UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 6

1445 ROSS AVENUE, SUITE 1200

SEP 2 9 2015

Mr. Tim Baker, Director
Oil and Gas Conservation Division
Oklahoma Corporation Commission
P.O. Box 52000-2000
Oklahoma City, OK 73152-2000

Dear Mr. Baker:

Enclosed is our evaluation of Oklahoma's Class II Underground Injection Control (UIC) program performance during state fiscal 2014. The Environmental Protection Agency (EPA) representatives did not hold an on-site meeting to discuss EPA's annual end-of-year evaluation with the Oklahoma Corporation Commission (OCC) management, as discussions and e-mails were ongoing throughout the year. By e-mail on April 3, 2015, we invited OCC's comments on the draft evaluation and again with the revised version on September 9, 2015.

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 Jim Brown or Philip Dellinger of my staff at (214) 665-7150.

Sincerely yours,

WK Honker

William K. Honker, P.E.
Director
Water Quality Protection Division

Enclosure

cc: Patricia Downey
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 2014 (SFY2014)
July 1, 2013 through June 30, 2014

I. INTRODUCTION

EPA has approved the Oklahoma Corporation Commission (OCC) as the primary enforcement 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. EPA retains primary authority for Class I, III, IV and V on certain 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, 2013 and June 30, 2014.

EPA representatives did not hold an on-site meeting to discuss EPA's annual end-of-year (EOY) evaluation with OCC management, as discussions and e-mails were ongoing throughout the year. Many of the points related to the OCC's Risk Based Data Management System (RBDMS) were discussed in a separate adobe connect meeting on February 26, 2015 and again in their office on March 9, 2015. (See Appendix A for attendees). Appendix B contains OCC's annual narrative required in the SFY2014 UIC grant work plan.

The single biggest issue facing the OCC in 2014 was the dramatic increase in seismic activity in some areas of the state. EPA closely monitored this increase using Oklahoma Geological Survey (OGS) and United States Geological Survey (USGS) databases, and these areas include active Class II disposal wells. Many experts, including USGS scientists (Rubinstein and Mahani, 2015), the Oklahoma Geologic Survey (Statement on Oklahoma Seismicity dated April 21, 2015) and academic researchers (Walsh and Zoback, 2015), along with other Oklahoma state agencies and elected officials, have concluded a connection likely exists between disposal well location, injection volumes and rates, and seismic activity.

In February 2015, EPA released a report on managing injection-induced seismicity developed by a National Technical Workgroup consisting of State and EPA injection well regulators, including a representative from OCC. EPA also has provided technical support to OCC via a geologist in the Region 6 office in Dallas, related to assessment of the ongoing seismic activity, including defining high priority seismic areas. OCC has implemented some actions that are consistent with recommendations in the National Technical Workgroup report, such as increased reporting frequency of well operational data, attempts to prevent injection pressure transfer to basement rock and requiring some reductions in disposal volumes. However, EPA remains concerned with the continued upward trend in seismicity and recommends that OCC implement additional regulatory actions to assure protection of Underground Sources of Drinking Water (USDWs), including further reduction of injection volumes into the Arbuckle disposal formation in seismically active areas. EPA also recommends further assessment and mapping of the Arbuckle Formation, including its ability to transmit increased pore pressure to basement rock, and the presence or absence of vertically confining strata between the Arbuckle and basement rock.

This report is broken into six main sections: Introduction, Grant Work Plan, Program Revisions, OCC Procedural Areas, UIC Oversight Issues, and Summary and Recommendations. Additional information is included in the appendices.

II. GRANT WORK PLAN

A. SFY2014 GRANT

OCC's SFY2014 application was for a total of $419,567 in Federal funds. EPA approved $276,000 as the Federal 2014 allotment for the State of Oklahoma's UIC program administered by the OCC, and awarded this amount to OCC in SFY2014. In addition, EPA awarded OCC $31,368 in UIC Special Project funds in FY2014. Work plan Deliverables–OCC submitted all required State program updates and other deliverables required during SFY2014.

B. SPECIAL PROJECTS

EPA commends OCC on their continuing commitment to improving their information resource base through Special Project initiatives, such as the geo-referenced archival aerial photos, and Document Imaging. The OCC Narrative in Appendix B describes the status of OCC's special projects for the year.

III. PROGRAM REVISIONS

OCC submitted updates for the Safe Drinking Water Act Section 1425 program to EPA on September 26, 2011. EPA delayed its review of this program update due to seismicity driven priorities in the State. OCC continues to revise their rules as they work to manage the seismicity issue.

IV. OCC PROCEDURE AND PUBLIC ACCESS

Like all state and federal agencies, OCC's UIC office has undergone numerous changes through advances in technology and personnel changes over the years. These changes have provided opportunities to review and modify existing procedures. All programs benefit from these reassessments, which are part of the basis of the Quality Management / Quality Assurance system that EPA requires of itself and all grantees.

A. RBDMS

After considerable time, expense and effort, OCC has transitioned completely to the Risk Based Data Management System (RBDMS) created through the Ground Water Protection Council. EPA commends OCC for persevering through the numerous obstacles and completing the data transfers necessary to use the system. Despite these accomplishments, the system continues to have significant issues with operations and data quality. Due to ongoing problems with the system, as discussed below, OCC terminated the IT contract in place for this project early. The discussion on problems with the system is broken into two categories below.

1. RBDMS Public Access

The public now has the option of using the RBDMS to access UIC data with some locational representation. However, there are still a number of issues with the public access to the mapping system (GIS), including:

- No well numbers are included.
- There is no zoom to select as an option, therefore no way to see the actual well's location.
- Insufficient instructions exist on using the query options.
  - Advanced query should show format examples such as listed below:
    - Does API include the lead state code, is it hyphenated, i.e., 3500302111 or 00302111 or 003-02111 or 35-003-02111?
    - Too much space is allowed for two digit section, township and range numbers.
    - Are lead zeros required for the township and range?
    - Is the Operator search conducted by name of operator or their code number?
  - Full text search shows examples of a location search, using the section, township and range.
    - It is not clear what other text entries may be searched.
      - It is not clear what search options exist. For example are standard search terms allowed, such as 'and', 'or' '+', '-'?

2. RBDMS OCC UIC Staff Access

RBDMS is difficult for OCC UIC staff use due to major data accessibility problems and unreliability. Examples of these problems are described below. For a variety of reasons, this system currently prevents accurate tracking and reporting for Mechanical Integrity Tests (MIT, F1075), Annual Fluid Injection Reports (F1012), and EPA Form 7520. Additionally, essential data cannot be retrieved, including well locations or specific lists of wells and operators in specific formations or areas.

a) Mechanical Integrity Tests (F1075)

Letters to the operators concerning their upcoming or late MITs were sometimes late and/or inaccurate. Attempts of UIC staff to work with IT resulted in reliability changing from 63% to 70%. IT staff identified the problem as "the UIC oracle tables in RBDMS_Test have not been updated since 6/1/2012."

Currently, RBDMS populates both the order number and related pressure limits to the MIT forms. There is no ability to edit this data, which is sometimes necessary. A number of the scanned completed forms list incorrect or blank orders. This effectively prevents verifying activation of new permits and tracking order/permit compliance.

Additionally, some of these electronically filed MIT reporting forms (F1075s) either do not make it into the imaging system, or end up with multiple copies. In one observed case, more than ten copies of the same form were present. There is no way for UIC staff to delete duplicate copies. IT provided UIC with a way to 'hide' them from the viewer.

The viewed image of F1075 titles the comment field incorrectly as "Repair Date". The correct title, as seen on the actual form is "Repair or Testing Date". There is a significant difference between the two meanings of these two terms.

b) Annual Fluid Injection Report (F1012)

UIC staff have lost the ability to obtain a list of operators delinquent in filing the F1012.

c) EPA Form 7520

UIC staff can no longer use the database to supply all the required federal information to complete the 7520s, such as monitoring and enforcement violations, since RBDMS will not permit the query or accurately report the results through IT queries.

d) Well locations

UIC staff is unable to obtain location information from the system, except on a well-by-well basis, preventing use of the GIS mapping tool. Instead, OCC staff purchased the necessary information from an external source.

e) Specific lists

Basic quality assurance and quality control checks should be built into the system, so that apparent errors can be prioritized for systematic correction. Examples include:

Filed F1012s (injected volumes), but no F1075 (MIT);

1) All forms need to list the active order number(s).
2) Some active orders have no associated F1075s or F1012s.
3) The system needs to have the ability to verify order and well status (thru Forms F1072, F1073, F1073I or F1002A).

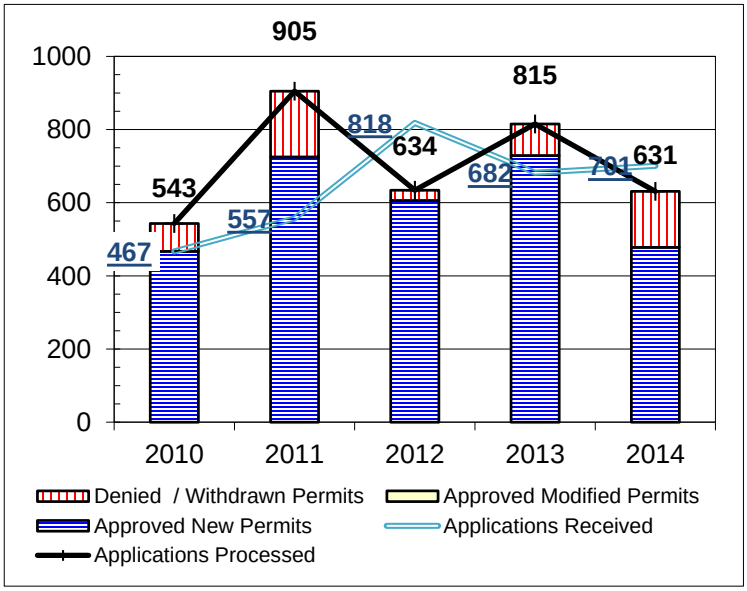
Additionally UIC staff needs to be able to query the system for a number of different options; including a unique list of active UIC wells either by given formation with location; or missing locational data (zero latitude /longitude values).

Although there are substantial problems with the existing database, EPA believes these issues are resolvable. EPA recommends OCC devote necessary resources toward improvement of this critical program component, which would likely entail an outside contract.

V. EPA 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, and gaps in permit coverage. Although these issues remain of concern to EPA, resolution of RBDMS database issues and addressing areas of high seismic activity were higher priorities for SFY2014.

Figure 1 (to the right) shows the variation in UIC permit and order volume over the last five years.



A. INVESTIGATIONS/COMPLAINTS

EPA commends OCC for keeping EPA informed of the most important UIC investigations and complaints; and for efficient handling of forwarded complaints received by EPA. For example, the Iowa Tribe of Oklahoma's concern about permitted disposal wells near their municipal drinking water system. The Tribe objected

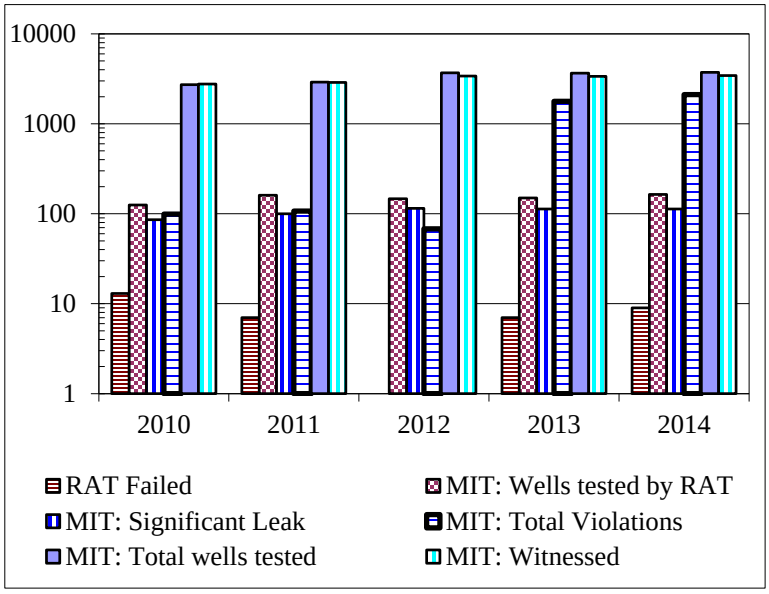
to a proposed disposal well within one mile of their water well. OCC spoke with the operator, who withdrew the permit application.

This case also highlighted an issue with locating tribal system drinking water wells not carried by the ODEQ's database. Some tribal wells fall between the ODEQ and US EPA SDWIS water well database tracking methods, necessitating the operator requesting a disposal well permit to check with the relevant tribe.

B. Mechanical Integrity Tests

OCC continues to annually conduct and witness (Appendix B) mechanical integrity tests for well over 20% of the inventoried injection wells, as required to meet the maximum five-year testing frequency for each well. EPA again commends OCC for this accomplishment and for witnessing the majority of the MITs. Figure 2 shows the number of MIT's witnessed, and the number of site inspections. However, the lack of RBDMS functionality compromises the ability of staff and the public to track the MITs from the scanned F1075 forms.

Figure 2: Class II MITs



C. Enforcement Actions

Figure 3 provides a summary of OCC enforcement actions. The absence of Monitoring and Reporting entries for years 2013 and 2014 represents a failure of RBDMS to provide required information.

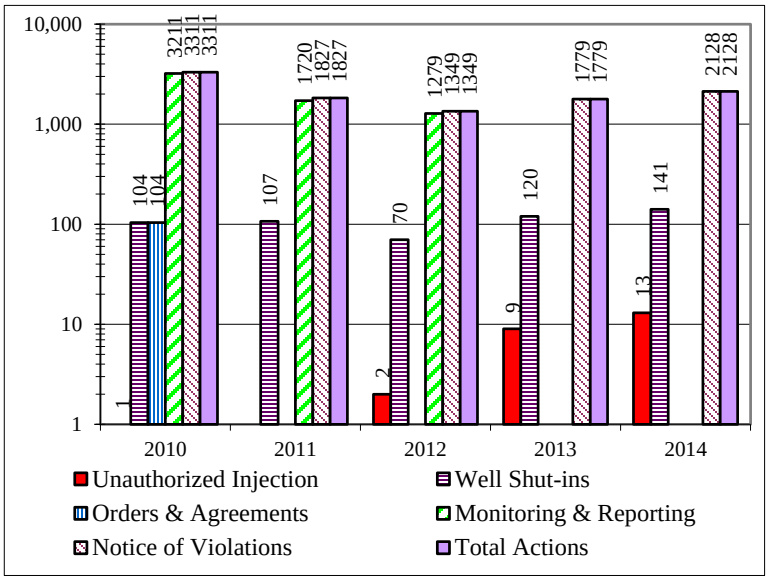
D. Special Investigation

OCC effectively coordinated with the EPA staff implementing the UIC program in Osage County to investigate and remedy a CO2 purge west of the Chaparral Osage CO2 project.

Seismicity

OCC continued to focus significant amounts of UIC staff time to track and evaluate ongoing seismicity in the state. Actions to improve understanding and confront the issue are described below, including both changes to existing permits and rules (approved in early state fiscal year 2015).

Figure 3: Enforcement Actions



1. **Rule Change: Arbuckle Monitoring**

   Monitoring frequency for operational data of all Arbuckle wells increased from monthly to daily, and is submitted to OCC on a weekly basis.

2. Arbuckle Permit Verification: no basement rock open to injection.

OCC implemented an effort to identify all the permitted Arbuckle wells, particularly in areas with seismicity. This effort was to verify if the wells were open only to the Arbuckle, as permitted, or drilled deeper into the basement granite or granite wash. This resulted in several operators (B&W Operating, LLC; RC Taylor Companies; Red Ford/East OK Pipe) plugging wells back above basement.

3. Required Testing and Rate Reduction or Shut-In

OCC required several operators (Love County Disposal LLC; Bosque Disposal Systems LLC) to verify the bottom-hole pressure in their wells, and to reduce injection pressure and rate or cease injection. Both operators ceased injection. Spess Oil Company was required to run a Fall-Off Test, but no rate or pressure reduction was required.

4. Rate Reduction

One of Pedestal Oil's wells had its permitted rate reduced to a third (temporarily).

5. Ongoing Activities

OCC kept maps up-to-date using Oklahoma Geologic Survey (OGS) seismic event and fault locations, in combination with third party UIC well locations (See above notes on RBDMS issues). OCC posted to their website or otherwise provided compilations of UIC operational data to OGS, EPA researchers and the press. The OGS performed seismic analyses for OCC.

VI. SUMMARY AND RECOMMENDATIONS

While changing to RBDMS was a reasonable solution to OCC's database issues, implementation has been less than satisfactory. The key advantages to the system include a single database and public GIS viewing capabilities. The disadvantages center on lack of effective IT support to replace the abilities to query and verify data that was present with the earlier system. This results in multiple decentralized data repositories and use of external data in order to ensure that UIC staff can effectively do their jobs.

EPA recommends OCC invest in additional specialized support staff or a contract to resolve ongoing issues with RBDMS. Specifically, OCC needs to have staff charged with data quality assurance to systematically correct errors in the system; and specialized IT programming support with knowledge of the program and communications skills that will enable both an effective working relationship with the UIC program staff and resolution of the multitude of ongoing problems.

EPA recommends that OCC implement additional regulatory actions to assure protection of Underground Sources of Drinking Water (USDWs), including further reduction of injection volumes into the Arbuckle disposal formation in seismically active areas. EPA also recommends further assessment and mapping of the Arbuckle Formation, including its ability to transmit increased pore pressure to basement rock, and the presence or absence of vertically confining strata between the Arbuckle and basement rock.

VII. REFERENCES

F. R. Walsh, M. D. Zoback, Oklahoma's recent earthquakes and saltwater disposal. *Sci. Adv*. 1, e1500195 (2015). https://scits.stanford.edu/sites/default/files/walsh_zoback_science_2015.pdf

Rubinstein, J.L. and A.B. Mahani (2015), Myths and Facts on Wastewater Injection, Hydraulic Fracturing, Enhanced Oil Recovery, and Induced Seismicity, *Seismological Research Letters*, doi:10.1785/0220150067
https://profile.usgs.gov/myscience/upload_folder/ci2015Jun1012005755600Induced_EQs_Review.pdf

M. Weingarten, S. Ge, J. W. Godt, B. A. Bekins, J. L. Rubinstein, High-rate injection is associated with the increase in U.S. mid-continent seismicity, *Science* 19 June 2015: Vol. 348 no. 6241 pp. 1336-1340 http://www.sciencemag.org/content/348/6241/1336

APPENDIX A

STATE/EPA Staff in Attendance

February 26, 2015 via Adobe Connect

repeated **3/9/15 in OCC's office**

Discussion including points on RBDMS

NAME	AGENCY	PHONE
Mr. Charles Lord**	Oklahoma Corporation Commission	(405) 522-2751
Mr. Tim Baker*	Oklahoma Corporation Commission	(405) 522-2763
Mr. Matt Skinner	Oklahoma Corporation Commission	
Mr. Bob Griffith	Oklahoma Corporation Commission	
Ms. Nancy Dorsey**	Environmental Protection Agency	(214) 665-2294

* only via conference call

**both meetings

APPENDIX B
Oklahoma Corporation Commission
Underground Injection Control
Class II Wells
Year-end Narrative
Work-plan 2014
7/1/2013-6/30/2014

Oklahoma Corporation Commission (OCC) implemented a successful Program in FY 2014 meeting or exceeding most of the established targets as determined in Workplan 2014. The attached "Annual Report Card", depicts a summary of Activities.

Total UIC applications were at 801 for the year: 267 Disposals, 351 Injectors, 0 Annular, 0 SI, 46 Commercial Disposals and 138 Exceptions to the rules. There were 539 UIC approved orders/permits this year: 195 Disposals, 257 Injectors, 0 Simultaneous Injection, 34 Commercial Disposals and 53 exceptions to the rules. Total number of dismissals was 158.

UIC inspections for 2014 were 10,816, which is higher than the 10,000 target. MIT's numbered 3,920 this year.

In the area of GIS, UIC continues to sustain the OCC's 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, 2008, 2009, 2010, and 2013 in all 77 counties. These maps with well data are provided to our field inspectors, as the information is updated by our GIS specialist. All of this data is available to the EPA.

In addition to the aerial photos from NAIP, the georeferencing of archival photos is ongoing. This project has been aided by EPA through Special Project grants to purchase the needed ArcGIS license to georeference, and to hire temporary GIS specialist for georeferencing the OCC's aerial photo library. All archival photos available at the Oklahoma State Library, NCRS, and Oklahoma Geological Society have been scanned and saved to the R Drive. Subsequent georeferencing of these photos produces historic time frames that can be used by UIC and the OCC in investigations. The aerial maps provide a more precise determination of well locations and a detailed record of past surface pollution. A total of 109,684 archival aerial photos have been scanned to date. This project is still in progress using OCC, UIC Special Project, and Brownfield funds.

UIC staff continues to place an emphasis on the timely filing of 1012A forms (Annual Fluid Injection Reports) by operators in Oklahoma. Due to the delay in get the UIC module for RBDMS online and current errors in 1012A report modules, UIC is unable to get accurate compliance data for 2013 1012A forms at this time.

The Document Imaging Project has been successful. The well records in all four Districts have been imaged, and the PDF files made available in each district office. Currently, UIC is working on Phase II of this project. The goal of Phase II is to research the acquired imaged records, and compare them to the central OCC imaging database. Any missing records are then added to the central database. As of 9/3/2014, a total of 40,757 images have been reviewed and 1,610 of those images have been added to the central imaging database.

Annual Report Card
UIC Program Activities
Workplan 2014
(7-1-13 through 6-30-14)

Activity	Goals	Accomplishment
Inspections (On-site)	10,000	10,816
MITs (total)	2,300	3,920
MITs (Witnessed)	2,300	3,214
Permits (Total Issued)	NA	539
Technical Reviews	NA	801
Operatorship Transfers	NA	1,219*
Technical conferences	NA	440

Number represents total 1073i forms processed per well, both approved and rejected

The Oklahoma Corporation Commission (OCC), Oil and Gas Conservation Division has converted to the RBDMS database. The RBDMS_Soil Farming Module is under review, and scheduled for release by December 2014. All other RBDMS modules (including UIC) have been released, and are currently in production. OCC staff continues to review the modules for errors, make any needed corrections to RBDMS data, and develop updates to make the new database more user friendly for both OCC and the end users of our data.