



PROCEDURE FOR THE PLUGGING AND ABANDONMENT OF A NATURAL GAS STORAGE WELL

Procedure #: UICLPG-8

(6/11)

Narrative:

The operator shall submit a plugging and abandonment plan to the Kansas Department of Health and Environment (KDHE) prior to the plugging and abandonment of any natural gas storage well. The operator shall not commence plugging operations until the plan is approved by KDHE.

The well shall be plugged in a manner that will protect the usable or fresh water zones, and the soils from potential pollution. The well casing shall be filled with cement, from total well depth to surface, to prevent potential migration of any contaminants.

The plugging plan shall include the following information:

- A schematic of the well configuration
- A description of how the well will be plugged
- A description of the cement including type, grade, additives, volume of cement mixture slurry weight, and estimated compressive strength of the cement.
- Guidelines for plugging and abandonment (procedure)
- Schedule for plugging the well that provides the opportunity for KDHE to witness the plugging.
- K.A.R. 28-45a-18 establishes the basic plugging and abandonment procedures and requirements.

Procedure:

1. Depressure the cavern by removing all product that can feasibly be removed. Describe the procedure for removing product from the cavern, including any product trapped behind the casing.
2. Fill the cavern with brine.
3. Remove all tubing string(s) from the well.
4. Conduct a gamma-density log to determine the cavern top, salt top and to check for product behind the casing. Before proceeding with the plugging operation, submit to KDHE the log interpretation prepared by a person with the technical expertise to evaluate the log. If the log indicates product behind the casing; submit a plan for removing the product from behind the casing to KDHE for review and approval.
5. Conduct a sonar caliper on the storage cavern as required by K.A.R. 28-45a-13 or by KDHE.

6. Conduct a cement bond log on the production casing. A gamma ray log and collar locator log should be conducted in tandem with the cement bond log. The cement bond log shall consist of amplitude and travel time curves and an acoustic variable density log. Before proceeding with the plugging operation, submit to KDHE the log interpretation prepared by a person with the technical expertise to evaluate the log. If the log indicates poor cement bonding requiring remediation, submit a cement remediation plan to KDHE for review and approval. No cement remediation work shall commence until plan approval has been obtained from KDHE.
7. Conduct a hydraulic pressure mechanical integrity test of the production casing. This test can be conducted at the time of item #10 of these guidelines upon the approval of KDHE. A plan for the test procedure shall be submitted to KDHE for review and approval. The test shall not be conducted until plan approval has been obtained from KDHE. The schedule for the test shall be mutually agreed upon so KDHE may have the opportunity to witness the test. If leakage is indicated by the test, the location of the leakage must be identified to evaluate the impact to the environment. An environmental remediation plan and implementation schedule may be required by KDHE for review and approval. A repair plan for the well may also be required to be submitted to KDHE for review and approval. No work shall commence until plan approval has been obtained from KDHE.
8. All brine displaced from the well during the plugging operation shall be contained in a tank or pit lined with a durable liner. The brine shall be disposed in a manner approved by KDHE. Advise how the brine will be disposed.
9. Set a gas tight mechanical bridge plug in the production casing as deep as feasible in a location where the casing is supported by cement as indicated by available logs. Indicate the location of the mechanical bridge plug in a diagram in the plugging plan.
10. It is recommended a hydraulic pressure test of the plug and casing to a minimum of 300 psi be conducted to determine integrity. If the well has integrity, proceed with the plugging operation. If a lack of integrity is indicated, determine the source of leakage and take necessary remedial action approved by KDHE. If the mechanical integrity test required in item #7 is conducted during this step in the procedure, then all the requirements of item #7 apply at this time.
11. Only materials approved by KDHE may be placed in the production casing.
12. Spot a 50 foot thick thixotropic cement plug on top of the mechanical bridge plug by pumping through cement tubing. Allow the plug to set for 24 hours. Check the well for any signs of gas or leakage of the plug. Tag plug to determine if the plug is set. If plug is set, proceed with the plugging procedures. If a problem is indicated, take necessary corrective action approved by KDHE.
13. Fill the casing with cement, from the bridge plug to surface, by pumping cement through cementing tubing and slowly withdrawing the tubing from the well. The cementing must be done in a manner to prevent the development of voids in the cement column. Cement must circulate to the surface.

14. Remove cementing tubing from the well. Fill casing with cement back to surface. Pressure well to 300 psi and shut-in.
15. After cement has set, check cement level. If cement has fallen back, fill with cement back to surface.
16. Leave some casing above ground surface and establish a monument on the remaining wellhead for elevation survey purposes.
17. Flush or purge all brine and product lines connected to the well. Advise how the flushed or purged brine and product will be handled or disposed.
18. Submit a map showing the tri-coordinate location (includes elevation) of the remaining wellhead to the department within sixty days. The map shall be prepared by a licensed professional land surveyor licensed to practice in Kansas.
19. Submit a plugging report with related details such as copies of cement tickets and job reports to KDHE within 30 days of completing the plugging operation, on a form provided by KDHE.