Avoiding Leaks in Underground Gas Storage
Eni heals flow paths in Italian wells using FUTUR self-healing cement technology

**CHALLENGE**  
Minimize the risk of leaks from underground gas storage (UGS) wells in urban Italy with strict environmental regulations.

**SOLUTION**  
Apply FUTUR* self-healing cement technology, a responsive cement blend with self-healing properties that are automatically activated upon exposure to hydrocarbons.

**RESULTS**  
Completed wells without surface leaks. Achieved an excellent cement bond expected to last for the life of the facilities.

**Consistent leaks in storage wells**  
UGS wells help store natural gas and reduce the risk of service interruption. They often cross multiple hydrocarbon zones and have long lifetimes (80+ years). In Europe, these sites are mostly depleted gas reservoirs into which gas from other sites has been injected.

Operating on behalf of Stogit, Eni worked with Italian depleted gas production reservoirs at average depths of 1,000 to 1,500 m (3,280 to 4,921 ft). High injection pressures, high production rates, and frequent changes in temperature and pressure caused sustained casing pressure (SCP) that compromised well integrity. Leaks were common. Regulations also required low SCP thresholds near urban areas (facilities are located just 80 km [50 mi] from Milan, Italy).

Eni sought to improve its cementing strategy with better isolating properties.

**Self-healing cement blend**  
To counteract gas leakage caused by changes in pressure and temperature after the cementing process, Eni chose to use FUTUR cement, a cement blend with intrinsic self-healing properties automatically activated by hydrocarbon exposure. This technology protects against hydrocarbon leaks and SCP at the wellhead. Pumped and placed as part of a primary cementing operation, the FUTUR cement sheath forms an added isolation barrier above the reservoir. If the sheath becomes damaged, FUTUR cement responds within hours by swelling to close gaps and flow paths.

For the Eni wells, a 1,700-kg/m³ [14.2 lbm/galUS] FUTUR system was used, including the D600G GASBLOK* gas migration additive. The team placed 14 m³ [118 bbl] of slurry behind a 17.78-cm [7-in] liner. Over a 3-year period, 26 wells were cemented with FUTUR self-healing technology.

**Restored well integrity**  
The FUTUR system provided the required level of zonal isolation for the 26 wells. The hydraulic integrity of each was completely maintained—no SCP was experienced after the implementation of FUTUR technology. These successful operations also eliminated the costs related to remedial cementing operations and lost inventory.

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