a very important part of this CCS program and should not be adopted at a later time. The Wyoming CCS program should not be allowed to go forward in this piecemeal fashion.

Air Quality Must be Considered as Well as Water Quality

2. The carbon sequestration (CS) permit contemplated by these regulations (a Class VI well permit) should not be a stand-alone permit. The DEQ should recognize that there is another component to protecting the environment involved in carbon sequestration, and that is the purpose of the sequestration: to prevent carbon dioxide gas from being released into the atmosphere. Therefore, this process should involve the Air Quality Division as well, or at a minimum, the Class VI well permit should be tied to an air quality permit.

The ultimate goal of carbon sequestration is to permanently bury carbon dioxide gas in the ground, where it cannot escape to the surface. Of course, it is laudable that the DEQ/WQD seeks to insure that Underground Sources of Drinking Water (USDW) and groundwater in general are protected. But it is equally requisite that carbon dioxide gas does not reach the surface. The Air Quality Division should therefore be involved in the permitting of this as well, since it will be their concern to prevent leakage or escape to the surface.

Most carbon sequestration efforts at this point will be tied to a coal-fired power plant, or other industrial emitter of carbon dioxide. It is important that the Class VI well permit be tied to such a facility. Compliance with the Class VI well permit should be a pre-requisite to the continued operation of the facility that also has the air permit. No coal-fired power plant should be allowed to escape responsibility for a failure of a Class VI well that is sequestering carbon dioxide from its plant. If carbon dioxide is not being properly sequestered, and releases of the gas are occurring, that should be considered a violation of the air quality permit for the plant that is the source of the carbon dioxide.

There may come a time when carbon sequestration is not tied to any facility generating the carbon dioxide. But that time is in the future, perhaps the far future. For now, all carbon sequestration will occur only because some generating facility desires to sequester its carbon dioxide. The permitting system that DEQ contemplates must recognize this fact and provide

incentive for the air pollution emitter (the power plant or other facility) to insure that carbon dioxide will not leak or escape into the atmosphere.

While there is an economic incentive for the holder of an air quality permit for a power plant, or other emitting facility, to insure that the facility can keep operating without committing on-going violations of its permit, the only incentive of the permittee built into these Class VI well permits is to eventually close the facility once the pore space has been filled. But this is completely the wrong incentive for carbon sequestration. The permittee of the carbon sequestration permit must be incentivized to keep the carbon in the ground, and the best way to do this is to tie any leakage from the sequestration site to the air quality permit of the power plant that is generating the carbon dioxide (CD).

Sequestration Must Be Permanent Therefore Monitoring Must be Permanent

3. Chapter 24 discusses the concept of "site closure," (see Sec. 16 of Chapter 24). But carbon sequestration must be permanent. It is somewhat like the concept of nuclear waste storage in that society does not want the carbon dioxide (CD) to go anywhere. It must stay in the ground, and not leak, forever, for the entire carbon sequestration effort to be effective. Therefore, final site closure is not possible. Monitoring of the facility must be permanent. There must always be a permittee for the facility, the facility can never be closed, the permittee should provide a substantial bond or other financial assurance in the event that it goes bankrupt, because some entity (either governmental or corporate) will have to be responsible for monitoring and insuring that the carbon remains sequestered forever. Society will not know if the CD remains sequestered unless monitoring is ongoing and permanent.

While we understand that the EPA recommended the requisite time for monitoring as 50 years following cessation of injection, it cannot be assumed that this is adequate. Monitoring should never be abandoned completely. Rather, to the extent that monitoring may indicate that the permitted carbon storage (CS) is stable and leakage is not occurring, over a long period of time (4 or 5 decades) the monitoring schedule could be reduced both in terms of number of monitoring sites, and in terms of frequency of data collection. But post-injection care of the CS site must be permanent. There is too much possibility of leakage of CD in Wyoming, which is comparatively tectonically active, with new fractures and fissures being formed in response to geologic activity located miles away, to ever abandon post-injection monitoring and management.

All Wells in the Area of Review Should Be Properly Cemented, Plugged and Abandoned

4. Any well of any type poses the potential of allowing CD gas to travel through the well, or even through the annulus of the well, as a conduit to reach the surface or to leave the storage formation and trespass into other pore spaces. Therefore all wells in the area of review should be identified. The casings should be removed, and each well completely and thoroughly cemented, plugged and abandoned. The only exceptions to this rule should be wells less than 500 feet in depth that are necessary as stock watering wells or drinking water wells. Wells of any greater depth pose too large a risk of acting as a conduit to allow continued use above a

carbon sequestration project area. Section 3(b) of Chapter 24, which allows the make decisions exempting wells from "casing and cementing requirements," is too broad. The discretion of the Administrator should be restricted to only shallow drinking water or stock watering wells.

Underground Sources of Drinking Water Should be Protected

5. While Wyoming Outdoor Council recognizes that there may be circumstances where the geology of an area contains an excellent storage formation that is ideally suited for carbon sequestration, we are very concerned about the protection of Wyoming's precious groundwater. Wyoming has very good quality groundwater often located very deep underground, and is sourced from formations fed by pure mountain snowmelt. This groundwater should not be jeopardized. Therefore, we recommend that a substantial distance of separation, such as at least 2000 feet, including a confining layer, be documented in any area of review that is being contemplated as a CS project, which has a USDW vertically below the proposed storage formation. Site-by-site criteria may need to be developed as part of the Class VI well (CS) permit to insure protection of the USDW.

No Mineral Development Should be Allowed in the Area of Review

6. It has been suggested that depleted oil and gas fields may be a good place for depositing CD in a CCS storage formation. While this may be true, it should be clearly understood that no mineral development can occur in the area of review. More drilling in the area of review cannot be allowed. This would pose a serious threat of leakage of CD out of the storage formation and the out of the area of review. In most cases, mineral deposits will lie below the proposed storage formation, so piercing the storage formation would be quite likely, but even in cases where development is sought above the storage formation, it would still present substantial risk of promoting leakage of CD along new fractures or faults that may be created by the development activity.

All Mineral Rights To The Area Of Review Should Be Purchased By The Permittee, And Surrendered To The Government (State Of Wyoming)

7. It cannot be blithely assumed that no mineral development will occur during the life of a given CS project. Rather, the permittee must be required to show that it has acquired all mineral rights within the area of review. All mineral rights, whether for oil, gas, uranium, coal, gold, diamonds, hard rock mining, etc., must be purchased and retired. The mineral development rights in the area of review must be surrendered to the State of Wyoming, or possibly the federal government, with the understanding that they will never be leased again. Given the legal rights attached to mineral development, this is the only way to protect the storage formation from threats its integrity and "containment capability." The CCS storage formation cannot be compromised by drilling, which is, in effect, punching holes into a confining zone (including the pressure front).

Consultation with the Wyoming State Geologist Should be a Requirement

8. In the same way that this Class VI permit should be tied to an air quality permit for the carbon dioxide producer (usually a power plant, in all likelihood), the DEQ needs to be sure it has holistically examined the question of geological integrity of the storage formation and the surrounding geology to be sure that leakage of CD will not occur through faults, fractures, potential seismic activity, and so forth. Therefore the expertise of the Wyoming State Geologist (WSG) should be utilized. The WSG should examine the data presented in the permit application and make a recommendation to the DEQ as to the efficacy of the proposal, the geologic viability of the area of review as an appropriate location for CS, and should be able to make suggestions and amendments to the proposed permit that will insure the geologic integrity of the storage formation over a geologic time period.

Liability Remains with the Permittee

9. Language written into the permit should make it clear that the permittee retains complete liability for all environmental contamination and all excursions from the storage formation and area of review, and the migration of any and all gases or fluids outside the area of review caused by the pressurization of the storage formation, including movement of fluids or gases along fractures or fissures that causes damage or invades the pore space of other non-participating owners.

Definitions

10. a. The "area of review" definition (Sec. 2(c)) should include the phrase "area of review shall specifically include the area encompassed by any monitoring wells put in place to monitor the carbon dioxide stream plume and associated pressurized formation."

b. The "confining zone" definition (Sec. 2(k)) should be more specific. We suggest: "'Confining zone" means a geologic formation, group of formations, or part of a formation that is capable of confining injected gases and fluids within the formation and preventing movement of such fluids and gases outside of the formation(s) while under pressure."

c. The "excursion detection" definition (Sec. 2(q)) needs to include all migrating gases and fluids, in addition to carbon dioxide, that are detected to move beyond to boundary of the geologic sequestration site.

d. The term "pressure front" (Sec. 2(jj)) needs to be changed to "pressurized zone" or "pressure zone" as this more accurately reflects the term being used for this definition. There is no "pressure front," per se, in the pressurized zone.

Frequency of Monitoring

11. Monitoring of the area of review should be at least quarterly during injection operations and annually after injections of CD have ceased. After 20 years of annual monitoring, the permittee could ask for and obtain permission from DEQ to monitor only once every five years, based upon the criteria set forth in Chapter 24 for "closure" of the facility. But the Wyoming Outdoor

Council does not believe the facility should ever be closed in the sense that monitoring could cease entirely.

Time for Issuing Class VI Well Permit

12. Section 4(b)(ii) of Chapter 24 requires the DEQ to make a "completeness determination" for the permit application within 60 days. Section 19(l) goes on to require that the Director render a final decision within 60 days after the close of the public comment period on the permit application. Both of these time limits are untenable. These projects are likely to be very complicated and technical. The DEQ/WQD should allow plenty of time to make proper determinations with regard to these permits. Geologic sequestration of CO₂ is novel and untried. It is unlikely that the DEQ, as regulators, can be completely comfortable with CS for some time, and effective permit review should take months, or perhaps more than a year. This is particularly true given the fact that the DEQ is not now funded to handle such permits, and future funding sources are as yet unknown. Likewise, response to public comment should not be rushed, and that response should be submitted to the public before any final decision is made. Thus, response to public comment could take six months or more.

EOR and CCS

13. Generally speaking, we believe that enhanced oil recovery is a separate endeavor from carbon sequestration (CS). Enhanced oil recovery (EOR) is properly the jurisdiction of the Wyoming Oil and Gas Conservation Commission (WOGCC) and not the DEQ. Gas that is injected for the purpose of EOR ordinarily is not done with the purpose of ensuring that it stays put and does not escape from the formation into which it is injected. There is no such similar requirement for EOR operations. If a carbon dioxide injection project is approved for EOR, that is all well and good, but whether it could also satisfy the permit requirements for sequestration is an open question. Considering the fact that oil and produced water is continually being withdrawn in an EOR project, the chances are that CO₂ will also be withdrawn in that process as well. Such an EOR site, (as with any site where mineral development is on-going), by its very nature, will not have the necessary geologic integrity to also constitute a suitable CS site. So it would appear that EOR projects are not suitable for carbon sequestration.

The DEQ and the WOGCC should enter into a memorandum of understanding to cover any situation where an operator seeks to achieve both EOR and CS in the same project. If an applicant seeks to sequester carbon dioxide and enhance oil recovery in one project, then there should be a requirement for permits from both agencies, and those requirements should be coordinated through a memorandum of understanding or joint rule-making, in order to accommodate this eventuality.

It would appear that the debate between CO₂ as a waste stream versus a valuable stored product is not particularly relevant to the DEQ's rulemaking duties in Chapter 24. Wyoming Outdoor Council endorses the DEQ's approach to remain neutral on this subject. The important point is that the permittee shall remain responsible for the CO₂ -- whether as a benefit or a liability, or both.

Lessons from the Rock Springs Uplift Computer Modeling

14. The Wyoming Outdoor Council notes that the Wyoming State Geologist has recently looked into the question of carbon sequestration in Wyoming. He believes that two of the formations that are most promising in Wyoming for CS are the Moxa Arch and the Rock Springs uplift. These areas are seen as being good repositories for CO₂ because they can accept large amounts of CO₂ gas, and do not appear to be near any on-going mineral development. Dr. Ronald Surdam made a presentation to the Joint Minerals Committee of the Wyoming legislature on Sept. 15, 2009. It is very important that the Environmental Quality Council consider carefully the implications of Dr. Surdam's remarks.

Dr. Surdam made the following points during his presentation:

- a. The best places to sequester CO₂ are in limestone formations.
- b. In Wyoming, the best geologic locations for CS are in southwest Wyoming, such as the Moxa Arch and the Rock Springs uplift. The Moxa Arch is very deep, however, and thus CS wells would be very expensive there. Therefore the Rock Springs uplift (RSU) is the highest priority, best location, since some of the formations in the RSU are 8-10,000 ft deep, which is shallower than the Moxa formation.
- c. The CO₂ from the Jim Bridger power plant could be injected, for a period of 50 years, and the RSU could handle the injection -- but it would displace the briny fluids in the process. But 750 metric tons of CO₂ will displace 1 cubic kilometer of water, which is 6 billion barrels of water. Thus, unless the water is withdrawn, measurable pressure effects will be 30 miles (on each side) beyond the 100 square mile sequestration area -- or over 4900 square miles. This is a huge problem unless the water is withdrawn and treated. The greatest risk to such a project, then, is the displacement of water. The water will have 30,000 ppm to 60,000 ppm total dissolved solids (TDS). Treatment of such water will be very expensive.
- d. Failure to withdraw water as part of a CO₂ project in the RSU would pose great risks, for several reasons: 1) It could result in hydro-fracture of the rocks in the formation, thus causing the formation to lose its geologic integrity for CS. The cap or "ceiling" rock, in other words, would be destroyed. 2) It would be difficult to find a location where mineral development would not be impacted if water or other fluids that are forced to move by the CS project were not withdrawn.

While Dr. Surdam's presentation involved his use of a computer simulation program for just one location in Wyoming, the Rock Springs uplift, the implications of his discussion are clear:

- a. It is very important to separate any proposed CS project from all mineral development. The area of review needs to be completely surveyed for old drill holes and all wells need to be properly plugged and abandoned. Otherwise the geologic integrity of the site cannot be assured. Furthermore, new mineral development cannot be allowed to take place in the project area -- at least during the time in which the confining zone and the area of review remain under pressure from the CD injection. (Dr. Surdam indicates in his presentation that this could easily be 50 years.) An area that is supposed to maintain its geologic integrity in perpetuity cannot be drilled

or otherwise developed for minerals when the area remains under pressure. Such activity would obviously put in jeopardy the geologic integrity of the area of review.

b. The displacement of fluids outside of the area of review is likely to occur. This cannot be allowed to happen if the integrity of the area of review is to be maintained. Therefore any project must be able to demonstrate how it plans to remove brine or other fluids that will be displaced by the CS operations. A failure to withdraw such fluids (Dr. Surdam recommended treatment of some sort that would, in effect, desalinate the water before it was either used or discharged) to then be either used or discharged, would make CS projects unworkable. This should mean that the regulations to be adopted by the EQC should address this issue. Provisions should be included that will require a demonstration from the permittee regarding how the displaced fluids, brine or otherwise, will be removed, or otherwise addressed.

Addressing Mineral Development in the Area of Review

15. While the DEQ/WQD has argued that it does not have the authority to prohibit mineral development and/or to require that all mineral leases be purchased and retired by the CS permittee, we question this assertion. The mere fact that the mineral estate retains a "dominance" over the pore space in the new carbon sequestration legislation does not answer that question. Ownership and geologic integrity are two separate issues. One involves the right to develop a natural resource. The other involves a matter of science: can the proposed project be done effectively in a given area. The plain fact is that it cannot be done if the geologic integrity cannot be maintained. And mineral development cannot occur within the area of review either during operations or at any time after operations have ceased and the post closure phase has begun. If at some point after closure the area of review returns to normal (pre-injection) pressure levels, then perhaps mineral development could again be considered. But this could take a very long time and careful monitoring would have to be required before mineral development could again be re-started in any area of review.

Respectfully submitted, on behalf of the Wyoming Outdoor Council.

Dated this 24th day of June 2010.



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