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18. J. W. Green 3/30/94
Signature of EDT Originator — Date

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- [] Speech or Presentation
  - [] Full Paper
  - [] Summary
  - [] Abstract
  - [] Visual Aid
  (Check only one suffix)
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- [] Poster Session
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- [] Reference
- [X] Technical Report
- [] Thesis or Dissertation
- [] Manual
- [] Brochure/Flier
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- [] Controlled Document
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List attachments.

Date Release Required: March 30, 1994

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Classification/Unclassified Controlled Nuclear Information	[]	[X]	
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J. W. Green J. W. Green 3/30/94

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Stamp is required before release. Release is contingent upon resolution of mandatory comments.

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Signature

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7. Abstract

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9. Impact Level NA

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DATE MAR 3 1 1994
Station # 12

200-UP-1
PILOT-SCALE GROUNDWATER TREATMENT SYSTEM
OPERATING PROCEDURES

1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to describe the procedures for operating the Pilot-Scale Groundwater Treatment System for the removal of uranium and technetium from the groundwater in the 200-UP-1 Operable Unit located in the 200 West Area. The groundwater treatment system is an ion exchange (IX) system that has been selected as the technology to be evaluated in performing a treatability test. Treatability tests are used to confirm the selection of a particular technology for remediating the groundwater. This treatability test will evaluate the effectiveness of IX for the removal of uranium and technetium from the groundwater. Construction and operating costs will also be gathered as an evaluation of the cost effectiveness for this type of technology performed on the Hanford Site.

1.2 Scope

This treatability test will be performed at the 200-UP-1 Operable Unit near the U-17 Crib just southeast of the U-Plant, 200 West Area (see Figures 1 and 2). The operation will include a series of wells; an extraction well for groundwater treatment and a disposal well for the treated effluent:

- two 20,000 gallon storage tanks, one for storage of influent and one for storage of treated effluent;
- a 10,000 gallon process water tank that provides water for chemical makeup (if required) and backflushing of the IX columns;
- an influent pump station with prefilters;
- a process treatment skid with control panel;
- and an effluent pumping station with filters for pumping treated effluent to the disposal well.

The overall system will be connected together with a series of hoses fitted with quick disconnect fittings, power and signal cables. A portable generator will provide 480 VAC, 3-phase power that will power the pumps and in turn be broken down to 240/120 VAC single- phase with transformers and a power distribution system.

The Pilot-Scale Groundwater Treatment System will be started up in two phases: Phase 1 will be manual operation where flows will be established under manual control, and pressure gages and available installed instrumentation will be used for process monitoring of the system. The system will operate on an 8-hour/day schedule. Phase 2 operations will be initiated after installation of all instrumentation and interlocks. Phase 2 operations will commence with operation of the well pump and the effluent pump(s) on a 24-hour/day schedule. This will allow for filling the influent tank and disposing of treated effluent from the effluent storage tank. The process system will operate on an 8-hour/day schedule. The pH adjustment and neutralization systems, and the oxygen scavenging system will be installed at a later time if it is determined they are required for optimization of treatment effectiveness.

1.3 Pre-Startup Check

1.3.1

A startup checklist will be completed prior to startup and a copy is to be maintained in the field files. Completion of the startup checklist will be documented in the field logbook.

Refer to process flow diagram, drawing number 122893-A, or for Phase 1 - drawing number 122893-D, and the process and instrument diagram drawing number 122293-K and 122293-L for performing the startup checklist. In addition, utilize the equipment list below for performing the equipment component check.

- Extraction Well Pump
- Feed Pumps
- Acid Metering Pump — Phase 1 N/A _____
- Caustic Metering Pump — Phase 1 N/A _____
- Oxygen Scavenging Chemical Metering Pump — Phase 1 N/A _____
- Effluent Pumps
- Filters, Influent and Effluent
- Ion Exchange Columns
- Influent/Effluent Storage Tanks
- Acid Storage Tank — Phase 1 N/A _____
- Caustic Storage Tank — Phase 1 N/A _____
- Oxygen Scavenger Chemical Storage Tank — Phase 1 N/A _____
- Fail-Safe Motor Operated Ball Valve — Phase 1 N/A _____
- Air Release Valves
- Flowmeters
- Flow Switches
- Level Indicators/Controls — Phase 1 N/A _____
- Pressure Indicator/Transmitters — Phase 1 N/A _____
  (substitute pressure gages for Phase 1)
- Differential Pressure Indicator/Transmitter
  (substitute pressure gages - Phase 1) — Phase 1 N/A _____
- Temperature Indicator/Transmitter — Phase 1 N/A _____
- Dissolved Oxygen Monitor
- Turbidity Monitor
- Oxidation/Reduction Potential Monitor — Phase 1 N/A _____

- pH Indicator/Transmitter/Controller
- Flex Hose
- Flexible Connectors
- Static Mixers Phase 1 N/A _____

1.3.2

Perform a safety and readiness walkthrough (a physical inspection) of the system, including: the storage tanks, wells being used, hoses, process system and generator to verify the system is functional, properly connected and ready for safe operation. If discrepant conditions are found, note them in the logbook and correct the condition prior to startup. In checking the hoses, perform a walkdown of the hoses connecting the system together following the flow from the well pump to the disposal well to verify the following integrity:

- Extraction well pump discharge to the influent storage tank inlet;
- Influent storage tank outlet to the influent pump skid suction;
- Influent pump skid discharge to the process system skid inlet manifold;
- From the inlet manifold to the first IX column inlet (at top for down flow), then from the bottom of the first IX column to the inlet (top) of the second IX column;
- From the outlet (bottom) of the second, or polishing IX column, to the discharge manifold;
- Process system skid discharge manifold to the effluent storage tank inlet;
- Effluent storage tank outlet to the effluent pump skid suction; and
- Effluent pump skid discharge to the disposal well.

1.3.3

Verify all valves are closed, including sample valves, and verify switches are in the appropriate position for the equipment that may be operating (for example, the well pump - if it is operating 24-hours/day).

1.3.4

Verify that filter housing lids are closed and filters are ready to accept flow.

1.3.5

For Phase 1, verify that the temporary pressure gages for monitoring differential pressures of the influent and effluent filters, and the IX columns are operable. In addition, verify that the influent and effluent storage tank sight gages are operable.

1.3.6

Verify IX columns are properly connected for series flow through two columns, then to the outlet manifold.

2.0 STARTUP AND OPERATION

To startup Phase 1 operations, the process treatment system will be configured by manually aligning valves, using level sight gages on the influent and effluent storage tanks, and using pressure gages instead of pressure and differential pressure instrumentation for monitoring conditions in the process. Valves will be aligned for flow from the extraction well pump to the influent storage tank, then from an influent pump through one set of filters, through two IX Columns in series flow and out to the effluent storage tank. When a sufficient volume of treated effluent is in the effluent storage tank, it will be discharged to the disposal well via one of the effluent pumps to the disposal well.

The Phase I system operation is manually operated and controlled, as shown on Westinghouse Hanford Company drawing number 122893-D. It omits the following instruments and controls:

- level interlocks,
- fail-safe motor automated valves,
- pH adjustment system,
- neutralization system,
- pressure differential instrumentation (pressure gages will be installed at the inlets and outlets of filters and IX Columns to monitor differential pressure),
- oxygen scavenging system (includes sodium sulfite feed system and control system based on oxidation/reduction, ORP, potential monitors).

Phase 2 operations will utilize the following components:

- fail-safe motor operated valves in the inlets and outlets of both the influent and effluent storage tanks,
- level controls and interlocks to prevent overflows and protect pumps,
- pressure instrumentation,
- differential pressure instrumentation and interlocks to alarm on high differential pressures at the filters and IX columns,
- pH instrumentation for control of pH adjustment and neutralization (if determined to be required for optimization of IX removal of contaminants),

- and instrumentation to control the addition of an oxygen scavenging chemical (sodium sulfite) if it determined to be needed for control of biological growth in the Disposal Well.

2.1 Electrical Power

2.1.1

Verify the main disconnect switch and the control power switch are off. Verify the electrical connector from generator and cable to the process skid is connected.

2.1.2

Before starting operation, start the generator, or if permanent power is available go to the next step.

2.1.3

If generator is not running and prior to start of operations, verify the control switches are closed. If the generator is running, verify control switches are in the appropriate positions.

2.1.4

Energize power to the control panel by actuating the main disconnect switch and the control power switch(es).

2.2 Start Extraction Well Pump

2.2.1

The following ball valves (BV) are to be positioned prior to startup of the extraction well pump.

- All valves are to be closed except, the following:

  BV-1, BV-2, BV-4

2.2.2

Open motor operated ball valve, MBV-1 by setting MBV-1 "Manual-Auto" switch to "Manual", then set the "Open-Off-Close" switch to "Open" to open valve (for Phase 1 manually open ball valve next to MBV-1).

2.2.3

Start the extraction well pump by holding in the "Start" pushbutton until flow is established. Watch for flow on FIT-1 and makeup of Flow Switch FS-1, then release the pushbutton.

2.2.4

Switch MBV-1 selector switch to "Auto" which brings in the interlocks for shutting off the pump as shown in the interlock checklist in Section 4.0 below. Note: For Phase 1, there are no interlocks or selector switches; go to 2.3.

2.2.5

Verify the following lights on the annunciator panel are not illuminated:

Influent Storage Tank Level, "High"
Extraction Well Level, "Low"
FS-1
Influent Storage Tank Level, "High High"

2.3 Establish Flow from Influent Storage Tank to the Process System

Note: The influent storage tank must have liquid in the tank before starting the influent pump as noted in 2.2.1.

2.3.1

The following ball valves (BV) are to be positioned prior to startup of the influent pump(s).

- If running influent pump P-2A and (A) set of filters for extraction, open:

  BV-8, BV-11, BV-14, BV-15, BV-27, BV-30, BV-33, BV-31, BV-35, and BV-64.

- If running influent pump P-2B and (B) set of filters for extraction, open:

  BV-8, BV-13, BV-16, BV-17, BV-27, BV-30, BV-33, BV-31, BV-35, and BV-64.

2.3.2

When water the influent storage tank is at an appropriate level, open MBV-2 by setting MBV-2 "Manual-Auto" switch to "Manual", then set the "Open-Off-Close" switch to "Open" (Note: for Phase 1 manually open ball valve next to MBV-2).

2.3.3

Start either influent pump P-2A or P-2B by holding in the "Start" pushbutton until flow is established. Watch for flow on FIT-2 and makeup of FS-2 and FS-3.

2.3.4

Switch MBV-2 to "Auto" when flow is established and open MBV-5 in the "Manual" mode to allow flow from the influent pumps through the filters and IX columns to the effluent storage tank.

2.3.5

When flow starts to fill the effluent storage tank, switch MBV-5 to "Auto" which brings in the interlocks as described in the interlock checklist in Section 4.0 below. Note: For Phase 1, there are no interlocks or selector switches; go to 2.4.

2.3.6

Verify that the following lights on the annunciator panel are not illuminated.

FS-2
FS-3
FS-4
Influent Storage Tank Level, "Low"
Effluent Storage Tank Level, "High"
Effluent Storage Tank Level, "High High"

2.3.7

When flow has been established for a period of time, take readings of: flow, pressure and pressure differential, on filters and IX Columns.

Phase I N/A _____ (substitute pressure gages)

Flow Readings:_____

Pressure Readings:_____

Differential Pressure Readings:_____

_____

2.4 Start Effluent Pump

When the effluent storage tank has a sufficient volume of treated effluent, an effluent pump is started to discharge the treated effluent into the selected disposal well.

2.4.1

The following ball valves (BV) are to be positioned prior to startup of the effluent pump(s).

- If running effluent pump P-5A and A set of filters for extraction, open:

  BV-65, BV-70, BV-71, BV-74, BV-75, BV-86, and BV-89.

- If running effluent pump P-5B and B set of filters for extraction, open:

  BV-65, BV-72, BV-73, BV-76, BV-77, BV-86, and BV-89.

2.4.2

Open MBV-6 by setting MBV-6 "Manual-Auto" switch to "Manual", then set the "Open-Off-Close" switch to "Open" (for Phase 1 manually open ball valve next to MBV-6).

2.4.3

Start either pump P-5A or P-5B by holding in the "Start" pushbutton until flow is established. Watch for flow on FIT-3 and makeup of FS-5.

2.4.4

After flow is established, switch MBV-6 to the "Auto" position which brings in the interlocks for shutting off the pump as described in the interlock checklist in Section 4.0 below. Note: For Phase 1, there are no interlocks or selector switches; go to 2.5.

2.4.5

Verify that the following annunciator lights on the annunciator panel are not illuminated:

Disposal Well Level, "High"
Effluent Storage Tank Level, "Low"
FS-5
FS-6

2.4.6

When flow has been established for a time, take readings of: flow, pressure and pressure differential, on the filters.

Flow Readings:_____

Pressure Readings:_____

Differential Pressure Readings:_____

_____

Phase I N/A _____ (substitute pressure gages)

Note: Pressure differential alarm is set to alarm (illuminate annunciator light) at approximately 15 psi differential.

2.4.7

Metering Pump, Acid (Note: This pump/system may be added at a later date. Therefore, the pump/system will not be described herein until such time it is determined to be necessary. After completion of laboratory tests and after sufficient operational data has been gathered a determination on the need will be made.)

2.4.8

Metering pump, caustic (Note: See discussion on need in 2.4.7).

2.4.9

Metering pump, oxygen scavenger chemical (Note: See discussion on need in 2.4.7.)

2.5 Process Water Tank

The process water tank is a 10,000 gallon tank containing "process water" to be used for backwashing the IX columns and for makeup water. The tank will be filled from a water truck on an "as needed" basis, and flow will be manually controlled via valve and flowmeter. Hoses will be used to connect to appropriate equipment as required.

3.0 LEVEL INTERLOCK CHECKLIST

3.1 This Section describes testing of level interlocks. The interlocks shall be tested quarterly.

3.2 Each interlock will be tested by shorting out the appropriate relays and verify that each will stop the appropriate pump or close the appropriate valve (see Logic Description).

3.3 Start extraction well pump, restart after each test.

LSL-1 (Low Level, Extraction Well)	Stop P-1	_____	_____
LSH-1 (High Level, Influent Tank)	Stop P-1	_____	_____
LSHH-1 (High-High Level, " ")	Stop P-1	_____	_____
FS-1 (Low Flow, Extraction Pump)	Stop P-1	_____	_____

3.4 Start Influent Pumps P-2A or P-2B, restart after each test.

LSL-2 (Low Level, Influent Tank)	Stop P-2A/B	_____	_____
LSH-2 (High Level, Effluent Tank)	Stop P-2A/B	_____	_____
LSHH-2 (Hi-Hi Level, Effluent Tank)	Stop P-2A/B	_____	_____
FS-2 (Low/No Flow, Influent Pumps)	Stop P-2A/B	_____	_____
FS-3 (No Flow, Hose to Process Skid)	Stop P-2A/B	_____	_____
FS-4 (No Flow, Hose to Effluent Tank)	Stop P-2A/B	_____	_____

3.5 Start Effluent Pumps P-2A or P-2B, restart after each test.

LSH-3 (High Level, Return Well)	Stop P-5A/B	_____	_____
FS-5 (No Flow, Hose to Effluent Skid)	Stop P-5A/B	_____	_____
FS-6 (No Flow, Hose to Well)	Stop P-5A/B	_____	_____
LSL-3 (Low Level, Effluent Tank)	Stop P-5A/B	_____	_____

4.0 FAIL-SAFE MOTOR OPERATED VALVE INTERLOCK CHECKLIST

The fail-safe motor operated ball valves are located on the inlet and outlet of both the influent and effluent storage tanks. They are interlocked to close on a series of conditions as noted in the logic description (see Appendix), and are to close on loss of power. The fail-safe feature of motor operated ball valves MBV-1, MBV-2, MBV-5 and MBV-6 and are to prevent spilling of tank contents to the ground in the event of a power failure.

Note: These valves will not be used during Phase 1 operations.

4.1 MBV-1, Manual Mode

4.1.1

Set MBV-1 "Manual-Auto" switch to "Manual", then set the "Open-Off-Close" switch to "Open" to open valve.

4.1.2

Verify that valve is open, then close panelboard circuit breaker for MBV-1.

4.1.3

Verify closure of valve on loss of power.

4.2 MBV-1, Automatic Mode

4.2.1

Set MBV-1 "Manual-Auto" switch to "Auto", then set the "Open-Off-Close" switch to "Open".

4.2.2

Open manual ball valves BV-1, BV-2 and BV-4, then start pump P-1 (well pump) and watch for valve to open.

4.2.3

Close panelboard circuit breaker for MBV-1 and verify closure of valve on loss of power.

4.2.4

Open panelboard circuit breaker to open valve, then shut off well pump P-1 and verify that valve closes when P-1 shuts down.

4.3 MBV-2, Manual Mode

4.3.1

Set MBV-2 "Manual-Auto" switch to "Manual", then set the "Open-Off-Close" switch to "Open" to open valve.

4.3.2

Verify that valve is open, then close panelboard circuit breaker for MBV-2.

4.3.3

Verify closure of valve on loss of power.

4.4 MBV-2, Automatic Mode

4.4.1

Set MBV-2 "Manual-Auto" switch to "Auto", then set the "Open-Off-Close" switch to "Open".

4.4.2

Open the manual ball valves as noted in 2.3.1 above for the respective pump P-2A or P-2B to assure flow can be established. Start influent pump P-2A, or P-2B (Note: These pumps are wired so that both cannot be started at the same time, and watch for valve to open.)

4.4.3

Close panelboard circuit breaker for MBV-2 and verify closure of valve on loss of power.

4.4.4

Open panelboard circuit breaker to open valve, then shut off whichever pump is running, P-2A or P-2B, and verify that valve closes when pump shuts down.

4.5 MBV-5, Manual Mode

4.5.1

Set MBV-5 "Manual-Auto" switch to "Manual", then set the "Open-Off-Close" switch to "Open" to open valve.

4.5.2

Verify that valve is open, then close panelboard circuit breaker for MBV-5.

4.5.3

Verify closure of valve on loss of power.

4.6 MBV-5, Automatic Mode

4.6.1

Set MBV-5 "Manual-Auto" switch to "Auto", then set the "Open-Off-Close" switch to "Open".

4.6.2

Open manual ball vlaves as noted in 4.4.2 above, then start influent pump P-2A, or P-2B (Note: These pumps are wired so that both cannot be started at the same time and watch for valve to open.)

4.6.3

Close panelboard circuit breaker for MBV-5 and verify closure of valve on loss of power.

4.6.4

Open panelboard circuit breaker to open valve, then shut off whichever pump is running, P-2A or P-2B, and verify that valve closes when pump shuts down.

4.7 MBV-6, Manual Mode

4.7.1

Set MBV-6 "Manual-Auto" switch to "Manual", then set the "Open-Off-Close" switch to "Open" to open valve.

4.7.2

Verify that valve is open, then close panelboard circuit breaker for MBV-6.

4.7.3

Verify closure of valve on loss of power.

4.8 MBV-6, Automatic Mode

4.8.1

Set MBV-6 "Manual-Auto" switch to "Auto", then set the "Open-Off-Close" switch to "Open".

4.8.2

Open manual ball valves as noted in 2.4.1 above for the respective pump P-5A or P-5B to assure flow can be established, then start effluent pump P-5A, or P-5B (Note: These pumps are wired so that both cannot be started at the same time and watch for valve to open.)

4.8.3

Close panelboard circuit breaker for MBV-6 and verify closure of valve on loss of power.

4.8.4

Open panelboard circuit breaker to open valve, then shut off whichever pump is running, P-5A or P-5B, and verify that valve closes when pump shuts down.

5.0 EMERGENCY SHUTDOWN SWITCHES

5.1 The emergency shutdown switch (or switches) will shut the Treatment System down in case of an emergency. Items included on this emergency switch include the Well Pump, Influent Pumps, Effluent Pumps, chemical metering pumps and mixer motors, and Fail-Safe Motor Operated Valves (MBV-1, MBV-2, MBV-5 & MBV-6). The emergency shutdown system will be tested quarterly.

5.2 Verify system is operating: Well Pump (P-1), Influent Pump (P-2A or 2B), and Effluent Pump (P-5A or 5B), and chemical metering pumps and mixers (if applicable) are running, and that Fail-Safe Motor Operated Valves are open.

5.3 Actuate Emergency Shutdown Switch(es) and verify shutdown of pumps and closure of valves.

P-1	_____	_____
P-2A/2B	_____	_____
P-5A/5B	_____	_____
MBV-1	_____	_____
MBV-2	_____	_____
MBV-5	_____	_____
MBV-6	_____	_____

6.0 TROUBLE SHOOTING

6.1 Extraction Well Pump will not operate:

6.1.1

Influent Storage Tank level is "High" or "High-High".

6.1.2

Extraction Well level is low.

6.1.3

Flowswitch, FS-1 not satisfied - There is no flow in the line from the well to the influent storage tank.

6.2 Either Pump P-2A or P-2B will not operate:

6.2.1

Flowswitches FS-2, FS-3 or FS-4 not satisfied - There is no flow in the lines to the Influent Pumps, to the inlet manifold on the Process Skid, or the line to the Effluent Storage Tank.

6.2.2

Influent Storage Tank level is "Low".

6.2.3

Effluent Storage Tank level is "High".

6.3 Either Pump P-5A or P-5B will not operate:

6.3.1

Disposal Well level is "High".

6.3.2

Effluent Storage Tank level is "Low".

6.3.3

Flowswitches FS-5 and FS-6 not satisfied - There is no flow in the lines from the Effluent Storage Tank to the Effluent Pumps, or from the Effluent Pump(s) to the Disposal Well.

DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	J. W. Green	Date 3/31/94
Project Title/Work Order: 200-UP-1 Treatability Test		EDT No. 604278
		ECN No.

Name	MSIN	With Attach.	EDT/ECN & Comment	EDT/ECN Only
J. W. Green	H6-04	X		
R. A. Carlson	H6-03	X		
R. R. True	T7-09	X		
D. B. Tullis	N1-80	X		
EPIC (2)	H6-08	X		
ERC	H6-07	X		
Central Files (2)	L8-04	X		

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