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Department of Energy

Ohio Field Office  
Fernald Environmental Management Project  
P. O. Box 538705  
Cincinnati, Ohio 45253-8705  
(513) 648-3155



AUG 08 2002

Mr. Tom Schneider, Project Manager  
Ohio Environmental Protection Agency  
401 East 5<sup>th</sup> Street  
Dayton, Ohio 45402-2911

DOE-0650-02

Dear Mr. Schneider:

**Responses to the Ohio Environmental Protection Agency comments on the Project Specific Plan for the Installation of the Southfield Phase II Module Extraction/Re-injection Wells and Additional Monitoring Wells**

The purpose of this letter is to transmit, for your review and approval, responses to your comments on the draft Project Specific Plan for the installation of the South Field Phase Module Extraction and Re-injection Wells and additional monitoring wells.

If you should have any questions or comments, please contact Robert Janke at (513) 648-3124.

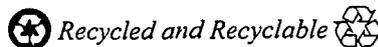
Sincerely,

FEMP:R.J. Janke

Johnny W. Reising  
Fernald Remedial Action  
Project Manager

Enclosure: As Stated

000001



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Mr. Tom Schneider

-2-

DOE-0650-02

cc w/enclosure:

R. J. Janke, OH/FEMP  
K. Nickel, OH/FEMP  
J. Saric, USEPA-V, SRF-5J  
T. Schneider, OEPA-Dayton (three copies of enclosure)  
G. Jablonowski, USEPA-V, SRF-5J  
F. Bell, ATSDR  
M. C. Wojciechowski, Tetra Tech  
M. Shupe, HSI GeoTrans  
R. Vandegrift, ODH  
AR Coordinator, Fluor Fernald, Inc./MS78

cc w/o enclosure:

R. Greenberg, EM-31/CLOV  
N. Hallein, EM-31/CLOV  
A. Tanner, OH/FEMP  
D. Brettschneider, Fluor Fernald, Inc./MS52-5  
D. Carr, Fluor Fernald, Inc./MS2  
M. Frank, Fluor Fernald, Inc./MS90  
T. Hagen, Fluor Fernald, Inc./MS9  
W. Hertel, Fluor Fernald, Inc./MS52-5  
M. Jewett, Fluor Fernald, Inc./MS52-5  
T. Poff, Fluor Fernald, Inc./MS65-2  
ECDC, Fluor Fernald, Inc./MS52-7

000002

**RESPONSES TO OEPA COMMENTS ON THE PSP FOR THE  
INSTALLATION OF THE SOUTH FIELD PHASE II MODULE  
EXTRACTION/RE-INJECTION WELLS AND ADDITIONAL  
SOUTH FIELD MONITORING WELLS**

**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT  
FERNALD, OHIO**

**AUGUST 2002**



Commenting Organization: Ohio EPA  
 Section #: 3.3.1 Pg #: 17  
 Original Comment #: 4

Commentor: GeoTrans, Inc.  
 Line #: 17

Code: C

Comment: What parameters are monitored for the indicated development procedure and what criteria must be met to develop each well? Please provide a reference for Procedure DRL-03.

Response: During development of monitoring wells, temperature, pH, specific conductance, turbidity, and dissolved oxygen are monitored using a Horiba Water Quality Meter. The objective is to obtain clear water, < 5 NTU (Nephelometric Turbidity Units), containing little or no sediment. However since this is not always achievable, the development activities may be considered complete when the following criteria are met:

- Requirements of the PSP
- Minimum calculated volume of water to be removed has been removed, and
- Temperature and specific conductance have stabilized to +/- 10% over at least three successive well volumes.

DRL-03 is the procedure number for the Monitoring Well Development/Redevelopment Procedure. A copy of the procedure is attached to this response document.

Action: Future plans will clarify that, in addition to the objective of obtaining well discharge with turbidity of <5 NTU, development of both conventional and CMT monitoring wells would proceed until the pH, temperature, and conductivity have appropriately stabilized and the stabilization criteria will be indicated. Procedure DRL-03 will also be included as an appendix in future plans.

Commenting Organization: Ohio EPA  
 Section #: 3.4.1 Pg #: 20  
 Original Comment #: 5

Commentor: GeoTrans, Inc.  
 Line #: 15

Code: C

Comment: How do the standards for CMT monitoring well development differ from those for the development of Type 2 and Type 6 monitoring wells? If the CMT well monitoring data are considered equivalent to that from a conventional monitoring well, it would seem appropriate that equivalent standards for CMT well development should be followed.

Response: The CMT wells are developed in a similar manner to conventional monitoring wells. With the following exceptions:

- Surging method: The CMT wells are surged using tubing rather than a surge block, because the CMT channels are too small to allow for a tight-fitting surge block.
- Purge Calculation: The same calculation is used to determine the volume of water to purge from the CMTs with one exception. As stated in the PSP, five times the volume of water lost during drilling is divided evenly between the 6 sampling channels.
- Field Measurements: Due to the uncertain durability of the CMTs, it was decided that once NTU values had reached a degree of consistency (i.e., were not improving with additional pumping), that the channel would be considered developed provided the minimum volume is removed. In our experience with the 5 CMTs currently installed, the closer to the water table the screens are placed, the more difficult it is to reach 5 NTUs without excessive pumping (i.e., Channel 1 and 2 yield higher turbidity than channels 5 and 6).

If after purging a monitoring well, either a conventional well or a CMT well, the sample turbidity is greater than 5 NTU, then the sample is filtered. Use of filtering for > 5 NTU samples will assure that un-dissolved constituents do not bias the analysis.

Action: See action for Comment 4.

Commenting Organization: Ohio EPA  
 Section #: App. A Pg #: A-3  
 Original Comment #: 6

Commentor: GeoTrans, Inc.  
 Line #: 4

Code: C

Comment: A Type 2 well should be installed east of the proposed re-injection basin (i.e., northwest of proposed Monitoring Well 23281). The well would provide data regarding the effectiveness of re-injection by basin infiltration.

Response: Monitoring Wells 2046, 23280, and 23281 should provide adequate monitoring coverage east of the re-injection basin. Figure 1 (attached to this comment response document) illustrates the location of these wells in relation to the subject basin.

Action: No action required.

Commenting Organization: Ohio EPA

Commentor: GeoTrans, Inc.

Section #: App. A

Pg #: A-3

Line #: 11

Code: C

Original Comment #: 7

Comment: A Type 8 well should be installed east of Extraction Well 33262. Multilevel monitoring capability is needed in this area because of the thickness of the plume and the relatively high concentrations that are encountered. Above FRL concentrations occur to a depth of 40 feet below the water table (Sections A-A' and B-B' from the South Field Phase II Design Report). Well 2385 (indicated as the east well at 33262) is not adequately positioned or of sufficient depth to achieve the stated monitoring objectives for the proposed monitoring network.

Response: Although the Type-8 wells appear to provide useful data concerning groundwater quality they are relatively new to the site, and long-term reliability is questionable. With this in mind, DOE limited the number of Type-8 wells proposed in this PSP to those areas that have relatively thick plumes, high uranium concentrations at depth, and appear to decrease in concentration slowly, therefore requiring longer monitoring times. Those areas where the plume appears to be decreasing relatively quickly, like the area beneath the former Southern Waste Units, can be monitored more cost effectively using periodic "snap-shot" profile data collected using a direct-push tool.

Although above FRL uranium concentrations extend in this area to approximately 40 feet below the water table, the concentrations in the lower portion of the plume are only slightly above the FRL. Given what has been seen in this area concerning decreasing concentrations, it is believed that this lower portion of the plume will dissipate rather quickly. Therefore the approach taken was to install Type-2 wells, and utilize the direct-push technique in the future to provide "snap-shot" profile data as necessary. However, if warranted, based on the results of the future direct push sampling, an additional monitoring well may be installed at this location to monitor the deeper contamination.

Action: As noted in the response.

Commenting Organization: Ohio EPA

Commentor: GeoTrans, Inc.

Section #: App. A

Pg #: A-6

Line #: 27

Code: C

Original Comment #: 8

Comment: Proposed Monitoring Well 23273 south of 33061 should be designated as a Type 6 well. GP-12836 from Section B-B' (located in close proximity to the proposed monitoring well) shows that above FRL concentrations occur to a depth of over 30 feet and exceed 50 µg/L at a depth of 25 feet below the water table. The observed elevated concentrations occurring at significant depth below the water table warrant the installation of a deep monitoring well.

Response: A Type 2 Well is best if the highest uranium concentration is located at the water table because it provides a longer screen than a Type 6 well does. Although the plume is approximately 30 feet thick at Location 12836, the highest concentration is at the water table; therefore a Type 2 well is more appropriate. However, DOE will utilize the direct-push technique in the future to provide "snap-shot" profile data as necessary. If warranted, based on the results of the future direct push sampling, an additional monitoring well may be installed at this location to monitor the deeper contamination.

Action: As noted in the response.



ENVIRONMENTAL  
MONITORING PROJECT  
PROCEDURE

Fluor Fernald, Inc.

EFFECTIVE DATE:  
2/28/01 for Revision 1  
8/2/01 for PCN1

REV. NO: 2, PCN1

PAGE 1 OF 26

PROCEDURE TITLE

Monitoring Well Development/Redevelopment

PROCEDURE NUMBER

DRL-03

PROCEDURE CATEGORY

Technical (Non-Operationally Significant)

PROCEDURE AUTHORIZATION

PREPARED BY: Keith A. Payne and Karen S. Voisard/Elizabeth R. Burk  
SUBJECT EXPERTS/TECHNICAL WRITER

APPROVAL:

Mike Frank  
Mike A. Frank  
ENVIRONMENTAL MONITORING PROJECT  
DOCUMENT OWNER

7-26-01  
ISSUE AUTHORIZATION  
DATE

APPROVAL:

Frank B. Thompson  
Frank B. Thompson  
QUALITY ASSURANCE

7-27-01  
DATE

APPROVAL:

H. Keith Lanning  
H. Keith Lanning  
SAFETY AND HEALTH

7-27-01  
DATE 000007

TITLE: Monitoring Well Development/Redevelopment		PROCEDURE NO: DRL-03
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EFFECTIVE DATE: 8/2/01	REV. NO: 2PCN1	PAGE 2 of 26

RECORD OF ISSUE/REVISIONS

**4421**

Revision	Issue Authorization Date	Effective Date	Description
0	NA	6/28/96	Initial
1	NA	10/20/97	Revision incorporates comments from annual review initiated by Environmental Monitoring Project.
2	2/15/01	2/28/01	Review initiated in response to NCR FY2000-1392. Also formatted to comply with ADM-01, and updated to current field practices as requested by Karen Voisard.
PCN1	7/26/01	8/2/01	Change requested by Mike A. Frank per Memorandum M:ARP(EM):2001-0007 regarding the re-evaluation by Health and Safety personnel of the use of portable eyewash units for Environmental Monitoring field activities. Personal eyewash bottles can be used for the activities described in this procedure. Changes were made to pages 2, 6, and 8, removing references to the use of eyewash units. Eyewash requirements are detailed in ADM-02.

**000008**

TITLE: Monitoring Well Development/Redevelopment		PROCEDURE NO: DRL-03
<i>Compliance with this procedure is mandatory when executing activities within its scope. Only controlled copy may be used in the performance of work.</i>		
EFFECTIVE DATE: 2/28/01	REV. NO: 2	PAGE 3 of 26

**TABLE OF CONTENTS**

**4421**

<u>SECTION</u>	<u>TITLE</u>	<u>PAGE</u>
Preface:	PROCEDURE TITLE/AUTHORIZATION PAGE .....	1
	RECORD OF ISSUE/REVISIONS .....	2
	TABLE OF CONTENTS .....	3
1.0	PURPOSE .....	4
2.0	SCOPE .....	4
3.0	DEFINITIONS .....	4
4.0	RESPONSIBILITIES .....	5
5.0	PREREQUISITES .....	5
	5.1 Background .....	5
	5.2 Forms .....	6
	5.3 References .....	6
	5.4 Required Equipment .....	6
6.0	PROCEDURE .....	7
	6.1 Training .....	7
	6.2 Preparation .....	7
	6.3 Pre-Development Measurements .....	9
	6.4 Development Using Development Rig .....	11
	6.4.1 Preparation, Mobilization, and Set Up of Development Rig .....	11
	6.4.2 Development Activities .....	12
	6.5 Development Using Submersible Pump .....	16
	6.6 Development Using Slug and Bailer .....	18
	6.7 Post-Development Requirements .....	21
7.0	RECORDS .....	22
8.0	DRIVERS .....	22
9.0	INFORMATION SOURCES .....	22

**LIST OF ATTACHMENTS**

<u>ATTACHMENT</u>	<u>TITLE</u>	
A	EXAMPLE Well Development Form, FS-F-3680 .....	23
B	EXAMPLE Well Development Form (Continuation Page), FS-F-3680-1 .....	25

TITLE: Monitoring Well Development/Redevelopment		PROCEDURE NO: DRL-03
<i>Compliance with this procedure is mandatory when executing activities within its scope. Only controlled copy may be used in the performance of work.</i>		
EFFECTIVE DATE: 2/28/01	REV. NO: 2	PAGE 4 of 26

## 1.0 PURPOSE

This procedure provides the criteria for the development of monitoring wells performed to restore the natural hydrogeologic conditions altered during drilling and well installation processes, and the redevelopment of monitoring wells to maintain or improve conditions in the screened interval of a well. A well must be properly developed and maintained to yield samples representative of the aquifer.

4421

## 2.0 SCOPE

This procedure applies to activities associated with the development of monitoring wells following well installation completion and the redevelopment of wells for maintenance purposes.

## 3.0 DEFINITIONS

Borehole - A circular open or uncased subsurface hole created by drilling.

Drawdown - Amount water level falls from the static water level as water is withdrawn from a well.

Filter pack - A clean silica sand or sand and gravel mixture of selected grain size and gradation installed between the borehole wall and the well screen and extends an appropriate distance above the screen. The purpose of the filter pack is to retain and stabilize the particles from the adjacent strata.

Fines - Clay, silt and/or fine sand from the formation surrounding the borehole that enters the well screen and settles at the well bottom (as a sediment or sludge) or remains suspended, causing turbid water.

Project Manager - Person, exclusive of Department personnel, responsible for the management of a project.

Redevelopment - The process of restoring a well to its most efficient condition by removing accumulated sediment from the screened interval.

Riser - An impervious durable pipe placed in a borehole to prevent the walls from caving and surface drainage or undesirable fluids from entering the well.

Saturated filter pack - Filter pack, or portion of, in which all pore spaces are completely filled with water.

Static water level - The depth to the surface of the ground water at equilibrium with the aquifer as measured from a reference point.

Surge block - A solid, weighted, cylindrical object that attaches to a drill stem used to surge the screened interval of a well for development purposes.

000010

442		PROCEDURE NO: DRL-03
<i>Compliance with this procedure is mandatory when executing activities within its scope.  Only controlled copy may be used in the performance of work.</i>		
EFFECTIVE DATE: 2/28/01	REV. NO: 2	PAGE 5 of 26

**Surging** - Action that applies sufficient energy in the water column in a monitoring well to create flow reversals through the screen, filter pack and formation, drawing fines into the well and enhancing the natural hydraulic conductivity characteristics of the formation surrounding the well screen.

**Well screen** - A slotted or wire-wrapped portion of casing used to stabilize the sides of the borehole, prevent the movement of sand into the well, and allow the maximum amount of water to enter the well with a minimum of resistance.

#### 4.0 RESPONSIBILITIES

Field Supervisor - Ensures compliance with DRL-03 (specifics addressed in Section 6.0).  
Geologist - Ensures compliance with DRL-03 (specifics addressed in Section 6.0).  
Team Coach - Ensures compliance with DRL-03 (specifics addressed in Section 6.0).  
Technician - Ensures compliance with DRL-03 (specifics addressed in Section 6.0).

#### 5.0 PREREQUISITES

##### 5.1 Background

The purpose of a monitoring well at the FEMP is to allow access to groundwater for the collection of representative samples and water level measurements. To achieve this objective, a newly-installed monitoring well must be developed to enhance the natural hydrogeologic conditions that existed prior to drilling and well installation processes. Proper well development improves the hydraulic characteristics of the monitoring well screen/filter pack/formation interface to provide optimal hydraulic communication between the well screened interval and the adjacent hydrogeologic unit. Proper well development is crucial to obtaining sediment free groundwater samples from the well.

There are instances when an existing well must be redeveloped due to the accumulation of solids in the well over time. The accumulation of sediments in the screened interval of a well decreases the hydraulic activity of the well. Samples collected under these conditions are not representative of actual aquifer conditions. The well must be redeveloped to improve these conditions, and must be maintained in this manner to ensure the collection of representative samples. Redevelopment is accomplished by using the same techniques used for development.

The methods of well development and redevelopment are determined on a well by well basis. Both development and redevelopment are completed by surging the well and then removing several volumes of water and sediment by either bailing or pumping. Criteria for selecting the method of development or redevelopment include the following: amount and type of sediment contained within the well screen, well depth, well diameter, location of well screen in relation to the water table, volume of water in well, hydrogeologic formation characteristics, and recharge rate of well.

000011

TITLE: Monitoring Well Development/Redevelopment		PROCEDURE NO: DRL-03
<i>Compliance with this procedure is mandatory when executing activities within its scope. Only controlled copy may be used in the performance of work.</i>		
EFFECTIVE DATE: 8/2/01	REV. NO: 2PCN1	PAGE 6 of 26

**4421**

5.2 Forms

- Field Activity Log, FS-F-3682*
- Wastewater Discharge Request Form, FS-F-4045*
- Well Completion Log (completed) for well being developed*
- Well Development Form, FS-F-3680*
- Well Development Form (Continuation Page), FS-F-3680-1*

5.3 References

*Barricades, Safety Performance Requirement 3-5, RM-0021*  
Procedures:

PCN1

- Field Project Prerequisites, ADM-02*
- Groundwater Level/Total Depth Measurements, SMPL-05*
- Horiba Water Quality Meter, EQT-02*
- Liquids and Sludge Sampling, SMPL-02*
- Photoionization Detector, EQT-04*
- Portable Shower/Eyewash Unit, EQT 49*

Project Specific Plan (PSP) or Scope of Work (SOW)

5.4 Required Equipment

- NOTE 1 *Additional equipment requirements may be specified in PSP or SOW.*
- NOTE 2 *If drilling personnel are performing development activities, drilling personnel may supply equipment.*
- NOTE 3 *Equipment from procedures listed in Section 5.3 is required to perform development using a development rig, pump, and/or bailer.*

PCN1

- Bailer
- Buckets (2)
- Deionized water
- Detergent water (phosphate-free detergent)
- Development rig and associated equipment
- Plastic bag, large
- Plastic sheet
- ~~Portable shower/eyewash unit (if development rig is used)~~
- Safety glasses
- Steel toe shoes
- Submersible pump
- Towel, disposable

**000012**

TITLE: Monitoring Well Development/Redevelopment		PROCEDURE NO: DRL-03
<i>Compliance with this procedure is mandatory when executing activities within its scope. Only controlled copy may be used in the performance of work.</i>		
EFFECTIVE DATE: 2/28/01	REV. NO: 2	PAGE 7 of 26

## 6.0 PROCEDURE

### 6.1 Training

4421

#### Team Coach (Section)

- [1] Ensure personnel are trained to this procedure, or if in training, are closely supervised by personnel trained to this procedure.

#### Team Coach (Project Development and Reports)

- [2] Forward personnel training documentation to FEMP Training Department files.
- [3] Maintain copy of personnel training documentation in Environmental Monitoring Project files.

### 6.2 Preparation

#### Field Supervisor

- [1] Ensure compliance with *Field Project Prerequisites*, ADM-02 and any other procedures applicable to the field activity (see Section 5.3).
- [2] Review PSP for required well development technique(s), and type of equipment and materials.
- [3] Ensure subcontractor(s) has necessary resources, personnel, materials, and training necessary for satisfactory completion of project.
- [4] Perform periodic on-site field inspections to ensure development of well is performed in accordance with requirements of this procedure and PSP.

**CAUTION**

Failure to ensure well was completed a minimum of 48 hours PRIOR to initiation of development may result in compromised well integrity.

- [5] Ensure well was completed (i.e., completion of grouting ) a minimum of 48 hours PRIOR to initiation of development activities.

#### Technician/Geologist

- [6] Ensure compliance with *Field Project Prerequisites*, ADM-02.

000013

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EFFECTIVE DATE: 8/2/01

REV. NO: 2PCN1

PAGE 8 of 26

**4421**

- [7] Review PSP for required well development technique(s), and type of equipment and materials.

**NOTE** *If PSP requirements CANNOT be achieved and/or Variance/Field Change Notice to PSP is required, the Field Supervisor must be notified.*

- [8] Ensure compliance with PSP.

- [9] Obtain completed Well Completion Log for monitoring well to be developed or redeveloped.

- [10] Obtain equipment required for well development; refer to Section 5.4.

**WARNING**

~~Failure to ensure portable shower/eyewash unit is available and in proper working order may result in personal injury.~~

PCN1

- ~~[11] IF development rig is used during field activity, THEN ensure compliance with Portable Shower/Eyewash Unit, EQT 49.~~

**NOTE** *Complete forms using black or blue indelible ink. Place letters "N/A" for "not applicable" in all spaces for which information is NOT applicable. Entries must be legible, accurate, and complete so that field activity may be reconstructed without reliance on memory. All corrections must be dated and initialed. Diagonal line must be drawn through any unused area. This line must be dated and initialed:*

- [12] Record all field preparation activities, equipment calibration, and relevant comments/observations on the following forms:

- *Monitoring Well Development Form (Attachment A and B), FS-F-3680 and*
- *Field Activity Log, FS-F-3682.*

- [13] Calibrate water quality meter and photoionization detector in accordance with the following procedures:

- *Horiba Water Quality Meter, EQT-02 and*
- *Photoionization Detector, EQT-04.*

**000014**

TITLE: Monitoring Well Development/Redevelopment <b>4421</b>		PROCEDURE NO: DRL-03
<i>Compliance with this procedure is mandatory when executing activities within its scope. Only controlled copy may be used in the performance of work.</i>		
EFFECTIVE DATE: 2/28/01	REV. NO: 2	PAGE 9 of 26

- NOTE 1**      *New disposable equipment does **NOT** require decontamination, if certified clean.*
- NOTE 2**      *Any equipment which comes into contact with groundwater, including pumps and hoses, used during well development must be decontaminated after use.*
- NOTE 3**      *Any decontaminated equipment, which is **NOT** to be used immediately, must be wrapped in plastic and taped shut when dry to provide air-tight seal. All decontaminated equipment will remain stored in plastic **UNTIL** immediately **PRIOR** to use in field.*

[14]    Ensure equipment is decontaminated **PRIOR** to use for development activities.

### 6.3 Pre-Development Measurements

#### Technician/Geologist

- [1]    Ensure safety glasses and steel-toe shoes are worn during field activities.
  - [2]    Approach **AND** open monitoring well **WHILE** monitoring for organic vapors according to *Photoionization Detector, EQT-04*, if photoionization detector is required per EQT-04.
  - [3]    Measure water level and well depth using water level indicator according to *Groundwater Level/Total Depth Measurements, SMPL-05*.
- NOTE** *Well depth recorded on Well Completion Log may vary slightly from depth measured at time of well development due to possible buildup of sediment on well bottom.*
- [4]    Compare well depth measured in Step [2] to well depth recorded on Well Completion Log.
  - [5]    **IF** measured well depth differs significantly from information recorded on Well Completion Log, **THEN** verify well number and location with Well Completion Log.
  - [6]    **IF** measuring correct well **AND** referencing correct paperwork, **THEN** measure bottom of well again, according to *Groundwater Level/Total Depth Measurements, SMPL-05*.
  - [7]    **IF** second reading is acceptable, **THEN** proceed to Step [9].
  - [8]    **IF** second reading is still significantly different, **THEN** notify Field Supervisor.

#### Field Supervisor

- [9]    Contact Project Manager and Geologist for direction.

TITLE: Monitoring Well Development/Redevelopment		PROCEDURE NO: DRL-03
Compliance with this procedure is mandatory when executing activities within its scope. Only controlled copy may be used in the performance of work.		
EFFECTIVE DATE: 2/28/01	REV. NO: 2	PAGE 10 of 26

Technician/Geologist

4421

- [10] Calculate well volume (volume of water in well screen **AND** riser **PLUS** saturated filter pack) using the following formula **AND** record calculations on *Monitoring Well Development Form, FS-F-3680*:

$[(TD - WL) (gpf_{rd})] + FPV = 1$  well volume (gallons), where:

**TD** = total depth of well (feet)

**WL** = water level as measured day of development (feet)

**gpf<sub>rd</sub>** = gallons per foot based on riser diameter:

2-inch diameter = 0.16 gpf

4-inch diameter = 0.65 gpf

6-inch diameter = 1.5 gpf

8-inch diameter = 2.6 gpf

10-inch diameter = 4.1 gpf

11-inch diameter = 4.9 gpf

12-inch diameter = 5.9 gpf

**FPV** = filter pack volume, calculated as follows:

**NOTE** *Length of filter pack is recorded on Well Completion Log.*

$FPV = (gpf_{bd} - gpf_{rd})(length)(0.3)$ , where:

**gpf<sub>bd</sub>** = gallons per foot based on borehole diameter

**gpf<sub>rd</sub>** = gallons per foot based on riser diameter

**length** = length of saturated filter pack in feet

**0.3** = greatest porosity of filter pack material

- [11] **IF DEVELOPING** well following installation, **THEN** determine volume of water to be evacuated from monitoring well according to the following:

- [a] **IF** borehole was completed **WITHOUT** added water, **THEN** remove minimum of five well volumes.

**NOTE 1** *When measuring the volume of water that has been removed from the monitoring well, include ALL water that has been removed. This includes water removed by development rig bailer, development rig pumps, submersible pump, bailer, or other means of removing water during development activities.*

**NOTE 2** *Volume of water lost during drilling and installation is recorded on Well Completion Log.*

- [b] **IF** borehole was completed **WITH** added water, **THEN** remove minimum of five well volumes **PLUS** five times volume of water lost (if any) during drilling and installation of monitoring well.

000016

TITLE: Monitoring Well Development/Redevelopment <b>4421</b>		PROCEDURE NO: DRL-03
<i>Compliance with this procedure is mandatory when executing activities within its scope. Only controlled copy may be used in the performance of work.</i>		
EFFECTIVE DATE: 2/28/01	REV. NO: 2	PAGE 11 of 26

**NOTE** Although water quality field parameter readings are required only before and after removal of each well volume, more frequent readings (especially when removing large well volumes) will provide more complete representation of development process and are, therefore, encouraged.

- [12] Obtain water quality field parameter readings according to *Horiba Water Quality Meter, EQT-02*, periodically throughout development process **AND** after removal of each well volume.
- [13] IF REDEVELOPING already existing well, **THEN** remove minimum of five well volumes.
- [14] Proceed according to the following:
  - Section 6.4 for development using development rig,
  - Section 6.5 for development using submersible pump, and/or
  - Section 6.6 for development using slug and bailer.

**6.4 Development Using Development Rig**

**6.4.1 Preparation, Mobilization, and Set Up of Development Rig**

Technician/Geologist

**NOTE** Development activities using development rig are performed jointly by drilling personnel and Environmental Monitoring Technician(s)/Geologist(s).

- [1] Coordinate development activities with Contract Technical Representative personnel responsible for drilling subcontractors.

**WARNING**

Failure to ensure adequate equipment clearance of overhead utility lines or obstacles **PRIOR** to development activities may result in personal injury.

- [2] Ensure adequate clearance from overhead utility lines and nearby obstacles/hazards for project equipment.
- [3] IF overhead utility lines are located within 15 feet of development location, **THEN** field activities will **NOT** be conducted **UNTIL** health and safety personnel have determined if adequate clearance exists to prevent any possibility of electrical shock hazard, **OR** precautions have been taken to mitigate the hazard.

TITLE: Monitoring Well Development/Redevelopment		PROCEDURE NO: DRL-03
<i>Compliance with this procedure is mandatory when executing activities within its scope. Only controlled copy may be used in the performance of work.</i>		
EFFECTIVE DATE: 2/28/01	REV. NO: 2	PAGE 12 of 26

- [4] Ensure development rig is inspected by safety and, if required, by Radiological Control upon arrival at site.
- [5] Ensure development rig is decontaminated in accordance with PSP or SOW decontamination criteria.
- [6] Ensure development rig has been mobilized to well location identified in PSP or SOW.
- [7] Ensure development rig has been set up in accordance with development rig manufacturer's or drilling subcontractor's specifications.

4421

**WARNING**

Failure to properly establish warning barricade could result in unauthorized entry into exclusion zone increasing potential for personnel injury.

**NOTE** *Size of exclusion zone may vary based on mast height or surrounding hazards.*

- [8] Ensure establishment of warning barricade around development rig in accordance with Safety Performance Requirements 3-5, *Barricades*, and manufacturer's or drilling subcontractor's specifications.
- [9] Ensure work area is secured if work is left unattended.

**6.4.2 Development Activities**

**Technician/Geologist**

- [1] Ensure development rig bailer is attached to cable.
- [2] Ensure development rig bailer is lowered slowly to bottom of well.
- [3] Ensure development rig bailer cable is marked at top of well to identify well depth for future reference.
- [4] Ensure water and sediment removed from well will be properly contained, if required by PSP.

**NOTE** *Monitoring well must be bailed PRIOR to beginning surge block development to induce flow into well.*

- [5] Ensure initial bailing process continues UNTIL majority of fine particles in water (fines) are removed.
- [6] Ensure bailing tool is removed.

000018

*Compliance with this procedure is mandatory when executing activities within its scope.  
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EFFECTIVE DATE: 2/28/01

REV. NO: 2

PAGE 13 of 26

- [7] Ensure surge block is attached to drill stem.
- [8] IF surge block has pressure relief holes, THEN ensure surge block fits snugly in well.
- [9] IF surge block does NOT have pressure relief holes, THEN ensure surge block has clearance of 1/4 inch on all sides.
- [10] Ensure surge block is of sufficient weight to overcome friction of cable system and surge block discs.
- [11] Ensure surge block has sufficient density to overcome effects of buoyancy.
- [12] Ensure the following WHEN water level is above top of well screen:
- NOTE** For wells with screens five feet in length or less, surging above the screen is effective for the entire screen length.
- [a] IF screen length is 5 feet or less, THEN ensure surging action is accomplished above well screen.
- [b] IF screen length is greater than 5 feet, THEN ensure surging is initiated at top of well screen and gradually moves toward bottom.
- [13] Ensure surging begins just below the water level WHEN water level is below top of well screen.

**CAUTION**

Failure to periodically monitor sediment level during surging within well screen could result in damage to well or make removal of surge block impossible.

- [14] Ensure well is monitored frequently to avoid accumulation of excessive amount of fines which causes difficulty during removal of surge block from well.
- [15] Ensure surge begins slowly and gently and increases in vigor gradually to avoid damage to well.
- [16] Ensure surge block is removed from well when surging is completed.
- [17] Ensure development rig bailer is attached to cable.
- [18] Ensure development rig bailer is lowered slowly to bottom of well.
- [19] Ensure bailing process continues UNTIL majority of fines are removed.

*Compliance with this procedure is mandatory when executing activities within its scope.  
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4421

- [20] Ensure development rig cable is marked second time to identify any change in location of well depth marked in Step [3] **AND** document any change on *Monitoring Well Development Form, FS-F-3680*.

**NOTE** *Bailed water may continue to have some fines present. Pumping of well generally follows bailing using development rig. Geologist and Project Manager will determine when to begin pumping following bailing completion.*

- [21] Ensure Step [7] through Step [20] are repeated **UNTIL** fines are no longer present.
- [22] Ensure bailing tool is removed from well **AND** disconnected from cable.
- [23] Ensure decontaminated submersible pump and associated pipe/hose are attached to cable.

**CAUTION**

Failure to lower pump assembly into well with care may result in damage to well screen.

- [24] Ensure submersible pump assembly is lowered slowly into well.

**CAUTION**

Failure to prevent submersible pump from drawing air may cause pump and motor to overheat resulting in equipment damage.

**NOTE** *Pumping well at rate that will limit well drawdown so that water level in well does NOT fall below pump inlet is dependent upon recharge rate of well. Drawdown may be a problem for wells screened just below or across water table.*

- [25] Ensure pumping rate is **NOT** causing excessive well drawdown by performing the following:
- [a] Monitor water level periodically during pumping with water level indicator according to *Groundwater Level/Total Depth Measurements, SMPL-05*.
  - [b] Monitor flow rate through submersible pump to detect reduced flow due to intake of air.
- [26] **IF** excessive well drawdown is observed, **THEN** make necessary adjustments to minimize well drawdown.

000020

TITLE: Monitoring Well Development/Redevelopment <b>4421</b>		PROCEDURE NO: DRL-03
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EFFECTIVE DATE: 2/28/01	REV. NO: 2	PAGE 15 of 26

[27] Ensure water is alternately pumped and water level allowed to equilibrate UNTIL water is clear AND calculated volume of water has been removed.

[28] Contact Field Supervisor.

**Field Supervisor**

**NOTE** *A goal of development is to achieve clear water < 5 NTU (Nephelometric Turbidity Units), containing little or no sediment. However, since this is NOT always achievable, the development activities may be considered complete when the following criteria are met:*

- *requirements of PSP,*
- *minimum calculated volume of water to be removed has been removed, and*
- *water is visually clear of sediments (e.g., turbidity < 5 NTUs) and pH, temperature, and specific conductance have stabilized to +/- 10% over at least three successive well volumes.*

[29] Determine, with input from Geologist and Project Manager, if monitoring well development is complete.

[30] IF development is complete, THEN notify Technician.

[31] IF development is NOT complete, THEN determine, with input from Geologist and Project Manager, best method to continue development activities AND notify Technician.

**Technician**

[32] IF notified that development is complete, THEN proceed to Section 6.7.

[33] Continue with additional development activities in accordance with this procedure as determined by Geologist and Project Manager.

[34] Notify Field Supervisor when additional development activities are completed.

**Field Supervisor**

[35] Return to Step [29].

000021

TITLE: Monitoring Well Development/Redevelopment		PROCEDURE NO: DRL-03
<i>Compliance with this procedure is mandatory when executing activities within its scope. Only controlled copy may be used in the performance of work.</i>		
EFFECTIVE DATE: 2/28/01	REV. NO: 2	PAGE 16 of 26

## 6.5 Development Using Submersible Pump

4421

### Technician/Geologist

- [1] Insert pump slowly into well **AND** lower to bottom of screened interval or lowest depth recommended by pump manufacturer.
- [2] Ensure water removed from well is properly contained.
- [3] Pump accumulated sediment out of sump.
- [4] **SLOWLY** raise pump to top of screened interval.
- [5] Surge pump over length of well screen, while purging, beginning at top of well screen and gradually working toward bottom **UNTIL** no additional fines are generated.

**CAUTION**

Failure to prevent submersible pump from drawing air may cause pump and motor to overheat resulting in equipment damage.

**NOTE** *Pumping well at rate that will limit well drawdown so that water level in well does NOT fall below pump inlet is dependent on recharge rate of well. Drawdown may be a problem for wells screened just below or across water table.*

- [6] Ensure pumping rate is **NOT** causing excessive well drawdown by performing the following:
  - [a] Monitor water level periodically during pumping with water level indicator according to *Groundwater Level/Total Depth Measurements, SMPL-05*.
  - [b] Monitor flow rate to detect reduced flow due to intake of air.
- [7] **IF** excessive well drawdown is observed, **THEN** make necessary adjustments to minimize well drawdown.
- [8] Ensure water is alternately pumped and water level allowed to equilibrate **UNTIL** water is clear **AND** calculated volume of water has been removed.
- [9] Contact Field Supervisor.

000022

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EFFECTIVE DATE: 2/28/01

REV. NO: 2

PAGE 17 of 26

**Field Supervisor**

**NOTE** *A goal of development is to achieve clear water < 5 NTU (Nephelometric Turbidity Units), containing little or no sediment. However, since this is NOT always achievable, the development activities may be considered complete when the following criteria are met:*

- *requirements of PSP,*
- *minimum calculated volume of water to be removed has been removed, and*
- *water is visually clear of sediments (e.g., turbidity < 5 NTUs) and pH, temperature, and specific conductance have stabilized to +/- 10% over at least three successive well volumes.*

- [10] Determine, with input from Geologist and Project Manager if monitoring well development is complete.
- [11] IF development is complete, THEN notify Technician.
- [12] IF development is NOT complete, THEN determine, with input from Geologist and Project Manager, best method to continue development activities AND notify Technician.

**Technician/Geologist**

- [13] IF development is complete, THEN perform the following:
- [a] Remove pump from well AND decontaminate pump in accordance with the *Liquids and Sludge Sampling, SMPL-02.*
  - [b] Proceed to Section 6.7.
- [14] Continue with additional development activities in accordance with this procedure as determined by Geologist and Project Manager.
- [15] Notify Field Supervisor when additional development activities are completed.

**Field Supervisor**

- [16] Return to Step [9].

TITLE: Monitoring Well Development/Redevelopment		PROCEDURE NO: DRL-03
<i>Compliance with this procedure is mandatory when executing activities within its scope. Only controlled copy may be used in the performance of work.</i>		
EFFECTIVE DATE: 2/28/01	REV. NO: 2	PAGE 18 of 26

## 6.6 Development Using Slug and Bailer

442 11

### Technician/Geologist

- [1] Place plastic sheet large enough to accommodate two buckets at base of monitoring well.
- [2] Place two buckets on plastic sheet at distance that will allow water to be caught from either end of bailer while bailer is in horizontal position at well head.
- [3] **IF** using PVC slug to surge wells, **THEN** attach line to slug **AND** proceed to Step [5].
- [4] **IF** using bailer to surge well, **THEN** attach line to bailer.
- [5] **IF** bailer/slug line is coated with Teflon™, **THEN** wipe line with clean disposable towel saturated with deionized water as bailer/slug is lowered into monitoring well.
- [6] **IF** bailer/slug line is **NOT** Teflon™, **THEN** ensure line is new (do **NOT** reuse line).
- [7] **GENTLY** lower decontaminated bailer/slug to bottom of well.
- [8] **IF** using bailer to surge well, **THEN** allow bailer to fill with water for use during surging.
- [9] **GENTLY** surge well screen beginning at top of well screen and gradually working toward bottom.
- [10] Repeat Step [9] for approximately ten minutes or as specified in PSP, slowly increasing vigor of surging action.
- [11] **IF** bailer was used to surge well, **THEN** proceed to Step [20] to continue development process.
- [12] **IF** slug was used to surge well, **THEN** remove slug by performing the following:
  - [a] **IF** slug line is coated with Teflon™, **THEN** wipe slug line with new disposable towel saturated with detergent water below new disposable towel saturated with deionized water, **WHILE** slowly retracting slug from monitoring well, ensuring water does not drip into well.
  - [b] **Do NOT** allow line to touch ground as slug is retracted.
- [13] Disconnect slug line from slug **AND** place slug in plastic bag labeled "DIRTY".

000024

*Compliance with this procedure is mandatory when executing activities within its scope.  
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EFFECTIVE DATE: 2/28/01

REV. NO: 2

PAGE 19 of 26

- [14] IF slug line is Teflon™, THEN place reel of Teflon™ line inside clean plastic bag labeled with the following:
- "DECONNED - DRL-03",
  - Technician's initials,
  - badge number, and
  - date.
- [15] IF slug line is NOT Teflon™, THEN dispose of line with accumulated waste from development event.
- [16] Attach bailer line to decontaminated bailer.
- [17] IF bailer line is coated with Teflon™, THEN wipe bailer line with clean disposable towel saturated with deionized water as bailer is lowered into monitoring well.
- [18] IF bailer line is NOT Teflon™, THEN ensure line is new (do NOT reuse line).
- [19] GENTLY lower decontaminated bailer into well.
- [20] Bail water from bottom of screen UNTIL as many fines as practical are removed AND calculated volume of water has been removed.
- [21] IF well is de-watered (goes dry) before calculated volume of water is removed, THEN perform the following:
- [a] IF PSP does NOT provide directions or is unclear on response to dry well, THEN immediately contact Field Supervisor PRIOR to proceeding.  
**Field Supervisor**
- [b] Contact Project Manager and Geologist for direction.

**Field Supervisor**

**NOTE** *A goal of development is to achieve clear water < 5 NTU (Nephelometric Turbidity Units), containing little or no sediment. However, since this is NOT always achievable, the development activities may be considered complete when the following criteria are met:*

- requirements of PSP,
  - minimum calculated volume of water to be removed has been removed, and
  - water is visually clear of sediments (e.g., turbidity < 5 NTUs) and pH, temperature, and specific conductance have stabilized to +/- 10% over at least three successive well volumes.
- [22] Determine, with input from Geologist and Project Manager, if monitoring well development is complete.

**000025**

*Compliance with this procedure is mandatory when executing activities within its scope.  
Only controlled copy may be used in the performance of work.*

[23] IF development is complete, THEN notify Technician.

Technician

[24] IF notified by Field Supervisor that development is complete, THEN perform the following:

- 4421  
4421
- [a] IF bailer line is coated with Teflon™, THEN upon final withdrawal from well, wipe bailer line with new disposable towel saturated with detergent water below new disposable towel saturated with deionized water, WHILE slowly retracting bailer from monitoring well.
- [b] IF bailer line is NOT Teflon™, THEN disconnect bailer line from bailer AND place bailer in plastic bag labeled "DIRTY".
- [c] IF bailer line is Teflon™, THEN place reel of Teflon™ line inside clean plastic bag labeled with the following:
- "DECONNED - DRL-03",
  - Technician's initials,
  - badge number, and
  - date.
- [d] IF bailer line is NOT Teflon™, THEN dispose of line with accumulated waste from development event.
- [e] Empty contents of buckets into proper storage container AND store all equipment in appropriate locations.
- [f] Proceed to Section 6.7.

Field Supervisor

[25] IF development is NOT complete, THEN determine, with input from Geologist and Project Manager, best method to continue development activities AND notify Technician.

Technician

[26] Continue with additional development activities in accordance with this procedure as determined by Geologist and Project Manager.

[27] Notify Field Supervisor when additional development activities are completed.

Field Supervisor

[28] Return to Step [23].

TITLE: Monitoring Well Development/Redevelopment <b>4421</b>		PROCEDURE NO: DRL-03
<i>Compliance with this procedure is mandatory when executing activities within its scope. Only controlled copy may be used in the performance of work.</i>		
EFFECTIVE DATE: 2/28/01	REV. NO: 2	PAGE 21 of 26

**6.7 Post-Development Requirements**

**Technician/Geologist**

**NOTE** *All forms completed in field must be subject to peer review within one week of completion of field activities. Reviewing personnel **CANNOT** be person who recorded information on forms during field activities. If errors are noted, person who made the mistake should be notified and the error must be corrected.*

- [1] Review field documentation by performing the following:
  - [a] Ensure all entries are legible and accurate.
  - [b] Ensure all blocks are complete.
  - [c] Ensure single line has been drawn through all corrections **AND** is dated and initialed.
- [2] Obtain Control Number from Field Data Coordinator **AND** record on field data package.
- [3] Stamp "RECORD" on first page of field data package in red ink.
- [4] Number each page of field data package sequentially, in red ink, including total number of pages (e.g., 7/9 = Page 7 of 9).
- [5] Review field data package.

**NOTE** *Reviewing Technician/Geologist **CANNOT** be same Technician/Geologist who completed field documentation.*

- [6] Deliver field data package to Reviewing Technician/Geologist.

**Technician/Geologist (Reviewing)**

- [7] Review field data package, ensuring following:
  - **NO** "write-overs" are present,
  - all entries are legible and accurate,
  - dated and initialed line is drawn through all mistakes and through any unused area, and
  - information can reconstruct field activity without reliance on memory.
- [8] Indicate review completion in appropriate location where indicated on individual form **WHEN** all field documentation is acceptable.
- [9] Forward field data package to Field Data Coordinator.

**000027**

TITLE: Monitoring Well Development/Redevelopment		PROCEDURE NO: DRL-03
<i>Compliance with this procedure is mandatory when executing activities within its scope. Only controlled copy may be used in the performance of work.</i>		
EFFECTIVE DATE: 2/28/01	REV. NO: 2	PAGE 22 of 26

Field Data Coordinator

442!

[10] Maintain original field data package in EM Project files.

## 7.0 RECORDS

Training documentation (Maintained by Site Training)

**NOTE** *The following records are retained in Environmental Monitoring Project files. At completion of project needs, records will be transferred and stored in accordance with General Handling and Filing of Records, MS-1037.*

*Field Activity Log, FS-F-3682*

*Well Development Form, FS-F-3680*

*Well Development Form (Continuation Page), FS-F-3680-1*

## 8.0 DRIVERS

*Sitewide CERCLA Quality (SCQ) Assurance Project Plan, FD-1000*

## 9.0 INFORMATION SOURCES

Aller, et al, U.S. Environmental Protection Agency, EPA/600/4/034, *Handbook of Suggested Practices for the Design and Installation of Ground Water Monitoring Wells*, February 1990.

American Society for Testing and Materials (ASTM) Designation: D 5092-90, *Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers*, October 1990.

*Controlling Wastewater Discharges Into The FEMP Wastewater Treatment System*, EP-0005

Driscoll, F. 2nd Ed, 1986, *Groundwater and Wells*, SES, Johnson Division.

*Fluor Daniel Fernald Lockout/Tagout (Hazardous Energy and Material Control) Program*, OP-0004

Lewis Publishers, Inc., *Practical Handbook of Ground-Water Monitoring* edited by David M. Nielsen, 1991.

Ohio Environmental Protection Agency (OEPA), Division of Drinking and Ground Waters, *Ground Water Program*, February 1995.

Ohio Environmental Protection Agency (OEPA), *Technical Guidance Manual for Hydrogeological Investigations and Ground Water Monitoring*, February 1995.

Safety Performance Requirements 7-4, *Drilling Equipment*

000028

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**ATTACHMENT A**  
**EXAMPLE Well Development Form, FS-F-3680**

**NOTE** Refer to this as example only, it is not to be copied for use. If a copy is needed, contact Technical Writer identified on coversheet of this procedure.

**FEMP**  
**WELL DEVELOPMENT FORM**

PREPARED BY (NAME):	BADGE NO.:	DATE:	REVIEWED BY (NAME):	BADGE NO.:	DATE:	
WELL NO.:	INSTALLATION COMPLETION DATE:		CONTROL NO.:	PAGE _____ OF _____		
PROJECT NAME:			PROJECT NO.:	CHANGE NO.:		
FIELD PERFORMANCE:						
WELL DEVELOPMENT START DATE / TIME:			WELL DEVELOPMENT COMPLETION DATE / TIME:			
<b>WATER LEVEL</b>			<b>BEFORE DEVELOPMENT:</b>			
<b>TOTAL DEPTH OF WELL</b>			<b>AFTER DEVELOPMENT:</b>			
<b>FILTER PACK VOLUME CALCULATIONS:</b>						
$\left( \frac{\text{gpf}}{\text{ft}} - \frac{\text{gpf}}{\text{ft}} \right) \times \text{length of saturated filter pack (ft)} \times 0.3 = \text{filter pack volume (gal)}$					<b>VOLUME CONVERSION (gpf):</b> 2 inches = 0.18 4 inches = 0.65 8 inches = 1.5 9 inches = 2.6 10 inches = 4.1 11 inches = 4.9 12 inches = 5.8	
<b>WELL VOLUME CALCULATIONS:</b>						
$\left[ \left( \frac{\text{total depth (ft)} - \text{water level (ft)}}{\text{gpf}} \right) \times \text{filter pack volume (gal)} \right] + \text{well volume (gal)}$						
<b>TOTAL MINIMUM CALCULATED VOLUME OF WATER TO BE REMOVED:</b>						
<b>IF BOREHOLE WAS COMPLETED WITHOUT DRILLING FLUID:</b>						
$5 \times \text{well volume (gal)} = \text{total volume of water to be removed (gal)}$						
<b>IF BOREHOLE WAS COMPLETED WITH DRILLING FLUID:</b>						
$\left( 5 \times \text{well volume (gal)} \right) + \left( 5 \times \text{volume of water lost during drilling (gal)} \right) = \text{total volume of water to be removed (gal)}$						
TYPE AND DIAMETER OF PUMP:			TYPE AND DIAMETER OF BAILER:			
DESCRIPTION OF DEVELOPMENT METHOD:						
TOTAL VOLUME OF WATER REMOVED:						

<b>TITLE: Monitoring Well Development/Redevelopment</b>		<b>PROCEDURE NO: DRL-03</b>
<i>Compliance with this procedure is mandatory when executing activities within its scope. Only controlled copy may be used in the performance of work.</i>		
<b>EFFECTIVE DATE: 2/28/01</b>	<b>REV. NO: 2</b>	<b>PAGE 24 of 26</b>

**ATTACHMENT A**

Page 2 of 2

**4421**

**Well Development Form, FS-F-3680 (Completion Instructions)**

1. **PREPARED BY (NAME)/BADGE NO./DATE:** Print name and badge number of person preparing form and date of form preparation.
2. **REVIEWED BY (NAME)/BADGE NO./DATE:** Print name and badge number of person reviewing form and date of form review.
3. **WELL NO.:** Record identification number of well to be developed.
4. **INSTALLATION COMPLETION DATE:** Record date well installation was completed.
5. **CONTROL NO.:** Record sequential number obtained from Field Coordinator.
6. **PAGE\_\_OF\_\_:** Sequentially number pages in first blank and record total number of pages used for one day for one location in second blank.
7. **PROJECT NAME:** Record name of well development project.
8. **PROJECT NO.:** Record number of well development project.
9. **CHARGE NO.:** Record charge number of well development project.
10. **FIELD PERSONNEL:** Record names of field personnel participating in development activity.
11. **WELL DEVELOPMENT START DATE/TIME:** Record date and time field work was initiated for development activity.
12. **WELL DEVELOPMENT COMPLETION DATE/TIME:** Record date and time field work was completed for development activity.

**WATER LEVEL**

13. **BEFORE DEVELOPMENT:** Measure and record depth to water from reference point before development.
14. **AFTER DEVELOPMENT:** Measure and record depth to water from reference point following development.

**TOTAL DEPTH OF WELL**

15. **BEFORE DEVELOPMENT:** Measure and record total depth of well from reference point before development.
16. **AFTER DEVELOPMENT:** Measure and record total depth of well from reference point following development.

**FILTER PACK VOLUME CALCULATIONS:**

17. **gpf<sub>bd</sub>:** Record borehole diameter gpf conversion volume value from VOLUME CONVERSION block.
18. **gpf<sub>rd</sub>:** Record riser diameter gpf conversion volume value from VOLUME CONVERSION block.
19. **length of saturated filter pack (ft):** Record length of saturated filter pack determined from water level and length of filter pack found on Well Completion Log.
20. **filter pack volume (gal):** Record result from calculation for volume of filter pack determination.

**WELL VOLUME CALCULATIONS:**

21. **total depth (ft):** Record total depth of well determined in Number 15 (above).
22. **water level (ft):** Record water level of well determined in Number 13 (above).
23. **gpf<sub>rd</sub>:** Record riser diameter gpf conversion volume value from VOLUME CONVERSION block.
24. **filter pack volume (gal):** Record volume of filter pack determined in Number 20 (above).
25. **well volume (gal):** Record result from calculation for volume of well.

**TOTAL MINIMUM CALCULATED VOLUME OF WATER TO BE REMOVED:**

26. If borehole was completed without the use of drilling fluid, then record volume of well determined in Number 25 (above) on well volume (gal) line (Number 26) in IF BOREHOLE WAS COMPLETED WITHOUT DRILLING FLUID: block.
27. Multiply well volume by 5 and record result on **total volume of water to be removed (gal)** line.
28. If borehole was completed with the use of drilling fluid, then record the volume of well determined in Number 25 (above) on well volume (gal) line.
29. Record volume of drilling fluid lost during installation on **volume of drilling fluid lost (gal)** line in IF BOREHOLE WAS COMPLETED WITH DRILLING FLUID: block..
30. Perform the calculation and record result on **total volume of water to be removed (gal)** line.
31. **TYPE AND DIAMETER OF PUMP:** Record type and diameter of pump used to develop well.
32. **TYPE AND DIAMETER OF BAILER:** Record type and diameter of bailer used to develop well.
33. **DESCRIPTION OF DEVELOPMENT METHOD:** Describe method used to develop well.
34. **TOTAL VOLUME OF WATER REMOVED:** Record the total volume of water removed during the development process.

**000030**



<b>TITLE: Monitoring Well Development/Redevelopment</b>		<b>PROCEDURE NO: DRL-03</b>
<i>Compliance with this procedure is mandatory when executing activities within its scope. Only controlled copy may be used in the performance of work.</i>		
<b>EFFECTIVE DATE: 2/28/01</b>	<b>REV. NO: 2</b>	<b>PAGE 26 of 26</b>

**ATTACHMENT B Page 2 of 2**

**4421**

**Well Development Form (Continuation Page), FS-F-3680-1 (Completion Instructions)**

1. **CONTROL NO:** Record sequential number obtained from Field Coordinator.
2. **PROJECT NAME/NO.:** Record name and number of well development project.
3. **PAGE \_\_\_ OF \_\_\_:** Sequentially number pages in first blank and record total number of pages used for one day for one location in second blank.
4. **PREPARED BY (NAME)/BADGE NO./DATE:** Print name and badge number of person preparing form and date of form preparation.
5. **WELL NO.:** Record identification number of well to be developed.
6. **REVIEWED BY (NAME)/BADGE NO./DATE:** Print name and badge number of person reviewing form and date of form review.
7. **SAMPLE COLLECTION DATE/TIME:** Record date and time of water quality sample collection.

**VOLUME OF WATER PURGED (gals.):**

8. **NO. GALS:** Record volume of water purged at time of water quality sample collection.
9. **CUM. TOTAL:** Record cumulative volume of water purged at time of water quality sample collection.
10. **TEMP.(°C):** Record temperature of water quality sample from water quality meter.
11. **pH (SU):** Record pH of water quality sample from water quality meter.
12. **SPEC. COND. (mS/cm):** Record specific conductivity of water quality sample from water quality meter.
13. **TURB (NTU):** Record turbidity of water quality sample from water quality meter.
14. **D.O. (mg/L):** Record dissolved oxygen of water quality sample from water quality meter.
15. **COLOR:** Record color of water quality sample (e.g., orange, brown).
16. **COMMENTS:** Record any additional comments or observations concerning the water quality sample (e.g., presence of particulates, odor, sudden color change).

**000032**