



### **Process to Confirm that the Leaking Well is Sealed**

#### **California Department of Conservation, Division of Oil, Gas, and Geothermal Resources**

The leaking well (SS25) at the Aliso Canyon Gas Storage Facility will be sealed with cement by the Southern California Gas Company (SoCalGas), which is responsible for the gas leak. The Department of Conservation, Division of Oil, Gas, and Geothermal Resources (Division) is supervising SoCalGas' attempt to stop the leak. The Division will also independently confirm whether the well has been properly sealed by utilizing a series of tests described below. This testing procedure has been established in consultation with technical experts from the Lawrence Berkeley, Lawrence Livermore and Sandia National Laboratories.

SoCalGas is planning to intercept, control and seal the leaking well using a multi-step process. This process includes intercepting the bottom of the leaking well — several thousand feet below where the well appears to be leaking — with a separate relief well, pumping a mud/fluid mixture into the bottom of the leaking well to control and prevent gas from moving up the well, and then pumping cement through the relief well in order to seal the leaking well. As planned, once this process is complete, a cement seal at the bottom of the leaking well will prevent gas from moving up the well. Fluids and mud used to initially control the leak will be displaced by cement and remain above the cement seal. It cannot be predicted how long this process will take, and the Division has required SoCalGas to have in place a contingency plan should this effort not succeed in stopping the leak.

Once the multi-step process to seal the well and stop the leak is complete, SoCalGas will be required to conduct a series of tests mandated by the Division and under the Division's direct supervision. The results of these mandated tests will be posted on the Department of Conservation's website. Additionally, gas emissions at and around the surface of the leaking well will be measured to verify that the leaking well has been effectively sealed.

SoCalGas must complete the following five tests, which will be independently reviewed by the Division, to confirm the seal of the leaking well:

#### **1. Temperature Log/Test**

A sensor will be lowered down the entire depth of SS25 to measure the temperature of the material inside the metal tubing in the well. If the cement seal of the well is not complete, gas leaking around the cement seal will expand and cool, and reduce temperatures within the well above the cement seal. A temperature test that verifies no cooling is taking place above the cement seal indicates that this cement seal is effective. The temperature test will also identify the precise depth of the cement plug within the leaking well.

## **2. Noise Log/Test**

A highly sensitive microphone capable of detecting the sound of gas flowing through fluid will be lowered down the entire length of the well above the cement seal. This microphone will listen for any gas escaping around the cement. If the cement has not properly sealed the well, gas will escape around the cement and form bubbles in the fluid within the well that will be detected by the microphone. The absence of sound above the cement seal indicates an effective seal of the well.

## **3. Fluid Level Monitoring**

As cement is pumped into the leaking well through the relief well, this cement will push the lighter mud and fluid — used to initially control the leak — upward through the inside of the leaking well. These materials will rest on top of the cement seal while the cement hardens. The level of fluids and mud in the leaking well will be measured once the cement is pumped into the well, and will then be monitored as the cement hardens. If the level of the fluids and mud does not fall, this provides evidence that the cement seal is complete and that the gas leak has stopped.

## **4. Cement Bond Test/Log**

A specialized probe will be lowered down the entire length of the leaking well. The probe will indicate the quality of the bond between cement and the well's interior metal tubing, as well as the bond between cement and the well's exterior casing. When the cement is pumped into the leaking well from the relief well, modeling indicates the level of cement will be lower inside the interior tubing than in the surrounding space between the interior tubing and the well's outer casing. This difference in cement level allows the probe to measure the outer ring of cement from inside the interior tubing. Cement with a complete bond to the metal tubing and metal casing further indicates the effective sealing of the well.

## **5. Positive Pressure Test**

Once the test is completed to determine the cement bond to the well (test #4), a hole will be drilled into the interior tubing at a level in the well where cement has hardened between the interior tubing and the well's outer casing. Pressure will be raised inside the interior tubing to demonstrate that the cement outside of the interior tubing, between the tubing and casing, is solid. Passing the pressure test provides further verification that the cement seal is complete.

Once the well is initially controlled with mud and fluids, and safety protocol allows, the California Air Resources Board (CARB) and the South Coast Air Quality Management District (SCAQMD) will monitor for methane emissions at the surface around the well. Also, air measurements will be recorded using downwind airplane flights shortly after the well is controlled. All of these measurements will indicate whether methane and associated compounds are abating. Some amount of residual methane trapped in the soil is expected to seep out of the ground around the leaking well after the well is successfully controlled and then sealed.

Additionally, an infrared camera trained on the leak site will document whether a reduction occurs to the gas plume from the leaking well. When the leaking well is effectively sealed, the plume of methane that has been visible using infrared imaging should slow and ultimately stop.

Real-time air quality monitoring in nearby residential communities, which is ongoing and publicly available through CARB's and SCAQMD's websites, will indicate if levels of methane and benzene measured in the community decrease to background levels expected for the Porter Ranch and surrounding communities. That monitoring will continue for the foreseeable future.

In order to determine the well is sealed, the Division will confirm that the five tests listed above have been successfully completed. Additionally, if air quality measurements taken after the leaking well is controlled do not indicate that leaking gas has diminished consistent with successfully controlling the leak, further investigation will be required in collaboration with CARB and other agencies before the Division confirms the leaking well successfully sealed. Once the criteria explained above have been met, the Division will publicly confirm that the well has been sealed, and will post the test results on its website. It cannot be predicted how long the Division's overall confirmation process will take.