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1 Introduction and Objectives

This Analysis Plan (AP) directs the documentation of hydrologic testing activities into Hydrologic Data Reports for monitoring wells associated with the Waste Isolation Pilot Plant (WIPP) site. Hydrologic testing activities are completed in support of WIPP compliance activities to generate hydrologic parameters used in conceptual models. Hydrologic Data Reports (HDRs) are created to summarize the methods utilized for hydraulic testing and the resulting pressure and water quality information; therefore this is considered a programmatic decision analysis per NP 9-1.

The objectives of Hydrologic Data Reports are to document and summarize the details of hydrologic testing activities conducted in the WIPP wells, and will include the following features and events:

- Descriptions of hydraulic tests, including specialized tests such as slug, pressure pulse, and tracer, associated with the target well;
- Descriptions of the flow systems or other methodology utilized during the hydraulic tests;
- Well configuration during testing;
- List of observation wells and their responses for large-scale tests;
- Pressure data collected from the well; and
- Water quality data and chemical analysis of sampled water.

Additional information can be added to the report or information identified in this plan can be excluded, as deemed appropriate by the author of the report. If the information identified in this plan is excluded, a justification for the exclusion will be stated in the report. Additional information included in the report will require no additional justification.

2 Approach

Hydrologic Data Reports have historically been completed for hydrologic testing activities completed in the 1990s. This AP is intended to direct the creation of Hydrologic Data Reports for testing completed from 2000 until present time, but may be utilized for historical work as deemed necessary. The reports are intended to provide comprehensive descriptions of the testing

performed as part of hydrogeologic investigations conducted at the WIPP site. The reports will include all relevant information about the process of testing in each well and the data acquired as a result of that testing.

3 Software List

The development of the Hydrologic Data Reports will entail utilizing numerous pieces of software including, but not limited to, the following:

- The computer code to be used for pressure data management is nSIGHTS v. 2.41 (qualified under NP 19-1) or later ; and
- Commercial off-the-shelf programs including:
 - Spreadsheet programs, such as Microsoft Excel;
 - WinSitu and PocketSitu (as appropriate for the gages used in testing)
 - Word processing programs, such as Microsoft Word;
 - Graphing programs, such as Golden Software Grapher;
 - Mapping programs, such as ArcGIS; and
 - Design software, such as AutoCAD.

These programs will all be utilized in accordance with NP 19-1.

4 Tasks

The Hydrologic Data Reports are intended to summarize and document testing activities performed in monitoring wells at the WIPP site. The components to be included in the Hydrologic Data Reports are outlined and detailed following:

Section 1: Introduction. Provide a general description of the subject monitoring well and the test(s) including:

- The test objectives;
- The test method utilized; and
- A well location map.

Section 2: Test Equipment. Provide a list of the major equipment used for each test, including detailed specifications and figures when applicable for:

- The data-acquisition system (DAS) used including the functionality of its components, and a flow chart of the interconnected components;
- The downhole pump assembly used including the pump type, model number, the type and specifications of tubing/piping used, depth of install, surface piping used, and any pertinent additions to the assembly. Include a figure that shows the well configuration during each test;
- The downhole pressure transducers used, the depth and configuration of installation, the start and end dates and times for the pressure reading tests, and how data on the transducers was read/recorded;
- The water-level measurement devices used;
- The discharge-measurement and flow-regulation system used, the configuration and placement of the system, how the system functions, its interaction with the DAS, and how it regulates flow;
- Water-quality measurement devices used, the parameters the devices measured, the frequency of measurement, when the samples were taken, and the tools used to make the measurements and their measurement range; and
- The barometric data recorded, details of the instrument used, its connection to the overall system, and the instrument specifications.

We note that all equipment used is properly calibrated under quality assurance standards at the time of the tests described unless otherwise stated.

Section 3: History of Well Development and Testing. Provide a general description of the construction and testing that took place in the target well, and provide figures when applicable for:

- The drilling history of the well, the date drilled and by whom, the drilling method used, the stratigraphy encountered, drilled through, the type of casing installed and its measurements, the well completion details, and include as-built diagram for the well, and a history of well maintenance activities like bailing, jetting with water, perforations, scrapping, plugged, etc. ;
- A map displaying well location;
- The methods utilized for well-development, the dates development took place, and the approximate volumes of water removed during development;

- The pre-test activities including pumping rate assessments and other activities completed prior to testing;
- The video logging conducted in the well and the report generated from that video log; and
- The testing activities conducted including the start time/date, the completion time/date, the volume of water pumped and pumping rates, water samples collected during the test, and a list of files produced as a result of the testing activities. Include a plot of the pumping rates used during testing activities.

Section 4: Testing results. Give a description of pressure, water level, and water chemistry measurements and changes in the well including:

- The water level measurements taken prior to testing in the target well,
- The fluid-pressure response description, the sensor used to record the changes, the pressure prior to the start of the test, the pressure at the end of the test, and the pressure maintained once the well recovered from testing events. Include a pressure vs. time graph for pressures before, during, and after each test. The pressure data recorded by the transducers should be post-processed to remove earth-tide and barometric effects as per SP 9-13;
- The barometric-pressure data recorded, the transducer that recorded the data, and the minimum and maximum barometric pressure during each test. Include a graph of the barometric pressure vs. time before, during, and after each test; and
- Water quality data results, the range of specific conductance, specific gravity, and pH of the samples, and analytical results including the laboratory that conducted the analyses of each sample. Include a graph and table of the specific gravity, pH, and specific conductance recorded and a table of the analytical chemistry results for each test.
- Include a listing of anomalies or discrepancies that need to be considered when reviewing the data (i.e. CARs, equipment failures, pump failures, gage failures, DAS problems, etc.).

We note that all equipment used is properly calibrated under quality assurance standards at the time of the tests described unless otherwise stated.

Section 5: Appendices. Provide a list of data recorded for the following:

- Pumping rates and/or pressure influences exhibited during testing;
- Fluid pressures recorded during testing;
- Barometric pressures recorded during testing;
- Water quality data recorded during testing; and
- List of source documents, ie notebooks, etc that provided the META data contained in the report.

Additional sections shall be added to the testing descriptions for any notable activities.

The HDRs shall be developed and written by individuals that are familiar with hydraulic testing and the resulting data including but not limited to Dale Bowman, Lauren Hillesheim, and Patricia Johnson. Data processing, including data thinning and corrections for barometric and earth tides, shall be performed using nSIGHTS per the requirements of SP 9-13, and by individuals trained in using the code. HDRs shall be prepared, reviewed, and submitted to the WIPP Records Center by the responsible writer at the completion of each well description. The HDRs are an ongoing project subject to past and future testing of individual wells; subsequently, the a final completion date for the HDRs is undefined.

5 Special Considerations

No Special Considerations are necessary for this Analysis Plan.

6 Applicable Procedures

All applicable WIPP quality-assurance procedures will be followed for these tasks. Training of personnel will be done in accordance with the requirements of NP 2-1 *Qualification and Training*. All software used will meet the requirements of NP 19-1 *Software Requirements*. Data and report generation will be done in accordance with the requirements of NP 9-1. The analyses will be reviewed following NP 6-1 *Document Review Process*.

7 References

Bowman II, D.O., 2012. SP 9-13: Data Thinning and Removal of Barometric and Earth Tide Effects from Water-Level Data, Revision 0. Albuquerque, NM: Sandia National Laboratories.

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