# EP-DIV-SOP-20221, R0

# WELL DEVELOPMENT

Effective Date: 7/9/2014

| Procedure Owner: | Signature: | Date: |
|---|---|---|
| Craig Douglass | /s/ Signature on File | 7/9/2014 |

## REVISION HISTORY

| Document No./ Revision No. | Issue Date | Action | Description |
|---|---|---|---|
| EP-ERSS-SOP-5033 R. 0 | 02/09/07 | | Reformatted and renumbered, supersedes SOP-05.02 |
| EP-ERSS-SOP-5033 R.0, IPC1 | 11/3/2010 | Revision | Section 2.1, Background, second paragraph modified to read: "Well development is conducted to remove fines from the vicinity of the well screen, restore the aquifer properties disturbed during the drilling process, improve the hydraulic characteristics of the filter pack and hydraulic communication between the well and the hydrologic unit adjacent to the well screen, and remove water introduced into the monitored zone during drilling. Section X.C.5 of the consent order provides general well development requirements however, well-specific development requirements will be proposed in individual drilling work plans and will require NMED approval." |
| EP-ERSS-SOP-5033, R.0, IPC2 | 5/13/12 | Revision | Sec 4, Step-by-Step Process Description. These changes are specific to the continued development effort at well R-64 during the months of September and October 2012 only. All modifications are necessary to meet water volume removal targets. This is a limited duration scope and the changes will not be incorporated into the next procedure revision. |
| EP-DIV-SOP-20221, R.0 | 7/9/2014 | Major Revision | Superseded with new document number. Incorporated IPC-1 comments and rescinded IPC-2 comments. |

## TABLE OF CONTENTS

## 1. PURPOSE AND SCOPE

The purpose of this procedure is to describe the responsibilities and processes for development of newly installed monitor wells and wells being redeveloped for the Los Alamos National Laboratory (LANL or Laboratory) Environmental Programs (ADEP).

## 2. BACKGROUND AND PRECAUTIONS

### 2.1 Background

This procedure is used in conjunction with an approved Integrated Work Document (IWD). Also, consult the IWD for information on and use of all PPE.

Well development is conducted to remove fines from the vicinity of the well screen, restore the aquifer properties disturbed during the drilling process, improve the hydraulic characteristics of the filter pack and hydraulic communication between the well and the hydrologic unit adjacent to the well screen, and remove water and drilling fluids introduced into the monitored zone during drilling and well construction. Section X.C.5 of the consent order provides general well development requirements however, well-specific development requirements will be proposed in individual drilling work plans and will require NMED approval.

There are various techniques that may be effective in developing wells depending on the hydrogeologic conditions encountered in the aquifer, drilling method used, and well design. Since hydrogeologic conditions may be complex and unpredictable, a single procedure cannot be developed that will apply to all possible situations. Refer to the site-specific work plan or FIP for more information on the scope of work activities for determining the most appropriate method to be used for existing conditions.

### 2.2 Precautions

None.

## 3. EQUIPMENT AND TOOLS

- Water Level Meter
- YSI 650 or equivalent multimeter with sondes capable of measuring specific conductance/temperature/pH/dissolved oxygen (DO)/oxidation-reduction potential (ORP), and turbidity.

- Flow-through cell
- Distilled Water for decontamination of flow-through cell and meters
- Stop Watch

## 3. EQUIPMENT AND TOOLS (continued)

- Plastic Sheeting
- Wire Brush Assembly sized appropriately for the well
- Bailer sized appropriately for the well and the development objectives
- Pump(s) appropriately sized for the well
- Jetting tool
- Surge Block
- Turbidity Meter (with range of 0-400 NTU)
- Borehole/Well Completion Information Form
- Any Personal Protective Equipment and monitoring equipment listed or required in the SSHASP
- Any additional supplies listed in associated procedures, as needed

## 4. STEP-BY-STEP PROCESS DESCRIPTION

### 4.1 Pre-Operational Activities

[1] Coordinate efforts for on-site staging of water that is produced during development.

[2] Mobilize and stage containers for temporary water storage.

[3] Ensure containers are structurally sound, decontaminated, compatible with anticipated contaminants, and field manageable.

[4] Containerize all development water until it can be discharged in accordance with an NMED-approved Notice of Intent (NOI) or other appropriate disposal method.

[5] Clearly label each container in accordance with the waste characterization strategy form.

**4.1 Pre-Operational Activities (continued)**

[6]

[7] Decontaminate all equipment that will enter the well or come into contact with the development water before developing each well according to procedure EP-ERSS-SOP-5061, Field Decontamination of Drilling and Sampling Equipment.

[8]

[9] Begin well development within 14 days of completion, but no sooner than 48 hours after grouting is completed.

[10] Do not use any dispersing agents, acids, or disinfectants to enhance the development of the well unless specifically approved in writing by the Project Leader through the STR, as appropriate.

**NOTE**: In the installation of some monitoring wells in perched alluvial aquifers at Los Alamos, partial development is desirable before emplacing the bentonite seal and cement grout because of filter pack settling that commonly occurs.

**4.2 Well Development Activities**

**EP Project Personnel**

[1]

[3] Measure and record depth to water and the total depth of the well according to procedure SOP-5223, Manual Groundwater Level Measurements.

**4.2 Well Development Activities (continued)**

[4] Perform wire-brush procedures throughout the saturated length of the well casing, screen(s), and sump, if applicable. Wire-brushing is not required for newly completed wells.

[5] Begin surging and bailing to remove turbid water from the well and sediment from the sump.

[8] Note and record volumes and observations of water produced as bailing proceeds.

[9] Continue surging and bailing as prescribed by the Work Plan or FIP or as otherwise directed by the Project Leader through the STR, as appropriate.

[10] Begin pump-development procedures, using the following general steps to develop each screen individually and in succession:

- Install a submersible pump and packer (if necessary) assembly across the first screen to be developed;
- Pumping is initiated at a sustainable rate that will not induce excessive drawdown;
- Pump intake is set at multiple intervals within the screen and in the sump, as specified in the work plan or FIP.
- A transducer may be installed in the well to measure water levels during the pump-development phase. Monitoring water levels allows calculation of specific capacity stability of which is one indication that development may be complete. for wells greater than 50 ft depth, the transducer should be deployed in a gauge tube.
- Field water quality measurements shall be collected in a flow-through cell;
- Note the initial color, clarity, effervescence, and any obvious odor of the water;
- Periodically monitor water quality parameters throughout the pump-development phase as prescribed in the Work Plan or FIP;
- Likewise, note and record flow measurements (flow rate and volume produced) as indicated by an in-line flow meter; and
- Continue to record measurements until the screen interval has been fully developed.

**NOTE**: For wells with multiple completions, each water-bearing zone is isolated using inflatable packers.

[11] The pump will be run as dictated by the schedule until work plan or FIP specified volume and water quality targets are met.

[12] Continue until the turbidity readings stabilize at levels of less than 5 NTU or cannot be improved per the Hazardous and Solid Waste Amendments Permit (May, 1990).

[13] If the well is not free of sediment after the work plan or FIP specified volume of water has been removed, continue pumping until twice that volume has been purged or approval to cease development activities is authorized by the Project Leader through the STR, as appropriate.

[14] Be sure to document all turbidity measurements in the Daily Activity Log in accordance with procedure WES-EDA-QP-219, Sample Control and Field Documentation.

[15] For wells where borehole drilling and construction was completed without the use of drilling fluid (water, mud, or additives), purge a minimum of five casing volumes (excluding filter pack volume) of water before stopping well development.

**NOTE**: In situations where the groundwater flow from the screen interval is exceeded by the development pumping rate, the well may temporarily dry up.

[16] Contact the Project Leader when it is determined that five casing volumes cannot be purged within a 24-hour period.

[17] For completing well development, ensure field chemical parameters have stabilized over a series of monitoring measurements as specified in Table 4.2.

| Field Parameter | Field Indicator Parameter Stability Criteria (for at least 3 consecutive measurements) |
|---|---|
| Turbidity | <5 NTUs |
| DO | DO varies no more than 0.3 mg/L |
| pH | pH varies no more than 0.2 SU |
| SC | For SC>100 µS/cm, SC varies no more than 3%, or<br>for SC≤100 µS/cm, SC varies no more than 5% |

**Site Geologist**

[18] If it is determined that one or more of the above criteria for well development cannot be met regardless of the amount of pumping, coordinate with the Project Leader or STR, as

appropriate to select an alternate procedure for verifying that the well is adequately developed.

**4.3 Documentation**

**EP Project Personnel**

[1] Record all manually measured data and procedural descriptions in a field notebook as required by procedure SOP-5181, R.1, Notebook and Logbook Documentation for Environmental Directorate Technical and Field Activities. [2]

Comple

te the appropriate data entry requirements on the Borehole/Well Completion Information Form to document well development.

**4.3 Documentation (continued)**

[3] Record all well development activities in the field log book.

[4] Document maximum discharge rate used in final development.

[4] Document all deviations from the Work Plan or FIP in accordance with procedure P322-4 – Laboratory Performance Feedback and Improvement Process.

**4.4 Post-Operation Activities**

**Field Team Leader**

[2] Insure that all equipment is accounted for and decontaminated (see procedure EP-ERSS-SOP-5061, Field Decontamination of Equipment).

## 4.5 Records

**Field Team Leader**

[1] Submit the following records generated from this procedure to the Records Processing Facility:

- Copy of field log book notes
- Completed Daily Field Summary Report