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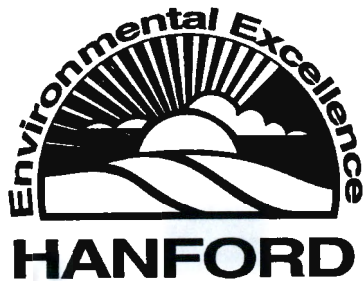
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## 200-BP-5, Unit #1 Pilot-Scale Groundwater Treatment System Operating Procedures

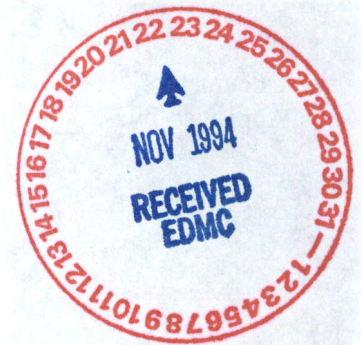
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Richland, Washington

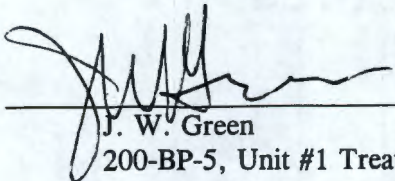


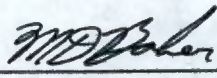
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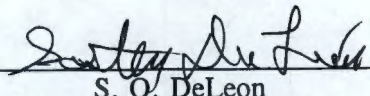
200-BP-5, UNIT #1  
PILOT-SCALE GROUNDWATER TREATMENT SYSTEM  
OPERATING PROCEDURES

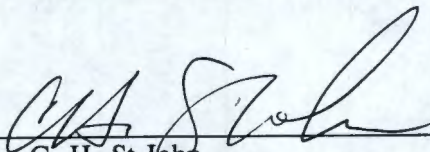
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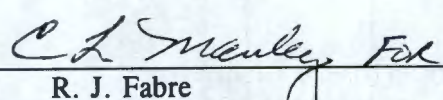
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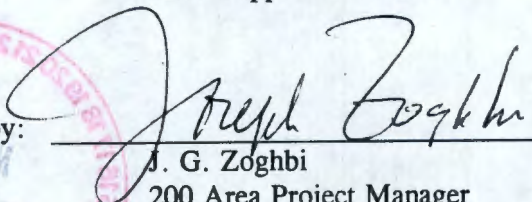
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**200-BP-5, UNIT #1**  
**PILOT SCALE GROUNDWATER TREATMENT SYSTEM**  
**OPERATING PROCEDURES**

**1.0 INTRODUCTION**

**1.1 Purpose**

The purpose of this document is to describe the procedures for operating the Pilot Scale Treatment System for the removal of plutonium, strontium and cesium from the groundwater in the 200-BP-5 Operable Unit, more specifically the B-5 Reverse Well Site also known as BP-5, Unit #1, located in the 200 East Area. The Treatment System is an bonechar and zeolite adsorption system that has been selected as the technology to be evaluated in performing a treatability test. A Granulated Activated Carbon (GAC) column is added on the effluent end to remove any organic contaminants that may occur within the system. Unless otherwise specified, all procedures apply to normal operating conditions. During off-normal conditions, care will be taken in the field to prevent any mishaps. Treatability tests are used to confirm the selection of a particular technology for remediating groundwater prior to proposing an Interim Remedial Measure (IRM) plan. This treatability test will evaluate the effectiveness of bone char and zeolite for the removal of cesium, strontium and plutonium, respectively, from the groundwater. Construction and operating costs will also be gathered as an evaluation of the cost effectiveness of this type technology performed on the Hanford Site.

**1.2 Scope**

The treatability test for Unit 1 will be performed at the 200-BP-5 Operable Unit near the 216-B-5 reverse well near B-plant in 200 East Area (see Figure, in appendix). The operation will include well (or wells) for extraction of groundwater to be treated and a well for disposal of the treated effluent; four 8,200-8,600 gallon storage tanks, two for storage of influent and two for storage of treated effluent; a process water tank that provides water for chemical makeup (if required) and backflushing of the adsorption columns; an influent pump station (mounted on a skid) with prefilters; a process treatment skid with control panel; and an effluent pumping station (on a skid) 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, and power and signal cables. The tanks and skids are fitted with manifolds for ease of connection to the hoses. A portable generator will provide 480 VAC, 3 phase power that will provide primary power to run the pumps. The 480 VAC in turn will be reduced to 240/120 VAC single phase with transformers and a power distribution system.

The Pilot Scale Treatment System will initially be operated on a 6 hour/day basis. Once shakedown of the system has been completed, it may commence with operation of the extraction well pump and the effluent pump(s) on a 24 hours/day basis for filling the influent tank(s) and disposing of treated effluent from the effluent storage tank(s); and operating the process system on an 6-8 hour/day basis.

### 1.3 Pre-Startup Check

- 1.3.1 Startup checklist will be completed prior to startup and a copy is to be maintained in the field files. Performance of the startup checklist will be documented in the field logbook. Copies of the logbook and startup checklists will be put into the project file.

Refer to process flow diagram, Figure 1, for performing the startup checklist. In addition, utilize the equipment list below for performing the equipment component check.

- Extraction Well Pump
- Feed Pumps
- Effluent Pumps
- Filters, Influent and Effluent
- Adsorption Columns
- Column discharge filters
- Influent/Effluent Storage Tanks
- Fail-Safe Motor Operated Ball Valve
- Air Release Valves
- Flowmeters
- Flow Switches
- Level Indicators/Controls
- Pressure Indicators/Transmitters/Controllers
- Differential Pressure Indicators/Transmitters
- Temperature Indicators/Transmitters
- Dissolved Oxygen Monitors
- Turbidity Monitors
- pH Indicators/Transmitters
- Flex hose
- Flexible Connectors
- Adsorbant in columns

- 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 that the system is functional, properly connected and ready for safe operation. If discrepant conditions are found, note them in the logbook and correct prior to startup. Verify that all necessary safety equipment is available and functional. In checking the hoses perform a walkdown of the hoses connecting the system together following the flow from the extraction Well Pump to the Disposal Well to verify integrity:

- Extraction well pump discharge to the Influent Storage Tank inlet;
- Influent Storage Tank outlet to the Influent Pump skid suction manifold;
- Influent Pump skid discharge to the Process System skid inlet manifold;
- From the Inlet manifold to the first column inlet (at top for down flow), from the bottom of the first column to the inlet of the second column, and from the bottom of the second column to the top of the third;

- From the outlet of the third column to the inlet of the fourth, GAC column.
- From the outlet of the fourth, or combination column, to the Process System skid discharge manifold;
- Process System skid discharge manifold, through the post-column filters, to the Effluent Storage Tank inlet manifold
- Effluent Storage Tank outlet to the Effluent Pump skid suction manifold; and
- The Effluent Pump skid discharge to the injection well.

- 1.3.3 If operating in day shift (6-8 hours) mode for treatment only, verify that all valves are closed, including sample valves. If operating in 24 hour mode, verify that switches and valves are in the appropriate position for the equipment that may be operating.
- 1.3.4 Verify that filter housing lids are closed and tightened and that filters are ready to accept flow.
- 1.3.5 Verify that gages are connected and are working properly.
- 1.3.6 Verify that columns are properly connected for series flow through four columns as noted in 1.3.2 above, then out to the outlet manifold.

Table 1.1. Pre-startup Readiness Checklist.

DATE: \_\_\_\_\_

OPERATORS: \_\_\_\_\_

Equipment Item	Verified/Date
1) Perform a safety walkthrough (physical inspection) of the system to verify that the system is functional, properly connected and ready for safe operation. Perform the following:	
2) Extraction well pump discharge to the Influent Storage Tank inlet	
3) Influent Storage Tank outlet to the Influent Pump skid suction	
4) Influent Pump skid discharge to the Process System Skid inlet manifold	
5) Process System trailer discharge manifold to the Effluent Storage Tank inlet	
6) Verify that the Columns are connected from the Process Manifold to the 3 columns in series flow, then out to the outlet side of the Process manifold	
7) Outlet side of Process Manifold, through the post-column filters, to the Effluent Storage Tank inlet manifold	
8) Effluent Storage Tank outlet to the Effluent Pump skid suction	
9) Effluent Pump skid discharge to the disposal well	
10) 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 hr/day).	
11) Verify filter housing lids are closed and tightened and that filters are ready to accept flow.	

## 2.0 STARTUP AND OPERATION

To start operations, the process treatment system will be configured by manually aligning ball valves, using sight level gages and or tank level indicators on the Influent and Effluent Storage Tanks, and differential pressure instrumentation for monitoring process conditions. Valves are to be aligned for flow from the Extraction Well Pump to the Influent Storage Tank(s), then from an Influent Pump through the Influent Filters, through three Columns in series flow, through another set of filters, through a column filled with GAC, and out to the Effluent Storage Tank(s). When a sufficient volume of treated effluent is in the Effluent Storage Tank(s), it will be discharged to the Disposal Well via one of the Effluent Pumps and of Effluent Filters to the Disposal Well.

The system will utilize level, flow and pressure instrumentation and interlocks to prevent overflows of the Influent and Effluent Storage Tanks, to protect pumps from loss of flow, alarm when to change filters and backwash columns, and monitor well levels.

Use the checklists provided in the following chapters to make a record of operating the system. These will be located onsite in a field notebook.

Note: During normal 24 hour operations, there may be some systems running before the rest of the system is started up. These systems may continue operating during system startup. The systems currently in operation need not be restarted.

### 2.1 Electrical Power

- 2.1.1 Verify that the main disconnect switches on the generator and the main control panel are off. Verify that the 480V disconnect behind the control panel is turned off. Verify that 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 that the 480 VAC power control switches to equipment (pumps, etc.) are closed. If the generator is running, verify that control switches are in the appropriate positions.
- 2.1.4 Energize power to the control panel by actuating the main disconnect switches (on generator and two on the main control panel) and the control power switch(es) to the equipment to be started.
- 2.1.5 Energize power to 110V system for level controls and PLC.
- 2.1.6 Reset MBV control switches at the influent skid.

**Table 2.1. Electrical Power Startup Checklist.**

DATE: \_\_\_\_\_

OPERATOR: \_\_\_\_\_

Electrical Power Start-Up		Verified/Date
1)	Verify the main disconnect switches on the generator and the main control panel are off.	
2)	Verify the electrical connection from generator to the main control panel on the Process Skid is connected.	
3)	If generator is not running and prior to start of operations, verify that the 480 VAC power control switches to equipment (pumps, etc.) are in the "Off" position. If the generator is running, verify that control switches are in the appropriate positions. Before starting operation, start the generator.	
4)	Energize power to the control panel by actuating the main disconnect switches (on generator and main control panel) and the control power switch(es) to equipment to be started.	
5)	Energize power to 110 Volt system for level controls and PLC.	
6)	Reset MBV control switches at the influent pump skid.	

**2.2 Start Extraction Well Pump, P-1**

Note: During normal 24 hour operations, there may be some systems running before the rest of the system is started up. These systems may continue operating during system startup. The systems currently in operation need not be restarted.

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

- LSH-1, Influent Storage Tank Level, "High"
- LSL-1, Extraction Well Level, "Low"
- LSHH-1, Influent Storage Tank Level, "High-High"

2.2.2 The following ball valves (BV) are to be positioned prior to startup of the Extraction Well Pump.

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

**BV-1, BV-2, BV-4** on the well manifold, valves **BV-6 or BV-7 & 8, BV-10 and BV-18** on the Influent Tank manifold.

- 2.2.3 Open Motor Operated Ball Valve, MBV-1 by setting MBV-1 "Open-Closed-Auto" switch to "Open." (Note: When the Motor Operated Valves are set to the "Automatic" mode, a series of interlocks are put in place that will provide protection of equipment and help keep the Influent Tank(s) from overflowing.
- 2.2.4 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.
- 2.2.5 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.
- 2.2.6 Verify that the following light on the annunciator panel is not illuminated:

FS-1, No Flow From Extraction Well

**Table 2.2. Extraction Well Startup Checklist.**

**DATE:** \_\_\_\_\_

**OPERATOR:** \_\_\_\_\_

Extraction Well Start-Up	Verified/Date
1) Verify the following lights on the annunciator panel are not illuminated: - LSH-1, Influent Storage Tank Level, "High" - LSL-1, Extraction Well Level, "Low" - FS-1, No Flow From Extraction Well - LSHH-1, Influent Storage Tank Level, "High High"	
2) Verify that all ball valves (BV) are closed except the following: <b>BV-1, BV-2, BV-4</b> on the well manifold, valves <b>BV-6 or BV-7 &amp; 8, BV-10 and BV-18</b> on the Influent Tank manifold.	
3) Open Motor Operated Ball Valve, MBV-1 by setting MBV-1 "Open-Closed-Auto" switch to "Open."	
4) 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.	
5) Switch MBV-1 selector switch to "Auto."	
6) Verify the following light on the annunciator panel is not illuminated: - FS-1, No Flow From Extraction Well	

## 2.3 Establish Flow from Influent Storage Tank(s) to the Process System

Note: The Influent Storage Tank(s) must have liquid in the tank(s) before starting the Influent Pump. The water level in the Influent Storage Tank(s) should be kept at at least four feet, to prevent the influent pumps from losing their prime.

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

Influent Storage Tank Level, "Low"  
Effluent Storage Tank Level, "High"  
Effluent Storage Tank Level, "High-High"

2.3.2 Verify that the following ball valves (BV) are to be positioned prior to startup of the Influent Pump(s). Note: This assumes that all valves were either closed or the alternate pump was previously used.

- If running through Influent Pump P-2A for extraction, Open:

**BV-11, BV-19, BV-30, BV-32, BV-33, BV-44, BV-50, BV-51, BV-55B, BV-56, BV-59, BV-62B, BV-64G, BV-64, BV-69, BV-64C, BV-64D, BV-64H, BV-64I, BV-64J, BV-64K, BV-70, BV-71 and BV-80.**

- If running through Influent Pump P-2B for extraction, Open:

**BV-11, BV-19, BV-30, BV-34, BV-35, BV-44, BV-50, BV-51, BV-55B, BV-56, BV-59, BV-62B, BV-64G, BV-64, BV-69, BV-64C, BV-64D, BV-64H, BV-64I, BV-64J, BV-64K, BV-70, BV-71 and BV-80.**

- If operating filter set #1, open:

**BV-38, BV-39, BV-40, and BV-41.**

- If operating filter set #2, open:

**BV-45, BV-46, BV-47, and BV-48.**

- To activate the pressure gages, open:

**BV-42, BV-43, BV-53, BV-54, BV-60, BV-63, BV-65, BV-66, BV-64L, and BV-64M.**

- To activate differential pressure transmitter, open:  
**BV-100, and BV-101**

2.3.3 When the Influent Storage Tank(s) level is above the extraction piping, open MBV-2 by setting MBV-2 "Open-Closed-Auto" switch to "Open."

2.3.4 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, FS-3 and FS-4.

- 2.3.5 Switch **MBV-2** to "Auto" when flow is established and open **MBV-5** (if applicable) in the "Manual" mode to allow flow from the Influent Pumps through the Filters and Columns to the Effluent Storage Tank(s).
- 2.3.6 When flow starts to fill the Effluent Storage Tank(s), switch **MBV-5** (if applicable) to "Auto," which brings in the interlocks as described in the Interlock Checklist in Section 4.0 below.
- 2.3.7 Verify that the following lights on the annunciator panel are not illuminated:
- FS-2 Flow From Influent tank to pump skid
  - FS-3 Flow From Pump skid to Process skid
  - FS-4 Flow From Process skid to Effluent tank
- 2.3.8 When flow has been established through the system and is at steady state, take readings of: flow, pressure and pressure differential, on filters and Columns. Record this information on the Process Flow Startup Checklist.

Table 2.3. Process Flow Startup Checklist.

DATE: \_\_\_\_\_

OPERATOR: \_\_\_\_\_

Process Flow Startup	Verified/Date
1) 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", and Effluent Storage Tank Level, "High-High."	
2) If Influent Pump P-2A is to be used to establish process flow, Open: BV-11, BV-19, BV-30, BV-32, BV-33, BV-44, BV-50, BV-51, BV-55B, BV-56, BV-59, BV-62B, BV-64G, BV-64, BV-69, BV-64C, BV-64D, BV-64H, BV-64I, BV-64J, BV-64K, BV-70, BV-71 and BV-80. If running Influent Pump P-2B for process flow, Open: BV-11, BV-19, BV-30, BV-34, BV-35, BV-44, BV-50, BV-51, BV-55B, BV-56, BV-59, BV-62B, BV-64G, BV-64, BV-69, BV-64D, BV-64H, BV-64I, BV-64K, BV-70, BV-71 and BV-80.	
3) If filter set F-1 is to be used for process flow, Open: BV-38, BV-39, BV-40, and BV-41. If filter set F-2 is to be used for process flow, Open: BV-45, BV-46, BV-47, and BV-48.	
4) To activate the pressure gages, open: BV-42, BV-43, BV-53, BV-54, BV-60, BV-63, BV-65, BV-66, BV-64L, BV-64M.	
5) Activate differential pressure transmitters by opening: BV-100, and BV-101.	
6) When the Influent Storage Tank(s) is at an adequate level open MBV-2 by setting MBV-2 "Open-Closed-Auto" switch to "Open."	
7) 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, FS-3 and FS-4.	
8) Switch MBV-2 to "Auto" when flow is established and open MBV-5 (if applicable) in the "Manual" mode to allow flow from the Influent Pumps through the Filters and columns to the Effluent Storage Tank(s).	
9) When flow starts to fill the Effluent Storage Tank(s), switch MBV-5 (if applicable) to "Auto."	
10) Verify that the following lights on the annunciator panel are not illuminated: FS-2, FS-3, and FS-4.	
11) When flow has reached steady state, record readings on the daily data log sheets of flow, pressure and pressure differential on filters and columns.  Flow: _____ Pressure: <u>Not to exceed 80 psi</u> _____ Diff. Pressure: <u>Not to exceed 60 psi</u> _____  <u>If pressure readings exceed these values, press emergency stop contact Cognizant Engineer.</u>	

## 2.4 Start Effluent Pump

When the Effluent Storage Tank(s) 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 Verify that the following alarm lights on the annunciator panel are not illuminated:

Disposal Well Level, "High"  
Effluent Storage Tank Level, "Low"

2.4.2 The following ball valves (BV) are to be positioned prior to startup of the Effluent Pump(s).

- If running Effluent Pump P-5A for extraction, Open:  
**BV-72, BV-81, BV-87, BV-90, BV-92, BV-93, BV-110, BV-111 and BV-112.**
- If running Effluent Pump P-5B for extraction, Open:  
**BV-72, BV-81, BV-87, BV-90, BV-94, BV-95, BV-110, BV-111 and BV-112.**
- If filter set F-3 is to be used, Open:  
**BV-98, and BV-99**
- If filter set F-4 is to be used, Open:  
**BV-102, and BV-103**
- To activate pressure gages on effluent skid, Open:  
**BV-100, and BV-101**

2.4.3 Open MBV-6 (if applicable) by setting MBV-6 "Open-Closed-Auto" switch to "Open."

2.4.4 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 and FS-6.

2.4.5 After flow is established, switch MBV-6 (if applicable) 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.

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

FS-5 Flow From Effluent tanks to Effluent Skid  
FS-6 Flow From Effluent Skid to Well

2.4.7 When flow reaches steady state, as specified by the Cognizant Engineer, take readings of: flow, pressure and pressure differential, on the filters. Record this on the Effluent Pump Startup Checklist.

2.4.8 Metering Pump, Acid

Note: This pump/system may be added at a later date, therefore 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.

2.4.9 Metering Pump, Caustic

Note: See discussion on need in 2.4.7.

2.4.10 Metering Pump, Oxygen Scavenger Chemical

Note: See discussion on need in 2.4.7.

**Table 2.4. Effluent Pump Startup Checklist.**

**DATE:** \_\_\_\_\_

**OPERATOR:** \_\_\_\_\_

Effluent Pump Startup	Verified/Date
1) Verify that the following alarm lights on the annunciator panel are not illuminated: Disposal Well Level, "High" Effluent Storage Tank Level, "Low"	
2) If Effluent Pump P-5A is to be used for pumping effluent to the disposal well, open: <b>BV-72, BV-81, BV-87, BV-90, BV-92, BV-93, BV-110 and BV-111 and BV-112.</b> If Effluent Pump P-5B is to be used for pumping effluent to the disposal well, open: <b>BV-72, BV-81, BV-87, BV-90, BV-94, BV-95, BV-110 and BV-111 and BV-112.</b>	
3) If Filter set F-3 is to be operated, open: <b>BV-98, and BV-99</b> If Filter set F-4 is to be operated, open: <b>BV-102, and BV-103</b>	
4) To activate pressure gages on effluent skid, open: <b>BV-100, and BV-101</b>	
5) Open MBV-6 (if applicable) by setting MBV-6 "Open-Closed-Auto" switch to "Open."	
6) 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 make-up of FS-5 and FS-6.	
7) After flow is established, switch MBV-6 (if applicable) to the "Auto" position.	
8) Verify that the following alarm lights on the annunciator panel are not illuminated: FS-5 Flow From Effluent tanks to Effluent Skid FS-6 Flow From Effluent Skid to Well	
9) When flow reaches steady state, take readings of flow, pressure and pressure differential, on the filters. Record the readings on the daily data log sheets.  Flow: _____ Pressure: <u>Not to exceed 80 psi</u> _____ Diff. Pressure: <u>Not to exceed 60 psi</u> _____  <u>If pressures are exceeded, press emergency stop and contact Cognizant Engineer.</u>  <b>NOTE:</b> Pressure differential alarm is set to alarm (illuminate annunciator light) at approximately 30 psi differential)	

## 2.5 Process Water Tank

The Process Water Tank is a tank containing clean "process water" that may be used for backwashing the columns and for makeup water. In addition, treated water may also be used for backwashing depending on status and arrangement of equipment and availability of treated water. The Process Water Tank will be filled from a water truck with potable water on an as needed basis, and water use will be manually controlled via a ball valve and flowmeter. Hoses will be used to connect to appropriate equipment as required.

## 2.6 Backwash Procedure

When new bone char or other adsorbent is loaded into a column and before the media is placed into service, it must be backwashed to remove fines and color bodies. When a backwash is to be done, the Treatment System will be shut down. The adsorbent manufacturer's backwash recommendations will be followed as best as the equipment allows. Two pumps are available for use for backwashing, Pump P-2B and P-3. Pump P-2B (located on the Influent Pump Skid) may be in closer proximity to the Process Water Tank and if that be the case P-2B may be used to pull water from the Process Water Tank. Pump P-3 (located on the Process Skid) has a rotameter and ball valve for controlling the backwash flow that is not as readily available for Pump P-2B. Alternatively, if sufficient treated or clean water exists in the Effluent Storage Tank(s), it may also be used for backwashing. When backwashing bone char, it is recommended a flow rate of 180 gpm be maintained. When backwashing clinoptilolite, a flow rate of 441 gpm is recommended. When backwashing GAC, a flow rate of 20 gpm should be maintained. If adsorbant is used, the manufacturers recommendations will be followed. Under no circumstances should the pressure on the system exceed 100 psi. Backwashing is performed manually; to set up for backwash perform the following (Note: The backwash will require nominally 1000-3000 gallons per column depending on size amount of media):

NOTE: When backwashing a material for the first time, it is recommended to let the material soak in water overnight before backwashing. When filling with water for the first time, the column should be filled from the bottom.

NOTE: Backwashing requires 1000-3000 gallons per column. Ensure sufficient backwash water is available.

- 2.6.1 Connect a hose from the Process Water Tank to the suction side of Pump P-2B at valve AC-2 (the female quick disconnect used for air blowdown), and open BV-34.
- 2.6.2 Connect a hose from the discharge of Pump P-2B at valve BV-31 to a quick disconnect at the bottom of the Column to be backwashed.
- 2.6.3 The backwash solution will be sent back through the influent filters, then to the Influent Storage Tank(s). Connect a hose from a quick disconnect at the inlet of the Column being backwashed to the influent pump skid connection at BV-49. After the water has passed through the filters, it is sent from BV-44 into the influent Storage Tank(s) (either BV-10 or BV-18 depending on which tank will be receiving backwash solution).
- 2.6.4 A portable rotameter will need to be temporarily installed in the hose from the column being backwashed to the Influent Storage Tank receiving backwash solution. This is needed for controlling flow, and watching for disappearance of color and whether any adsorbent escapes the column.
- 2.6.5 An alternative to that described in 2.6.3 and 2.6.4 and to eliminate the need for a temporarily installed rotameter would be to use the inlet manifold on the Influent Storage Tank(s). Disconnect the

hose coming from the well to the Influent Tank inlet manifold, then connect the hose from the top of the column to that inlet manifold. This will provide flow control and a rotameter for monitoring backwashing as described above.

- 2.6.6 If treated water is to be used as the water supply for the backwash, close BV-87 at the Effluent Storage Tank outlet manifold and disconnect the hose to the injection well. Then connect a hose from the quick disconnect at the effluent of the effluent skid to the bottom of the column being backwashed. Then follow either 2.6.3 and 2.6.4, or 2.6.5 above for conducting the backwash, except use one of the pumps on the effluent skid, pump P-5A or P-5B.
- 2.6.7 Backwash new media in each column until the colored backwash solution turns clear (media fines, carbon or fractured resin beads, or color bodies contribute to the color). As stated above this may require approximately 1000-3000 gallons per column, and may take approximately 1 - 2 hours. **Note: Sufficient backwash water must be available.**
- 2.6.8 When backwash is complete, secure hoses and valves and make correct hose connections to allow establishing normal processing water flow as described in Section 1.3 above.

**Table 2.5. Backwash of Columns.**

**DATE:** \_\_\_\_\_

**OPERATOR:** \_\_\_\_\_

Backwash Checklist	Verified/Date
1) Connect a hose from the Process Water Tank to the suction side of Pump P-2B at valve AC-2 (the female quick disconnect used for air blowdown), and open BV-34.	
2) Connect a hose from the discharge of Pump P-2B at valve BV-31 to a quick disconnect at the bottom of the Column to be backwashed.	
3) Connect a hose from a quick disconnect at the inlet of the Column being backwashed to the influent pump skid at BV-49. Connect to BV-44 to either Influent Storage Tank (either BV-15 or BV-22 depending on which tank will be receiving backwash solution).	
4) Connect a portable rotameter, temporarily, in the hose from the column being backwashed to the Influent Storage Tank receiving backwash solution. This is used for controlling flow, and watching for disappearance of color and whether any adsorbent escapes the column.	
5) An alternative to that described in 4 above to eliminate the need for the temporary rotameter would be to use the inlet manifold on the Influent Storage Tank(s). Disconnect the hose coming from the well to the Influent Tank inlet manifold, then connect the hose from the top of the column to that inlet manifold. This will provide flow control and a rotameter for monitoring backwashing as described above.	

Backwash Checklist	Verified/Date
6) If treated water is to be used as the water supply for the backwash, close BV-87 at the Effluent Storage Tank outlet manifold and disconnect the hose to the Effluent Pump Skid (at BV-87). Then connect a hose from the quick disconnect at BV-87 to the bottom of the column being backwashed. Then follow either step 3 and 4, or 5 above for conducting the backwash.	
7) Backwash new media in each column until the colored backwash solution turns clear (media fines, carbon or fractured resin beads, or color bodies contribute to the color). As stated above this may require approximately 1000-3000 gallons per column, and may take approximately 1 - 2 hours. <b>Note: Sufficient backwash water must be available.</b>	
8) When backwash is complete, secure hoses and valves and make correct hose connections to allow establishing normal processing water flow as described in Section 1.3 above.	

**3.0 LEVEL & FLOWSWITCH INTERLOCK CHECKLIST**

**3.1**

This Section describes testing of level and flowswitch interlocks. The interlocks shall be tested quarterly. The interlock test sheets will be kept in the Interlock Checklist Logbook and at completion of the interlock tests it will be noted in the field logbook together with any discrepancies or items that need to be corrected.

**3.2**

Each interlock will be tested by shorting out the appropriate relays (or if sufficient treated or potable water is available for filling and emptying each tank to conduct this test, use the water) and verify that the each will stop the appropriate pump or close the appropriate valve (see Logic Description). **Note:** There is a difference between the tank high and high-high level alarm logic. On high level alarm the appropriate filling pump is shut off and annunciated, but the pump may be restarted. On high-high alarm the appropriate pump is shut off and annunciated, but the pump **cannot be restarted**. **Note:** Only one influent tank, TNK-2, and one effluent tank, TNK-8, are instrumented.

**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 \_\_\_\_\_

\* See 3.2 note.

**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 Proc Skid) Stop P-2A/B	_____	_____
FS-4 (No Flow, Hose to Effluent Tk) Stop P-2A/B	_____	_____

\* See 3.2 note.

**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 Eff. 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	_____	_____

**Table 3.1. Interlock Test Checklists.**

DATE: \_\_\_\_\_

OPERATOR: \_\_\_\_\_

**EXTRACTION WELL PUMP INTERLOCK CHECKLIST**

Action	Result	Verified/Date
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	

**INFLUENT PUMP INTERLOCK TEST CHECKLIST**

Action	Result	Verified/Date
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	

**EFFLUENT PUMP INTERLOCK TEST CHECKLIST**

Action	Result	Verified/Date
LSH-3 (High Level, Return Well)	Stop P-5A	
FS-5 (No Flow, Hose to Effluent Skid)	Stop P-5A	
FS-6 (No Flow, Hose to Well)	Stop P-5A	

#### **4.0 FAILSAFE MOTOR-OPERATED VALVE INTERLOCK CHECKLIST**

The Failsafe 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 and will close on loss of power. The failsafe feature of Motor Operated Ball Valves **MBV-1, MBV-2, MBV-5 and MBV-6** (MBV-5 & MBV-6, if applicable) and is to prevent spilling of tank contents to the ground or back into a well or process equipment in the event of a power failure.

##### **4.1 MBV-1, Manual Mode**

- 4.1.1 Set MBV-1 "Open-Close-Auto" switch to "Open."
- 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 "Open-Close-Auto" switch to "Open."
- 4.2.2 Open manual ball valves as noted in 2.2.1 above, then start Pump P-1 (Well Pump) and watch for MBV-1 to open.
- 4.2.3 Open panelboard circuit breaker for MBV-1 and verify closure of valve on loss of power.
- 4.2.4 Close 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, 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.
- 4.4.3 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 (if applicable)**

- 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 (if applicable)**

- 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 valves as noted in 2.3.1 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 (if applicable)**

- 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 (if applicable)**

- 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, start Effluent Pump P-5A, or P-5B (Note: These pumps are wired so that both cannot be operated 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.

**Table 4.1. Failsafe Motor Operated Valve Interlock Checklists.**

**DATE:** \_\_\_\_\_

**OPERATORS:** \_\_\_\_\_

**MBV-1, AUTOMATIC MODE**

Action	Verified/Date
1) Set MBV-1 "Open-Closed-Auto" switch to "Auto."	
2) Start Pump P-1 (Well Pump) and watch for valve to open.	
3) Open panelboard circuit breaker for MBV-1 and verify closure of valve on loss of power.	
4) Close panelboard circuit breaker to open valve, then shut off Well Pump P-1 and verify that valve closes when P-1 shuts down.	

**MBV-2, AUTOMATIC MODE**

Action	Verified/Date
1) Set MBV-2 "Open-Closed-Auto" switch to "Auto."	
2) Start Effluent Pump P-2A, or P-2B (Note: These pumps are electrically interlocked so that both cannot be operated at the same time) and watch for valve to open.	
3) Open panelboard circuit breaker for MBV-2 and verify closure of valve on loss of power.	
4) Close 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.	

**Table 4.1. Failsafe Motor Operated Valve Interlock Checklists. (continued)**

DATE: \_\_\_\_\_

OPERATOR: \_\_\_\_\_

**MBV-5, AUTOMATIC MODE**

Action	Verified/Date
1) Set MBV-5 "Open-Closed-Auto" switch to "Auto."	
2) Start Influent Pump P-2A, or P-2B(Note: These pumps are wired so that both cannot be operated at the same time) and watch for valve to open.	
3) Open panelboard circuit breaker for MBV-5 and verify closure of valve on loss of power.	
4) Close panelboard circuit breaker to open valve, then shut off whichever pump is running, P-2A or P-2B, and verify that valve closes when the pump shuts down.	

**MBV-6, AUTOMATIC MODE**

Action	Verified/Date
1) Set MBV-6 "Open-Closed-Auto" switch to "Auto."; then set the "Open-off-Close" switch to "Open."	
2) Start Effluent Pump P-5A, or P-5B (Note: these pumps are electrically interlocked so that both cannot be operated at the same time) and watch for valve to open.	
3) Open panelboard circuit breaker for MBV-6 and verify closure of valve on loss of power.	
4) Close 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. Equipment that will be shut down with this emergency switch include the Well Pump, Influent Pumps, Effluent Pumps, and Failsafe Motor Operated Valves (MBV-1, MBV-2, MBV-5 & MBV-6, the latter two if applicable). The emergency shutdown system will be tested quarterly.  
Note: The emergency shut down switches are not to be used for routine starting-stopping of pumps/equipment; use the normal start-stop pushbuttons for this.
- 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 Failsafe 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\* \_\_\_\_\_  
\* If applicable

**Table 5.1. Emergency Stop Switch Verification Checklist.**

**DATE:** \_\_\_\_\_

**OPERATOR:** \_\_\_\_\_

**INFLUENT EMERGENCY STOP SWITCH**

<b>Pump</b>	<b>Verified/Date</b>
P-1	
P-2A/2B	
P-3A/3B	
MBV-1	
MBV-2	
MBV-5	
MBV-6	

Actuate Emergency Stop Switches and verify shutdown of pumps and closure of valves.

**EFFLUENT EMERGENCY STOP SWITCH**

	<b>Verified/Date</b>
P-1	
P-2A/2B	
P-3A/3B	
MBV-1	
MBV-2	
MBV-5	
MBV-6	

Actuate Emergency Stop Switches and verify shutdown of pumps and closure of valves.

**MAIN PANEL EMERGENCY STOP SWITCH**

	Verified/Date
P-1	
P-2A/2B	
P-3A/3B	
MBV-1	
MBV-2	
MBV-5	
MBV-6	

**6.0 TROUBLE SHOOTING**

**6.1** Extraction Well Pump will not operate, check the following:

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.

6.1.4 Additional problems, contact the Cognizant Engineer.

**6.2** Either Pump P-2A or P-2B will not operate, check the following:

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."

6.2.4 Additional problems, contact the Cognizant Engineer.

**6.3** Either Pump P-5A or P-5B will not operate, check the following:

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(s) to the Effluent Pumps, or from the Effluent Pump(s) to the Disposal Well.

6.3.4 Additional problems, contact the Cognizant Engineer.

## 7.0 SYSTEM SHUTDOWN

The general strategy for operating the Treatment System is to operate the well pump 24 hours/day to fill the Influent Storage Tank(s), and operate the Treatment System 6-8 hours during day shift to fill the Effluent Storage Tank(s). Then during the "off shift" the Effluent Pump(s) will empty the Effluent Tank contents to a disposal well. The following procedure describes the steps to shut down the Treatment System. In general, after the pump(s) are shut down the hoses and process equipment may be emptied of water via the air compressor. The water is directed either to the wells or the Influent and Effluent Storage Tanks. This is of particular importance during winter to keep equipment from freezing.

System shut down starts by stopping the Influent feed pump (P-2A or P-2B). It should be noted that in the event the Effluent Storage Tank reaches a high or high-high level, the feed pump(s) may already be shut down. (The extraction well pump, P-1, keeps filling the Influent Tank until a high, high condition is reached). The following steps assure a safe shutdown.

- 7.1 If the Treatment System is running, shut down the Influent Feed Pump(s), either P-2A or P-2B.
- 7.2 If water is not to be drained from the system, secure Motorized Ball Valve, **MBV-2** and ball valves **BV-11**, **BV-19**, **BV-50**, **BV-66**, **BV-70**, and the Effluent Tank(s) Sight Glass valves: **BV-73** and **BV-82** (the sight glass could break and dump the tank contents on the plastic liner).
- 7.3 If water is to be drained from the system, leave **MBV-2**, **BV-11** and **BV-19** open. Connect air compressor hose with cam-lock fitting at AC-2 (on Influent Pump Skid). To remove water from the hose between the Influent Tank(s) and the Influent Pump Skid perform the following:
  - 7.3.1 Close **BV-32** and **BV-34**, and verify that **BV-30** is open.
  - 7.3.2 Start compressor and slowly open ball valve at AC-2 to allow air to push the water back towards the Influent Storage Tank(s).
  - 7.3.3 After water is removed, secure **BV-11** and **BV-19**, turn compressor off. To bleed pressure off, open either **BV-32** or **BV-34**, then secure **MBV-2** and **BV-30**.
- 7.4 To remove water from the hose (and equipment) between the Influent Pump Skid and the Process Skid, verify that the air compressor is connected to the air connection at AC-2 and perform the following:
  - 7.4.1 Verify that **BV-30** is closed, and verify that Influent Pump inlet and outlet valves (either **BV-32** and **BV-33**, or **BV-34** and **BV-35**) are open, depending on which pump being run when the system was shut down.
  - 7.4.2 Verify that inlet and outlet valves of the Filter that was on-line are open.
  - 7.4.3 Verify that valve **BV-50** is open, start compressor and slowly open the ball valve at AC-2 to allow air to push the water towards the Columns.

7.4.4 After water is removed, turn compressor off, and after pressure has bled off, secure BV-50 and close the valve at AC-2 and disconnect air hose from AC-2.

Note: If the water is to be removed from the Columns, the water can be pushed all the way to the Effluent Storage Tanks which will also empty the hoses and equipment in between by following 7.5.1, 7.5.2 and 7.5.3 below, except the air hose will be connected/disconnected at AC-2 instead of AC-8.

7.5 To remove water from the hose between the Process Skid and the Effluent Storage Tank(s), connect the air compressor to air connection AC-7 and perform the following:

7.5.1 Verify that **BV-64G, BV-64, BV-69, BV-64H, BV-64I, BV-64J, BV-64K, BV-70, BV-71** and **BV-80** are open, close **BV-64**, start the compressor and slowly open the ball valve at AC-8 to allow air to push the water towards the Effluent Storage Tank(s).

7.5.2 After the water is removed, secure **BV-71** and **BV-80**, turn compressor off.

7.5.3 To bleed pressure off, slowly open the valve at AC-8 holding a bucket to catch water, after pressure has bled off, close valves at AC-7 and AC-8, secure **BV-69** and disconnect air hose from AC-8.

NOTE: Ear plugs may be worn during this operation.

7.6 In the event there is no treated water to be drained from the Effluent Storage Tank(s), and freezing conditions exist, remove the water from the hoses and equipment between the Effluent Storage Tank(s) to the disposal well, connect the air compressor to air connection AC-9 and perform the following:

7.6.1 Push water from the Effluent Pump Skid to the Effluent Storage Tank(s) by closing **BV-92/BV-94**, verify that **BV-72, BV-81, BV-87** and **BV-90** are open.

7.6.2 Start the compressor and slowly open the ball valve at AC-9 to allow air to push the water back towards the Effluent Storage Tank(s).

7.6.3 After the water is removed from that section, secure **BV-72** and **BV-81**, turn compressor off, and open **BV-92/BV-94** to bleed the pressure off and start pushing water from the Pump Skid towards the disposal well. After pressure has bled off, close **BV-90** and the valve at **AC-9**.

7.6.4 Push water from the Effluent Pump Skid towards the disposal well by verifying that the inlet and outlet valves on Pumps P-5A/P-5B (**BV-92, BV-93, BV-95, and BV-96**), and Filters F-3/F-4 (**BV-98, BV-99, BV-102 and BV-103**) are open, and verify that valves **BV-110** and **BV-111** are open, and close **BV-112** and **BV-113** to protect the Turbidity Monitor.

7.6.5 Start the compressor and slowly open the ball valve at AC-9 to allow air to push the water towards the disposal well.

7.6.6 After water is removed, turn compressor off, and let the pressure bleed off to the well.

7.6.7 After pressure has bled off, secure **BV-92** and **BV-94**, close valve at AC-9 and disconnect air hose.

**Table 7.1. System Shutdown Checklist.**

**DATE:** \_\_\_\_\_

**OPERATOR:** \_\_\_\_\_

System Shutdown Checklist	Verification/Date
<p>1) Stop either Influent Pump P-2A or P-2B by pushing in the "Stop" button. Watch for flow to cease on FIT-2 and of FS-2 and FS-3.</p>	
<p>2) If water is <u>not</u> to be drained from the system, secure <b>all</b> ball valves on-site. Start at the effluent side and work towards the influent side.</p>	
<p>3) If water <u>is</u> to be drained from the system, leave <b>MBV-2, BV-11, BV-19, and BV-30</b> open. Connect air compressor hose to air connection AC-2 (on Influent Pump Skid). To remove water from the hose between the Influent Tank(s) and the influent Pump Skid perform the following:</p> <ul style="list-style-type: none"> <li>● Close <b>BV-32 and BV-34</b>, and verify that <b>BV-30</b> is open.</li> <li>● Start compressor and slowly open ball valve at AC-2 to allow air to push the water back towards the Influent Storage Tank(s).</li> <li>● After water is removed, secure <b>BV-11, BV-19 and BV-30</b>, then continue with step 4.</li> </ul> <p>NOTE: Line from Influent Tank(s) to Influent Pump Skid will be pressurized until pressure is bled off in step 5.</p>	
<p>4) To remove water from the hose (and equipment) between the Influent Pump Skid and the Process Skid, verify that the air compressor is connected to the air connection at AC-2 and perform the following:</p> <ul style="list-style-type: none"> <li>● Verify that <b>BV-30</b> is closed, and verify that Influent Pump inlet and outlet valves (either <b>BV-32 and BV-33</b>, or <b>BV-34 and BV-35</b>) are open, depending on which pump was being run when the system was shut down.</li> <li>● Verify that inlet and outlet valves of the Filter that was on-line are open.</li> <li>● Verify that valve <b>BV-44, and BV-50</b> are open, start compressor and slowly open the ball valve at AC-2 to allow air to push the water towards the Columns.</li> <li>● After water is removed, turn compressor off, and after pressure has bled off, secure <b>BV-44, and BV-50</b> and close the valve at AC-2 and disconnect air hose from AC-2.</li> </ul> <p>Note: If the water is to be removed from the Columns, the water can be pushed all the way to the Effluent Storage Tanks which will also empty the hoses and equipment in between by following the steps in 5), below, except the air hose will be connected or disconnected at AC-2 instead of AC-8.</p>	
<p>5) To remove water from the hose between the Process Skid and the Effluent Storage Tank(s), connect the air compressor to air connection AC-7 and perform the following:</p> <ul style="list-style-type: none"> <li>● Verify that <b>BV-64G, BV-64, BV-69, BV-64C, BV-64D, BV-64H, BV-64I, BV-64J, BV-64K, BV-70, BV-71 and BV-80</b> are open, close <b>BV-62B</b>, start the compressor and slowly open the ball valve at AC-7 to allow air to push the water towards the Effluent Storage Tank(s).</li> <li>● After the water is removed, secure <b>BV-71 and BV-80</b>, turn compressor off.</li> <li>● To bleed pressure off, slowly open the valve at AC-8 holding a bucket to catch water (and wearing ear plugs), after pressure has bled off, close valves at AC-7 and AC-8, secure <b>BV-69</b> and disconnect air hose from AC-7.</li> </ul>	

System Shutdown Checklist	Verification/Date
<p>6) If no treated water is to be drained from the Effluent Storage Tank(s), and freezing conditions exist, remove the water from the hoses and equipment between the Effluent Storage Tank(s) to the disposal well, connect the air compressor to air connection AC-9 and perform the following:</p> <ul style="list-style-type: none"> <li>● Push water from the Effluent Pump Skid to the Effluent Storage Tank(s) by closing <b>BV-92/BV-94</b>, verify that <b>BV-72, BV-81, BV-87</b> and <b>BV-90</b> are open.</li> <li>● Start the compressor and slowly open the ball valve at AC-9 to allow air to push the water back towards the Effluent Storage Tank(s).</li> <li>● After the water is removed from that section, secure <b>BV-72</b> and <b>BV-81</b>, turn compressor off, and open <b>BV-92/BV-94</b> to bleed the pressure off and start pushing water from the Pump Skid towards the disposal well. After pressure has bled off, close <b>BV-90</b> and the valve at AC-9.</li> <li>● Push water from the Effluent Pump Skid towards the disposal well by verifying that the inlet and outlet valves on Pumps P-5A/P-5B (<b>BV-92, BV-93, BV-94</b>, and <b>BV-95</b>), and Filters F-3/F-4 (<b>BV-98, BV-99, BV-102</b> and <b>BV-103</b>) are open, and verify that valves <b>BV-110</b> and <b>BV-111</b> are open, and close <b>BV-112</b> and <b>BV-113</b> to protect the Turbidity Monitor.</li> <li>● Start the compressor and slowly open the ball valve at AC-9 to allow air to push the water towards the disposal well.</li> <li>● After water is removed, turn compressor off, and let the pressure bleed off to the well.</li> <li>● After pressure has bled off, secure <b>BV-92</b> and <b>BV-94</b>, close valve at AC-9 and disconnect air hose.</li> </ul>	
<p>7) To secure the site at the end of a shift close all ball valves that are not involved with equipment planned to be operating offshift, ie: 24 hour well pumping.</p>	

## 8.0 FILTER CHANGEOUT

Changing of filter cartridges should occur when the filters become clogged with fines. This is evident by the pressure differences before and after the filters.

### 8.1 Changing Influent Filters

Changing of the influent bag filters should occur when the pressure differential has reached 30 psi across the filters.

NOTE: an HPT must be present whenever system integrity is broken.

8.1.1 If the process is operating, follow procedures to shut down the system.

8.1.2 Isolate filter piping by closing:

**BV-33, BV-35, and BV-49.**

8.1.3 Attach sample connector to air connect coming off of BV-49. When pressure is relieved, close:

**BV-49.**

8.1.4 Reroute flow from the filter outlet to the influent tank(s) by switching 3-way ball valve: Ensure hose is connected from BV-44 to BV-22.

**BV-44, BV-22**

8.1.5 Ensure flow is able to proceed from filters to influent tank(s) by opening:

**BV-7, BV-8, BV-9, BV-38, BV-39, BV-40, BV-41, BV-45, BV-46, BV-47, and BV-48.**

8.1.6 Attach air compressor to air connect coming off of BV-49. Pressurize compressor to 30 psi, then open:

**BV-49.**

8.1.7 Allow air to blow through system for 1 minute, then close:

**BV-47, BV-48, BV-45, BV-46, BV-40, and BV-41.**

8.1.8 Blow each filter down separately for 10 minutes to ensure all water is purged from the system.

8.1.9 When all filters have been blown down, close:

**BV-49, BV-44**

8.1.10 Bleed pressure off of air compressor hose and disconnect.

8.1.11 When pressure is relieved, close:

**BV-49, BV-38, BV-39, BV-40, BV-41, BV-45, BV-46, BV-47, and BV-48.**

8.1.12 Double check system is isolated, then replace filters.

NOTE: be sure all pressure is bled out of lines before opening filter housings.

**Table 8.1. Influent Filter Changeout Procedure.**

DATE: \_\_\_\_\_

OPERATOR: \_\_\_\_\_

Influent Filter Changeout Checklist	Verified/Date
1) Verify that the treatment system is not operating. If system is operating, follow procedures to shut down the system.	
2) Isolate filter piping. Close: BV-33, BV-35, BV-49	
3) Verify HPT is onsite to provide coverage for filter change.	
4) Attach sample connector to air connect coming off of BV-49. Bleed excess water into purge bucket by toggling BV-49. When pressure is relieved, close: BV-49	
5) Reroute flow from the filter outlet to the influent tank(s) manifold by switching 3-way ball valve: BV-44, and BV-22	
6) Ensure flow is able to proceed from filters to influent tank(s) by opening: BV-7, BV-8, BV-9, BV-38, BV-39, BV-40, BV-41, BV-44, BV-45, BV-46, BV-47, and BV-48,	
7) Attach air compressor to air connect coming off of BV-49. Pressurize compressor to 30 psi, then open: BV-49.	
8) Allow air to blow through system for 1 minute, then close: BV-47, BV-48, BV-45, BV-46, BV-40, and BV-41.	
9) Blow each filter down individually for 10 minutes to ensure all water is purged from the system.	
10) When all filters have been blown down, close: BV-49, BV-49 (3-way)	
11) Bleed pressure off of air compressor hose and disconnect.	
12) When pressure is relieved, close: BV-49, BV-38, BV-39, BV-40, BV-41, BV-45, BV-46, BV-47, and BV-48	
13) Double check system is isolated, then replace filters.	

NOTE: Be sure all pressure is bled out of lines before opening filter housings.

## 8.2 Changing Post Column Filters

Changing of the clinoptilolite cartridge filters (after tank #5) should occur when the pressure differential has reached 60 psi across the filters.

8.2.1 If the process is operating, follow procedures to shut down the system.

8.2.2 Isolate filter piping by closing:

**BV-64C, and BV-64D**

8.2.3 Bleed excess water into purge bucket by toggling BV-64E and BV-64F.

8.2.4 Double check system is isolated, then replace filters.

NOTE: be sure all pressure is bled out of lines before opening filter housings.

**Table 8.2. Post-Column Filter Changeout Procedure.**

DATE: \_\_\_\_\_

OPERATOR: \_\_\_\_\_

Post Column Filter Changeout Checklist	Verified/Date
Verify the treatment system is not operating. If the system is operating, follow procedures to shut down the system.	
Isolate effluent filter piping by closing: BV-64C and BV-64D.	
Bleed excess water into purge bucket by toggling BV-64E.	
Double check system is isolated, then replace filters.	

NOTE: Be sure all pressure is bled out of the lines before opening filter housings.

## 8.3 Changing Effluent Filters

Changing of the effluent cartridge filters should occur when the pressure differential has reached 30 psi across the filters.

8.3.1 If the process is operating, follow procedures to shut down the system.

8.3.2 Isolate filter piping by closing:

**BV-93, and BV-95**

8.3.3 Attach sample connector to air connect upgradient of. Bleed excess water into purge bucket by toggling AC-9. When pressure is relieved, close:

**AC-9, BV-98, BV-99, BV-102, and BV-103**

8.3.4 Double check system is isolated, then replace filters.

NOTE: be sure all pressure is bled out of lines before opening filter housings.

**Table 8.3. Effluent Filter Changeout Procedure.**

**DATE:** \_\_\_\_\_

**OPERATOR:** \_\_\_\_\_

Effluent Filter Changeout Checklist	Verified/Date
Verify the treatment system is not operating. If the system is operating, follow procedures to shut down the system.	
Isolate effluent filter piping by closing: BV-93, BV-95, BV-100, and BV-101.	
Attach sample connector to air connect coming off of AC-9. Bleed excess water into purge bucket by toggling AC-9. When pressure is relieved, close: AC-9, BV-98, BV-99, BV-102, and BV-103.	
Double check system is isolated, then replace filters.	

NOTE: Be sure all pressure is bled out of the lines before opening filter housings.

## 9.0 SAMPLING

### 9.1 Sampling Frequency and Locations

Sampling points are provided to monitor the various stages in the treatment system. Samples will be taken a minimum of once a week while the system is operating. Additional sampling may take place during the first two weeks of operation as well as during events such as ion exchange column breakthrough. A Sampling & Analysis Plan will be put together that will provide detail on the types of analysis performed, and QA procedures that will be followed. Sampling will be conducted by someone from the IT Sampling group, or by a qualified operator. Sampling points are located at the following locations:

Sampling Connections	Location
AC-1	Well Manifold
SC-2	Influent Storage Tank Inlet
AC-2	Influent Pump Skid
AC-3	Top of Column TNK-3
AC-4	Bottom of Column TNK-3
AC-6	Bottom of Column TNK-4
AC-7	Top of Column TNK-5
AC-8	Bottom of Column TNK-5
AC-9	Effluent Pump Skid
SC-10	Disposal Well Manifold
SC-70B	Before effluent tanks

Additional sampling locations may be designated as needed as mobile sampling ports are available. Sampling locations will change as needed and determined by operations.

### 9.2 Sampling Procedure

- 9.2.1 Attach sampling apparatus to predetermined sampling point after flow has been established.
- 9.2.2 Open appropriate sampling ball valve slowly and purge at least three tubing volumes (approximately 1 gal) into a five gallon bucket. Place purged groundwater into holding drum.
- 9.2.3 Take needed samples.
- 9.2.4 Verify that sampling valves are closed after use.
- 9.2.5 Table 9.1 is provided to document these steps.

NOTE: An HPT may be required to be present during sampling. Check requirements per RWP.

**Table 9.1 Sampling Checklist**

Date: \_\_\_\_\_

Operators: \_\_\_\_\_

Sampling Checklist	Verified/Date
1) Attach sampling apparatus to predetermined sampling point after flow has been established.	
2) Open appropriate sampling ball valve slowly and purge at least three tubing volumes (approximately 1 gal) into a five gallon bucket. Place purged groundwater into holding drum.	
3) Take needed samples.	
4) Verify that sampling valves are closed after use.	

NOTE: An HPT may be required to be present during sampling.  
Check requirements per RWP.

### 10.0 DAILY DATA LOG TABLES

Entries to the Daily Data Logs are to be made approximately every hour each day that the system is operational. The Daily Data Logs consist of the Influent Pumping Station Data Log (Table 10.1), the Treatment System Data Log (Table 10.2), the Effluent Pumping Station Log (Table 10.3), and the Weekly Operational Status Log (Table 10.4).

**Table 10.1. Influent Pumping Station Data Log.**

200-BP-5, UNIT #2 OPERATIONAL LOG

DATE: \_\_\_\_\_

OPERATORS: \_\_\_\_\_

**EXTRACTION WELL:**

TIME	FLOW RATE FROM ROTAMETER	FLOW RATE FROM FIT-1	PUMP P1 (PSI)	TRANSDUCER WATER LEVEL (DELTA)

FILTERS IN OPERATION: 1 2 3 4  
PUMP IN OPERATION: P2-A P2-B

TIME	FLOW, FIT-2	GAGE P-2 (PSI)	GAGE P-3 (PSI)	GAGE P-4 (PSI)

Table 10.2. Treatment System Data Log.

200-BP-5, UNIT #2 OPERATIONAL LOG

DATE: \_\_\_\_\_

OPERATORS: \_\_\_\_\_

COLUMNS IN USE:

TIME	FLOW RATE (GPM) FROM FIT-2	PRE-LEAD P-8 (PSI)	POST-LEAD P-9 (PSI)	PRE-POLISH P-11 (PSI)	POST-POLISH P-12 (PSI)	PRE-COLUMN P-16 (PSI)	POST-COLUMN P-17 (PSI)

Table 10.3. Effluent Pumping Station Data Log.

200-BP-5, UNIT #2 OPERATIONAL LOG

DATE: \_\_\_\_\_

OPERATORS: \_\_\_\_\_

FILTERS IN OPERATION: 1 2 3 4  
PUMP IN OPERATION: P3-A P3-B

TIME	FLOW RATE (FIT-3, GPM)	P-14 (PSI)	P-15 (PSI)	TRANSDUCER READING (DELTA)	FLOW, ROTAMETER	TOTAL GALLONS DISPOSED

Table 10.4. 200-BP-5, Unit #2 Treatability Test Weekly Operational Status Log.  
Week Ending \_\_\_\_\_

OPERATIONAL PARAMETERS	MON	TUE	WED	THUR	FRI	SAT	WEEKLY TOTAL	RUNNING TOTAL
HOURS OF OPERATION								
HOURS OF TREATMENT								
VOLUME EXTRACTED								
VOLUME TREATED								
VOLUME INJECTED								

OPERATIONAL DIFFICULTIES:

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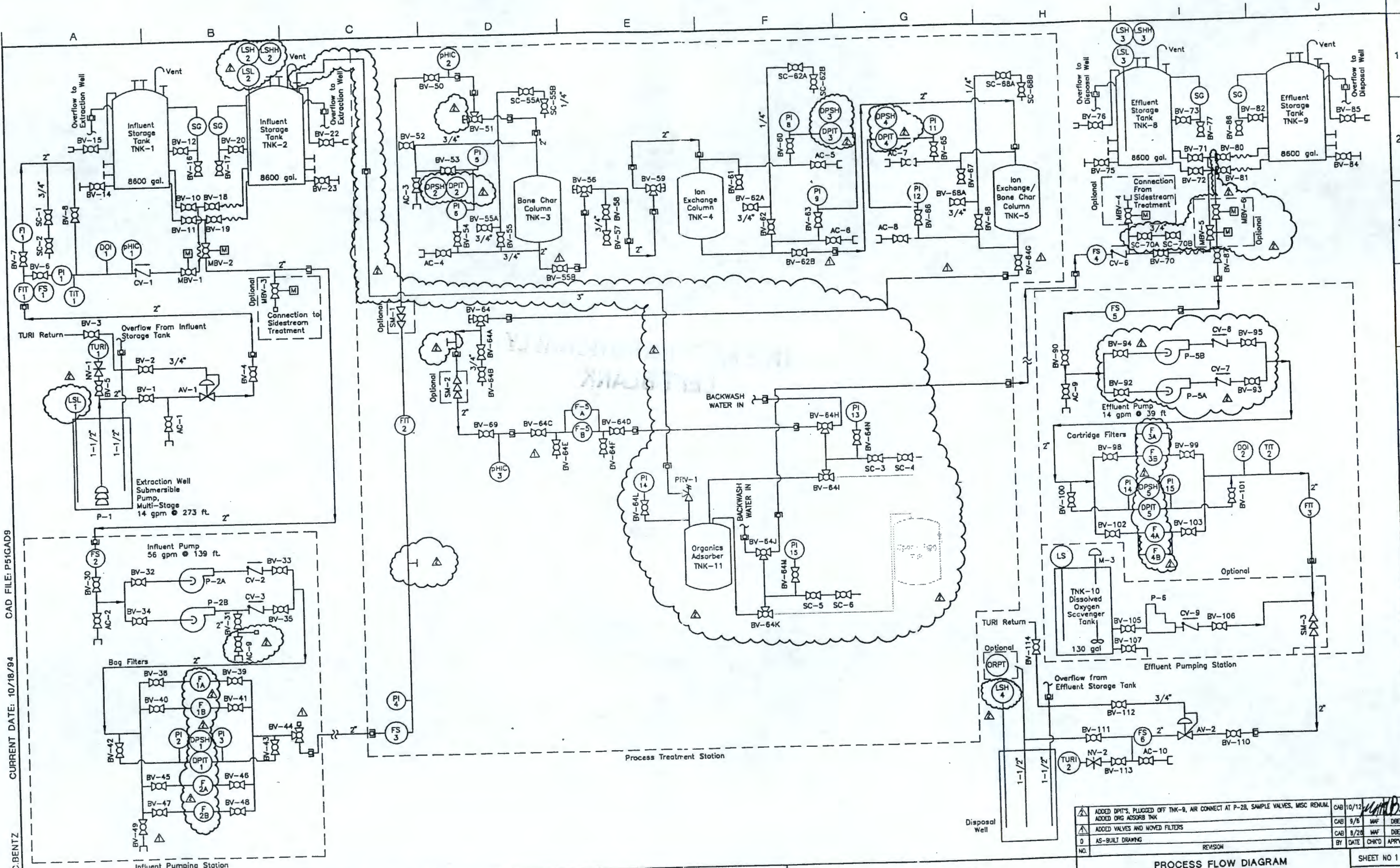
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EPIC 18 H6-08	Transmittal No. TR-OP-14	Date 10-25-94
	Document No./Title of Manual BHI-OP-00003	

The procedure(s) listed below are being issued by BHI Procedures Coordination as new or revised procedures.

PROCEDURE NO.	REV. NO.	TITLE
BHI-OP-00003	2	200-BP-5, Unit #1 Pilot-Scale Groundwater Treatment System Operating Procedures
		<b>NOTE: THIS REVISION SUPERSEDES REV. 1 OF THIS DOCUMENT</b>

### Receipt Acknowledgment

I acknowledge receipt of the procedure(s) listed above. These procedures have been appropriately inserted and the superseded material removed and disposed of.

Signature: *John Riley* Date: 11-22-94

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