

## Region 5

### Example: Underground Injection Control Class II Permit Application

**Attachment A:** Area of review methods. Give the method and, if appropriate, the calculations used to determine the size of the area of review (fixed radius or equation). The area of review shall be a fixed radius of 1/4 mile from the proposed injection well unless the use of an equation is approved in advance by the Director.

**Attachment B: Area of review**

Submit a topographic map, extending one mile beyond the property boundaries, showing the proposed injection well and the applicable 1/4 mile radius area of review. The map should include all existing wells, that penetrate the injection zone, along with any surface bodies of water, springs, mines (surface and subsurface), quarries, and other pertinent surface features, including residences and roads, and faults, if known or suspected. Also submit a tabulation of information on these wells which will include the following: well name; surface location; date drilled; state permit #; operator name; total depth and operating status.

**Attachment C: Corrective Action Plan**

Should upward fluid migration occur through the well bore of any previously unknown, improperly plugged or unplugged well due to injection of permitted fluids, injection will be shut-in until proper plugging can be accomplished. The Underground Injection Control Branch of the USEPA must be notified immediately. Should any problems develop in the casing of the injection well, injection will be shut-in until such repairs can be made to remedy the situation. Operations shall not be resumed until the Director gives approval to recommence injection in writing.

**Attachment D: Maps and Cross Sections of USDWs-** Does not apply to Class II wells

**Attachment E: Name and Depth of USDWs-** Provide the geologic name and depth of the formation containing the lowermost underground source of drinking water (USDW), including the depth to the base of the lowest USDW and the method of identification and/or sources of information used to identify the USDW location (USDW is defined as an aquifer or its portion which contains fewer than 10,000 mg/l of total dissolved solids).

**Attachment F: Maps and Cross Sections of Geologic Structure of Area-** Does not apply to Class II injection wells.

**Attachment G: Geologic Data on Injection and Confining Zones-** Provide the name, depth, thickness, and lithologic descriptions of the injection and confining zones.

**Attachment H: Operating Data-** Estimate the proposed maximum injection rate in barrels per day (BBL/Day). The proposed maximum injection pressure should be calculated using the following formula:  $P_{max} = \{ [0.8 - (0.433) (\text{specific gravity of injection fluid} + 0.05) ] \times \text{upper depth of injection formation} \} - 14.7$ . For a fracture gradient above 0.8 psi/ft, the owner/operator needs to submit justification data such as charts, graphs and jobs tickets from a step rate test or fracturing operation. Field data from a well in the same field, which is injecting in the same formation, may be used to justify a fracture gradient of greater than 0.8 psi/ft. This data should include charts, graphs and job tickets from a step rate test or fracturing operation on the well.

**Formation Testing Program:** The testing program, if necessary, must be designed to obtain data on fluid pressure, estimated fracture pressure, physical characteristics of the injection zone. The permittee must notify the UIC Branch at least (30) days prior to any testing and wait for approval.

**Attachment J: Stimulation Program**-Outline any proposed stimulation program.

**Attachment K: Injection Procedures**- Describe the proposed injection procedures including pump, tank etc.

**Attachment L: Construction Procedures**-This should include details of the casing and cementing program, logging procedures, deviation checks, drilling, testing program, and the nature of the annulus fluid.

- Surface casing size and weight, setting depth, # of sacks of cement, hole size
- Intermediate casing size and weight, setting depth, # of sacks of cement, hole size
- Longstring casing size and weight, setting depth, # of sacks of cement, hole size
- Size and weight and length of the tubing,
- Size and model of the packer and the setting depth

For a converted well, the owner/operator must submit along with the permit application the following information: state completion report, well rework record and cementing tickets for **all** work done on the well.

**Attachment M: Construction Details**-Submit schematic or other appropriate drawings of the surface and subsurface construction details of the well. Include a description of the exact point at which the injection fluid will be sampled. Sample well schematics are attached.

**Attachment N: Changes in Injection Fluid**-Does not apply to Class II injection Wells

**Attachment O: Plans for Well Failures**-Outline contingency plans to cope with all shut-ins or well failures, so as to prevent migration of fluids in any USDW.

**Attachment P: Monitoring Program**-The monitoring program for this well will consist of compliance with the EPA permit requirements of filing Monthly, Quarterly and Annual reports.

**Attachment Q: Plugging and Abandonment (P&A) Plan**-Submit a plan for plugging and abandonment of the well:

- All uncemented casing ripped.
- Plug of at least 250 feet immediately above the injection zone or
- 50 feet of cement immediately above a cast iron bridge plug. 250 feet is required above cement retainer if situated adjacent to the injection zone.
- Cement plug set at least 50 feet above and 50 feet below any casing rip point.
- If surface casing is not cemented to surface, a cement plug set at least 50 feet below the lowest USDW to surface.
- If surface casing is cemented to surface and extends below the lowermost USDW, a cement plug from at least 50 feet above the USDW base to 50 feet below the shoe is required and a cement plug from at least 50 feet depth to the surface is required.
- If surface casing is cemented to surface and the lowermost USDW is below the surface casing setting depth, a cement plug from at least 50 feet below the USDW base to 50 feet above the casing shoe is required and a cement plug from at least 50 feet depth to the surface is required.
- If the lowermost USDW depth is less than 500 feet, then set a continuous cement plug from 50 feet below the lowermost USDW to the surface.

**Example of how to calculate cement plug:**

From Halliburton cementing Tables: Section #210 Capacity:

5-1/2" casing and 15.5 lb weight	7.483 ft/ft <sup>3</sup>
7-7/8" hole	2.9565 ft/ft <sup>3</sup>

For Class A cement, the slurry volume is 1.18 ft<sup>3</sup>/sack of cement

For cement plug calculation in open hole and across perforations, 20% excess cement is used.

Example: # of sacks =  $\frac{(\text{bottom of plug} - \text{top of plug}) \times 1.2}{1.18 \text{ ft}^3/\text{sack} \times 2.9565 \text{ ft}/\text{ft}^3}$

For cement plug calculation inside 5-1/2 casing and weight 15.5#:

Example: # of sacks =  $\frac{\text{bottom of plug} - \text{top of plug}}{1.18 \text{ ft}^3/\text{sacks} \times 7.483 \text{ ft}/\text{ft}^3}$

An actual P&A plan sample is attached.

Include a detailed plugging cost estimate from an independent contractor which is broken down to include costs of cement, labor, rig time, materials, etc.

**Attachment R: Necessary Resources:** Submit evidence to verify that the financial resources that are necessary to close, plug and abandon the well are available. One of the following mechanisms may be used to meet the UIC requirements:

- 1) A Surety Bond along with a Standby Trust Fund
- 2) A Letter of Credit along with a Standby Trust Fund
- 3) A Trust Fund
- 4) State Mechanisms (the permittee needs to provide a copy of the state mechanism such as a surety bond, a letter of credit, a certificate of deposit or a blanket bond) along with a letter requesting acceptance of the state mechanism. Whenever a state blanket bond is used as a financial mechanism to cover the cost of plugging the well, the permittee is required to provide a list of all wells (producers and injectors) covered by the blanket bond and the estimated plugging cost for each well.
- 5) Financial Statement Coverage - the following are required when financial statement coverage is used as financial mechanism: chief financial officer's letter, an independent auditor's opinion of examination of the company's financial statements and a public accounting firm's statement of validation of the financial information in the chief financial officer's letter. Enclosed is a brochure discussing financial mechanisms.

**Attachment S: Aquifer Exemptions-**If an aquifer exemption is requested, submit data necessary to demonstrate that the aquifer meets the following criteria: (1) does not serve as a source of drinking water; (2) cannot now and will not in the future serve as a source of drinking water; and (3) the TDS content of the ground water is more than 3,000 and less than 10,000 mg/l and is not reasonably expected to supply a public water system. Submit data to demonstrate that the aquifer is expected to be mineral or hydrocarbon producing, or can be demonstrated by a permit applicant as part of a permit application for a Class II operation to contain hydrocarbons that considering their quantity and location are expected to be commercially producible.

**Attachment T: Existing EPA Permits-**List program and permit number of any existing EPA permits, for example, NPDES, PSD, RCRA, etc.

**Attachment U: Description of business** Give a brief description of the nature of the business, ( As an example, the company is involved in the exploration, production, and marketing of crude oil and natural gas).

**APPENDIX** should include the following:

- 1) List of names and addresses of all landowners of record within the 1/4 mile radius area of review of the proposed injection well along with a map showing landowners.
- 2) Evidence to verify that you have provided the State Historic Preservation Office (SHPO) with a topographic map which clearly shows any existing and all proposed road construction or

improvement leading up to the site. This information, which is required in order to complete the process of coordination specified in the National Historic Preservation Act, Section 106, should be submitted directly to the State Historic Preservation Office. A copy of the SHPO letter clearing the project must be submitted to the UIC Branch. You may contact SHPO at the following address:

Kristine Wilson, Environmental Review Coordinator  
State Historic Preservation Office  
Bureau of History  
717 West Allegan Street, 5th floor  
Lansing, Michigan 49918

3) If the proposed well location is in a county that borders the Great Lakes, the owner or operator needs to provide evidence that they have contacted the State Coastal Zone Management Program (CZMP) notifying them of the proposed activity. A copy of the CZMP letter clearing the project must be submitted to the UIC Branch. You may contact CZMP at the following address:

Cathy Cunningham, Land and Water Management Analyst  
Michigan Department of Natural Resources  
Division of Land and Water Management  
Coastal Management Program, P.O. Box 30458  
Lansing, Michigan 48909

4) Record of state completion and/or plugging for all area of review wells if applicable.

5) An analysis of the physical and chemical characteristics of the injection fluid, along with the description of the source of the injection fluid. The fluid analysis shall include, but not be limited to the following: Sodium, Calcium, Magnesium, Barium, Total Iron, Chloride, Sulfate, Carbonate, Bicarbonate, Sulfide, Total Dissolved Solids, pH, Resistivity (ohm-meters), and Specific Gravity.

Plug #1

a) Number of sacks from 2000 feet to 1800 feet with 20 % excess

$$\# \text{ of sacks} = \frac{(2000 \text{ feet} - 1800 \text{ feet}) \times 1.2}{1.18 \text{ ft}^3/\text{sack} \times 2.9565 \text{ ft}/\text{ft}^3} = 69 \text{ sacks}$$

b) Number of sacks from 1800 feet to 1550'(250' above injection zone)

$$\# \text{ of sacks} = \frac{250 \text{ feet}}{1.18 \text{ ft}^3/\text{sack} \times 7.483 \text{ ft}/\text{ft}^3} = 29 \text{ sacks}$$

Plug #2

# of sacks from 750' (50' below surface casing shoe) to 550' (50' above lowest USDW)

$$\# \text{ of sacks} = \frac{750' - 550'}{1.18 \text{ ft}^3/\text{sack} \times 7.483 \text{ ft}/\text{ft}^3}$$

Plug #3

# of sacks from 50' to surface

$$\# \text{ of sacks} = \frac{50'}{1.18 \text{ ft}^3/\text{sack} \times 7.483 \text{ ft}/\text{ft}^3}$$

## Figures

### Plug #1

- a) Number of sacks from 2000 feet  
To 1800 feet with 20% excess

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1550' (250' above injection zone)

$$\# \text{ of sacks} = \frac{250 \text{ feet}}{1.18 \text{ ft}^3/\text{sack} \times 7.483 \text{ ft}/\text{ft}^3} = 29 \text{ sacks}$$

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### Plug #3

# of sacks from 50' to surface

$$\# \text{ of sacks} = \frac{50'}{1.18 \text{ ft}^3/\text{sack} \times 7.483 \text{ ft}/\text{ft}^3}$$









