

**STATE OF MICHIGAN  
DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY**

**SUPERVISOR OF WELLS INSTRUCTION 10-2023**

**CLASS II INJECTION WELLS – INJECTION OF GASSES UNDER RESERVOIR  
CONDITIONS**

**Purpose**

The purpose of this Supervisor of Wells Instruction is to provide consistent standards for the maximum injection pressure and injectate analysis for the permitting or conversion of Class II Injection Wells that inject gasses under reservoir conditions under the authority of Part 615, Supervisor of Wells, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA), and the administrative rules promulgated thereunder.

**Applicable Statute and Rule**

Section 61506 of Part 615 states:

The supervisor shall prevent the waste prohibited by this part. To that end, acting directly or through his or her authorized representatives, the supervisor is specifically empowered to do all of the following: (a) To promulgate and enforce rules, issue orders and instructions necessary to enforce the rules, and do whatever may be necessary with respect to the subject matter stated in this part to implement this part, whether or not indicated, specified, or enumerated in this or any other section of this part.

R 324.1301 of the administrative rules promulgated under Part 615 states in part:

The supervisor, under section 61506 of the act, may do any of the following:

- (a) Enforce all rules, issue orders, determinations, and instructions necessary to enforce the rules and regulations, and do whatever may be necessary with respect to the subject matter stated in these rules to carry out the purposes of these rules and the act, whether or not the orders, determinations, or instructions are indicated, specified, or enumerated in the act or rules.

**Background**

R 324.807 of the administrative rules promulgated under Part 615 states:

During Class II well injection operations, a permittee shall ensure that the surface injection pressure does not exceed a pressure determined by the following equation:

$P_m = (fpg - 0.433 \times sg)d$  where:

$P_m$  = surface injection pressure

$fpg$  = fracture pressure gradient of the injection interval (if unknown, assume 0.800)

sg = specific gravity of the injection liquid (if unknown, assume 1.2)  
d = depth of the top of the injection interval in feet (true vertical depth).

The value for fpg may be determined by an instantaneous shut-in pressure or data derived from step rate testing. Other information to derive fpg values may be used with approval of the supervisor or authorized representative of the supervisor.

This formula for maximum injection pressure (MIP) is appropriate for injection of liquids, however R 324.807 does not specifically address the injection of gasses at reservoir conditions.

Additionally, R 324. 802(g)(iv) of the administrative rules promulgated under Part 615 states:

A qualitative and quantitative analysis of a representative sample of fluids to be injected. A chemical analysis shall be prepared for each type of fluid to be injected showing specific conductance as an indication of the dissolved solids, specific gravity, and a determination of the concentration of calcium, sodium, magnesium, chloride, sulfate, sulfide, carbonate, total iron, barium, and bicarbonate. However, if the fluid to be injected is fresh water, then an analysis is not required.

This rule is appropriate for the injection of liquids, but this analysis is not applicable to the injection of gasses under reservoir conditions.

The Supervisor of Wells is issuing this Instruction to provide clarity and consistency for the calculation of MIP and injectate analysis for Class II wells that inject fluids that are gasses at reservoir temperatures and pressures.

### **Definitions**

As used in this Instruction:

“Class II Injection Well” means a well that is used for disposal of Class II fluids or for enhanced recovery of oil or natural gas.

"Gas" means a fluid mixture that is in a gaseous state at reservoir temperature and pressure.

### **Instruction**

1. When applying for a Class II well that will inject fluids that are gas under reservoir temperature and pressure the following formula shall be used to determine MIP:

$$P_m = [fpg \times d / \exp^{\{ \text{gas gravity} \times d / (53.34 \times (460 + \text{temp})) \}}]$$

$P_m$  = surface injection pressure

fpg = fracture pressure gradient of the injection interval (if unknown, assume 0.800)

d = depth of the top of the injection interval in feet (true vertical depth)

gas gravity = specific gravity of the injection gas

temp = reservoir temperature in degrees Fahrenheit

2. Chemical composition of the injected fluid shall be submitted at the time of the application.
3. Chemical composition analysis shall include, but not be limited to the following: Hydrogen Sulfide, Nitrogen, Carbon Dioxide, Methane, Ethane, Propane, Isobutane, N-butane, Iso-pentane, N-pentane, Hexanes, Heptanes plus, and Gas Gravity (Air =1.000).
4. A chemical composition analysis shall be submitted to the MiSTAR injection application annually.
5. Maximum bottom hole pressure is determined by the following formula:

$$P_{bh} = P_m \times \exp\left(\frac{\text{gas gravity} \times d}{53.34 \times (460 + \text{temp})}\right)$$

Pbh = bottom hole pressure in psia

Pm = surface injection pressure

gas gravity = specific gravity of the injection gas

d = depth of the top of the injection interval in feet (true vertical depth)

temp = reservoir temperature in degrees Fahrenheit

### **Applicability of Instruction**

This Instruction applies to oil and gas operations commenced after the effective date of the Instruction. Other terms used in this Instruction have the same meaning as in the administrative rules promulgated under Part 615. All other administrative rules promulgated under Part 615 for Class II Injection Wells remain in effect.

### **Exceptions**

The Supervisor may grant an exception to the provisions of this Instruction if necessary to protect the environment, public safety, or worker safety.

THIS INSTRUCTION IS EFFECTIVE December 31, 2023.

Date: December 20, 2023



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ADAM W. WYGANT  
ASSISTANT SUPERVISOR OF WELLS