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Date: NOV 1 0 2016
Symbol: EPC-DO-16-341
LA-UR: 16-28427
Locates Action No.: U1601822

Ms. Michelle Hunter, Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2261
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Ms. Hunter:

SUBJECT: Mechanical Integrity Testing of Injection Wells CrIN-4 and CrIN-5, Discharge Permit DP-1835, Class V Underground Injection Control Wells

In accordance with Condition No. 3 of Discharge Permit DP-1835, the U.S. Department of Energy and Los Alamos National Security, LLC (DOE/LANS) are submitting mechanical integrity test methods for review and approval by the New Mexico Environment Department for the Chromium Pipeline and Infrastructure Project. The methods for ensuring injection well integrity are described below. Supporting information is provided in Enclosures 1 and 2.

1. **Well-Casing Construction.** Critical to well casing integrity is the quality of the welded joints. The integrity of welded joints is demonstrated through compliance with Los Alamos National Laboratory (LANL) Welding Standards. Welders must be certified by performance qualification testing at the LANL test facility. Ten percent of all welded joints are inspected by a qualified LANL Welding Inspector during well-casing construction.

2. **Video Logging**. Downhole video logging was conducted at all existing injection wells (CrIN-1 through CrIn-5). The principal reasons for video logging new wells are to (1) ensure the physical integrity and placement of casings and screens and (2) establish a baseline for future evaluations. The video logs are collected following well development and aquifer testing. Generally, they are a final check of the physical construction of the well. The condition and set depths of the well casing and screen are inspected. Also available from these videos are static water level, water clarity, condition of the filter pack behind the screen, casing joint condition, and any unusual condition in the sump space. Additional video logging may be performed if an injection/pumping system is removed from the well. The original video log will be used as a comparison to evaluate conditions that may affect water well performance, such as mineral encrustation or biofouling within the well screen interval.

   Enclosure 1 contains video logs (on CD) of injections wells CrIN-4 and CrIN-5. Video logs of additional injections wells will be provided as the wells are completed.

3. **Column Pipe.** The column pipe for the injection wells is a spline-lock coupling design manufactured by Johnson Screens. Each coupled union (20-ft pipe joints) is a mating pin-and-box with two inner o-rings and two stainless-steel wire-rope splines. The column pipe is tested for leaks during installation because it relies on the precise installation of the o-rings for sealing. Testing of the column pipe is a hydrostatic test that is also, by default, an additional pressure test of the Baski flow-control valve (FCV) and check valve between the FCV and pump shroud. The FCV in the injection well is open (full flow) at zero pressure. To test the column pipe, the FCV must be pressurized to a shut-in condition (zero flow). The column pipe in each injection well is tested three times as the downhole assembly is installed: once early in the process, a second time approximately at the half way point, and a third time when the assembly is fully installed. The FCV is pressurized and the column pipe is filled with potable water. Upon filling to the top, the water level in the column pipe is observed to see if it remains static or if it falls. A falling water level would indicate a leaky o-ring.

   Tables 1 and 2 below provide the results from three hydrostatic tests of the column pipes at injection wells CrIN-4 and CrIN-5. All tests at both locations passed indicating that that all joints are leak-free.

4. **FCV Installation and Testing.** Critical to the performance and operational integrity of an injection well is the FCV. The FCV regulates recharge injection flow into the well and provides controlled, noncavitating head loss from the column pipe. Because of the design of the FCV, injected water will enter the wells under significantly reduced pressure and velocity. The FCV is pneumatically adjustable, which will allow flexibility in optimizing flows for particular injection wells. The injection wells may require pumping periodically to prevent and/or remedy well-screen plugging. A submersible pump is installed inside a pump shroud beneath the FCV. A check valve is installed between the FCV and pump to allow pumping with a single column pipe when the FCV is shut-in (closed).

   Enclosure 2 provides a copy of the Baski Installation Procedures for the Downhole Flow Control Valve.

Pressure testing of the FCVs at injection wells CrIN-4 and CrIN-5 was conducted per the manufacturer's installation guidance. Testing is conducted to confirm the connections at the control line to FCV fittings and the FCV liquid inflation chamber and inflatable element. (The FCVs are new equipment and are thoroughly tested by the manufacturer before shipping.) This pressure test is conducted at approximately 400 pounds per square inch (psi) for a minimum of 30 minutes.

Tables 1 and 2 below provide the results from testing the FCV at injection wells CrIN-4 and CrIN-5. Test results from additional injection wells will be provided to NMED as the wells are completed.

Table 1. Results from Column Pipe and FCV Testing at Injection Well CrIN-4

Location	Test	Date	Pressure	Duration	Result
CrIN-4	FCV: initial pressure	10/12/16	430 psi	50 min.	Pass
	Column pipe: hydrostatic #1, 20 ft of pipe above FCV	10/13/16	230 psi	15 min.	Pass
	Column pipe: hydrostatic #2, 500.6 ft of pipe above FCV	10/13/16	230 psi	55 min.	Pass
	Column pipe: hydrostatic #2, 1126.6 ft of pipe above FCV	10/15/16	482 psi	60 min.	Pass

Table 2. Results from Column Pipe and FCV Testing at Injection Well CrIN-5.

Location	Test	Date	Pressure	Duration	Result
CrIN-5	FCV: initial pressure	10/16/16	394 psi	57 min.	Pass
	Column pipe: hydrostatic #1, 20 ft of pipe above FCV	10/16/16	200 psi	59 min.	Pass
	Column pipe: hydrostatic #2, 640.6 ft of pipe above FCV	10/17/16	300 psi	16 min.	Pass
	Column pipe: hydrostatic #2, 1219.5 ft of pipe above FCV	10/19/16	520 psi	30 min.	Pass

Please contact Robert S. Beers by telephone at (505) 667-7969 or by email at bbeers@lanl.gov if you have questions regarding the mechanical integrity test methods presented above.

Sincerely,

John C. Bretzke
Division Leader
Environmental Protection & Compliance Division
Los Alamos National Security LLC

Sincerely,

Cheryl L. Rodriguez
Program Manager, FPD-II
Environmental Management
Los Alamos Field Office

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Enclosures:

(1) Video logs (CD) from injection wells CrIN-4 and CrIN-5
(2) Baski Installation Procedures, Downhole Flow Control Valve

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GROUND WATER
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ENCLOSURE 1

Video logs (CD) from injection wells CrIN-4 and CrIN-5

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ENCLOSURE 2

Baski Installation Procedures,
Downhole Flow Control Valve

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Installation Procedure For Downhole Flow Control Valves (FCV™) in Submersible Pump Applications

Warning: Each FCV is shipped filled with inflation fluid. Do not remove caps from fittings on inflation ports when the valve is not in the upright and vertical position.

1. Make the connection between the bottom end of the FCV and the column pipe for the desired valve set depth. If possible, also install the joint above the valve, making sure there will be enough clearance to lift the string back up so that the fittings at the top of the valve are accessible. Lift the string so that fittings A and B (See Figure 1) are in an easy position for making connections.
2. Remove the caps from the stainless steel fittings installed in the inflation ports at the top of the valve, leaving the fittings in place.
3. Check the fluid level in the inflation chamber using a wire or wooden skewer to confirm that the liquid is still inside of the FCV. We recommend that you not use a wire less than 1/8" in diameter. The fill level is stamped on the valve. For instance, "F3.5" stamped on the valve would indicate that the fluid is filled to 3.5 inches below the flat top of the head when the valve is in the vertical position (see Figure 1). If the liquid is within 0.5" of the stamped distance, you are ok to proceed.
4. If necessary, add fluid. Use only propylene glycol, which is non-toxic. To add fluid, put the propylene glycol into a squeeze bottle then inject it through the inflation fittings. If you suspect that most or all of the liquid has drained out of the FCV, call the Baski factory for further instructions.
5. Connect stainless steel tubes to fittings A and B
   a. When connecting tubing to fittings for long-term installations, we recommend that you apply a very thin layer of thread compound (such as Jet-Lube's V2) to the outside surface of the tubing ferrule. We believe this will protect any corrosive elements from getting to the ferrule or deeper in the fitting over time.
   b. For tubing with nuts and ferrules already made up, insert the end of the tubing into the fitting until the end of the tubing reaches the internal shoulder of the fitting. Thread the tubing nut onto the fitting by hand until finger tight.
   c. Use two wrenches (9/16"), one as a backup wrench, to tighten up the tubing nut until a sharp increase in torque is felt. Tighten the nut another 1/16 of a turn.
   d. Cap the back end of one stainless steel tube.

      Tip- When we ship Duplex 2205 tubing for FCVs, we tie the back end of the tubing to the wood flange in two spots several inches apart using wire ties. This allows you to remove the outermost tie so that you can cap the fitting or hook up to it (in the next step) while the second tie holds tension on the tubing and prevents it from trying to unspool.

   e. Connect the back end of the other stainless steel tube to your pressure test tube or fittings, and in turn, the regulator to a nitrogen bottle.
6. Pressurize the FCV to 400psi for a minimum of 30 minutes to check for leaks
   a. It can help to inflate up to a lower pressure initially, such as 100 psi, and pause to listen for any large leaks at any of the connections. Fixing these larger leaks at lower pressures reduces waste of Nitrogen and makes it easier to get everything tight. Once you don't hear or feel any major leaks, inflate up to 400 psi.

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b. Once 400psi is attained, back off the regulator and close the valve on the nitrogen cylinder to create a closed system so that leaks can be more easily detected. Write down the exact pressure on the gauge, along with the time.
c. Check the fittings and connections for leaks at fittings A and B using Snoop (a Swagelok product), a bottle of which is included with each valve, or a soapy water solution. Also check for leaks at the connections to the regulator and any extra fittings between the stainless steel tubing and regulator.
d. Bend both stainless steel tubes together and towards the column pipe, where they will be banded/taped.
e. Wiggle the stainless steel lines above the fittings to simulate vibration and other movement.
f. Continue to check for leaks using Snoop until the valve has been pressurized at 400 psi for a minimum of 30 minutes.

Note: The pressure inside of the tubing may change up or down during the pressure test even without any leaks. Changes in temperature will directly affect the pressure in the tubing. This can happen as a result of a storm moving in to the area, or the sun going behind clouds (or coming out from clouds). When pressure testing at 400 psi, the pressure inside of the tubing and FCV will change approximately 0.75 psi per one degree Fahrenheit in temperature, up or down.

7. If no leaks exist, bleed off the gas, remove the pressure cap and pressure line on the backside of the SS tubing spools, and reconnect the original caps/fittings on the back end of the tubing.
8. Proceed with installation, securing the tubing to the column pipe along the way, next to the pump cable. We recommend that the tubing be secured at least at every coupling and once in the middle of each joint.

Notes:

-It is very helpful to keep control of the stainless steel tubing at all times during installation. Once the end of the tubing is disconnected from the spool, the tubing will want to unspool itself by spinning the spool. If this happens, it is not the end of the world, but you will likely be fighting it all the way down. There are several ways to keep the tubing under control. One method is to hold the two spools together by grabbing the two wooden flanges together with vice grips. This makes them act as one spool. A second vice grip can then be put on the outside flange on one of the spools and used as a stop against the stand that the tubing is held on. If a spooling unit is available, that would work as well.

-You do not need to keep track of which inflation port each of the SS tubes is coming from. The two ports (A&B in Figure 1) access the same liquid inflation chamber inside of the FCV.

-The tubing that we supply with Flow Control Valves is a high strength stainless steel alloy called Duplex 2205. We use it because it has much higher resistance to chloride corrosion than type 316/L SS.

If a chlorine solution is used to sanitize equipment going into the well, the chlorine in the solution must not exceed 200ppm. After using the chlorine solution, water should be injected down the annular area between the OD of the column pipe and the ID of the casing.

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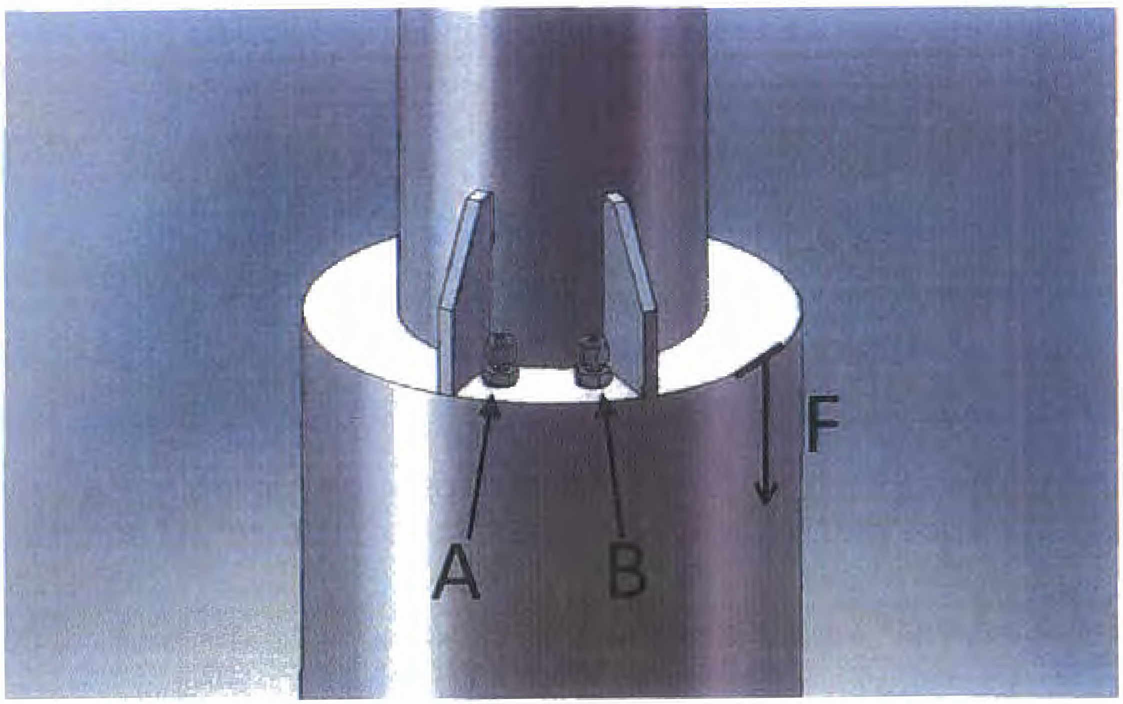

Figure 1: Flow Control Valve Diagram for Installation