

WP 02-PC.02  
Revision 5

# Delaware Basin Drilling Surveillance Plan

Cognizant Section: EPA Compliance Programs

Approved By: Steve Kouba



*A URS-led partnership with B&W and AREVA*

**Delaware Basin Drilling Surveillance Plan  
WP 02-PC.02, Rev. 5**

---

**TABLE OF CONTENTS**

CHANGE HISTORY SUMMARY ..... 3  
ACRONYMS AND ABBREVIATIONS ..... 4  
1.0 INTRODUCTION ..... 5  
2.0 PURPOSE ..... 7  
3.0 PROGRAM IMPLEMENTATION ..... 8  
    3.1 Monitoring Activities ..... 8  
        3.1.1 General Drilling Activities ..... 9  
        3.1.2 Borehole Drilling Characteristics ..... 9  
        3.1.3 Castile Brine Reservoirs ..... 10  
        3.1.4 Borehole Plugging ..... 10  
        3.1.5 Injection Well Activities ..... 11  
        3.1.6 Mining in the Delaware Basin ..... 12  
        3.1.7 Incidences of Noncompliance with BLM and OCD Rules ..... 12  
        3.1.8 Earthquake Activity ..... 12  
        3.1.9 Pipeline Construction ..... 12  
        3.1.10 Other General Monitoring Activities ..... 13  
    3.2 Information Sources ..... 13  
        3.2.1 Commercial and Government Databases ..... 13  
        3.2.2 Annual Surveys ..... 14  
        3.2.3 Literature Reviews and Technical and Industry Meetings ..... 14  
        3.2.4 Field Observations ..... 14  
        3.2.5 Monitoring Regulatory Developments ..... 14  
4.0 PROGRAM SCHEDULE ..... 15  
    4.1 Weekly Activities ..... 15  
    4.2 Monthly Activities ..... 15  
    4.3 Quarterly Activities ..... 16  
    4.4 Annual Activities ..... 16  
    4.5 Biennial Activities ..... 17  
    4.6 Unscheduled Activities ..... 17  
5.0 DATABASE MANAGEMENT ..... 17  
    5.1 Database ..... 17  
    5.2 Updating Databases ..... 18  
6.0 REPORTING ..... 18  
7.0 QUALITY ASSURANCE ..... 18  
REFERENCES ..... 20

**LIST OF FIGURES**

Figure 1 - Delaware Basin ..... 21

**LIST OF TABLES**

Table 1 - Parameter Values ..... 7  
Table 2 - FEP Screening Values ..... 8

**Delaware Basin Drilling Surveillance Plan**  
**WP 02-PC.02, Rev. 5**

---

**CHANGE HISTORY SUMMARY**

<b>REVISION NUMBER</b>	<b>DATE ISSUED</b>	<b>DESCRIPTION OF CHANGES</b>
4	05/15/12	<ul style="list-style-type: none"><li>• Revised step 3.2.1, changes for monthly information on injection wells and salt water disposal wells.</li><li>• Revised Section 7.0, Quality Assurance, Delaware Basin monitoring activities are conducted in accordance with WP 13-1.</li><li>• Updated References, added WP 13-1.</li></ul>
5	11/27/12	<ul style="list-style-type: none"><li>• Editorial revision in accordance with MD 1.1.</li></ul>

**Delaware Basin Drilling Surveillance Plan  
WP 02-PC.02, Rev. 5**

---

**ACRONYMS AND ABBREVIATIONS**

API	American Petroleum Institute
BLM	Bureau of Land Management
CBFO	Carlsbad Field Office
CBFO QAPD	Carlsbad Field Office Quality Assurance Program Document
CCA	Compliance Certification Application
CFR	Code of Federal Regulations
CO <sub>2</sub>	Carbon Dioxide
DBDSP	Delaware Basin Drilling Surveillance Plan (Program)
DOE	U.S. Department of Energy
DBWTA	Delaware Basin Well Tracking Application
EPA	U.S. Environmental Protection Agency
FEP	Features, Events, and Processes
NMIMT	New Mexico Institute of Mining and Technology
OCD	Oil Conservation Division (State of New Mexico)
PA	Performance Assessment
RRC	Railroad Commission (State of Texas)
SNL	Sandia National Laboratory
WIPP	Waste Isolation Pilot Plant

**Delaware Basin Drilling Surveillance Plan**  
**WP 02-PC.02, Rev. 5**

---

## 1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) environmental standards for the management and disposal of transuranic radioactive waste are codified in Title 40 *Code of Federal Regulations* (CFR) Part 191, "Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes" (EPA 1993). Subparts B and C of the standard, addresses the disposal of radioactive waste. The standard requires that the U.S. Department of Energy (DOE) demonstrate, through the use of a probabilistic risk assessment that the disposal system will function to contain radioactivity below specified release limits considering the effects of reasonably expected human-initiated and natural processes and events. This includes the consideration of inadvertent drilling into the repository at some future time.

Title 40 CFR Part 194, "Criteria for the Certification and Recertification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations" (EPA, 1996) provides a definition of the Delaware Basin (in 40 CFR §194.2), as follows:

Delaware Basin means those surface and subsurface features which lie inside the boundary formed to the north, east, and west of the [Waste Isolation Pilot Plant (WIPP)] disposal system, by the innermost edge of the Capitan Reef, and formed, to the south, by a straight line drawn from the southeastern point of the Davis Mountains to the most southwestern point of the Glass Mountains.

Figure 1 shows the location and extent of the Delaware Basin.

The EPA provided criteria in 40 CFR §194.33 that addressed the consideration of future deep and shallow drilling in Performance Assessments (PAs). These criteria lead to the formulation of conceptual models that incorporate the effects of these activities. These conceptual models use parameter values drawn from the databases in Appendix DEL of the Compliance Certification Application (CCA).

In accordance with these criteria, the DOE used the historical rate of drilling for resources in the Delaware Basin to calculate a future drilling rate. In particular, in calculating the frequency of future deep drilling, 40 CFR §194.33(b)(3)(i) (EPA 1996) provided the following guidance to the DOE:

Identify deep drilling that has occurred for each resource in the Delaware Basin over the past 100 years prior to the time at which a compliance application is prepared.

The DOE used the historical record of deep drilling for resources below 2,150 feet (656 meters) that has occurred over the past 100 years in the Delaware Basin. In the past 100 years, deep drilling for oil, gas, potash, and sulfur exploration has occurred. All of these drilling events were used in calculating the rate of deep drilling within the controlled area (the 16-section Land Withdrawal Boundary) and throughout the basin in

**Delaware Basin Drilling Surveillance Plan**  
**WP 02-PC.02, Rev. 5**

---

the future, as discussed in Appendix DEL of the CCA. Historical drilling for purposes other than resource exploration and recovery (such as WIPP site investigation) were excluded from the calculation in accordance with guidance provided in 40 CFR §194.33. In calculating the frequency of future shallow drilling, 40 CFR §194.33(b)(4)(i) states that the DOE should:

Identify shallow drilling that has occurred for each resource in the Delaware Basin over the past 100 years prior to the time at which a compliance application is prepared.

An additional criterion with respect to the calculation of future shallow drilling rates is provided in 40 CFR §194.33(b)(4)(iii):

In considering the historical rate of all shallow drilling, the Department may, if justified, consider only the historical rate of shallow drilling for resources of similar type and quality to those in the controlled area.

The only resources present at shallow depths (less than 2,150 feet [655 meters] below the surface) within the controlled area are water and potash. Thus, consistent with 40 CFR §194.33(b)(4), the DOE used the historical record of shallow drilling associated with water and potash extraction in the Delaware Basin in calculating the rate of shallow drilling within the controlled area. The DOE subsequently determined that influences on the repository from shallow holes may be screened from further consideration in the PA on the basis of low consequence to the performance of the disposal system (see Chapter 6.0, Section 6.2.5.2 of the CCA).

The EPA provides further criteria concerning the analysis of the consequences of future drilling events in performance assessments in 40 CFR §194.33(c) (EPA 1996). Consistent with these criteria, the following parameters regarding drilling were also included in the performance assessment as documented in Appendix DEL of the CCA:

- Types of drilling fluids
- Amounts of drilling fluids
- Borehole depths
- Borehole diameters
- Borehole plugs
- Fraction of such boreholes that are sealed by humans
- Natural processes that will degrade plugs
- Instances of encountering pressurized brine in the Castile Formation

The DOE will continue to provide surveillance of the drilling activity in the Delaware Basin in accordance with the criteria established in 40 CFR Part 194 during the operational phase and will continue until the DOE and EPA agree that no further benefit can be gained from continued surveillance. The results of this surveillance activity will be used in performance assessment calculations performed in support of recertification.

**Delaware Basin Drilling Surveillance Plan**  
**WP 02-PC.02, Rev. 5**

---

## 2.0 PURPOSE

The purpose of the Delaware Basin Drilling Surveillance Plan (DBDSP) is to provide for active surveillance of drilling activities within the Delaware Basin, with specific emphasis on the nine-township area that includes the WIPP site (figure 1). The surveillance of drilling activities will build on the data presented in Appendix DEL and comply with the activities presented in Appendix DMP of the CCA, which were used to develop modeling assumptions for performance assessment. The collection of additional information on drilling patterns and practices in the Delaware Basin will be used to define whether the drilling scenarios in the application continue to be valid at each five-year recertification time for WIPP.

Observations made through the DBDSP may be classed into two general groups: (1) those which support the definition of PA parameter values (see table 1); and (2) those which support the Features, Events, and Processes (FEP) screening process and the definition of conceptual models (see table 2). The first type of observations may serve as direct input to a code, such as the diameter of a drill bit intersecting waste, or they may provide the basis for the calculation of a derivative parameter value, such as the mean length of a borehole plug. In contrast, the second type of observations are generally not used as direct input to codes. Instead, they provide the basis for the screening of FEPs and the subsequent development of scenarios modeled in the PA. The acquisition of both types of observations is essential to support the continued validity of PA parameter values, modeling assumptions, computer codes, and scenarios selection.

<b>Table 1 - Parameter Values</b>	
<b>Parameter Identifier</b>	<b>Description</b>
PV-1	Total number of deep wells
PV-2	Drill bit diameter (same as diameter of open hole)
PV-3	Drill collar diameter
PV-4	Surface casing diameter
PV-5	Drill pipe diameter
PV-6	Speed of drill string rotation
PV-7	Penetration rate through the Salado Formation
PV-8	Type and characteristics of drilling mud
PV-9	Number of encounters of pressurized brine within the Castile Formation
PV-10	Castile brine reservoir pressure
PV-11	Castile brine reservoir volume
PV-12	Shortest time till shut-in
PV-13	Longest time till shut-in
PV-14	Method of plugging; pattern of plugs; plug materials
PV-15	Plug length

**Delaware Basin Drilling Surveillance Plan  
WP 02-PC.02, Rev. 5**

<b>Table 2 - FEP Screening Values</b>	
<b>Parameter Identifier</b>	<b>Description</b>
FEP-1	Total number of shallow wells
FEP-2	Total number and location of oil wells
FEP-3	Total number and location of gas wells
FEP-4	Total number and location of sulfur boreholes
FEP-5	Total number and location of water wells
FEP-6	Total number and location of potash boreholes
FEP-7	Ownership (name and address of leaseholders) of minerals and hydrocarbon leases
FEP-8	Amounts of drilling fluids used
FEP-9	Total number, location, and depth of injection wells for fluid disposal
FEP-10	Total number, location, and depth of injection wells for secondary recovery of oil
FEP-11	Total number of injection well failures
FEP-12	Total number, location, and depth of plugged and abandoned boreholes
FEP-13	Well casing type of steel alloy
FEP-14	Location of potash mining and leasing activity
FEP-15	Total number and location of potash and salt solution mining activity
FEP-16	Total number and type of noncompliance incidences
FEP-17	Total number, magnitude, and location of seismic events
FEP-18	Occurrence of natural gas and CO <sub>2</sub> pipeline construction

### **3.0 PROGRAM IMPLEMENTATION**

Surveillance of drilling activities within the Delaware Basin will be implemented no later than the beginning of the operational phase. This activity will continue until 100 years after closure or until the DOE can demonstrate to the EPA that there are no significant concerns to be addressed by further surveillance, as discussed in Chapter 7, Section 7.1.4, of the CCA. Beginning no later than the initiation of the operational phase and continuing through post-closure, drilling activities within the Delaware Basin will be tracked using commercially available databases. Drilling activities related to hydrocarbon resources, potash boreholes, and water wells that occur within the nine-township area, will be more rigorously monitored using the commercial databases and the drilling records maintained by both state and federal organizations.

#### **3.1 Monitoring Activities**

Parameter values monitored by the DBDSP in the PA are listed in table 1. FEPs screening values are listed in table 2. General topics and monitoring activities addressed by the parameters listed in these tables include the following:

- General drilling activities

**Delaware Basin Drilling Surveillance Plan**  
**WP 02-PC.02, Rev. 5**

---

- Borehole drilling characteristics
- Castile brine reservoirs
- Borehole plugging
- Injection well activities
- Mining in the Delaware Basin
- Incidences of noncompliance with Bureau of Land Management (BLM) and New Mexico Oil Conservation Division (OCD) rules
- Earthquake activity
- Pipeline construction

The following subsections present the specific parameters that are monitored to address each of these topics.

### **3.1.1 General Drilling Activities**

General drilling activities monitored through the DBDSP include the total number of deep and shallow wells; the number, location, and depth of oil wells, gas wells, all other hydrocarbon wells, sulfur boreholes, water wells, and potash boreholes. This information is acquired through commercially available electronic databases and from the records of government agencies such as the New Mexico Office of the State Engineer, the New Mexico OCD, the Texas Railroad Commission (RRC) in Midland, and the BLM. In addition, the ownership of minerals and hydrocarbon leases in the nine township area including and surrounding the WIPP site is monitored. Collection of this ownership information will facilitate contact with leaseholders, if necessary.

The total number of deep and shallow holes is tracked to comply with specified requirements in 40 CFR §194.33(b)(3). Consistent with the regulation, the number of deep holes is used to calculate a frequency of potential future intrusions into the repository. Information on shallow holes is collected to comply with the regulatory requirement; FEP screening analyses have shown that these holes have no impact on the performance of the repository.

### **3.1.2 Borehole Drilling Characteristics**

In the event that a borehole intercepts waste within the repository at some future time, the characteristics of the drilling activity may influence the magnitude of a potential release of radioactive materials to the environment. These characteristics of the drilling

**Delaware Basin Drilling Surveillance Plan**  
**WP 02-PC.02, Rev. 5**

---

activity are factored into PA computer models. Those which are monitored through the DBDSP include the following:

- Drill bit diameter
- Drill collar diameter
- Surface casing diameter
- Drill pipe diameter
- Speed of drill string rotation
- Penetration rate through the Salado Formation
- Type and characteristics of drilling mud
- Amounts of drilling fluid used

Some of this information is available through commercial sources. Additional information is available from the OCD and the Texas RRC. Other information is available only through surveys and interviews with area drillers and through literature reviews.

### **3.1.3 Castile Brine Reservoirs**

Scenarios evaluated in the PA process include the connection of the repository with an underlying pressurized brine pocket in the Castile Formation by one or more intruding boreholes. Assessment of these scenarios requires information on the characteristics of Castile brine pockets. The following parameters are monitored through the DBDSP to support related PA analyses:

- Number of encounters of pressurized brine within the Castile Formation
- Castile brine reservoir pressure
- Castile brine reservoir volume
- Shortest time till shut-in
- Longest time till shut-in

Encounters of pressurized brine are sometimes noted by the driller on the well completion form or on other forms. This information may be contained in OCD Forms C-103, C-105, and the Notification of Fires, Breaks, Spills, Leaks, and Blowouts form. Information may also be provided in BLM Forms 3160-4 and 3160-5, which are filed with the BLM office in Carlsbad, New Mexico. In addition, information regarding pressurized brine encounters is sought using surveys and interviews with drillers operating in the Delaware Basin.

### **3.1.4 Borehole Plugging**

PA scenarios involving interconnections between the repository and an underlying pressurized brine pocket in the Castile Formation are influenced by the manner in which boreholes may be plugged. Information regarding the method of plugging including plug materials and mixtures, plug dimensions, the steel alloy used in well casings, and

**Delaware Basin Drilling Surveillance Plan**  
**WP 02-PC.02, Rev. 5**

---

plugging patterns, is used to evaluate the process of borehole plug degradation and to evaluate the expected permeability of plugged holes. The following parameters related to borehole plugging are monitored through the DBDSP:

- Method of plugging
- Pattern of plugs
- Plug materials
- Plug length
- Total number, location, and depth of abandoned boreholes
- Well casing type of steel alloy

Plugging practices are specified by state regulations. The data related to plugging activities are available at the offices of the New Mexico OCD and the Texas RRC. New Mexico plugging data are used directly in PA analyses to calculate borehole permeability; Texas borehole plugging data, although not used directly, are collected to monitor any changes in plugging trends.

### **3.1.5 Injection Well Activities**

Analyses of FEPs that may impact the performance of the repository include assessments of the potential impacts of injection well activities in the vicinity of the project. It has been suggested that the injection of fluids at high pressures could create a pathway for the movement of the fluids into the repository. FEP screening analyses have shown that this is unlikely and, accordingly, the influence of fluid injection has been screened out of the PA. The following information is monitored through the DBDSP, however, to support continuing assessments of injection well influences:

- Total number, location, and depth of injection wells for fluid disposal
- Total number, location, and depth of injection wells for secondary recovery of hydrocarbons
- Total number of injection well failures

Information related to operating characteristics of injection wells is included on OCD Form C-108 and injection well reports on file in the OCD offices and BLM Form 3160-5 on file in the BLM office. If the well is located in Texas, relevant information is available at the Texas RRC.

Information regarding injection well failures is contained in the Notification of Fires, Breaks, Spills, Leaks, and Blowouts form that is completed by drillers and filed in the OCD offices. Similar information is available at the Texas RRC.

**Delaware Basin Drilling Surveillance Plan**  
**WP 02-PC.02, Rev. 5**

---

### **3.1.6 Mining in the Delaware Basin**

The likelihood and potential consequences of mining in the vicinity of the repository are assessed by FEP screening analyses. The following information is monitored through the DBDSP to support these analyses:

- Location of potash leasing and mining activity
- Total number and location of potash and salt solution mining activity

Potash leasing activity is tracked by monitoring lease records in the BLM office in Carlsbad. In addition, mining plans filed with the BLM provide information regarding plans or operations involving solution well mining.

### **3.1.7 Incidences of Noncompliance with BLM and OCD Rules**

The results of the FEP screening analyses pertaining to interconnections between the repository and Castile brine pockets and injection well influences are based, in part, on assessments of the effectiveness of relevant regulatory provisions. The total number and type of incidences of noncompliance with BLM and OCD rules are tracked through the DBDSP. This information is available on OCD Form C-141. Incidence reports are only collected on wells within the nine-township area immediately surrounding the WIPP site.

### **3.1.8 Earthquake Activity**

Seismic activity may potentially affect the repository and is assessed in FEP screening evaluations. On a quarterly basis, the New Mexico Institute of Mining and Technology (NMIMT) reviews and reports on earthquake activity in the New Mexico and Texas portions of the Delaware Basin. These reports are maintained on file by the DBDSP and seismic epicenters are recorded on maps maintained by the DBDSP.

### **3.1.9 Pipeline Construction**

The construction of natural gas pipelines in the vicinity of the WIPP site could enhance the economic viability of natural gas production from wells located near WIPP. This, in turn, could influence the total number of natural gas wells in the area, potentially influencing PA analyses. In addition, potential influences upon the repository from CO<sub>2</sub> (carbon dioxide) flooding (to enhance oil and gas recovery) have been assessed through FEP screening. The application of enhanced oil and gas recovery methods using CO<sub>2</sub> injection in the WIPP area would require construction of a pipeline to deliver the CO<sub>2</sub> to the enhanced recovery project. To support continuing evaluations, natural gas and CO<sub>2</sub> pipeline construction near WIPP is monitored through the DBDSP.

Records available at the BLM office in Carlsbad are reviewed to monitor pipeline construction activity.

### 3.1.10 Other General Monitoring Activities

In addition to the specific parameters described in the sections above, more general factors are monitored through the DBDSP. This monitoring is performed to track trends and developments that may potentially influence PA parameter values, FEP screening arguments, or conceptual models. Monitoring of this type includes:

- **Current drilling practices in the Delaware Basin** - The potential application of alternative drilling practices (such as the use of air instead of brine to circulate drill cuttings) may influence the compliance evaluations. Accordingly, the DBDSP includes the monitoring of general trends in drilling practices in the basin to track any emerging developments.
- **Injection practices** - General injection practices in the basin, including the application of new and emerging technologies, are monitored to provide a basis for updating relevant assumptions in the PA. Various aspects of injection practices, such as injection depths, bottom hole injection pressures, and injection pressure gradients, may be important to future compliance evaluations.
- **Borehole plugging methods** - General practices for plugging boreholes, including plug materials and plug configurations may influence the results of compliance evaluations. General plugging methods are monitored to track the validity of related modeling assumptions.
- **Potash mining technology** - Information related to the development and application of new potash mining technologies, including solution mining, is collected to help ensure the continuing adequacy of PA assumptions.

## 3.2 Information Sources

Sources that provide information monitored through the DBDSP are described in the following subsections.

### 3.2.1 Commercial and Government Databases

Many of the data monitored through the DBDSP are obtained from commercial databases. IHS Enerdeq, a commercial Internet-based database from IHS Energy Group, is a primary source of data. Another commercial source, Drillinginfo.com, is available for review on-line. Data available from these sources are verified by reviewing state and federal records, where possible.

Several different governmental sources serve as information resource centers. These include the New Mexico OCD offices in Artesia and Hobbs; the BLM offices in Carlsbad and Roswell, New Mexico; the Texas RRC; and the New Mexico State Engineer's Office

**Delaware Basin Drilling Surveillance Plan**  
**WP 02-PC.02, Rev. 5**

---

in Roswell. Monthly information on injection wells and salt water disposal wells are available from the New Mexico OCD website.

### **3.2.2 Annual Surveys**

To obtain additional information, a survey is distributed annually to drillers active in the nine-township area of the New Mexico portion of the Delaware Basin (see WP 02-EC3002, Delaware Basin Drilling Database Upgrade Process, which details this activity). For each well drilled during the previous twelve-month period, the survey requests information on the type of well, drilling methods, characteristics of holes, and injection information, if applicable. Information solicited by the use of the survey regarding Castile brine encounters includes reservoir pressure, reservoir volume, shortest time until shut-in, and longest time until shut-in.

### **3.2.3 Literature Reviews and Technical and Industry Meetings**

Literature reviews are performed on an ongoing basis to track trends and new developments in drilling, borehole plugging, mining, and secondary recovery activities in the basin. Some of the industry journals being reviewed are:

- West Texas Geological Society Bulletin
- PennWell Oil and Gas Journal
- Oil World One-Stop Oil Newsletter
- Journal of the American Petroleum Institute

When information of interest is identified, it is recorded and placed in the operating files of the DBDSP and summarized and reported in the annual report of the DBDSP. In addition, personnel supporting the DBDSP attend technical and industry meetings to monitor trends and new developments.

### **3.2.4 Field Observations**

Drilling activities in the nine-township area including and surrounding the WIPP site are observed by field visits (see WP 02-EC3002, which details this activity). These visits may occur whenever the status of a well in the nine-township area changes or when a new well is developed in the nine-township area. These visits serve to confirm the type of well its location, and ownership. In addition, any unusual or out-of-the-ordinary conditions are recorded.

### **3.2.5 Monitoring Regulatory Developments**

Changes in federal and state (Texas, and New Mexico) regulatory requirements that apply to energy and mineral resource development activities may potentially influence PA assumptions, FEP screening arguments, or scenarios development. Applicable

**Delaware Basin Drilling Surveillance Plan**  
**WP 02-PC.02, Rev. 5**

---

regulatory programs will be monitored to ensure that any relevant changes are accounted for in the PA.

#### **4.0 PROGRAM SCHEDULE**

Monitoring of activities within the Delaware Basin will continue until 100 years after closure or until the DOE can demonstrate to the EPA that there are no significant concerns to be addressed by further monitoring. The schedule of program activities is described in the following sections.

##### **4.1 Weekly Activities**

Activities of the DBDSP performed on a weekly basis are aimed to obtain sufficient information to be able to provide data on the following parameters on an annual basis.

- PV-1, Total number of deep wells
- PV-4, Surface casing diameter
- PV-9, Number of encounters of pressurized brine within the Castile Formation
- FEP-1, Total number of shallow wells
- FEP-2, Total number and location of oil wells
- FEP-3, Total number and location of gas wells
- FEP-9, Total number, location, and depth of injection wells for fluid disposal
- FEP-10, Total number, location, and depth of injection wells for secondary recovery of hydrocarbons
- FEP-12, Total number, location, and depth of plugged and abandoned boreholes

Activities performed on a weekly basis to monitor these parameters are:

- Weekly updates of electronic databases are obtained and entered into the Delaware Basin Well Tracking Application (DBWTA).

##### **4.2 Monthly Activities**

Activities of the DBDSP performed on a monthly basis are aimed to obtain sufficient information to be able to provide data on the following parameters on an annual basis.

- PV-2, Drill bit diameter

**Delaware Basin Drilling Surveillance Plan**  
**WP 02-PC.02, Rev. 5**

---

- PV-14, Method of plugging; pattern of plugs; plug materials
- PV-15, Plug length
- FEP-13, Well casing type of steel alloy

OCD and BLM forms are reviewed monthly to monitor these parameters.

#### **4.3 Quarterly Activities**

One parameter, FEP-17, total number; magnitude; and location of seismic events, is monitored quarterly. This parameter is tracked through the review of seismic activity reports from the New Mexico Institute of Mining and Technology.

#### **4.4 Annual Activities**

Activities of the DBDSP performed on an annual basis are identified in Tables 1 and 2. Parameters monitored on an annual basis include the following:

- PV-3, Drill collar diameter
- PV-5, Drill pipe diameter
- PV-6, Speed of drill string rotation
- PV-7, Penetration rate through the Salado Formation
- PV-8 Type and characteristics of drilling mud
- PV-10, Castile brine reservoir pressure
- PV-11, Castile brine reservoir volume
- PV-12, Shortest time till shut-in
- PV-13, Longest time till shut-in
- FEP-4, Total number and location of sulfur boreholes
- FEP-5, Total number and location of water wells
- FEP-6, Total number and location of potash boreholes
- FEP-7, Ownership of minerals and hydrocarbon leases
- FEP-8, Amounts of drilling fluids used
- FEP-11, Total number or injection well failures
- FEP-14, Location of potash mining and leasing activity
- FEP-15, Total number and location of potash and salt solution mining activity
- FEP-16, Total number and type of noncompliance incidences

Activities performed on an annual basis to monitor these parameters are:

- Surveys are distributed to area drillers.
- OCD and BLM forms are reviewed.
- Files maintained by the New Mexico and Texas State Engineers are reviewed.
- Texas Rail Road Commission files are reviewed.
- BLM lease records are reviewed.
- Mining plans available through the BLM and the New Mexico OCD are reviewed.

In addition, federal and New Mexico regulatory programs are reviewed annually to determine whether any changes have occurred that may potentially influence PA assumptions, FEP screening arguments, or scenarios development.

#### **4.5 Biennial Activities**

One parameter, FEP-18, occurrence of natural gas and CO<sub>2</sub> pipeline construction, is monitored biennially. This parameter is tracked through the review of BLM records and the review of commercial electronic databases.

#### **4.6 Unscheduled Activities**

Field visits in the nine-township area including and surrounding the WIPP site are conducted whenever the status of a well in the nine-township area changes or when a new well is developed in the area. In addition, personnel supporting the DBDSP attend technical and industry meetings when relevant meetings occur. Special studies are performed when necessary.

### **5.0 DATABASE MANAGEMENT**

Previously, four electronic databases were maintained in Microsoft Access and were incorporated into the new DBWTA (a Microsoft SQL Server database). The former visual database maintained in AutoCAD was able to be eliminated because newer Geospatial Information System software is capable of using data from the DBWTA.

All hydrocarbon wells have a unique identifier, called the API (American Petroleum Institute) number; this number is used to track the wells in the DBDSP databases. The information developed for each well is maintained in an individual case file.

#### **5.1 Database**

The database maintained in implementing the DBDSP is the Delaware Basin Well Tracking Application. This tracking application includes entries for all hydrocarbon, potash, sulfur, and water wells in the New Mexico and Texas portions of the Delaware Basin. The data are kept current. The tracking application also includes a section for seismic occurrences within the Delaware Basin and surrounding area. The seismic section is updated every three months with data sent from the New Mexico Institute of Mining and Technology.

**Delaware Basin Drilling Surveillance Plan**  
**WP 02-PC.02, Rev. 5**

---

## **5.2 Updating Databases**

Information used to update, maintain, and verify the DBWTA is obtained from a variety of sources, including IHS Energy's Enerdeq; Drillinginfo.com, WIPP borehole data, the Texas RRC, the New Mexico OCD, New Mexico and Texas State Engineers, the BLM, and from surveys sent to area drillers and interviews with drillers. Data are cross-referenced with the OCD database to check for accuracy. Inconsistencies are resolved and noted in the well files. (It is assumed that the original hard-copy filings in the government records will normally be correct).

## **6.0 REPORTING**

The current status of hydrocarbon development and potash mining within the Delaware Basin is provided in quarterly reports. These reports detail new drilling efforts in the basin and list the changes to the status of current drilling activities that occurred during the reporting period. Also, maps are available upon request that show the current status of the wells in the basin.

The quarterly reports and status reports are provided by the DBDSP to the DOE Carlsbad Field Office (CBFO) who, in turn, provides them to Sandia National Laboratories (SNL) personnel who formally review them to determine whether changes have occurred that may impact assumptions made in the PA. When appropriate, SNL personnel provide feedback to the monitoring program.

An annual report is prepared (DOE/WIPP 99-2308, *Delaware Basin Monitoring Annual Report*) and included with other environmental data that are provided to the CBFO and made available to the EPA as prescribed by 40 CFR §194.4(b)(4). The annual report consists of information developed from the quarterly reports along with any necessary maps. Supplemental information included in the annual report is the status of mining in the Carlsbad Mining District (R-111-P area), any new mineral exploration (core holes) within the Basin, the status of potash and hydrocarbon leases in the nine-township area, earthquake activity, pipeline activity, and updates of reports concerning drilling practices, fluid injection (including CO<sub>2</sub> injection practices), pipelines, plugging practices and mining (including solution mining technologies).

Every five years, information from the annual reports is summarized and reevaluated for input into the recertification process as defined in 40 CFR §194.15 (EPA, 1996).

## **7.0 QUALITY ASSURANCE**

Delaware Basin monitoring activities are conducted in accordance with the appropriate provisions of the CBFO Quality Assurance Program Document (CBFO QAPD) (DOE, 2009). Portions of the CBFO QAPD of particular relevance to the implementation of the DBDSP include Section 1.5, Records, and Section 2.1, Work

**Delaware Basin Drilling Surveillance Plan**  
**WP 02-PC.02, Rev. 5**

---

Processes. Delaware Basin monitoring activities are also conducted in accordance with WP 13-1, *Nuclear Waste Partnership LLC Quality Assurance Program Description*.

A WIPP implementing procedure, Delaware Basin Drilling Database Upgrade Process (WP 02-EC3002), has been developed and implemented to control the process of updating the DBWTA. This procedure focuses on ensuring the accurate recording of information and data taken from outside sources.

Field verification is conducted within the nine-township area to the extent necessary to verify the actual location, status and condition of the well. Field verification is recorded on a Field Report/Annual Survey form. The applicable information from the Field Report/ Annual Survey form is entered into the DBWTA. The originals are dispositioned in accordance with WIPP procedures governing such activities.

Annual surveys, requesting information not available from commercial sources or from state and federal records, are documented on a Field Report/Annual Survey form. When (if) the annual surveys are returned, the applicable information from the survey is entered into the DBWTA and the originals are dispositioned in accordance with WIPP procedures governing such activities.

Quarterly and annual reports are considered quality records and will be dispositioned in accordance with WIPP procedures governing such activities.

**Delaware Basin Drilling Surveillance Plan  
WP 02-PC.02, Rev. 5**

<b>REFERENCES</b>
DOCUMENT NUMBER AND TITLE
DOE, 1996. <i>Compliance Certification Application for the Waste Isolation Pilot Plant</i> , DOE/CAO 96-2184, WIPP, CAO (now Carlsbad Field Office), Carlsbad, New Mexico.
DOE, 2010. <i>Quality Assurance Program Document</i> , DOE/CBFO 94-1012, WIPP, Carlsbad Field Office, Carlsbad, New Mexico.
EPA, 1993. 40 CFR Part 191: "Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes"; Final Rule. <i>Federal Register</i> , Vol. 58, No. 242, p. 66398. December 20, 1993. Office of Radiation and Air, Washington, D.C.
EPA, 1996. 40 CFR Part 194: "Criteria for the Certification and Recertification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations"; Final Rule. <i>Federal Register</i> , Vol. 61, pp. 5224-5245, February 9, 1996. Office of Radiation and Indoor Air, Washington, D.C.
WP 13-1, <i>Nuclear Waste Partnership LLC Quality Assurance Program Description</i>

# Delaware Basin Drilling Surveillance Plan WP 02-PC.02, Rev. 5

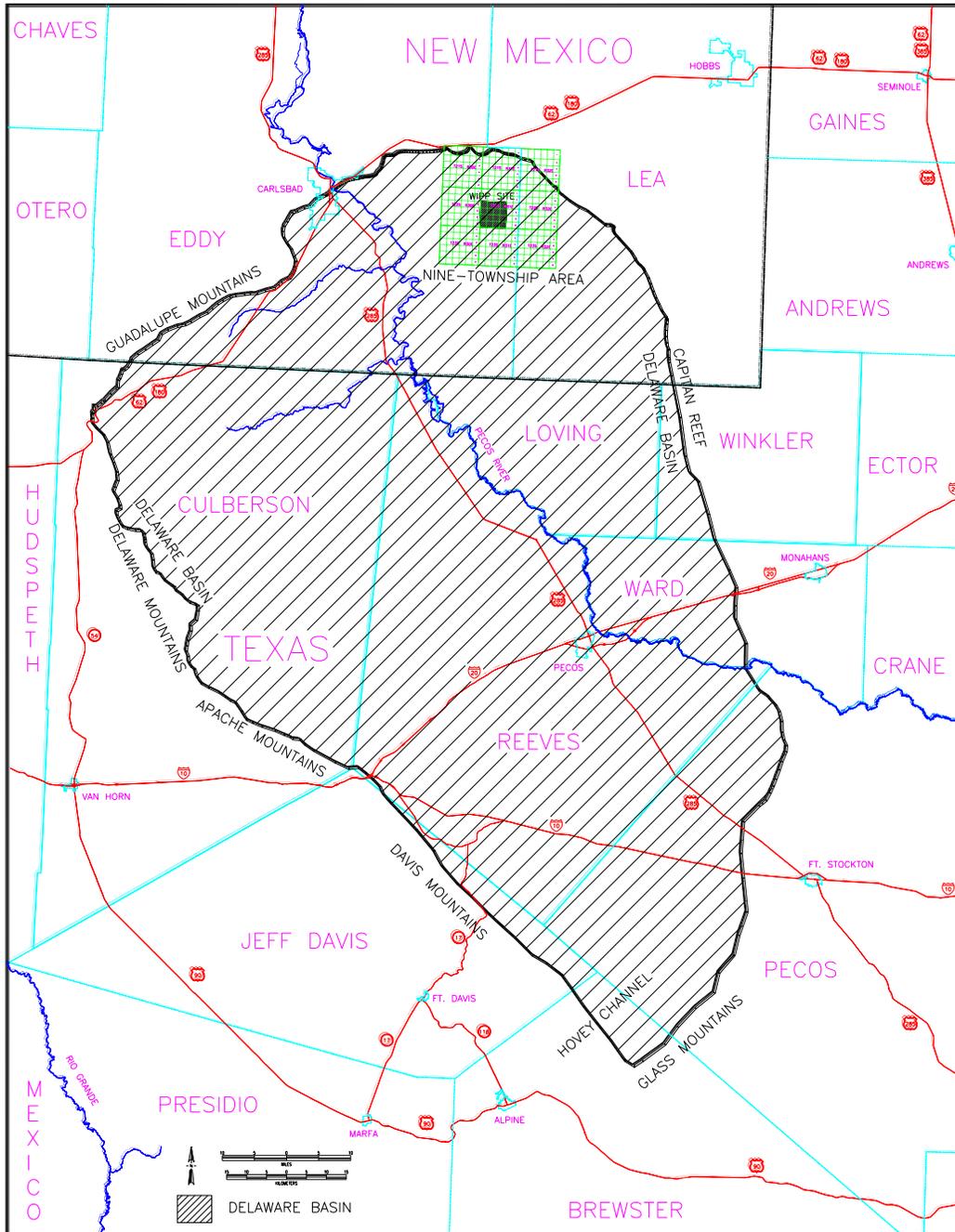


Figure 1 – Delaware Basin