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Delaware Basin Drilling Surveillance Plan

Cognizant Section: EPA Compliance

Approved By: Karen Day



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CHANGE HISTORY SUMMARY

REVISION NUMBER	DATE ISSUED	DESCRIPTION OF CHANGES
10	06/21/21	• Added the DBDSP Annual Report checklist for authors and reviewers as Attachment 1 • Updated acronyms
11	02/08/24	• Update company name from RES to LATA. • Change IHS Markit to S&P Global. • Change Enverus.com to Drilling Info. • Update Drilling Rate formula. • Clarify that information on gas storage wells is also monitored by the DBDSP. • Add new table, Table 3 Delaware Basin Well Tracking Application Record Categories. • Add acronyms and references. • Clarify information on noncompliance.

ACRONYMS AND ABBREVIATIONS

API	American Petroleum Institute
BLM	Bureau of Land Management
CBFO	Carlsbad Field Office
CCA	Compliance Certification Application
CFR	Code of Federal Regulations
CO_2	Carbon Dioxide
DBDIS	Delaware Basin Data Import System
DBDSP	Delaware Basin Drilling Surveillance Plan (Program)
DBMAR	Delaware Basin Monitoring Annual Report
DBWTA	Delaware Basin Well Tracking Application
DOE	U.S. Department of Energy
DPA	Designated Potash Area
EM&H	Environmental Monitoring and Hydrology
EPA	U.S. Environmental Protection Agency
FEP	Features, Events, and Processes
LATA	Los Alamos Technical Associates
NMIMT	New Mexico Institute of Mining and Technology
NMOCD	New Mexico Oil Conservation Division
PA	Performance Assessment
PB	Plugback
PV	Parameter Value
QAPD	Quality Assurance Program Document
RRC	Railroad Commission (State of Texas)
SNL	Sandia National Laboratory
WIPP	Waste Isolation Pilot Plant

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 address 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 (WIPP) 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 [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 Delaware Basin boundary will not change because it is a fixed geological boundary.

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 derived from the databases in Appendix DEL of the Compliance Certification Application (CCA).

Per 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 deeper than 2,104 feet (641 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 to calculate the rate of deep drilling within the controlled area (the 16-section Land Withdrawal Boundary (LWA)), also known as the WIPP site boundary, and throughout the basin in 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 per with requirements provided in 40 CFR §194.33.

In calculating the frequency of future shallow drilling, 40 CFR §194.33(b)(4)(l) 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 2,104 feet [641 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, (EPA 1998).

The EPA provides further criteria concerning the analysis of the consequences of future drilling events in PAs in 40 CFR §194.33(c) (EPA 1996). Consistent with these criteria, the following parameters regarding drilling were also included in the PA 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 per 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 Delaware Basin Drilling Surveillance Program (DBDSP) will provide the Delaware Basin Monitoring Annual Report (DBMAR) to the Sandia National Laboratory (SNL) and the results of this surveillance activity will be used in the PA calculations performed in support of recertification.

2.0 PURPOSE

The purpose of the 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 – Delaware Basin). 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 the PA. 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 period for the WIPP.

Observations made through the DBDSP are categorized into two general groups: (1) those which support the definition of PA parameter values (see Table 1 – Parameter Values); and (2) those which support the Features, Events, and Processes (FEP) screening process and the definition of conceptual models (see Table 2 – FEP Screening Values). The first type of observations serve as direct input to a code, such as the diameter of a drill bit intersecting waste, or they 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 is 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.

TABLE 1 – PARAMETER VALUES (PV)	
Parameter Identifier	**Description**
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 until shut-in
PV-13	Longest time until shut-in
PV-14	Method of plugging; pattern of plugs; plug materials
PV-15	Plug length
TABLE 2 – FEP SCREENING VALUES	
Parameter Identifier	**Description**
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_2 pipeline construction

3.0 PROGRAM IMPLEMENTATION

Surveillance of drilling activities within the Delaware Basin were implemented at 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 at the initiation of the operational phase and continuing through post-closure, drilling activities within the Delaware Basin are tracked using commercially available databases. Drilling activities related to hydrocarbon resources, potash boreholes, and water wells that occur within the nine-township area are 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
- 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 (NMOCD) rules
- Seismic activity
- Pipeline construction

The topics listed above are stored in the Delaware Basin Well Tracking Application (DBWTA) and 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, gas storage 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 NMOCD, the Texas Railroad Commission (RRC), 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 regulations, 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 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 NMOCD 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 until shut-in
- Longest time until 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 NMOCD Forms C-103, C-105, and the C-141 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 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 target area over which information on borehole plugging types and their associated frequencies are collected is the WIPP nine-township area, truncated on the northern edge by the Delaware Basin boundary (Day 2023). The data related to plugging activities are available at the offices of the NMOCD 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 NMOCD Form C-108 and injection well reports on file in the NMOCD offices and the 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 NMOCD offices. Similar information is available at the Texas RRC.

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, New Mexico. In addition, mining plans filed with the BLM provide information regarding plans or operations involving solution well mining.

3.1.7 Spill and Release Incidences

The total number and type of spill and release incidences are tracked through the DBDSP. This information is available on NMOCD Form C-141. Incidence reports are only collected on wells within the nine-township area immediately surrounding the WIPP site. This information/data can be found in NMOCD well records. The DBDSP records found instances of noncompliance quarterly then reports it in the DBMAR. The DBDSP only reviews files of wells located within the nine-township area around WIPP for instances of noncompliance. Any occurrences of state violations by an oil and gas company would be considered an indication of noncompliance. Spills, releases, and blowouts are examples of noncompliant activity.

3.1.8 Seismic 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 in a database 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 carbon dioxide (CO_2) flooding (to enhance oil and gas recovery) have been assessed through FEP screening. The application of enhanced oil and gas recovery methods using CO_2 injection in the WIPP area would require construction of a pipeline to deliver the CO_2 to the enhanced recovery project. To support continuing evaluations, natural gas, and CO_2 pipeline construction near WIPP is monitored through the DBDSP.

Records available at the BLM office in Carlsbad, New Mexico 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 and stored in the DBWTA. 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. S&P Global, a commercial Internet-based database from IHS Energy Group, is a primary source of data reviewed annually. Another commercial source, Drilling Info, 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 NMOCD offices in Artesia and Hobbs, New Mexico; the BLM offices in Carlsbad and Roswell, New Mexico; the Texas RRC; and the New Mexico Stat' Engineer's Office in Roswell. Monthly information on injection wells and salt water disposal wells are available from the NMOCD 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 Maintenance 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
- Permian Basin Water in Energy Conference

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

3.2.4 Field Observations

Site Environmental Compliance Monitoring and Hydrology (SECM&H) performs surveillances of drilling and mining activity, as required by DOE/WIPP-93-004, Waste Isolation Pilot Plant Land Management Plan. Performance is in accordance with WP 02-EM1024, EM&H Field Work and Implementation of the Land Use Request. The intent of these surveillances is to ensure oil and gas activities do not encroach onto the WIPP site, except as allowed through existing leases and agreements. Monitoring of drilling activities and routine monitoring of well sites and related appurtenances is performed on accessible oil and gas leases within the 1-mile perimeter outside the WIPP site boundary. Results of these surveillances are reported quarterly to the CBFO and the DBDSP.

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 potentially influence PA assumptions, FEP screening arguments, or scenarios development. Applicable 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 well updates of electronic databases are obtained from NMOCD and Drilling Info and entered using the DBDIS into the 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
- PV-14, Method of plugging; pattern of plugs; plug materials
- PV-15, Plug length
- FEP-13, Well casing type of steel alloy

NMOCD forms are reviewed monthly to monitor these parameters and stored in the DBWTA.

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 NMIMT and stored in the DBWTA.

Instances of noncompliance can be found in NMOCD well records. The DBDSP reviews the well files for instances of noncompliance of the wells located within the nine-township area around WIPP. The DBDSP records the noncompliance then reports any findings in the DBMAR.

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 until shut-in
- PV-13, Longest time until 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.
- NMOCD and Drilling Info spreadsheets drilling activities such as gas storage, water wells, and potash boreholes are reviewed.
- Files maintained by the New Mexico and Texas State Engineers are reviewed.
- Texas RRC files are reviewed.
- BLM lease records are reviewed.
- Mining plans available through the BLM and the NMOCD are reviewed.

Any information obtained from the above listed resources is stored in the DBWTA. In addition, federal and the state of New Mexico regulatory programs are reviewed annually to determine whether any changes have occurred that potentially influence PA assumptions, FEP screening arguments, or scenarios development.

4.5 BIENNIAL ACTIVITIES

One parameter, FEP-18, occurrence of natural gas and CO_2 pipeline construction, is monitored biennially. This parameter is tracked through the review of BLM records and the review of commercial electronic databases.

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 American Petroleum Institute (API) 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 DBDIS and the DBWTA. DBDIS is an automated internal data collection import system for NM and TX hydrocarbon wells and seismic data. The DBWTA 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 seismic section is updated every three months with data sent from the NMIMT.

5.2 UPDATING DATABASES

Information used to update, maintain, and verify the DBWTA is obtained from a variety of sources, including S&P Global, Drilling Info, WIPP borehole data, the Texas RRC, the NMOCD, 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 NMOCD 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). Table 3 provides a listing of the various record categories contained in the DBWTA. The data obtained from the below data fields are used to compile information into the DBMAR that is subsequently used in the screening of FEPs and the parameter values associated with the PA modeling performed to assess long-term repository performance.

TABLE 3 – DELAWARE BASIN WELL TRACKING APPLICATION RECORD CATEGORIES

Borehole Tab Details	Data to Record	Example
Notes	• Encounters	H_2S, Brine
Depth/Pressure	• Elevation • Total Depth • Plugback (PB) Depth	3017 15255 15211
Coordinates	• Latitude • Longitude	32.2686474 -103.9843423
Date/Time	• Spud date • Completion date • Plug date	11/16/2020 12/16/2021 01/20/2023
Casing	• Casing values • Cement type • Cement sack quantity	13 3/8 C or H 315
Plugs	• Depth of cement • Cement sack quantity	1200 25
Formations	• Name • Depth of formations	Wolfcamp 9396
Work Over	• Additions to well files	year and activity of pertinent information
Logicals	• Occurrences during drilling	air, brine, H_2S, if a well is located in the Designated Potash Area (DPA, formally KPLA), survey well
Misc B	• Additional pertinent Texas borehole information	TX block – 58 Permit – 766415

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 are provided by the DBDSP to the Los Alamos Technical Associates (LATA) Director. When requested, LATA will provide SNL the quarterly reports.

The DBMAR is prepared (DOE/WIPP 99-2308, Delaware Basin Monitoring Annual Report) and included with other environmental data that are provided to the Carlsbad Field Office (CBFO) and made available to the EPA as prescribed by 40 CFR §194.4(b)(4). The DBMAR consists of information developed from the quarterly reports along with any necessary maps. Supplemental information included in the report is the status of mining in the Carlsbad Mining District (Designated Potash Area), any new mineral exploration (core holes) within the Basin, the status of potash and hydrocarbon leases in the nine-township area, seismic activity, pipeline activity, and updates of reports concerning drilling practices, fluid injection (including CO_2 injection practices), pipelines, plugging practices and mining (including solution mining technologies).

Every five years, information from the DBMAR 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 per the appropriate provisions of the CBFO Quality Assurance Program Description (QAPD) (DOE 2017). Portions of the CBFO QAPD of particular relevance to the implementation of the DBDSP include Section 1.5, Records, and Section 2.1, Work Processes. Delaware Basin monitoring activities are also conducted in accordance with WP 13-1, Waste Isolation Pilot Plant Quality Assurance Program Description.

A WIPP implementing procedure WP 02-EC3002, Delaware Basin Drilling Database Maintenance Process, 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.

Annual surveys, request information not available from commercial sources or from state and federal records. When (if) the annual surveys are returned, the applicable information from the survey is entered into the DBWTA and the originals are dispositioned per WIPP procedures governing such activities.

The DBMAR is considered quality records and will be dispositioned per WIPP procedures governing such activities. Use Attachment 1, Delaware Basin Monitoring Annual Report Checklist, when performing QA on the DBMAR during the LATA internal peer review process to ensure completeness and accuracy of the report.

8.0 REFERENCES

DOCUMENT NUMBER AND TITLE
Day, K. 2023. Memo to Steve Wagner. Subject: "Borehole Plugging Practices White Paper". ERMS 578970. Carlsbad, NM: Los Alamos Technical Associates.
U.S. Department of Energy (DOE), 1996. Compliance Certification Application for the Waste Isolation Pilot Plant, DOE/CAO 96-2184, WIPP, CAO (now Carlsbad Field Office), Carlsbad, New Mexico
U.S. Department of Energy (DOE), 2017. Quality Assurance Program Document, DOE/CBFO 94-1012, Section 1.5, Records and Section 2.1, Work Processes. WIPP, Carlsbad Field Office, Carlsbad, New Mexico
U.S. Environmental Protection Agency (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. Federal Register, Vol. 58, No. 242, p. 66398. December 20, 1993. Office of Radiation and Air, Washington, D.C.
U.S. Environmental Protection Agency (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. Federal Register, Vol. 61, pp. 5224-5245, February 9, 1996. Office of Radiation and Indoor Air, Washington, D.C.
U.S. Environmental Protection Agency, 1998. "CARD No. 33: Consideration of Drilling Events in Performance Assessments." Compliance Application Review Documents for the Criteria for the Certification and Recertification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR 191 Disposal Regulations: Final Certification Decision. May 1998. Office of Radiation and Indoor Air, Washington, D.C.
DOE/WIPP-93-004, Waste Isolation Pilot Plant Land Management Plan
WP 02-EC3002, Delaware Basin Drilling Database Maintenance Process
WP 02-EM1024, EM&H Field Work and Implementation of the Land Use Request
WP 13-1, Waste Isolation Pilot Plant Quality Assurance Program Description

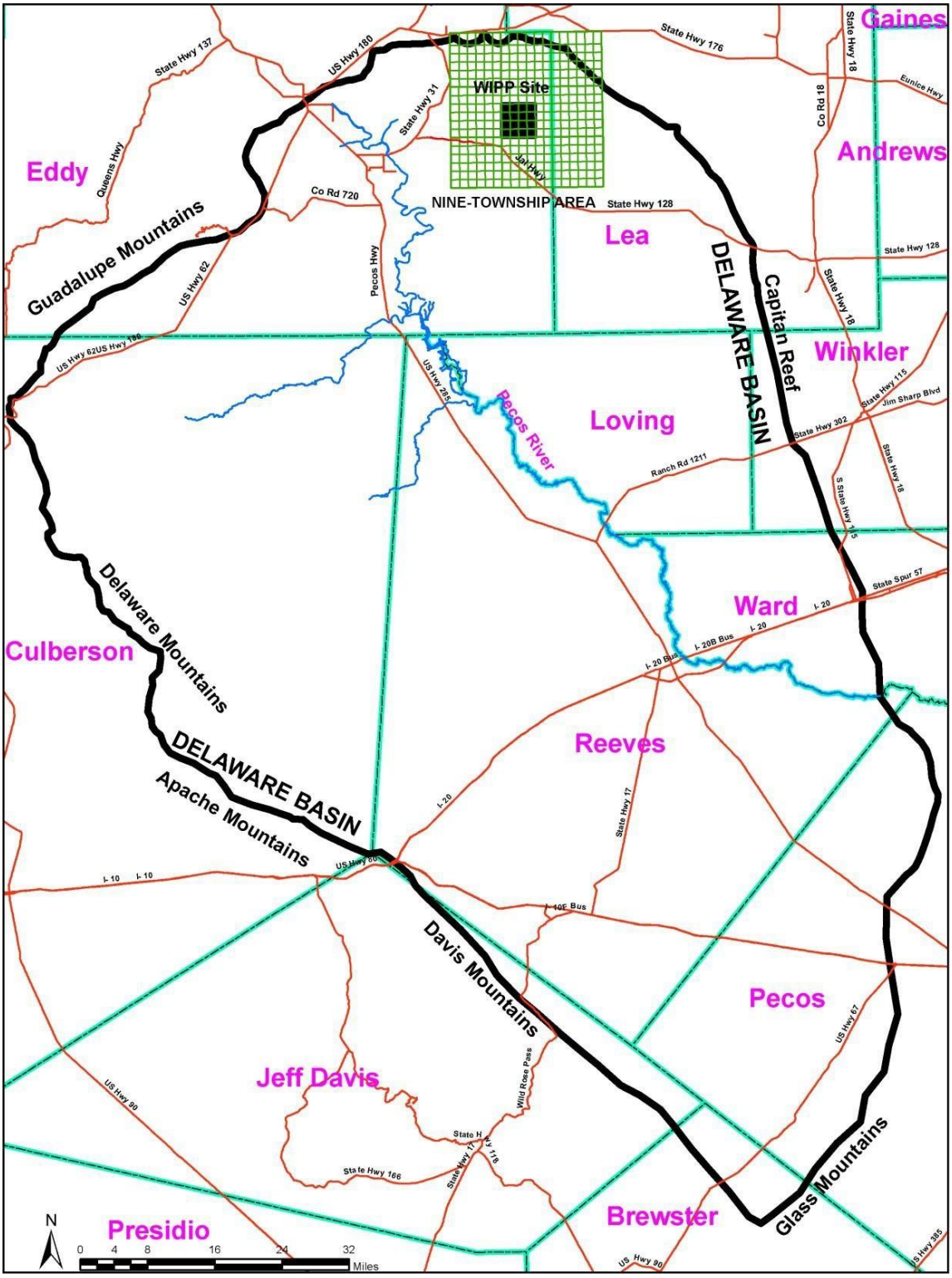


FIGURE 1 – DELAWARE BASIN

Attachment 1 – Delaware Basin Monitoring Annual Report Checklist

NOTE

For Reviewers: There are some items that rarely change from year to year, in these sections the author will provide notice of changes to the reviewers.

This is a checklist for use by LATA and subcontractor staff developing the DBMAR for the DBDSP. This checklist assumes that the author is using the previous year's report as a template and just updating and revising as necessary. Authors and reviewers of the DBMAR, please go through this checklist and ensure every item was addressed appropriately.

☐ Go through the entire document page by page and change the dates that mention the reporting period. These dates can be found on the Title Page, in the Footers of each page, and in the Body of the text throughout the document.

☐ Fill out Table 4 – Shallow Well Status in the Delaware Basin and Table 5 – Deep Well Status in the Delaware Basin with the updated well numbers for the new reporting period. This information/data can be found in Delaware Basin Well Data Record Update system (DBWDRU) report builder.

☐ In Section 1.0 – Delaware Basin Drilling Surveillance Program: ensure the Delaware Basin Drilling Surveillance Plan citation is the most recent revision of the plan. Check Documentum (D2) to verify.

☐ In Section 1.0, ensure the CRA citations include the most recent CRA, unless the reference is to a CRA other than the most current.

☐ In Section 2.0, report any drilling activity updates in the Delaware Basin during the reporting period, including if there were or were not any incidences of non-compliance. If instances of non-compliance were observed, summarize what was identified.

☐ In Section 2.1 Miscellaneous Drilling Information: ensure the borehole depth ranges are updated to reflect the most current depths represented in the database. This information/data can be found in the DBWDRU report builder and NMOCD well records.

☐ In Section 2.1, ensure the list of most common bit sizes are up to date and accurate by consulting the NMOCD well records.

☐ In Section 2.1.1 – Drilling Techniques: update the number of spudded wells in the New Mexico portion of the Delaware Basin for the current reporting period. This information/data can be found NMOCD well records.

☐ In Section 2.1.1, update the number of wells that were **completed** during the reporting period. This information/data can be found in the DBWDRU report builder.

- Ensure all the numbers in this section agree with one another.

☐ In Section 2.1.1, update the number of wells that were completed in the nine-township area of the Delaware Basin for the reporting period. This information/data can be found by using the DBWDRU report builder and ArcMap.

☐ In Section 2.1.1, update the range of depths for wells completed during the reporting period, within the nine-township area, and outside of the nine-township area. This information/data can be found by using the DBWDRU report builder and ArcMap.

☐ Table 3 – Air-Drilled Wells in the NM Portion of the Delaware Basin: ensure the table is accurate and up-to-date.

☐ In Section 2.1.3 – Air Drilling: update the text with any new instance of air drilling that has occurred during the reporting period. This information/data can be found in NMOCD records and the DBWDRU report builder.

☐ In Section 2.3 – Deep Drilling Events: ensure that the Delaware Basin Drilling Surveillance Plan citation is the most recent revision of the plan. Check in D2 to verify.

☐ In Section 2.3, update the number of deep wells that have been completed in the Delaware Basin during the reporting period. This information/data can be found in DBWDRU report builder.

- Ensure this number agrees with Table 5.

☐ In Section 2.3, update the number of deep wells that were **completed** in the Nine-Township area of the Delaware Basin. Wells with the status of Unknown will be included in the deep drilling rate calculation. This information/data can be found by using the DBWDRU report builder and ArcMap.

- Ensure this number agrees with the number reported in Section 2.1.1.

☐ In Section 2.5 – Current Drilling Rate: update the drilling rate for the reporting period. This information/data can be found in DBWDRU report builder. The deep boreholes used in the calculation includes many well status types (i.e., all resources). Using the formula:

$$Deep\ Drilling\ Rate\ \left(\frac{boreholes}{km^2}\right) = \frac{(Deep\ Boreholes + Unknown\ Boreholes)\ x\ \left(\frac{Deep\ Boreholes}{Total\ Deep\ Boreholes}\right)\ x\ (10{,}000\ years)}{(23{,}102.1\ km^2) x\ (100\ years)}$$

☐ In Section 2.5 – Calculate the time a new borehole is being drilled per square kilometer using the deep drilling rate calculated above with the formula below.

$$New\ Drilled\ Borehole\ \left(\frac{years}{km^2}\right) = \frac{10{,}000\ (years)}{Drilling\ rate\ \left(\frac{boreholes}{km^2}\right)}$$

☐ Table 6 – Drilling Rates for the Delaware Basin: update the new drilling rate for the reporting period with the above formula.

- Ensure the number agrees with the number reported in Section 2.5.

NOTE

Due to the way NMOCD files their paperwork, the number of wells spudded and the number completed, should usually be the same number, so check this number with what was reported in Sections 2.1.1 and 2.3.

☐ In Section 2.5.1 – Nine-Township Area Drilling Activities: update the wells **spudded** in the nine-township area for the reporting period. This information/data can be found by using the DBWDRU report builder and ArcMap.

☐ Figure 3 – Well Activity in the Nine-Township Area: Update the figure. Use information/data from DBWDRU and tools in ArcMap. The figure is located in a file titled ArcMap in the Delaware Basin folder on the Texico server. Upload the data to ArcMap to populate the Nine-Township Area with wells.

☐ In Section 2.5.2 – Drilling Activities Outside the Nine-Township Area: update the number of wells **spudded** in the New Mexico portion of the Delaware Basin outside of the nine-township area. This information/data can be found by using the DBWDRU report builder and ArcMap. Separate them out by county. Ensure the counties add up to the total number of spudded wells. Due to how NMOCD files paperwork, this number should usually be the same as wells completed.

☐ In Section 2.5.2, update the number of wells **spudded** in the Texas portion of the Delaware Basin for the reporting period. This information/data can be found in the DBWDRU report builder. Separate them out by county as well. Ensure the counties add up to the total number of spudded wells.

☐ In Section 2.6 – Castile Brine Encounters: update the number of Castile Brine encounters, if any have been reported during the reporting period. This information/data can be found in the DBWDRU report builder and NMOCD.

☐ In Section 2.6, update the probability of Castile Brine encounters. This information/data can be found from natural gas companies that are drilling in the Delaware Basin or NMOCD well files.

NOTE

The area monitored is the entire DPA area within the Delaware Basin.

☐ Table 8 – Plugged Well Information: update the reporting period. Update the wells plugged in the Designated Potash Area (DPA). This information/data can be found using the DBWDRU report builder and ArcMap.

☐ In Section 2.7 – Borehole Permeability Assessment-Plugging Practices: update the number of wells plugged in the DPA of the Delaware Basin. This information/data can be found using the DBWDRU report builder and ArcMap.

- Ensure the monitoring area described is the entire DPA are within the Delaware Basin.

☐ Figure 9 – DPA: update if necessary. To update the figure, contact James Rutley, JRutley@blm.gov or a geologist at the Bureau of Land Management (BLM) for a shape file and use ArcMap. This figure is located in a file titled ArcMap in the Delaware Basin server.

☐ Table 9 – Seismic Activity in the Counties of the Delaware Basin: update the reporting period. Update the table by using information/data found in the Delaware Basin Seismic Data Update system. The data can be accessed through the DBWDRU report builder.

☐ In Section 2.8 – Seismic Activity in the Delaware Basin: ensure the information written about the seismic network is still accurate. This information/data can be found in the Seismicity of the WIPP Site report. The seismic network is often updated with new equipment and additional monitoring stations.

☐ In Section 2.8, update references for the reporting period's seismic reports. This information/data can be found in the Seismicity of the WIPP Site report.

☐ In Section 2.8, update the total number of seismic events reported for the reporting period. Also, separate the events out by County, with their respective ranges in each county. Ensure the events separated out by County, add up to the total number of events. This information/data can be accessed in DBWDRU report builder.

- Ensure the numbers reported in this section agree with the numbers reported in Table 9.

☐ In Section 2.9 – Secondary and Tertiary Recovery: update any relevant information concerning Waterflooding projects in the Delaware Basin. This information/data can be found in NMOCD well records.

☐ In Section 2.9, update information on Tertiary recovery projects occurring in the Delaware Basin (if any). This information/data can be found in NMOCD well records.

☐ In Section 2.9, if there is new science or research on secondary or tertiary recovery methods utilized in the Delaware Basin that has been published during the reporting period, include a summary of those findings here. This information/data can be found in scholarly sources on the Internet or in NMOCD well records.

- In addition to online research, there is an annual "Water in Energy" conference that is held in Lubbock, Texas every year which the Delaware Basin personnel should be attending to gather this kind of information.)

☐ Table 10 – Nine-Township Injection and SWD Well Information, for the reporting period. This information/data can be found by using the DBWDRU report builder, and NMOCD Well Records.

☐ In Section, 2.9.1 – Nine-Township Injection Wells: update all of the relevant information for injection wells operating within the Nine-township portion of the Delaware Basin. Ensure the numbers in the text agree with the numbers reported in Table 10. This information/data can be found by using the DBWDRU report builder, NMOCD Well Records, and ArcMap.

☐ Figure 6 – Active Injection and SWD Wells in the Nine-Township Area. Use ArcMap. The figure can be found in a file titled ArcMap in the Delaware Basin server. DBWDRU report builder and ArcMap tools are needed to update this figure.

☐ In Section 2.9.2 – Nine-Township Salt Water Disposal Wells: update the number of Salt Water Disposal wells in the nine-township portion of the Delaware Basin for the reporting period. This information/data can be found by using DBWDRU report builder and ArcMap.

- Ensure the number of wells agree with the number of wells in Figure 6.

☐ In Section 2.9.2, update the list of Operators operating Salt Water Disposal Wells within the nine-township portion of the Delaware Basin. This information/data can be found using DBWDRU report builder, NMOCD Well Records, and ArcMap.

☐ In Section 2.9.2, update the depth ranges for Salt Water Disposal Wells within the nine-township portion of the Delaware Basin. This information/data can be found using DBWDRU report builder, NMOCD Well Records, and ArcMap.

☐ In Section 2.10 – Mining: in the unlikely case that a new minable resource has been discovered in the Delaware Basin, update this section as appropriate. This information/data can be found from the BLM or scholar sources on the Internet.

☐ In Section 2.10.1 – Potash Mining: update any new developments in the Potash mines in the New Mexico portion of the Delaware Basin (if any). This information/data can be requested from the BLM.

- Plan ahead and update the potash portion of the database several months in advance of writing the report as it takes time to get this information.

☐ In Section 2.10.2, update with new developments in sulfur extraction in the Delaware Basin (if any). This information/data can be found in NMOCD well records.

☐ Table 11 – Brine Well Status in the Delaware Basin: Update the numbers to ensure they agree with Tables 4 and 5.

☐ In Section 2.10.3, Solution Mining: update with any news on the two collapsed brine wells, and on any other pertinent solution mining developments in the Delaware Basin. This information/data can be requested from the BLM.

- Plan ahead and request the information several months in advance of writing the report as it takes time to get this information.

☐ In Section 2.11 – New Drilling Technology: Update with any new drilling techniques or technologies newly employed in the Delaware Basin within the reporting period, or which the DBDSP personnel became aware of in within the reporting period. This information/data can be requested from the BLM, NMOCD or found using scholarly sources on the Internet.

- The annual “Water in Energy” conference is a good source of information for this section.

☐ In Section 2.12 – Alternative Energy Activities: update with any new developments in alternative energy use in the Delaware Basin for the reporting period. This information/data can be found in from scholarly sources on the internet.

☐ In Section 2.13 – Delaware Basin Drilling Surveillance Program Quality Assurance: List any audits/surveillances the DBDSP has undergone during the reporting period. Also, list continuous improvement projects that the DBDSP is engaged in, as well as their completion date, if available.

☐ In Section 3.0 – Survey of Well Operators for Drilling Information: update with the results (if any) of the DBDSP’s efforts in soliciting feedback from drilling operators via the annual surveys during the reporting period.

☐ In Section 4.0 – Summary: update all the numbers in this section, ensuring that they all agree exactly with what has been reported previously in the report. This information/data can be found in throughout the DBMAR.

- Ensure number agreement throughout the report. Historically, there have been errors in this section.

☐ In Section 5.0 – References: update the references section as needed. Use D2 to ensure the documents referenced in the report are accurate and up-to-date.

☐ Figure 7 – Potash Areas in the Vicinity of the WIPP Site: update the figure using ArcMap, if needed. The figure can be found in a file titled ArcMap on the Delaware Basin server.

☐ Figure 8 – Active Brine Well Locations in the Delaware Basin: update the figure using ArcMap, if needed. The figure can be found in a file titled ArcMap on the Delaware Basin server. DBWDRU report builder and ArcMap tools are needed to update this figure.

☐ Table 1 – Nine-Township Area Casing Sizes. This information/data can be found using report builder and NMOCD well records.

☐ Table 2 – Nine-Township Area Bit Sizes. This information/data can be found using report builder NMOCD well records.

☐ Table 7 – Castile Brine Encounters in the Vicinity of the WIPP site, if needed. This information/data can be found using NMOCD well files, DBWDRU report builder, Annual Survey Responses, and ArcMap.

☐ Review the entire report one more time to ensure that all the reported numbers agree and make sense within the text, between the text and the tables, the table of contents match with the report, and also in the context of the previous quarterly and annual reports.