



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 6  
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DALLAS TX 75202-2733

MAY 2 2011

Ms. Lori Wrotenbery, Director  
Oil and Gas Conservation Division  
Oklahoma Corporation Commission  
P.O. Box 52000-2000  
Oklahoma City, OK 73152-2000

Dear Ms. Wrotenbery:

Enclosed is our evaluation of Oklahoma's Class II Underground Injection Control (UIC) program performance during state fiscal year 2010 (FY10). On September 15, 2010, Ms. Nancy Dorsey met with Oklahoma Corporation Commission (OCC) representatives Mr. Charles Lord, Mr. Tim Baker and Ms. Patricia Downey to discuss current UIC program implementation. Mr. Michael Vaughan (via phone) of EPA's Grants Section participated for the grants discussion on September 21, 2010. By e-mail on December 15, 2010, we invited OCC's comments on the draft evaluation. This report considers OCC's comments received by e-mail on February 3, 2011.

First, we would like to commend OCC on the continued and streamlined productivity of the department. We would also like to commend OCC on several program areas:

- ❖ The number of 5-year mechanical integrity tests (MITs) submitted, performed and witnessed continues to exceed minimum requirements.
- ❖ Well handled brine contamination investigations.
- ❖ OCC showed continued innovation and effective use of special project funding as documented in OCC's Annual UIC Narrative for FY09, (see Appendix B).
- ❖ The initial RBDMS modules are up, with considerable unseen effort made to combine to disparate well database systems.
- ❖ The combination of improved information tracking and enforcement initiative has greatly increased operator compliance in reporting.

The primary issues discussed in this report involve changes in OCC procedures; review methods; quality assurance procedures; and needed program revisions. These were discussed with your staff during the September 15<sup>th</sup> End-of-Year (EOY) conference or follow-up e-mail.

Oklahoma Corporation Commission (OCC) initially submitted their draft SDWA 1425 primacy revision package covering changes to the Class II Underground Injection Control (UIC) program, on November 30, 1998. Following efforts were ineffective in reaching resolution. EPA requests a new draft submission to cover all changes from Oklahoma's applicable Class II UIC primacy program pursuant to the requirements of 40 CFR §145.32, in order to assure OCC's Class II primacy program meets Safe Drinking Water Act (SDWA) protection standards.

Ms. Lori Wrotenbery

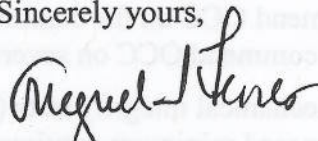
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In addition, OCC and the Oklahoma Department of Environmental Quality (ODEQ) submitted the draft SDWA 1422 primacy revision package to Region 6 in June 2000. Subsequently, changes to both EPA's Class V federal permitting requirements and Oklahoma's program took place. ODEQ has their submission ready, but the package requires revisions from OCC Oil and Gas Division (Class V brine recovery operations) and the Petroleum Storage Tank Division (Class V wells for aquifer remediation activities associated with leaking aboveground and underground storage tanks).

Oklahoma is one of the states selected for a Headquarters Part 147 update pilot project. As such, the program revision packages will be receiving high-level attention within both Oklahoma government and the EPA hierarchy. Please do not hesitate to communicate with us any major hindrance to the package submissions. Upon receipt of either complete revision package (SDWA 1425 or 1422), Region 6 will evaluate and process the revisions pursuant to 40 CFR §145.32.

I thank you and your staff for your efforts in the implementation of this challenging program. I consider our open dialogue a key component of effective communication between our agencies. If you have any questions on the evaluation report or the revision requests, you may contact me at (214) 665-7100, or your staff may call Stacey Dwyer or Philip Dellinger of my staff at (214) 665-7150.

Sincerely yours,



Miguel I. Flores  
Director

Water Quality Protection Division

Enclosure

cc: Charles Lord, OCC UIC Manager, w/encl.

**EPA Region 6  
End-Of-Year (EOY) Review**

**Oklahoma Corporation Commission (OCC)  
Underground Injection Control (UIC) Program**

**State Fiscal Year 2010 (FY10)  
July 1, 2009 through June 30, 2010**

**I. INTRODUCTION**

This report is broken into six main sections: [Introduction](#), [Grant Work Plan](#), [Program Revisions](#), [OCC Procedural Areas](#), [UIC Oversight Issues](#), and [Summary and Recommendations](#)<sup>1</sup>. Additional information is included in the appendices.

By EPA delegation, the Oklahoma Corporation Commission (OCC) is the lead agency for the State's Class II injection wells while the Oklahoma Department of Environmental Quality (ODEQ) implements the applicable State UIC program for all other injection wells in Oklahoma. (This does not match the state delegation—see Program Revisions.) EPA maintains authority for Class I, III, IV and V on all Indian Lands and Class II on some Indian Lands not under the authority of OCC. This annual review considers the approved State UIC program administered by OCC, including the UIC grant work plan and other program activities, between July 1, 2009 and June 30, 2010.

On September 15, 2010, EPA Region 6 representatives spoke with OCC management for EPA's annual end of year (EOY) evaluation. The September 21, 2010, teleconference covered the grants portion of the EOY. (See [Appendix A](#) for attendees of both conferences). [Appendix B](#) contains OCC's annual narrative required in the FY10 UIC grant work plan.

**II. GRANT WORK PLAN**

**A. FY2010 Grant**

OCC's FY2010 application was for a total of \$1,047,220 in Federal funds. EPA approved \$289,000 as the Federal 2010 allotment for the State of Oklahoma's UIC program administered by the OCC, and awarded this amount to OCC in FY2010. In addition, EPA awarded OCC \$56,528 in UIC Special Project funds in 2010:

- \$43,122 in general UIC Special Project funds,
- \$4,306 in UIC Special Project travel funds to attend the Fall 2009 "Cased Hole and Production Log Training", and
- \$9,100 in UIC Special Project funds carried over from FY2009 to allow OCC to complete their project work.

Work plan Deliverables—[Table 1](#) identifies State program updates and other deliverables required during FY10. OCC submitted most quarterly and annual reporting items although several were late:

- Most of the 7520's, the quarterly lists of terminated injection orders and the annual narrative were late.

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<sup>1</sup> Blue, underlined words are hyperlinked for easier electronic navigation. You can add a 'back button' by going to View: Toolbars: Web.

- A letter received June 9, 2010 listed the single, possible UIC violation in which leakage or discharge took place into a USDW. No significant noncompliance (SNC) took place as OCC had taken action before the end of that quarter.

**Table 1. Grant Deliverables**

Deliverable	Due Date	Date Received
Form 7520 Quarterly Reports	January 30, 2010 April 30, 2010 July 30, 2010 October 30, 2010	February 25, 2010* June 11, 2010* August 9, 2010* December 09, 2010
Grant Work plan/Application: FY10	May 1, 2009	May 6, 2009
Annual UIC Narrative Report	August 15, 2010	October 1, 2010
Final Financial Status	September 30, 2010	September 7, 2010
UIC Well Inventory	October 30, 2009 or on request	On time, Part of PAM**
EPA PAM Reporting	Within 7 days of EPA request	On time
Revised QAPP	Extended to Nov. 2, 2009	Approved Oct. 6, 2009

\* Without additional information listed in Workplan: quarterly terminations & leakage/discharge to USDW lists; semi-annual SNC summaries.

\*\* Program Activity Measures (PAM)

## B. Special Projects

EPA commends OCC on their continuing commitment to improving their information resource base through Special Project initiatives, such as the Well Location Project; georeferenced archival aerial photos; Document Imaging; and attending the Cased Hole and Production Log Analysis Training. The OCC Narrative in [Appendix B](#) describes the status of OCC's special projects for the year.

## III. PROGRAM REVISIONS

Progress on longstanding program revision issues appears to be forthcoming, as both EPA and OCC have committed to recommencing efforts to update the 1425 and 1422 programs for the 40 CFR Part 147 submissions. EPA provided copies of the appropriate guidance documents and crosswalk information needed for the states and EPA to develop and process revisions to State UIC programs, on October 6, 2010.

Federal rule 40 CFR 145.32 requires crosswalks and program revisions from the original approved programs to Oklahoma's UIC programs as currently implemented. EPA requests OCC submit the Class II UIC revision package, in redline-strikeout form, to expedite EPA's review and subsequent discussions. Regulatory and statutory information should be in pdf format. Ultimately, the revision will require EPA Headquarters' approval. A separate effort for Oklahoma's 1422 UIC program revisions requires both ODEQ and OCC participation. EPA understands that ODEQ has prepared its part.

## IV. OCC PROCEDURAL AREAS

Like all state and federal agencies, OCC's UIC office has undergone numerous changes through advances in technology and personnel changes. Each provides opportunities to review and modify procedures. All programs benefit from this reassessment, which is part of the basis of the Quality Management / Quality Assurance system that EPA requires of itself and all grantees.

EPA commends OCC for creating a number of tracking spreadsheets prior to full RBDMS implementation. Any design, which minimizes the room for error, while collecting information and semi-automating reporting, is commendable. EPA has several procedural recommendations, (discussed further later in this document):

- Refine the application review system to include quality assurance/data verification information to be included in the scanned exhibit package.
- Create a form, or forms, for reporting each type of periodic UIC requirement, not limited to static levels in monitor wells, production or perhaps days producing from intercept wells, special logging run dates, and fluid levels in simultaneous injection wells.
- Switch the new permit forms to fillable pdf forms, only permitting information in certain blocks and/or choices from specific options. Automatic collection of the information to a database on permit finalization would be preferable.
  - Add lines to enter any necessary permit numbers, such as the order amended, any *Nunc Pro Tunc* (Scribner error correction), Exception Order, or possibly Emergency Orders.
  - Add a place to include the field and producing unit to the EOR application.
  - For wells that are ‘to be drilled’, perhaps the spud date would be useful.

#### **A. New Permit Procedure**

The new injection permit process has now been in effect over a year. The new form has the advantage of providing terminology that is more consistent, and it is easier to make corrections. OCC immediately fixed minor problems noted during review.

As with any, new system it takes time and a lot of fine-tuning to reach full efficiency. Educating the operators and the public on the intricacies of the new procedure should be a priority, followed by simplifying in-house procedures. Externally there are two issues: operator confusion as to the application process and logical public access to the permits. Internally, EPA recommends greater consistency with the Pollution Docket system, specifically scanning all applications on receipt.

Operators need to understand the difference between the two procedures and the circumstances that dictate the choice. EPA suggests including clear instructions along with the application forms.

- As EPA understands the current injection application system, the original, pollution docket (PD) order applications apply to all court hearing cases (protested applications, operator requests, emergency permits and/or rule exception requests). Protested permit application receive a PD number and go to the clerk’s office, otherwise only the UIC Department handles them.

Public access to the new permit information online is currently difficult, unless someone literally guides you through the process. While there is a distinct legal difference between an injection permit and an injection order, it is irrelevant to the public. Within OCC, that difference appears on one hand to smooth some problems and on the other to create new ones.

- The OCC Imaging Web Application is the portal for public access. *OAP Orders and Case Files* literally refers to all court orders. EPA understands the only place easily updated to accept the new permits was under *UIC 1012, 1072 and 1075 Forms*, but the name refers only to forms filed for injection operations, not permits.

#### **B. QAPP**

Currently, it is difficult to tell if an issue is truly quality related or simply information not scanned into the exhibit package. Quality Assurance Project Plans (QAPP) should minimize ‘grey areas’.

Based on findings discussed in the EOY meeting, EPA makes two requests:

- First, amend the QAPP to incorporate clear-cut data validation methods for any collected information open to interpretive error or license. Examples are available on either EPA's website<sup>2</sup> or on other state agency websites. Major data categories to include follow:
  - Static level measurements;
  - Production logging, and
  - Field tests not already covered in sufficient detail;
- Second, include the appropriate QAPP validation information in the exhibit package.

### **C. Stipulations**

Typical permit stipulations added to an injection permit include requirements to monitor nearby wells, and to run initial and/or periodic radioactive tracer surveys. These are an important part of ensuring ground water protection. EPA is pleased with OCC's special grant project to list all active order stipulations and have them accessible to the inspectors.

Creating appropriate forms will both enable operators to file the information and OCC to track it. Tracking compliance of special stipulations, such as the annual RAT, various period water level recordings and production requirements, is an integral part of program effectiveness. Specific examples, to cover cases found during the permit review:

- Exception 569013 & injection 571177 orders, substitute running a radioactive tracer survey (RAT) in lieu of a mechanical integrity test. A RAT for this purpose is acceptable if properly run for that specific purpose, i.e. run with time drives and slug chases.
- PD200900304 (572767) accepted a relatively new method of verifying injection does not impact the USDW in an area with problem wells: dynamic fluid level testing via Echometer. Interestingly, Echometer ran the test as a test case when the operator expressed interest. They were unaware that the operator filed it with the State, but said the fluid level was clearly identifiable on the runs. The order requires monitoring either through Echometer readings during injection or daily disposal pressures. How will operators report to OCC and how will OCC verify the data has good quality?

### **D. New Well Browse & RBDMS**

EPA commends OCC on releasing the [RBDMS](#) well module and first batch of e-forms, as discussed in Appendix B.

EPA commends OCC on their plan to update their website with the new online well browser connected to RBDMS. It is good that both the new system and the older *Oil and Gas Well Records Forms* Imaging Web Application are both active and point to the same data, for the interim. However, EPA experienced increased difficulty in locating 1002A records reportedly scanned.

EPA understands the hold-up in funding has adversely affected the RBDMS rollout. The planned replacement GIS well browser looks like an excellent addition. In the mean time, EPA recommends adding a disclaimer to the well search page, reminding the viewer that the list may be incomplete.

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<sup>2</sup> <http://www.epa.gov/region6/water/swp/uic/landban.htm>

## V. UIC OVERSIGHT ISSUES

EPA has expressed concerns with some aspects of the OCC permit process over the years. These concerns primarily focus on OCC's area of review process, financial surety requirements, permit stipulation tracking, gaps in permit coverage and follow-through. Stated another way, EPA concerns include differences from the original EPA approved program, differences from the current OCC published program and either insufficient record keeping or quality control.

The final federal FY2010 7520 filing is not due until the end of October, so is not included this year's report.

### A. Permit Review

This year EPA reviewed every 11 of the 486 applications for injection or disposal, and all 11 annular injection and all five simultaneous injection applications. After editing the list for applications not covered by our program, there were 47 injection or disposal applications, including seven associated exception orders reviewed, as shown in Table 2.

**Table 2: Applications Reviewed**

	Total For Review	Issued	In Progress
	<b>63</b>	38	25
<b>Commercial</b>	<b>4</b>	2	2
<b>Non-commercial</b>	<b>18</b>	9	9
<b>EOR</b>	<b>25</b>	19	6
<b>Annular Injection</b>	<b>11</b>	4	7
<b>Simultaneous Injection</b>	<b>5</b>	4	1

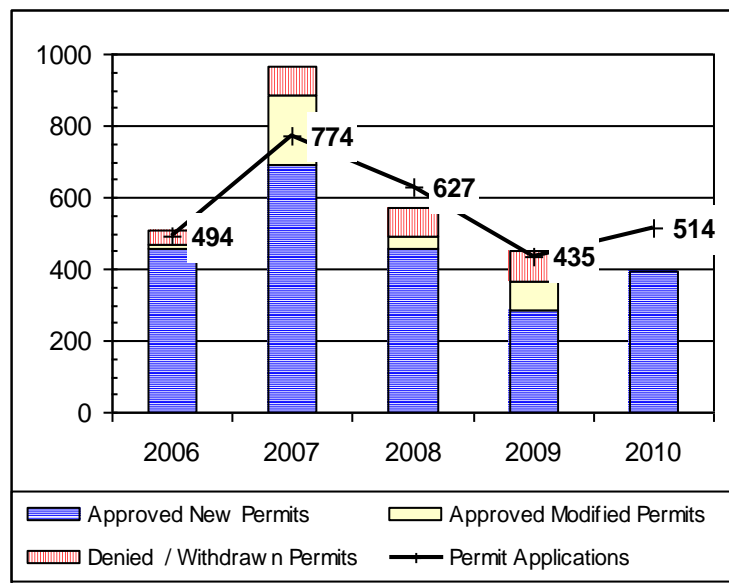
[Figure 1](#) shows the change in permit applications over the last five years. The number of applications for this fiscal year was slightly up from last year.

EPA commends OCC for always checking the AOR for permit applications, including simultaneous injection, and for expeditiously sending out deficiency letters. Of the 22 letters in the exhibit packages, only two went out more than 10 days after receipt of the application.

### Protested Applications

There have been several protested case hearings in this last year, worth noting.

The Town of Vian, the Cherokee Nation, and others, protested the I-Mac Petroleum Services, Inc application for a commercial disposal well within the city limits. The March 3, 2010 hearing reported, "ALJ finds that the Commission has exclusive jurisdiction over the subject matter, but said jurisdiction is concurrent with the jurisdiction granted to cities and towns to implement rules and regulations enacted to provide for the welfare of its inhabitants. Therefore, the recent ordinance passed by the Town of Vian stands on its own as do the rules and regulations of the Commission. The Commission permitting process cannot take the place of compliance with applicable town



**Figure 1: Class II Permitting Actions**

ordinances, nor can meeting the requirements of the town take the place of compliance with Commission permit requirements. The permitting of the subject well by the Commission and by the Town of Vian are separate requirements all of which must be satisfactorily complied with prior to the drilling of the Vian SWD #27-1.” The appeal case transcript was not included in the online documentation, but the applicant decided to dismiss their application. Possibly this decision was related to the new Town of Vian ordinance requiring among other things, three million dollar liability insurance and irrevocable credit letter, plus a \$75,000 annual fee.

The Cherokee Nation and at least one citizen protested the B & B Saltwater Disposal, LLC application for a commercial disposal well in Muskogee County. EPA declined to handle the permit application as requested by the Cherokee, as it is not within our jurisdiction. The final order included extra protective measures, including 24-hour pressure monitoring of the casing-tubing annulus, and a larger than required lined containment berm. The only note of concern to EPA is the follow-up well database tracking. EPA contacted OCC in March saying there was a scanned spud notice and a passed MIT, but no completion report. OCC responded there must be a glitch in the system, there is a filed 1002A. However, in September neither of OCC’s online database systems have any record of the well completion report.

OCC reports that, “RBDMS will have a flagging system that will present a list of UIC wells without an accurate completion report (1002a) to our compliance officer. Our compliance officer is currently pursuing all 1002a violations found.”

## **1. Construction Requirements and Exceptions**

EPA recommends procedural changes to verify appropriate Exception Orders exist, based on discrepancies between OAC 165:1, casing and cementing requirements, and file review results.

- 19% of the well applications show open hole completions (11, incl. two Arbuckle)
  - none are commercial
  - 1 permitted with an exception order
  - 7 permitted with no exception order: incl. 2 with <250’ cement above the top perforations
    - Recent rule change allows for openhole Arbuckle wells without rule exception 165:10-5-5(h)(3)
- 25% of the well applications show surface casing set too shallow on converted wells (14)
  - 6 permitted with exception orders
  - 7 permitted without exception orders
- 10% of the well applications show surface casing set too deep (6) on converted wells

## **2. Fracture Potential**

As discussed in previous years, EPA continues to have concerns over the review and handling of wells requesting permits with a maximum injection pressure above 0.5 psi/ft, which may cause fracturing above the injection horizon. While OCC made some changes to resolve this issue, the process needs improvement.

In FY08, OCC added a Standard Operating Procedure (SOP) to their Quality Assurance Project Plan to cover Step Rate Tests (SRT). Running these tests allows verification of what pressure and rate cause fracturing within the reservoir rock. EPA provided a copy of our *Fracture Analysis Guidelines for States*. OCC chose to use a simplified form with few of EPA’s suggested details. The key points in the OCC SRT SOP are as follows:

- “An operator requesting an injection pressure higher than the 1/2 psi per foot of depth to the top of the injection/disposal interval, will need to run a Step Rate Test (SRT) to demonstrate



that the requested injection pressure is below the fracture gradient for the injection zone. The operator will submit a step rate test plan to OCC for approval to insure that adequate measuring and pump equipment are used, and pressure and rate are plotted on the proper axis. The operator will supply OCC personnel a final report with all pertinent data.”

- “The highest injection pressure justified by the SRT will be the last data point set just below the fracture pressure.”
- “Note that if the formation is overpressured, the well will have to be backflowed for a significant length of time in order to establish the linear relationship with at least two pressure/rate data points below the expected fracture gradient of 0.5 psi/ft. If this is not possible or feasible, then the injection permit will be limited to the 0.5 psi/ft. pressure limit.”

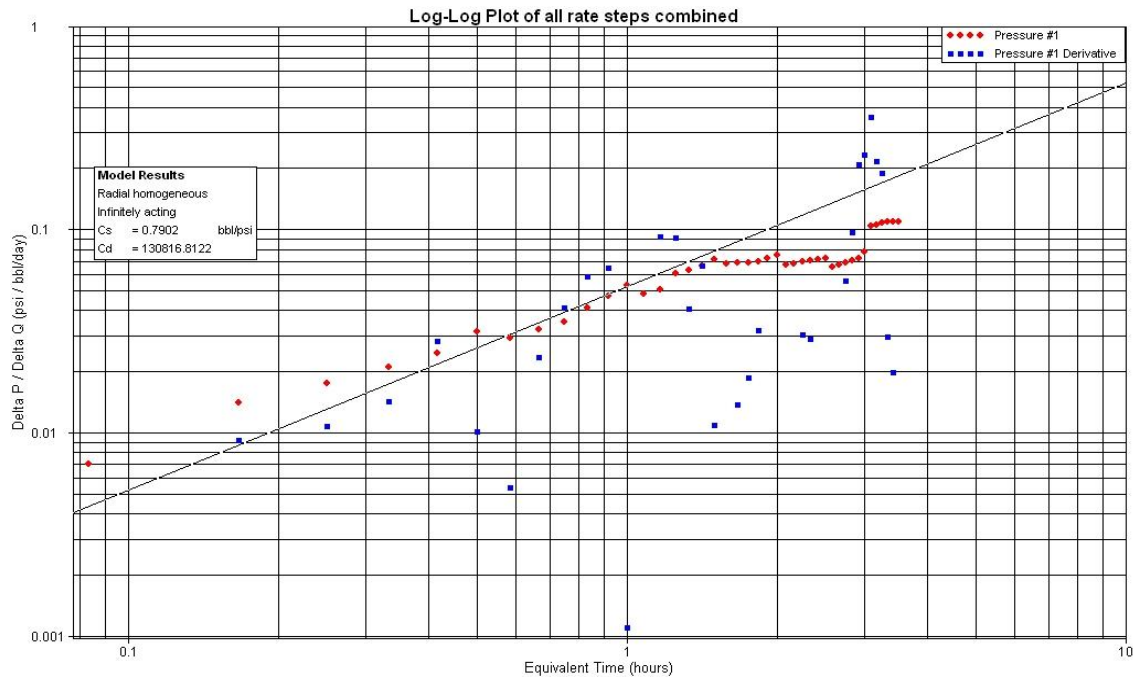
**a) Permit Reviews**

Ten permit applications contained requests for maximum injection pressure exactly equal 0.5 psi/ft from the top injection perforation. Six requests were for greater pressure and one for a lower pressure, but with less than 200’ of strata between the base USDW and top injection. Of the seven that failed to meet OCC criteria, two are not yet final (201000041, 1000520023), three reduced the pressure requested (200900249, 201000024, 1006790003), one received a permit at the requested pressure (1004670028), and the last received a slightly reduced pressure (1006500033).

For the two permits failing OCC specifications, the reviewers apparently did not request or review the planned tests prior to initiation, nor analyze the results. Neither test appears valid. The plots indicate primarily wellbore storage. One started roughly 200 psi over the anticipated fracture pressure, which is invalid for the purpose. OCC accepted both sets of results without comments noted in the exhibit package.

**i) Points relating to permit 1004670028, (Whitney 29-8)**

- The operator predicted only 162’ between the top perforation and the base treatable water, for the newly drilled well.
- Maximum pressure permitted is 430 psi, (less than 0.5 psi/ft).
- Special stipulations apply, to mitigate one problem well identified within AOR.
- Exhibit package details indicate several points:
  - Telephone communications are not generally noted in the exhibit packages;
  - The operator was not completely familiar with step-rate tests or at least Instantaneous ;
  - The step-rate test results suggest wellbore storage, (see Figure 2).

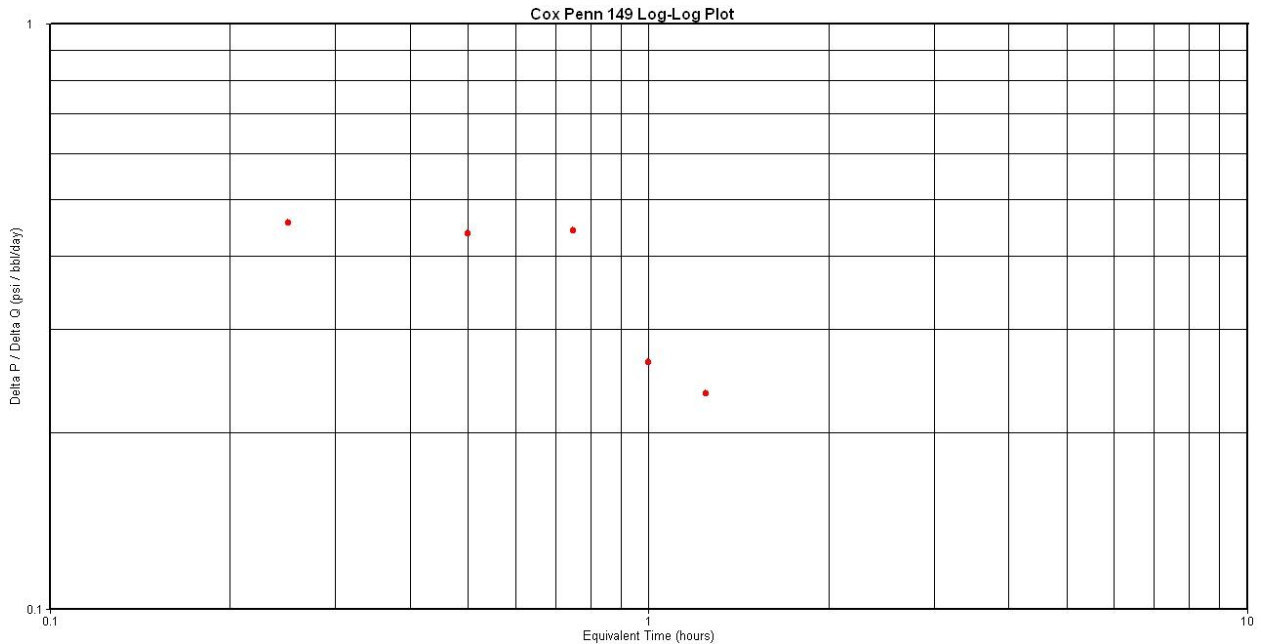


**Figure 2: Whitney 29-8, EPA Pan Systems Analysis**

**ii) Points relating to permit 1006500033 (CPU 149)**

- The original application requested 1000 psi maximum pressure, (0.78 psi/ft), with a top perforation of 1276'.
  - OCC approved the permit on 5/17/10.
  - The operator completed the well on 8/6/10, classifying it as an oil well(?), with perforations from 1272'-1296', 1316'-1334', 1342'-1358, 1376'-1396', 1684'-1698', and 1709'-1720.
- The Step-rate test was run 4/16/10 on injection well CPU 73 (1007330057). The top perforation is 1088', and the well has 980 psi maximum permit pressure (0.90 psi/ft).
  - The operator provided essential test details: data summary tables, a linear graph of rate versus pressure and a copy of the circular pressure chart, but little well information.
  - The operator did not provide the location of CPU 73, its proximity to CPU 149, or the producing horizon.
  - The test started at 800 psi (0.74 psi/ft), well above anticipated fracture pressure.
  - The linear rate versus pressure plot appears to substantiate a 900 psi maximum pressure. However, as seen in Figure 3, the log-log plot of the combined data is unanalyzable. In this case, the log-log plot doesn't indicate wellbore storage, but instead shows an abrupt shift downward. It could mean a decrease in skin has occurred (i.e. more negative skin factor) or it could be meaningless due to the limited number of data points.

- The drilling permit allowed an alternate casing program, instead of the required surface casing a minimum of 50' below the 800' base treatable water. Casing string is to be 90' with the production casing cemented to surface.
- The cement program does not follow OCC enhanced recovery unit



**Figure 3: CPU 149 application using test on CPU 73**

standards.

**b) Historic Practice in the Cox Penn Sand Unit**

The Cox Penn Sand Unit is undergoing a revamped EOR effort. As such, OCC received a number of EOR applications for wells within this unit over the last year. The majority of the applications requested maximum pressures well above 0.5 psi/ft. To support the formation fracture estimates, most referred to step-rate tests run earlier in other EOR wells. EPA reviewed 13 permit applications, with respect to the fracture pressure issue. Five separate well tests supported the applications, including the CPU 73 discussed previously.

- Injector CPU 65 (501042, PD200400500), test run 3/28/07
  - This well has a top perforation of 1110' and a maximum order pressure of 1000 psi (0.90 psi/ft).
  - ISIP was listed as 850 psi (0.77 psi/ft)
  - Step-rate pressures ran from 1000 psi (0.9 psi/ft) to 1500 psi (1.35 psi/ft).
  - Linear rate versus pressure is a straight line.
  - This was run in support of application PD200700188 (CPU 73)
    - This well has a top perforation of 1088' and a maximum order (540392) pressure of 1500 psi (1.38 psi/ft).
    - BTW listed as 870'.
    - Stipulation: RAT required with each MIT.

- Injector CPU 71 (355334 in 1991), no date
  - This well has a top perforation of 1064' and a maximum order pressure of 2000 psi (1.88 psi/ft).
  - Step-rate pressures ran from 750 psi (0.70 psi/ft) to 1500 psi (1.32 psi/ft).
  - Linear rate versus pressure is a straight line.
  - This was run in support of application PD200800200 (CPU 55)
    - This well has a top perforation of 1154' and a maximum order (558699) pressure of 1400 psi (1.21 psi/ft).
    - BTW listed as 1040'.
    - One problem well, no AOR calculated in exhibit package.
    - Stipulations: Intercept well; initial RAT and CBL.
- Injector CPU 75 (323672 in 1988), test run 7/16/09
  - This well has a top perforation of 1470' and a maximum order pressure of 1500 psi (1.02 psi/ft).
  - Step-rate pressures ran from 640 psi (0.44 psi/ft) to 1500 psi (1.02 psi/ft).
  - Linear rate versus pressure is a straight line.
  - This was run in support of application 1000550033 (CPU 96)
    - This well has a top perforation of 1123' and a maximum permit pressure of 1000 psi (0.89 psi/ft).
    - BTW listed as 830'.
    - One problem well, AOR calculated with assumed pressure.
    - Stipulations: monitor well with annual fluid level readings.
  - This was run in support of application 1000810045 (CPU 143)
    - This well has a top perforation of 1100' and a maximum permit pressure of 1000 psi (0.91 psi/ft).
    - BTW listed as 790'.
    - One problem well, no AOR calculated with assumed pressure.
    - Stipulations: monitor well with annual fluid level readings.
  - This was run in support of application 1000810046 (CPU 144)
    - This well has a top perforation of 1050' and a maximum permit pressure of 1000 psi (0.95 psi/ft).
    - BTW listed as 620'.
    - One problem well, no AOR calculated with assumed pressure.
    - Stipulations: CBL.
- Application 1006910145 (CPU 103) is still pending.
- Injector CPU 78 (323674 in 1988), test run 4/05/07
  - This well has a top perforation of 1240' and a maximum order pressure of 1500 psi (1.21 psi/ft).
  - Step-rate pressures ran from 500 psi (0.40 psi/ft) to 1400 psi (1.13 psi/ft).
  - Linear rate versus pressure is a 'straight' line.
  - This was run in support of application PD200900006 (CPU 81)
    - This well has a **top perforation of 980'** and a maximum order (565351) pressure of 1400 psi (1.43 psi/ft).
    - **BTW listed as 950'**
    - Stipulation: RAT required with each MIT.
  - This was run in support of application PD200800379 (CPU 13)

- This well has a top perforation of 935' and a maximum order (562114) pressure of 1400 psi (1.50 psi/ft).
- BTW listed as 740'
- Stipulations: RAT required with each MIT.
- Injector CPU 68 (order 326677 in 1988)
  - This well has a top perforation of 1350' and a maximum order (326677) pressure of 1500 psi (1.11 psi/ft).
  - BTW listed as 1070'.
- Injector CPU 69 (order 326671 in 1988)
  - This well has a top perforation of 1101' and a maximum order (323671) pressure of 1500 psi (1.36 psi/ft).
  - BTW listed as 1070'.

EPA requests OCC to identify, at least one, unquestionably valid Step-Rate test in this field, to define the formation fracture pressure gradient in this Cox Penn Unit.

**c) SOP revision request**

Review of the FY10 application exhibit packages gives no indication that OCC reviewers required any operator to submit a step-rate test plan, or that OCC reviewers conducted their own analysis of the operator's results. EPA requests revision of the Step-Rate Test SOP to ensure results are unambiguous and actions are trackable. The revisions should cover both acceptable test and analysis procedures, not limited to the following items:

- Require at least two rate steps below 0.5 psi/ft, not just for overpressured formations.
- Require a stable static fluid level, prior to the step-rate test.
- Define how the number and length of steps are determined;
- Define the method of setting the maximum test pressure.
- Define the minimum acceptable recording method. Optionally, recommend an optimal sampling interval for the data recorder, including when surface or bottomhole pressure data is appropriate.
- Optionally, during the test request records of all (same zone) offset well injection and production volumes.
- Define how exceedance of wellbore storage will be verified within each rate step;
- Define criteria for identifying fracture initiation.
- Define an alternate acceptable method if physical well and pump conditions do not permit low injection rates.
- Define criteria to limit duplication of effort. Specifically, under what conditions a single test will suffice for a greater (field or unit) area.

OCC Response: There is disagreement on this subject. OCC proposes a technical meeting on determining a satisfactory SOP, including both OCC and EPA engineers, plus at least one industry PE in attendance.

**3. Simultaneous Injection Wells**

*165:5-15 (3) (B) Mechanical integrity will be demonstrated by filing annual reports of surface casing pressure, production casing pressure and fluid level.*

EPA commends OCC on quickly adding the simultaneous injection wells to the *UIC 1012, 1072 and 1075 Forms* in the OCC Imaging Web Application, and developing a tracking spreadsheet.

Several examples from the SI well review support the need for well-written quality assurance procedures for the benefit of operators and reviewers alike. How is the injection pressure in a

simultaneous injection well determined? What methods will be allowed to determine rate and pressure?

- Permit 800124, contains a proposed casing string that would not result in simultaneous injection. There is only one pipe string with a downhole pump normally designed for production in the proposal. In addition, there is confusion about the injection pressure.
  - The application/signed permit states 100 psi (from 1200' F.L.) injection pressure. Does that mean 100 psi on top of the hydrostatic head in the tubing?
  - An attachment/exhibit e-mail discusses the requirement of 0 psi injection pressure, owing to a mud plugged well in the area of review. The discussion of increased fluid level and resulting tubing pressure appears to agree to 0 psi injection pressure. This should be stated in the permit.
- Permit 800123, states that calculated rate and pressure will come from a tracer survey. A calculated rate can come from a tracer survey, with skill and attention to detail. However, pressure cannot.
  - An SOP should be added for obtaining rate from a tracer survey to the QAPP, and a copy provided to the operator.

EPA noted a few additional minor bookkeeping issues or observations of sloppy filing by the operator or consultant:

- The wrong type of filing ('well to be converted' instead of 'to be drilled') and variable inclusion of an AOR map. One applied for and received its simultaneous injection permit after the drilling permit had expired.
- One of the reviewers leaves the 'clerk check list' items unchecked.
- Two of the exhibit packages contain completion reports not available through OCC's online system.
- None of the operators of the three already drilled wells filed amended completion reports, not even the one granted the permit in October 2009.

EPA recommends creating a form, to permit operator submission of fluid levels in simultaneous injection wells. Does OCC have a list of existing wells with active simultaneous injection?

#### **4. Annular Injection Wells**

A review of the eleven annular injection applications received between 2/25/09 and 2/10/10 indicated a fundamental lack of compliance by operators to the applicable regulations.

- Sixty-seven percent of one operator's submissions covered wells completed over 153 days earlier, and three of them did not have sufficient surface casing to qualify.
- None listed annular injection as the disposal method on their F1000, not even the three that received permits.

Questions from this review include the following. How did OCC verify the correct use of the permit, i.e. disposal of only that well's pit contents, for the Roberts 1-9H completed 371 days prior to the permit receipt? Is the operator required to amend the F1000 to reflect the appropriate disposal method for the pit contents? Are the F1015T applications and permits available for public view?

## **5. Public Notice**

In last year's EOY report, EPA discussed the difference in interpretation of OCC's public notice requirements with respect to Oklahoma County under OAC 165:5-7-27(d). This section is now under 165:5-5(d), but remains unchanged. EPA continues to suggest OCC clarify the regulation during next year's changes.

This will become a more important issue if it becomes part of the approved 147 program.

## **6. Supplied Data Issues**

In previous years, the EPA reported problems with operators not submitting key permit information, i.e. actual reservoir pressure or measured depth-to-static water level, porosity and permeability. This trend continues. OCC cited the lack of this information, in support of their decision not to run a Zone of Endangering Influence calculation, except where problem wells exist.

Surprisingly, operators are more willing to provide porosity and permeability information on the applications (48% & 42% respectively) than the current pressure information (31%).

EPA understands the OCC's practice, when mud plugged or problem wells are located, is to allow a zero pressure permit. To increase the protection to the USDW, EPA continues to strongly recommend requiring documentation of either a valid bottom hole pressure test or static fluid level as part of the application review process.

## **B. Post Permit Issues**

### **1. Brine Complaint Response**

EPA commends OCC on keeping EPA informed of on-going brine complaint investigations and complaints. On several occasions citizen's called EPA when not happy with the results of OCC's investigations. OCC did a commendable job of investigating the complaints. One related discussion held during the year covered OCC's use of the Hounslow chart. The chart published in *Water quality data analysis and interpretation*, by Hounslow, Arthur (CRC Lewis Publishers, 1995. OCLC Number 31901359), does not appear to have undergone independent testing and verification.

Robert Zielinski, a USGS geochemist, looked at the information and offered an opinion:

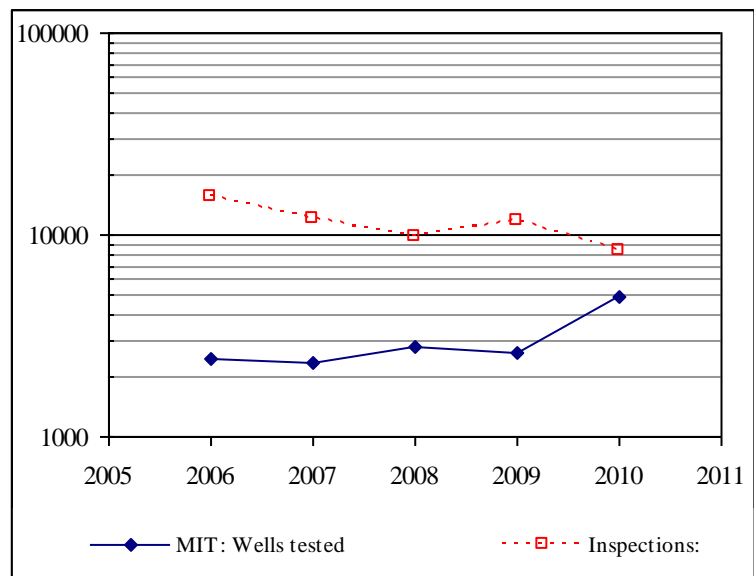
“The origin and chemical evolution of brines can be myriad and complex and a continuum of brine compositions is to be expected. This is indicated, for example, by the large generalized compositional field for oil field brines shown on Hounslow's fig. 4.34. More specifically, it would be informative to plot the chemical compositions of previously analyzed oil field brines of Oklahoma on fig. 4.34. This would show to what extent Oklahoma oil field brines approach and partially overlap the "evaporite" field. If a particular Oklahoma brine plots well away from the "evaporite" field, then the argument is stronger for chemical evolution of the brine via water/rock interaction. As I understand current ore-deposit research, basinal brines that produced Paleozoic-age hydrothermal (MVT) ore deposits in oil-rich northeastern Oklahoma were transported considerable distances from source areas to the south. Such brines probably experienced considerable compositional modification by water/rock interaction. It is probable that oil field brines of Oklahoma record a similar history. In contrast, brines derived from simple dissolution of evaporite deposits within the Oklahoma stratigraphic section would be expected to plot closer to the evaporite field in fig. 4.34.

Without more specific compositional information for Oklahoma oil-field brines I would caution against sole reliance on fig. 4.34 to assign the origin of ground water or soil contamination to oilfield produced water or some other source. Particularly problematic are brine compositions that plot near the "evaporite" field. Other forensic geochemical indicators for discriminating amongst brines could include Br/Cl ratios, radium isotope ( $^{228}\text{Ra}/^{226}\text{Ra}$ ) ratios, or organic-chemical markers of petroleum. Such analyses could be performed on suspected candidate source brine(s), contaminated ground waters, or aqueous extracts of contaminated soils. In my opinion use of plots such as fig.4.34 can be helpful as a preliminary indication of a broadly defined brine type, (chemically evolved, evaporite-like) but may not definitively prove an oil field source versus a natural source.”

EPA understands the cost issue involved with water samples, but recommends additional verification based on the above comments. Perhaps through analyzing both ground water and injection water samples, so the chart includes both water chemistries.

## 2. Mechanical Integrity Tests

OCC continues to annually conduct and witness (Appendix B) mechanical integrity tests for far greater than 20% of the inventoried injection wells, as required to meet the maximum five-year testing frequency for each well. OCC is again highly commended for this accomplishment and for witnessing all MITs. [Figure 3](#) shows the number of MIT's witnessed, and the number of site inspections. Site inspections have decreased owing to the combined loss of inspectors and furlough days in FY10.



**Figure 3. MIT & RAT Results**

EPA commends OCC for completing the 2009 scans and adding the up-to-date 2010 MIT's (F1075) into the online system with all the API and Order numbers.

## VI. SUMMARY AND RECOMMENDATIONS

Last year EPA discovered several problems and made a number of recommendations. Owing to the delay in finalizing the document, OCC has had no time to act on our comments and recommendations. EPA has mostly excluded those areas from this report.

In this last fiscal year, OCC underwent furlough days and lost 14% of their field inspectors, greatly increasing the difficulty in keeping up with the necessary workload. In response, OCC continues effectively streamlining UIC procedures.

EPA commends OCC's actions in a number of additional areas:

- For their efforts in bringing RBDMS on-line;
- For witnessing all mechanical integrity tests, far exceeding the EPA minimum recommended standard of 25%;



- For their commitment to submit for review the Class II and Class V well program revision packages;
- For their Special Project initiatives,
- For their spreadsheet tracking and enforcement resultant improvement in related Operator compliance;
- For their AOR permit reviews;
- For updating their UIC 1012, 1072 and 1075 Forms to include simultaneous injection;
- For their brine complaint investigations; and
- For updating their on-line data collection.

Based on our review, while OCC has demonstrated a number of improvements, there are still areas that would benefit from additional changes. Our suggestions range from minor changes, which could increase focus on operator compliance to potentially significant improvements in quality assurance. The latter, may result from actual review changes or from better tracking of the reviews. To recapitulate recommendations made within the body of the report:

- Increase compatibility between procedures and viewing of UIC orders and permits;
- Increase the ease and accuracy of locating UIC information on the web;
- Accelerate implementation of RBDMS for UIC use;
- Revise UIC forms and permits to allow greater flexibility in tracking operator compliance, especially for stipulation reporting and exception tracking;
- Change the permits to fill-able e-forms to reduce errors;
- Modify the brine comparison procedure to better support the results of the Hounslow chart, coincidentally building effective documentation for its use;
- Complete all Special Grant Projects within the year granted;
- Ensure all necessary information is included on the UIC permit application, particularly with respect to either the current reservoir pressure or the static water level.
  - For applications where problem wells are identified, require acquisition of a properly documented bottom hole pressure or a static water level.
  - If the top of static water level is within the USDW, require either well treatment or a different reservoir to protect the USDW.
  - For injection pressure requests over 0.5 psi/ft, require complete documentation according to OCC's SOP—particularly not accepting fracture treatment statements that do not meet the requirements, have no location, or are not an acceptable analog.

EPA requests OCC revise the Step-Rate Test SOP in FY11 to ensure fracture gradient results are unambiguous and all actions are trackable.

**APPENDIX A**  
STATE/EPA Staff via conference call  
**September 15, 2010**  
FY 2010 EOY Discussion

NAME	AGENCY	PHONE
Mr. Charles Lord	Oklahoma Corporation Commission	(405) 522-2751
Mr. Tim Baker	Oklahoma Corporation Commission	(405) 522-2763
Ms. Patricia Downey	Oklahoma Corporation Commission	(405) 522-2802
Mr. Jim Phelps	Oklahoma Corporation Commission	(405) 521-2242
Ms. Nancy Dorsey	Environmental Protection Agency	(214) 665-2294

STATE/EPA Staff via conference call  
**September 21, 2010**  
FY 2010 Grants Discussion

NAME	AGENCY	PHONE
Mr. Charles Lord	Oklahoma Corporation Commission	(405) 522-2751
Mr. Michael Vaughan	Environmental Protection Agency	(214) 665-7313

**APPENDIX B**  
**Oklahoma Corporation Commission**  
**Underground Injection Control**  
**Class II Wells**  
**Year-end Narrative**  
**Work-plan 2010**

Oklahoma Corporation Commission implemented a successful Program in FY 10 meeting or exceeding most of the established targets as determined in Work-plan 2010. The attached “Annual Report Card”, depicts a summary of Activities.

Total UIC applications were at 552 for the year, 186 Disposals, 280 Injectors, 6 Annular, 4 SI, 38 Commercial Disposals and 38 Exceptions to the rules. Totals for approved orders were 144 Disposals, 228 Injectors, 1 Simultaneous Injection, 23 Commercial Disposals and 28 exceptions to the rules. Total dismissals numbered 87.

UIC inspections for 2010 were at 8,280, short of the 10,000 target. This was primarily due to a corresponding 14% reduction in the total number of field inspectors from the previous year.

Field Operations is still collecting GPS data for UIC facilities in all four Districts. This is part of Field Operations long-term goal of obtaining a GPS position on all UIC and O&G wells over a five year period.

UIC began the Well Location Project, which utilizes the GPS well location data from the districts. The purpose of project is to examine oil and gas well locations to determine if the approximate well location were true to within a 50 feet from preexisting maps. To date, 24,621 well locations have been examined spanning 49 counties. Of these, 1663 locations have been corrected.

In the area of GIS, UIC has completed the Oklahoma Corporation Commissions aerial photo library. We are current on all aerial photos from the NAIP. At this time, we have county wide aerial photos for the years 1995, 2003, 2004, 2005, 2006 and 2008 in all 77 counties. UIC is currently adding the NAIP 2010 Aerials to the GIS drive. Updated maps with well data current to 11/04/2009 should be in the hands of our field inspectors by the end of January of 2010. All of this data we have made available to the EPA.

In addition to the aerial photos from NAIP, the georeferencing of archival photos is ongoing. All archival photos (primarily from the 1940's) available at the Oklahoma State Library have been scanned and saved to the R Drive. Subsequent georeferencing of these photos produces a continuous historic map of this time frame. This map provides a more precise determination of well locations and a more detailed record past surface pollution. Currently, 11 counties are referenced in their entirety. This project has been continued through December of 2010 using Oklahoma Corporation Commission funds.

UIC currently has received 94.00% of the 2009 1012A forms (Annual Fluid Injection Reports) from operators in Oklahoma. UIC staff continues to place an emphasis on the timely filing of these reports. Compliance for 2008 was 99.70% by January of 2009.

The Document Imaging Project has been successful. All of the well records in District I have been imaged and made available in their office. Approximately 20% of District IV has been imaged. Funds from this fiscal year will continue the project first by completing imaging in District IV then moving on to District III and District II. The files that have been imaged to date will be available on line as PDF files in early December of 2010.

**Annual Report Card  
UIC Program Activities  
Work-plan 2010  
(7-1-09 through 6-30-10)**

As of September 22, 2010

Activity	Goals	Accomplishment
Inspections (On-site)	10,000	8,280
MITs (total)	2,300	4,896
MITs (Witnessed)	2,070	4,896
Permits (Total Issued)	NA	396
Technical Reviews	NA	424
Operatorship Transfers	NA	379
Technical conferences	NA	352

The Oklahoma Corporation Commission, Oil and Gas Conservation Division has committed to converting to the RBDMS database. We have a projected conversion to the system for the Oil and Gas Division by 02/30/2011.

Since the beginning of this project in FY-2008 many facets have been completed. RBDMS\_Entity-Bond was released in the fall of 2009 and has had much success in allowing the Oklahoma Corporation Commission Oil & Gas Conservation Division to help the oil & gas industry with their need in keeping operator records current. The system has automated processes to allow online sign up for operators and allow easy checking for commission staff of bonding information, address changes, officer changes and additional record keeping.

RBDMS\_WELL was released in the spring of 2010 and has been a great success in allowing us to finally have one stop shopping for the large state well inventory. With over 513,000 plugged/active wells in the state and over 813,000 records associated with those wells the task of data collection is very important. RBDMS has allowed us to move forward and implement some changes to insure data integrity. Also the use of the 14 digit API# has also been released with this module to allow for event and laterals tracking. This will ensure we have all pertinent data attached to the well from cradle to grave. This module also connects operators and their well inventory on one page for easier data retrieval.

RBDMS\_EWFiles release came in June of 2010. The first three forms of this project were 1002A, Completion Report, 1001A Spud Report and 1023 Comingle Report the 1004 Production Report, 1016 Pressure Test 1012 Annual Injection Report and the Mechanical Integrity Test are all in development. These E-forms allow commission staff and industry to use the same data entry screen to data enter these critical report and to insure data integrity. While the commission still accepts paper reports the industry for the first time can now file them electronically and submit them for approval. The next year holds the prospect of several more of these forms being released for the industry to use and upon completion of this portion of the project 23 commission report will go from paper to electronic saving both time and money.

Other parts of the RBDMS project that are under development are the Inspection and Incident Modules, Underground Injection Control Module, Soil Farming Module. We are very excited about the completion of this project and look forward to continued work with our partners (GWPC, DOE, EPA, Oklahoma Secretary of Energy) in its completion.

For the fourth quarter of FY10, the Field Operations Department inventoried 23,499 wells with GPS as compared to 8,402 inventoried wells in the second quarter of FY10. The grand total of wells inventoried since this project in started in FY07 is 139,709. (See attached map). The new corrected positions will be associated with wells in the OCC database in January of 2011.