ATTACHMENT G: CONSTRUCTION DETAILS

Facility Information

Facility Name: FutureGen 2.0 Morgan County CO_2 Storage Site
IL-137-6A-0001 (Well #1)

Facility Contacts: Kenneth Humphreys, Chief Executive Officer,
FutureGen Industrial Alliance, Inc., Morgan County Office,
73 Central Park Plaza East, Jacksonville, IL 62650, 217-243-8215

Location of Injection Well: Morgan County, IL; 26−16N−9W; 39.80111ºN and 90.07491ºW

Borehole and Casing and Tubing Program for the Horizontal CO_2 Injection Wells

Casing String	Casing Depth, TVD (ft bgs)	Casing Depth, MD (ft bgs)	Borehole Diameter (in.)	Casing Outside Diameter (in.)	Coupling Outside Diameter (in.)	Casing Material (weight/grade/ connection)	String Weight in Air (lb)
Conductor	140	140	30	24	25.198	140 lb/ft, K-55, MTC	19,600
Surface	570	570	20	16	17	84 lb/ft, K-55, BTC	47,880
Intermed.	0-3,150	3,150	14.75	10.75	11.25	51 lb/ft, K-55, BTC	160,650
Long String	0-3,398	0-3,400	9.5	7	7.656	29 lb/ft, N-80, BTC	98,600
	3,398-4,030	3,400-7,004		7	7.669	29 lb/ft, P-110, Premium[(a)]	91, 466
Tubing	3,819.1	3,949	NA	3.5	4.5	9.3 lb/ft, N-80, EUE	36,270

(a) A corrosion-resistant alloy such as 13 Cr (13 percent chromium) having strength properties equal to or greater than 29-lb/ft P-110 and having premium connections will be used for this section. Perforated interval.
EUE = external upset end; TVD = total vertical depth; MD = measured depth.

Properties of Well Casing and Tubing Materials

Casing String	Casing Material (weight/grade/ connection)	Casing Outside/Inside/ Drift Diameter (in.)	Yield (ksi)	Tensile (ksi)	Internal (Burst) Yield (psi)	Collapse (psi)	Tension (1,000 lb) Body (B) Joint (J)	Compression (1,000 lb)
Conductor	140 lb/ft, K-55, MTC	24/22.938/22.751	55	95	2,130	530	(1,967)	1,139
Surface	84 lb/ft, K-55, BTC	16/15.010/14.823	55	95	2,980	1,410	1,326 (B) 1,499 (J)	868
Intermediate	51 lb/ft, K-55, BTC	10.75/9.85/9.694	55	95	4,030	2,700	801 (B) 1,042 (J)	604
Long String	29 lb/ft, N-80, BTC	7.0/6.184/6.059	80	110	8,100	7,020	676 (B) 746 (J)	597
	29 lb/ft, P-110, BTC	7.0/6.184/6.059	110	125	11,220	8,530	929 (B) 955 (J)	488

Casing String	Casing Material (weight/grade/ connection)	Casing Outside/Inside/ Drift Diameter (in.)	Yield (ksi)	Tensile (ksi)	Internal (Burst) Yield (psi)	Collapse (psi)	Tension (1,000 lb) Body (B) Joint (J)	Compression (1,000 lb)
Tubing	9.3 lb/ft, N-80, EUE	3.5/2.992/2.867	80	100	10,160	10,530	207.2 (B) 207.2 (J)	207.2
MTC = metal to metal seal threaded and coupled; BTC = buttress thread coupling; ksi = kilopound per square inch								

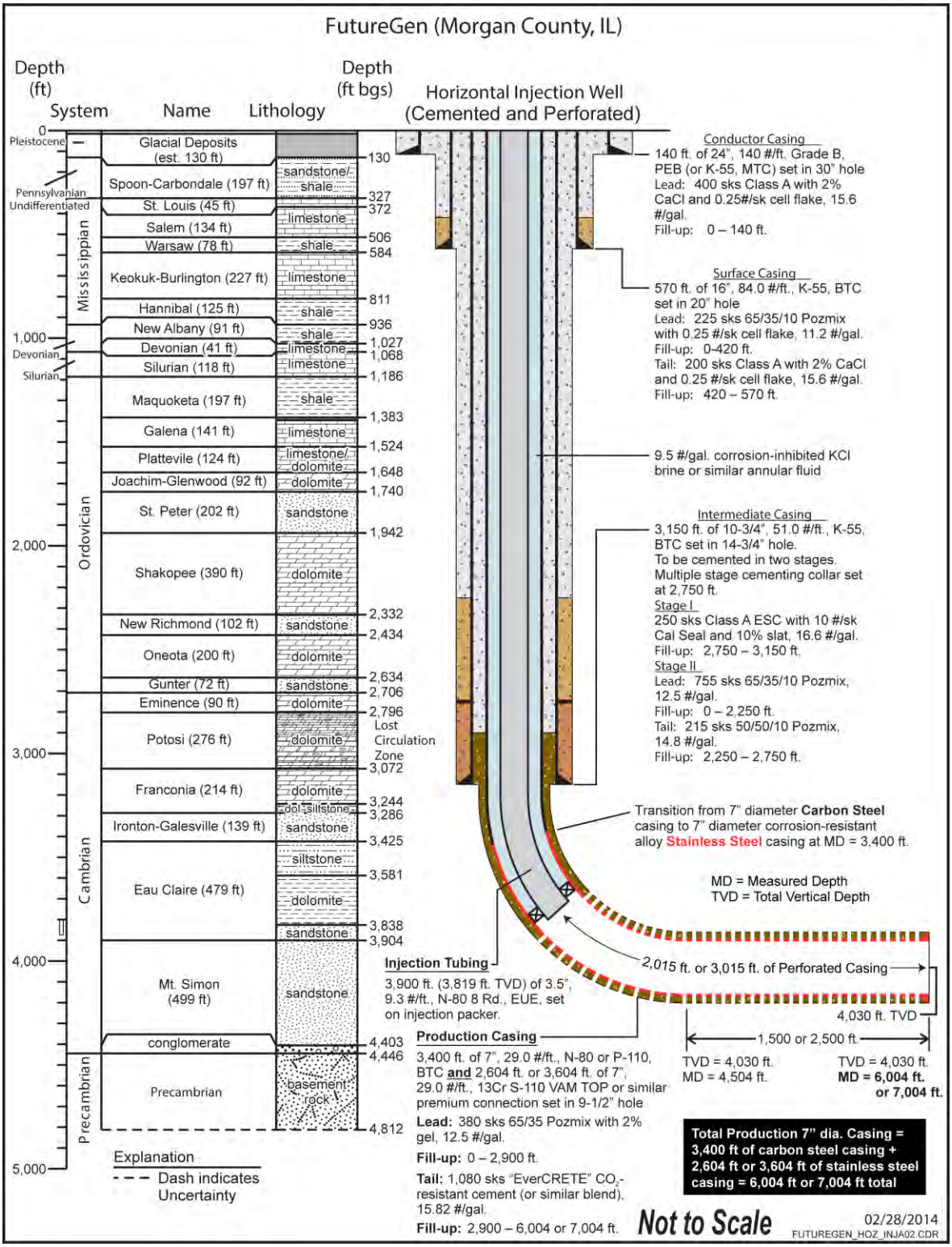

Figure 1. Injection Well Construction Schematic (geology and depths shown in this diagram are based on site-specific characterization data obtained from the FutureGen 2.0 Stratigraphic Well).

Pre-Injection Testing Plan

The pre-operational formation testing program will be implemented to obtain an analysis of the chemical and physical characteristics of the injection zone and confining zone(s) that meets the testing requirements of 40 CFR 146.87 and well construction requirements of 40 CFR 146.86. The pre-operational formation testing program will include a combination of logging, coring, formation hydrogeologic testing (e.g., a pump test and/or injectivity tests), and other activities during the drilling and construction of the CO2 injection well, monitoring well(s), and the FutureGen 2.0 stratigraphic well. The pre-operational testing program will determine or verify the depth, thickness, mineralogy, lithology, porosity, permeability, and geomechanical information of the Mount Simon Sandstone (CO_2 injection zone), the overlying Eau Claire Formation (confining zone), and other relevant geologic formations. In addition, formation fluid characteristics will be obtained from the Mount Simon Sandstone to establish baseline data against which future measurements may be compared after the start of injection operations.

The results of the testing activities will be documented in a report and submitted to the U.S. Environmental Protection Agency (EPA) after the well drilling and testing activities have been completed but before the start of CO_2 injection operations. Before drilling the injection wells, a vertical pilot hole will be drilled through the Mount Simon Formation at the injection well location to collect pre-operational characterization and testing data for the injection wells. After completing the characterization and testing in the vertical pilot hole, the borehole will be plugged (cemented) from total depth to the kick-off point (approximate depth of 3,200 ft bgs) and converted to one of the horizontal injection wells. Additional selected pre-operational testing will be conducted within one or more lateral boreholes. The permittee shall submit to the Director for review all pre-injection testing procedures for logging, sampling and testing required by 40 CFR 146.87 no later than 30 days prior to performing the first test, along with the schedule for such testing. The permittee shall submit any changes to the schedule 30 days prior to the next scheduled test. Testing shall not proceed without the Director's approval of the schedule.

Wireline Logging

Open-borehole logs will be run to obtain densely spaced, in situ, structural, stratigraphic, physical, chemical, and geomechanical information for the Mount Simon Sandstone, the Eau Claire confining zone, and other key formations. Open-borehole characterization logs will be obtained at the surface casing point, the intermediate casing point, and at the long-string casing point (i.e., total borehole depth) in the vertical pilot borehole. Open-borehole wireline logs will not be run in the 30-in.-diameter conductor casing borehole, because logging tools are not suited for this large-diameter hole size. Open-borehole logs for the surface, intermediate, and long-string sections of the well will include a suite of standard logs including gamma ray, formation density, neutron porosity, resistivity, spontaneous potential, photoelectric factor, and caliper. In addition, one or more specialized logs may also be run on the long-string section of the well, including for example, spectral gamma, sonic, resistivity-based and/or acoustic-based image, nuclear magnetic resonance, and elemental capture spectroscopy.

Demonstration of Mechanical Integrity

This table summarizes the MITs and pressure fall-off tests to be performed prior to injection:

Class VI Rule Citation	Rule Description	Test Description	Program Period
[40 CFR 146.89(a)(1)]	MIT - Internal	Annulus Pressure Test	Prior to Operation
[40 CFR 146.87(a)(4)]	MIT - External	Temperature Log	Prior to Operation
[40 CFR 146.87(e)(1)]	Testing prior to operating	Pressure Fall-off Test	Prior to Operation

Additional information about testing procedures is addressed in the QASP attached to the Testing and Monitoring Plan of this permit. A successful test will be confirmed when casing pressure holds for one hour with less than 3% loss or gain in pressure.