

OCD Exhibit 23

**STATE OF NEW MEXICO
NEW MEXICO OIL CONSERVATION DIVISION**

**APPLICATION OF OIL CONSERVATION DIVISION
TO ADOPT 19.15.41, 19.15.42, AND 19.15.43 NMAC**

No. 25875

**REBUTTAL TESTIMONY OF DR. HASSAN KHANIANI
ON BEHALF OF THE OIL CONSERVATION DIVISION**

JULY 13, 2026

Q. DID YOU PROVIDE DIRECT WRITTEN TESTIMONY IN THIS MATTER AND HAVE YOU PROVIDED A COPY OF YOUR RESUME/CV AS AN EXHIBIT?

A. Yes, my direct written testimony was submitted as OCD Exhibit 8 and my resume summarizing my qualifications and experience was provided as OCD Exhibit 9.

Q. HAVE YOU REVIEWED THE DIRECT WRITTEN TESTIMONY AND ASSOCIATED EXHIBITS OF THE CENTER FOR BIOLOGICAL DIVERSITY (“CBD”) TO PREPARE THIS WRITTEN REBUTTAL TESTIMONY?

A. Yes.

Q. HAVE YOU REVIEWED THE DIRECT WRITTEN TESTIMONY AND ASSOCIATED EXHIBITS FOR DINE C.A.R.E., EARTHWORKS, SAN JUAN CITIZENS ALLIANCE, SIERRA CLUB RIO GRANDE CHAPTER, TO NIZHONI ANI AND WESTERN ENVIRONMENTAL LAW CENTER’S (COLLECTIVELY CONSERVATION GROUPS) TO PREPARE THIS WRITTEN REBUTTAL TESTIMONY?

A. Yes.

Center for Biological Diversity Rebuttal

Q. THE CENTER FOR BIOLOGICAL DIVERSITY SUGGESTS AN ADDITION TO INJECTION WELL OPERATING REQUIREMENTS TO INCLUDE PUMPING PRESSURE RAMP-UP INCREMENTALLY WITH A SPINNER LOG.¹ WHAT IS YOUR RESPONSE?

¹ CBD Exhibit 1 at 15

- A. It is my opinion that a fixed 80 percent fracture-pressure limit, mandatory five-day ramp-up period, and universal spinner-log requirement are unnecessarily prescriptive for a statewide Class VI regulatory program. These operational parameters should instead be established based on site-specific technical considerations, including formation fracture pressure, geomechanical conditions, confining-zone integrity, fault and fracture characterization, reservoir pressure response, and monitoring data.

In my opinion, the Oil Conservation Division should retain the discretion to require lower injection pressure limits, staged ramp-up procedures, spinner logs, or other operational measures where warranted by the characteristics of a particular project. However, requiring these measures for every Class VI well, regardless of site-specific conditions, is not technically necessary and may impose requirements that do not meaningfully enhance protection of underground sources of drinking water.

Q. CBD PROPOSES REDUCING THE MAXIMUM INJECTION PRESSURE LIMIT FROM 90 PERCENT TO 80 PERCENT OF FRACTURE PRESSURE.² WHAT IS YOUR RESPONSE?

- A. In my opinion, retaining the proposed 90 percent fracture-pressure limit is appropriate. That limit remains below the fracture pressure of the injection zone and operates in conjunction with the other safeguards required under the Class VI program, including site-specific geomechanical evaluation, continuous pressure and injection monitoring, mechanical integrity testing, pressure falloff testing, Area of Review modeling, and the Director's authority to establish a lower project-specific pressure limit where warranted. As a result, I do not believe a universal 80 percent limit is technically necessary. In my

² CBD Ex. 3 at 80

experience, maintaining a 10 percent safety margin below fracture pressure is a commonly accepted engineering practice and is consistent with EPA's implementation of the Class VI program. Similar safety margins have also been used in the permitting of acid gas injection wells, although project-specific limits may vary depending on site conditions. The proposed 90 percent limit reflects an engineering approach that has been successfully applied in practice while still allowing the Division to require a lower injection pressure where warranted by the characteristics of a particular project.

I also do not believe the Redbird #4 case cited by CBD provides a technical basis for imposing a universal 80 percent limit for all Class VI wells. Redbird involved a Class II saltwater disposal well in a different operational and geologic setting, where the reported concerns related to pressure communication, legacy well pathways, and brine migration. While that case reinforces the importance of thorough site characterization, corrective action, monitoring, and Area of Review evaluation, those protections are already incorporated into the Class VI regulatory framework. In my opinion, Redbird demonstrates the importance of a robust, site-specific permitting process, but it does not support replacing the proposed 90 percent limit with a universal 80 percent fracture-pressure limit for all Class VI projects.

Q. CBD SUGGESTS AN ADDITION TO THE MECHANICAL INTEGRITY REQUIREMENTS WITH AN ADDITION OF ALTERNATIVE ACOUSTIC NOISE METHODS.³ WHAT IS YOUR RESPONSE?

³ CBD Ex. 1 at 16

A. Noise logs can be an effective tool for detecting fluid movement behind casing or through channels near the wellbore. However, in my opinion, they are not universally the most appropriate method for demonstrating external mechanical integrity. The effectiveness of a noise log depends on several site-specific factors, including the rate of fluid movement, acoustic contrast, background noise, well configuration, casing and cement conditions, and whether the movement generates a detectable acoustic signal.

Other diagnostic methods, including temperature logs, tracer surveys such as oxygen-activation logging, cement evaluation logs, pressure tests, or other Director-approved acoustic methods, may provide equivalent or more reliable information depending on the characteristics of a particular well and the conditions being evaluated.

In my opinion, a performance-based approach that allows the Director to select the method, or combination of methods, most appropriate for a particular well would provide greater technical flexibility while continuing to ensure protection of underground sources of drinking water.

Q. CBD SUGGESTS AN ADDITION TO THE TESTING AND MONITORING REQUIREMENTS OF CLASS VI WELLS INCLUDING AN ADDITION OF AMBIENT NOISE TOMOGRAPHY.⁴ WHAT IS YOUR RESPONSE?

A. In my opinion, requiring Hall Plot analysis, or other specific analytical tools, for every Class VI project is not technically necessary because the usefulness of these methods depends on site-specific geology, monitoring design, data quality, and project-specific objectives. Hall Plot analysis can be a valuable diagnostic tool for evaluating injectivity trends, near-wellbore conditions, skin effects, plugging, stimulation response, and changes

⁴ CBD Ex. 1 at 17

in reservoir transmissivity. However, it is not a direct method for tracking plume migration or pressure-front movement and should not be viewed as a replacement for pressure monitoring, pressure falloff testing, plume and pressure-front modeling, or geophysical monitoring.

The data required to perform Hall Plot analysis - including injection pressure, injection rate, cumulative injected volume, and time - are already collected as part of the operational monitoring required for Class VI wells. Those same data are routinely used for reservoir model calibration, history matching, injectivity evaluation, pressure-front assessment, and Area of Review reevaluations. As a result, Hall Plot analysis can be performed whenever it provides meaningful technical value without requiring it as a mandatory element of every Class VI project.

Conservation Groups Rebuttal

Q. THE CONSERVATION GROUPS SUGGESTS AN ADDITION TO THE PUBLIC NOTICE REQUIREMENTS, WITH AN ADDITION OF THIRD-PARTY VERIFICATION OF THE MODELING ENSEMBLE.⁵ WHAT IS YOUR RESPONSE?

A. In my opinion, requiring independent third-party technical review raises practical questions regarding reviewer qualifications, certification standards, the scope of the review, and the process for addressing technical disagreements. These considerations should be clearly defined if such a requirement is adopted.

Under the proposed Class VI permitting framework, both the Division and EPA already conduct detailed technical reviews of permit applications, and the public notice and

⁵ Conservation Groups at 009

comment process provides an additional opportunity for technical evaluation of the application and supporting materials. In my opinion, meaningful public participation is best supported by ensuring that the administrative record contains sufficient technical information to allow interested parties to independently evaluate the applicant's modeling and analyses.

That information should include, at a minimum, the modeling approach, software used, geologic framework, model assumptions, input parameters, boundary conditions, calibration data, sensitivity and uncertainty analyses, plume and pressure-front projections, and Area of Review results. With this information, technically qualified reviewers—including consultants, academic researchers, nongovernmental organizations, and other interested parties—can independently evaluate the modeling using a variety of commercially available, proprietary, or open-source modeling platforms and analytical methods.

In my opinion, the regulations should not prescribe or require the use of any particular modeling software or analytical platform. Rather, the focus should remain on providing sufficient technical information to allow meaningful review of the modeling and supporting analyses, regardless of the software used to perform that evaluation.

Q. THE CONSERVATION GROUPS SUGGESTS AN ADDITION TO THE AREA OF REVIEW AND CORRECTIVE ACTION REGARDING AN ADDITION TO USE AN INDEPENDENT THIRD-PARTY VERIFICATION AND ADDITIONS TO THE AREA OF REVIEW REEVALUATION REQUIREMENTS.⁶ WHAT IS YOUR RESPONSE?

⁶ Conservation Groups at 035

A. In my opinion, requiring third-party certification of Area of Review modeling raises practical questions regarding the applicable certification standards, reviewer qualifications, the scope of the review, and the process for resolving technical disagreements among the applicant, the Division, EPA, third-party reviewers, and public commenters. These considerations should be clearly defined if such a requirement is adopted.

From a technical perspective, the more significant consideration is whether the administrative record contains sufficient information to allow an independent evaluation of the Area of Review model and its conclusions. That information should include the modeling approach, software used, site characterization data, geologic framework, model assumptions, input parameters, boundary conditions, calibration methodology and results, sensitivity and uncertainty analyses, plume and pressure-front projections, and the resulting Area of Review determination.

Under the proposed Class VI permitting framework, OCD already performs technical reviews of Area of Review modeling, and the public notice and comment process provides an additional opportunity for technically qualified third parties to evaluate and comment on the modeling record. In my opinion, providing a complete and transparent technical record is a more effective means of facilitating meaningful technical review than requiring mandatory third-party certification. A transparent record allows independent reviewers to evaluate the assumptions, methodology, and conclusions underlying the Area of Review analysis, regardless of whether a separate third-party certification has been performed.

In my opinion, Area of Review reevaluation triggers are an important component of the proposed Class VI permitting framework because they help ensure that the predicted

carbon dioxide plume and pressure front remain consistent with observed project performance throughout the life of the injection operation.

However, the technical significance of any particular pressure difference, seismic event, or other monitoring result depends on site-specific conditions. Factors such as reservoir pressure regime, formation compressibility, permeability, monitoring well locations, model uncertainty, injection rate, baseline seismicity, fault and fracture characteristics, and potential pathways to underground sources of drinking water all influence whether a particular observation warrants reevaluation of the Area of Review.

As a result, in my opinion, fixed statewide numerical thresholds - such as a specified percentage pressure mismatch, a fixed pressure differential, or a particular seismic magnitude - may not be appropriate for every Class VI project because those values may represent materially different conditions from one site to another.

Q. THE CONSERVATION GROUPS STATE THAT RESERVOIR SIMULATION MODELS ARE “INHERENTLY UNRELIABLE”.⁷ WHAT IS YOUR RESPONSE?

A. I do not agree that reservoir simulation models used to establish the Area of Review are inherently unreliable. Like all engineering and geologic models, reservoir simulation models contain some level of uncertainty because subsurface conditions cannot be measured directly at every location. However, uncertainty does not mean that a model is unreliable or unsuitable for its intended purpose.

Class VI reservoir simulation models are developed using a broad range of site-specific data, including well logs, seismic surveys, core analyses, laboratory testing, formation pressure measurements, fluid samples, mineralogical data, porosity and permeability

⁷ Conservation Group at 94

measurements, and geomechanical properties of the injection and confining zones. Where direct measurements are not available, accepted engineering methods and published technical data are used to develop reasonable assumptions. As additional site data become available, the models can be calibrated and refined to improve their predictive capability. The Area of Review model is also not a one-time prediction. Under the Class VI program, it is part of an ongoing model-monitor-update process that includes pressure monitoring, injection rate monitoring, mechanical integrity testing, pressure falloff testing, plume and pressure-front monitoring, and periodic Area of Review reevaluation. This process allows the model to be compared against observed field performance and updated, when appropriate, as additional operational and monitoring data are collected.

In my opinion, reservoir simulation models are reliable engineering tools when they are developed using site-specific data, evaluated through sensitivity analyses, and periodically updated as new information becomes available. That adaptive approach is a fundamental component of the Class VI regulatory framework and provides a technically sound basis for forecasting carbon dioxide plume migration, pressure-front development, and the continued protection of underground sources of drinking water.

Q. DOES THIS CONCLUDE YOUR REBUTTAL TESTIMONY?

A. Yes.