

3.4.6 Well Casing Integrity

After an injection, recovery **or monitor** well has been completed, and before it is made operational, a Mechanical Integrity Test (MIT) of the well casing is conducted. For the integrity test, the bottom of the casing adjacent to or below the confining layer above the production zone is sealed with a plug, down hole packer, or other suitable device. The top of the casing is then sealed in a similar manner or with a sealed cap, and a pressure gauge is installed to monitor the pressure inside the casing. The pressure in the sealed casing is then increased to 125% of the **limiting surface injection** pressure or to an amount less than the formation fracture pressure (**whichever** is less). The well pressure is then monitored for a period of 10 minutes. A well is considered satisfactory with a pressure drop of no more than 10%.

If there are obvious leaks, or the pressure drops by more than 10% during the 10 minute period, the seals and fittings will be reset and/or checked and another test is conducted. If the pressure drops less than or equal to 10% the well casing is considered to have demonstrated acceptable mechanical integrity.

The results of the MITs conducted during a quarter are documented on a quarterly bases to include the well designation, date of the test, method by which the MIT was completed, verification of whether the MIT was or was not established, test duration, beginning and ending pressures, and the signature of the individual responsible for conducting the test. Results of the MITs are maintained on site and are available for inspection by NRC and WDEQ personnel. In accordance with regulatory requirements the results of MITs are reported to the WDEQ on a quarterly basis for those wells that were tested. In accordance with WDEQ and EPA requirements, MITs are repeated once every five (5) years for all wells used for injection of lixiviant, or injection of fluids for restoration operations. **MITs on production area monitor wells are also repeated every 5 years as required by NRC license.**

If a well casing does not meet the MIT criteria, the well will be placed out of service and the casing may be repaired and the well re-tested or abandoned. If a repaired well passes the MIT, it will be employed in its intended service. If an acceptable test cannot be obtained after repairs, the well will be plugged and abandoned. The WDEQ-LQD Administration will be notified in

the quarterly report of wells that fail the MIT. In the quarterly report the following is required: the identification of the failed well, a description of the method of plugging or repair, a status of the corrective actions on defective wells, the results of well plugging or repair, statements that the wells were plugged according to the approved permit and that the volume of material used for plugging equals the volume of material placed in the well.

The injection pressure of the Class III wells for the Nichols Ranch Unit, Hank Unit, and Jane Dough will be calculated to assure the pressure in the production zones do not generate new fractures or spread existing fractures. Uranerz Energy Corporation will operate the Class III wells in a manner that the injection pressure will be lower than the calculated pressure that could fracture the confining zone, or cause the injection fluid to migrate to unauthorized zones.

Search of published fracture gradient information, “Underground Injection Control Program, Water Quality Division, Wyoming Department of Environmental Quality, Guidance Document Number 1, 1994” resulted in selecting a conservative fracture gradient of 0.80 psi/ foot of depth, for reservoir rock formations of 2,000 feet in depth or less. The following formation fracture pressure and maximum surface injection pressures are:

Formation Fracture Pressure

Casing Depth x Fracture gradient pressure = Formation fracture pressure (psi)

Nichols Ranch- 600 ft. x 0.80 psi/ft. = 480 psi

Hank- 375 ft. x 0.80 psi/ft. = 300 psi

Jane Dough- 500 ft. x 0.80 psi/ft. = 400 psi

Maximum Surface Injection Pressure

[(Fracture gradient – 0.433 psi/ft.) x Specific gravity, water] x Casing Depth = injection pressure (psi)

To be conservative, Uranerz will limit the surface pressure to 90% of the calculated maximum injection pressure.

Nichols Ranch- $[(0.80 \text{ psi/ft} - 0.433 \text{ psi/ft}) \times 1] \times 600 \text{ ft.} = 220.2 \text{ psi} (\times 0.90) = 198 \text{ psi}$

Hank- $[(0.80 \text{ psi/ft} - 0.433 \text{ psi/ft}) \times 1] \times 375 \text{ ft.} = 137.6 \text{ psi} (\times 0.90) = 123 \text{ psi}$

Jane Dough- $[(0.80 \text{ psi/ft} - 0.433 \text{ psi/ft}) \times 1] \times 500 \text{ ft.} = 183.5 \text{ psi} (\times 0.90) = 165 \text{ psi}$

Uranerz intends to use 5-inch diameter PVC casing for well bore completion. The maximum operating pressure rating for 5-inch diameter SDR 17 casing is 180 psi and for SDR 21 casing (if used would only be at Hank) is 130 psi. However, the lowest pressure rated component of the present surface infrastructure is 150 psi and will therefore be the maximum surface injection pressure for Nichols Ranch and Jane Dough Units unless components rated for higher pressures are utilized. The limiting injection pressure for Hank would be the pressure rating of the SDR 21 casing or 130 psi, but limiting the operating pressure to 90% yields a maximum surface injection pressure, 123 psi.

MIT testing will be conducted at the limiting surface injection pressure of the lowest pressure rated component. Nichols Ranch and Jane Dough will be 150 psi unless components rated for higher pressures are utilized and Hank will be 123 psi. The MIT test will be conducted at 125% of these pressures for the respective locations.

Injection wells will not be used for injection purposes if they do not demonstrate mechanical integrity. Additionally, a MIT will be conducted on any well to be used for injection purposes after any well repair where a down hole drill bit or under reaming tool is used. Any injection well with evidence of suspected subsurface damage will require a new MIT prior to the wellbeing returned to service.