Long-Term Zonal Isolation in UGS Wells
FUTUR self-healing cement technology ensures long-term well integrity in Italy

CHALLENGE
Create long-term isolation in underground gas storage (UGS) wells in an area with strict environmental regulations where surface leaks are common occurrences.

SOLUTION
Apply an integrated solution including the FUTUR* self-healing cement technology to protect against the loss of well integrity.

RESULTS
Detected no surface leaks after completion and achieved an excellent cement bond across the gas injection interval expected to last for the life of the well.

Critical isolation
Many UGS wells in Italy are very close to urban areas, and stringent regulations require leak-free wells. In this area, sustained casing pressure (SCP) and its effects on well integrity can lead to premature abandonment if leaks exceed the low threshold set by authorities. To avoid this waste of resources, a long-lasting solution was sought.

Innovative solution
For the Cortemaggiore 155dir well, the revolutionary FUTUR self-healing cement technology was selected. Used in conjunction with good cementing practices and the GasMigrationAdvisor* software package, this technology offered excellent protection against the loss of well integrity.

When the FUTUR sealant contacts hydrocarbons, it swells to close gaps and flow paths. Within hours, the cracks or fissures are healed, and the hydraulic seal is reestablished. The self-healing cement rapidly forms a complete barrier that continues to reseal if annular integrity is further compromised. FUTUR cement can be strategically placed—from surface to reservoir depth in any string of the well—to distribute an effective long-term seal throughout the well.

The Cortemaggiore 155dir slurry was formulated to mitigate the concerns specific to the well. Risks included a well deviation of 48°, expected washouts in depleted formations, a high risk of gas percolation, slow cement compressive strength development owing to a low bottomhole static temperature (44 degC [111 degF]), and a high risk of set-cement mechanical failure caused by cyclical stresses related to production and injection phases.

FUTUR self-healing cement technology was used to cement two strings on the same well—around the 7-in [17.78-mm] liner, across the injection/production zone, and around the 7-in [17.78-mm] casing tieback.
**Successful cementing**

Once the cement was placed, it was evaluated using a cement bond log–variable density log (CBL-VDL) wireline logging measurement. The CBL-VDL readings were enhanced with readings from the Sonic Scanner* acoustic scanning platform, which generates a solid-liquid-gas map of the material behind casing. These analyses showed an optimal cement bonding across the treated interval, ensuring that the FUTUR self-healing cement technology would be able to react efficiently and self-repair if the cyclical injection and production stresses were to cause a loss of isolation.

After the success of Cortemaggiore 155dir, FUTUR cement was used for 26 more wells in areas prone to gas leaks after completion. For more than 3 years after implementation, these UGS wells showed no signs of pressure buildup in the annulus or at the surface. FUTUR self-healing cement contained the leaks to protect the environment and the investment made in gas storage.

**Suggested reading**