ENGINEERING UNIT
CLASS II UNDERGROUND INJECTION CONTROL WELLS

COGCC permits and regulates Class II Underground Injection Control (“UIC”) wells. Class II wells are used specifically to inject oil and gas exploration and production waste for disposal, and for enhanced oil recovery through injection of water, gas, or other substances.

The COGCC Class II UIC permit process involves the review and approval of:

- Well construction;
- Isolation of ground water aquifers;
- Maximum injection pressure;
- Maximum injection volume;
- Injection zone water quality; and
- Potential for seismicity.

Well Construction and Isolation

Injection wells must utilize a well construction method of cemented surface casing and production casing, which isolates and prevents fluid flow between injection zones and Underground Sources of Drinking Water (“USDWs”). To verify this isolation, the COGCC reviews all relevant information, including:

- Hydrogeologic studies;
- Colorado Division of Water Resources water well information; and
- COGCC’s geophysical well log database.

This information is used in conjunction with specific formation and well construction data submitted by the injection well operator, including resistivity and cement bond geophysical logs, to ensure that:

- The surface casing is set below all fresh water zones used as a water supply; and
- The placement and quality of production casing cement allows for adequate isolation of the injection zone and USDWs, including fresh water zones that are not currently being used as a water supply.
The geophysical logs are also used to determine the injection zone thickness and porosity, which confirms that the bounding shale zones are thick enough to provide zonal isolation.

**Maximum Injection Pressure and Volume**

Maximum surface injection pressure is calculated based on a default fracture pressure gradient of 0.6 pounds per square foot (“psi”) of depth. The operator may elect to conduct a Step Rate Injection Test to determine whether a higher injection zone fracture gradient exists. From the resulting fracture gradient, the COGCC designates a maximum surface injection pressure at the operator’s requested injection rate as a condition of permit approval. The COGCC’s policy is to keep injection pressures below the fracture gradient, which is uniquely defined for each injection well, in order to minimize the potential for seismic events related to fluid injection.

The COGCC calculates a maximum injection volume, based on thickness and porosity from the log data. By COGCC policy, the injection volume calculation is restricted to a one-quarter mile radius. This restriction is intended to constrain the total volume of injected fluids during the life of the injection well.

**Seismicity Review**

The UIC permit review also includes a review for seismicity. This was previously performed by the Colorado Geological Survey (“CGS”) but is currently performed by a former CGS staff member now working for the COGCC. The seismic review uses CGS geologic maps, the United States Geological Survey earthquake database, and area-specific knowledge to assess seismic potential. If historical seismicity has been identified in the vicinity of a proposed Class II UIC well, COGCC requires an operator to define the seismicity potential and the proximity to faults through geologic and geophysical data prior to any permit approval.

**Water Analysis**

Injection permits are only approved if water analyses from the injection zones show an acceptable level of total dissolved solids or an Aquifer Exemption is required. If the total dissolved solids are between 3,000 and 10,000 milligrams per liter, then a request for an Aquifer Exemption is sent to the U.S. Environmental Protection Agency and Colorado Department of Public Health and Environment. An Aquifer Exemption will only be granted if the injection zone: 1) is not currently a source of drinking water, and 2) is unlikely to become one, because it is or may be a hydrocarbon producing interval, is too deep to be economically or technically practical, or currently has more than 10,000 milligrams per liter of total dissolved solids.
Mechanical Integrity Test

Finally, the well must pass a Mechanical Integrity Test ("MIT") after it has been set up in the final injection configuration. The MIT assures that any leaking fluids from the injection tubing, which conveys fluid from the surface to the injection zone and past the packer, or the packer, which separates the injection zone from the tubing-casing annulus, are contained within the tubing-casing annulus.