WELL INSPECTION MANUAL FOR
CLASS I INJECTION WELLS

I. INTRODUCTION

In Kansas, the subsurface environment has been used for many years for the injection of fluids. After several incidents nationwide involving pollution which was traced to the use of injection wells, it was realized injection activities could contaminate groundwater if not conducted under strict controls. This realization prompted Congress to enact the Federal UIC program as a part of the Safe Drinking Water Act of 1974. In December of 1983, the Kansas Department of Health and Environment (KDHE) received primacy from EPA to administer the UIC program in Kansas for Class I, III, IV and V wells. The purpose of the UIC program is to prevent endangerment of the environment and human health by injection activities.

The Geology Section within the KDHE Bureau of Water, administers the Underground Injection Control (UIC) program. The UIC program regulates the subsurface emplacement of fluids through injection wells. Injection wells are placed into six classifications:

- **Class I:** These wells inject hazardous waste, as defined under the Resource Conservation Recovery Act (RCRA), and non-hazardous wastes into deep rock formations that are separated vertically from the lowermost source of fresh or usable water by many layers of impermeable shales and limestones.

- **Class II:** These wells are used for injection of fluids brought to the surface in connection with oil and natural gas production. The Kansas Corporation Commission regulates Class II wells.

- **Class III:** These wells inject fresh or slightly mineralized water for the extraction of salt from underground formations.

- **Class IV:** These wells inject hazardous waste, as defined under RCRA, or radioactive wastes into or above the fresh or usable water zone. These wells are prohibited because they directly endanger the environment and human health.

- **Class V:** These are wells not included in Class I, II, III or IV. Typically Class V wells are shallow wells used to place a variety of nonhazardous fluids, that is those wastes which are not hazardous waste under the RCRA, directly below the land surface. However, there are some deep Class V wells that inject below the lower most source of fresh or usable water.

- **Class VI:** These wells inject carbon dioxide (CO₂) for long term storage, also known as Geologic Sequestration of CO₂.
II. DEFINITIONS

**Annulus:** is the space between the cemented longstring well casing and the injection tubing.

**Fluid:** means any material or substance which flows or moves whether in a semisolid liquid, sludge, gas or any other form or state.

**Injection:** is defined as the subsurface emplacement of fluids through a well.

**Injection well:** is defined as a bored, drilled or driven shaft; or a dug hole whose depth is greater than the largest surface dimension; or an improved sinkhole; or a subsurface fluid distribution system used for the subsurface emplacement of fluids.

**Packer:** is a device lowered into a well used to produce a liquid-tight seal.

**Injection tubing:** is a smaller diameter uncemented casing string hung inside the longstring casing which is used to convey the injection liquid into the disposal formation.

**Seal pot:** is a metal tank which is connected to the tubing/casing annulus of an injection well to continuously maintain pressure on the annulus, to monitor the annulus liquid level and to allow expansion of the annulus liquid. The seal pot is partially filled with liquid and has a pressurized gas (usually nitrogen) blanket above the liquid. Temperature changes of the annular liquid can cause wide fluctuations of annulus pressure in the tightly sealed annulus space which could damage the well components. The gas blanket minimizes the pressure fluctuations by allowing for liquid expansion/contraction. A sight glass on the tank allows for the liquid level to be observed by the operator (See Figure 3).

III. ROUTINE FIELD INSPECTIONS

- **Purpose:**
  The purpose of periodic routine field inspections is to check the well for assurance that operations are being carried out in accordance with permit conditions or rules, that repairs are being made as required or that enforcement actions are satisfactorily resolved. Field presence and feedback are necessary to implement an effective program.

- **Timing:**
  The number of routine inspections required per each well class are negotiated each year between KDHE and EPA. The numbers agreed upon are included in the State/EPA Workplan. A number of factors are considered when determining which wells to inspect. These factors include the date of the last inspection, compliance history and characteristics of the injected fluid.

- **Authority:**
  The authority to allow KDHE inspection and right of entry is established at KDHE regulation K.A.R. 28-46-35. The right of inspection and entry is also listed in the Standard Conditions of the UIC permits.
IV. **PROCEDURE**

Below is a discussion of the procedure to follow for inspection of Class I wells: Figure 1 depicts a common Class I well surface configuration.

- Contact a representative at the facility to arrange a time for the inspection. Although KDHE has authority to conduct unannounced inspections, it is generally best to make prior arrangements for a routine inspection. This will assure that a person familiar with the well will be available during the inspection to advise of the operation of the system and for answering any questions. Also, any delays of waiting for appropriate personnel to arrive should be eliminated.

- The following are the requirements for the electronic continuous monitoring system.
  - The continuous recorder must be able to collect and record annulus and injection pressure readings, for each well as required by regulations and the permit, a minimum of every 30 seconds. However, KDHE would prefer readings be collected and recorded on a more frequent time interval. (Most units are capable of collecting and recording readings every 5 seconds.)
  - The continuous recorder must have alarm capabilities to notify the operator of any violation of annulus and/or injection pressure limits.
  - The recorder must have a battery back-up or alternative power supply to ensure continued collection of data during power failures.
  - The electronic data from the continuous recorder must be stored on multiple sources of data storage media for redundancy. The data must be backed up to a computer server, zip drive, compact disk, or other electronic media storage device.
  - Multiple sources of data storage maybe necessary to ensure compliance with the 3-year record retention requirement.

- Make sure all monitoring devices are in place and are operational. (See attached Figure 2 depicting a typical Class I wellhead, including monitoring devices.)
  - **Pressure gauge and pressure transmitter for measuring annulus pressure.** Sometimes the gauge is located on top of the seal pot.
  - **Pressure gauge and pressure transmitter for measuring injection tubing pressure.** The gauge should record both vacuum and positive pressure.
  - **Flow meter.** These meters should have a totalizer to show the total volume injected. Also, an injection rate should be obtained either by calculation using an injection volume per unit of time or from an instantaneous reading.
○ **Seal pot.** The sight glass on the seal pot must be clean so a fluid level can be obtained. A scale should be mounted on the sight glass. There will probably be a nitrogen tank with a pressure regulator attached to the seal pot so nitrogen can be added if necessary.

- If the well is located in a sump or pit, note if any liquid is present. The sump must be essentially empty at all times.

- Obtain readings from monitoring devices and observe condition of wellhead and associated equipment. Record the data on the inspection form (See Attachment 1). The following readings and observations must be taken:

  ○ **Annulus pressure.** A reading from the gauge and the electronic continuous recorder is needed. The readings of the continuous recorder should vary by no more than 5% of the gauge reading. The UIC permit establishes the minimum annulus pressure required for the well.

  ○ **Injection pressure/vacuum.** A reading from the gauge and the electronic recorder is needed. The readings of the continuous recorder should vary by no more than 5% of the gauge reading. The UIC permit and regulations establish the maximum injection pressure. The injection pressure is limited to “gravity” and in no case shall exceed 35 psig. No pump pressure is allowed.

  ○ **Seal pot level.** Record the fluid level in the seal pot by reading the level observed in the sight glass. The sight glass should be clean so the level can be easily seen and a scale should be mounted on the sight glass. The UIC permit requires the liquid level to be visible in the sight glass at all times.

  ○ **Flow meter.** If the well is being used for injection during the time of inspection, record the flow rate. Some wells have meters with digital readouts or with needle readouts that show instantaneous flow rates in gallons/minute or some other volume per time period. Many wells have meters with a needle which revolves around a dial to register a volume of flow per each revolution. To obtain a flow rate, the needle revolutions must be observed for a minute or more to obtain flow in gallons/minute.

  ○ Make note of condition of the wellhead and associated equipment. Check for leaks, seeps, spills, corrosion. Make sure all monitoring equipment is in place and operational. If a sump or pit is present, note if it is wet or dry.

- During the inspection, advise the facility representative of any problems, violations or corrective action needed.

V. **REPORT FORM**

A KDHE report form documenting the inspection must be completed by the KDHE representative for each well inspected. An example of the form is included as Attachment 1. Submit an originally signed form to KDHE, Geology Section, 1000 SW Jackson Street, Ste. 420, Topeka, Kansas 66612.
An original, signed copy of the report form is kept for the KDHE files. A copy of the signed form is provided by KDHE to the owner/operator for their files.

The form is available at the following website:

Figure 1

Class I Injection Well

Seal Pot

Sight Glass

Injection Tubing

Nitrogen tank

Annulus Line to Seal Pot

Annulus
TYPICAL CLASS I WELL CONFIGURATION

- Injection String or Tubing
- Packer
- Long String
- Cement
- Staging Collar
- Intermediate String
- Surface Pipe
- Annulus Noncorrosive Fluid
- Cement
- Fresh Water Zones
- Annulus Pressure Gauge and Pressure Transmitter
- Tubing Injection Pressure Gauge and Pressure Transmitter
- Waste
- Porous Dolomite Disposal Zone

Figure 2
TYPICAL ANNULUS SEAL POT CONFIGURATION

Figure 3
## INSPECTION REPORT FOR CLASS I INJECTION WELL

### WELL IDENTIFICATION

<table>
<thead>
<tr>
<th>Type of Inspection:</th>
<th>Announced</th>
<th>Unannounced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of Inspection:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time of Inspection (24 hour):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Well No.:</td>
<td>Permit No.:</td>
<td></td>
</tr>
<tr>
<td>1/4 1/4 1/4</td>
<td>Section Township South Range E/W County</td>
<td></td>
</tr>
</tbody>
</table>

| Owner/Operator: |

### INSPECTION INFORMATION

<table>
<thead>
<tr>
<th>Type of Well:</th>
<th>Hazardous Waste Disposal</th>
<th>Non-Hazardous Waste Disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injection Pressure:</td>
<td>Gauge</td>
<td>Continuous Recorder</td>
</tr>
<tr>
<td>Annulus Pressure:</td>
<td>Gauge (psig)</td>
<td>Continuous Recorder (psi)</td>
</tr>
<tr>
<td>Injection rate (gpm):</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Condition of wellhead and associated lines, tanks, meters, gauges, emergency containment structure (corrosion, leakage, operational, etc.) |

### RECOMMENDATIONS OR COMMENTS

### PERSONNEL MET DURING INSPECTION

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Signature of Inspector | Title | Date
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4/2011