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200-BP-5, Unit #2 Pilot-Scale Groundwater Treatment System Operating Procedures

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200-BP-5, UNIT #2
PILOT-SCALE GROUNDWATER TREATMENT SYSTEM
OPERATING PROCEDURES

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200-BP-5, UNIT #2
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 cobalt and technetium from the groundwater in the 200-BP-5 Operable Unit, more specifically the BY Crib Site also known as BP-5, Unit #2, located just north of the 200 East Area. The Treatment System is an ion exchange adsorption 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 groundwater prior to proposing an Interim Remedial Measure (IRM) plan. This treatability test will evaluate the effectiveness of ion exchange for the removal of cobalt and technetium, 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 2 will be performed at the 200-BP-5 Operable Unit near the BY Crib which used to be part of treatment and disposal system for the B-plant in 200 East Area. The operation will include a well (or wells) for extraction of groundwater to be treated and a well for disposal of the treated effluent; two 8,200-8,600 gallon storage tanks, one for storage of influent and one for storage of treated effluent; an 4,200 gallon process water tank that provides water for chemical makeup (if required) and backflushing of the IX 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. In addition, due to the long distance to the disposal well, another tank may be required as a holding tank for a tank truck to transport treated water 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 will commence with operation of the extraction well pump and the effluent pump(s) on a 24 hours/day basis for filling the influent tank and disposing of treated effluent from the effluent storage tank; and operating the process system on an 6-8 hour/day basis.

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. Performance of the startup checklist will be documented in the field logbook. Refer to process flow diagram and the Process and Instrument Diagram 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
- Ion Exchange Columns
- 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

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. Verify that all necessary safety equipment is available and functional, i.e. fire extinguishers, eye wash, etc. If discrepant conditions are found, note them in the logbook and correct 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 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;

- From the outlet (bottom) of the second column, to the Process System skid discharge manifold;

- Process System skid discharge manifold to the Effluent Storage Tank inlet manifold;
- Effluent Storage Tank outlet to the Effluent Pump skid suction manifold;
- Effluent Pump skid discharge to the holding tank or tanker truck (if applicable); and
- The second holding tank (at the disposal well) to the disposal 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 ball valves **BV-1, BV-2, BV-4, BV-6** or **BV-7 and BV-8**, **BV-9,** and **MBV-1** are open while the extraction well pump is 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 appear to be working properly.

1.3.6 Verify that columns are properly connected for series flow through two columns as noted in 1.3.2 above, then out to the outlet manifold.

1.3.7 Table 1.1 is provided to document the steps.

Table 1.1 Pre-startup Readiness Checklist

Date:_____

Operators:_____

	Prestartup Check	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)	Verify that the IX columns are connected from the Process Manifold to the 2 columns in series flow, then out to the outlet side of the Process Manifold	
6)	Process System Skid discharge manifold to the Effluent Storage Tank inlet	
7)	Effluent Storage Tank outlet to the Effluent Pump skid suction	
8)	Effluent Pump skid discharge to the holding tank or tanker truck	
9)	The second holding tank (at the disposal well) to the disposal well	
10)	Verify that gages are connected and appear to be working properly	
11)	Verify filter housing lids are closed and tightened and that filters are ready to accept flow	
12)	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)	

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, then from an Influent Pump through Influent Filters, through two Columns in series flow and out to the Effluent Storage Tank. The treated effluent in the Effluent Storage Tank will be discharged to an effluent holding tank via one of the Effluent Pumps and Effluent Filters. A tank truck will transport and pump the treated effluent to another holding tank at the Disposal Well site. The treated effluent then will be gravity drained 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, protect pumps from loss of flow, alarm when to change filters and backwash IX 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 on site in a field notebook.

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 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 for the equipment that is operating.

2.1.4 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.

2.1.5 Energize power to 110 VAC system for level controls and PLC.

2.1.6 Reset MBV control switches at the influent skid.

2.1.7 Table 2.1 is provided to document these steps.

Table 2.1. Electrical Power Startup Checklist.

DATE:_____

OPERATOR:_____

	Electrical Power Checklist	Verified/Date
1)	Verify the main disconnect switches on the generator and the main control panel are off.	
2)	Verify the electrical generator to the main contol 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 contol switches at the influent skid.	

2.2 Start Extraction Well Pump, P-1

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 and **BV-2** on the well manifold, valves **BV-6** or **BV-7** and **BV-8** on the Influent Tank manifold .

2.2.3 Open **BV-4** on the well manifold about 25%.

2.2.4 When back pressure has been established, open **BV-9.**

2.2.5 Open Motor Operated Ball Valve, MBV-1 (if applicable) 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 from overflowing. It is impossible to establish flow to the Influent Tank and keep Pump P-1 running because of flow switch FS-1 in the pump start circuit).

2.2.6 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.

2.2.7 Switch MBV-1 selector switch (if applicable) to "Auto" which brings in the Interlocks for shutting off the pump as shown in the Interlock Checklist in Section 4.0 below.

2.2.8 Verify that the following light on the annunciator panel is not illuminated: F-1, No Flow From Extraction Well

2.2.9 Table 2.2 is provided to document these steps.

Table 2.2 Extraction Well Startup Checklist.

Date:_____

Operators:_____

	Extraction Well Checklist	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" - LSHH-1, Influent Storage Tank Level, "High High"	
2)	Verify that all ball valves (BV) are closed except the following : **BV-1** and **BV-2** on the well manifold, valves **BV-7, BV-8** and **BV-9** (if the rotameter is to be used) or, **BV-6** and **BV-9** (if rotameter will not be used) on the Influent Tank manifold.	
3)	Open **BV-4** on the well manifold about 25%.	
4)	When back pressure has been established, open **BV-9.**	
5)	Open Motor Operated Ball Valve, MBV-1 (if applicable) by setting MBV-1 "Open-Closed-Auto" switch to "Open."	
6)	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.	
7)	Switch MBV-1 selector switch to "Auto" (if applicable).	
8)	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 To The Process System

Note: The Influent Storage Tank must have liquid in the tank before starting the Influent Pump.

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

- LSL-2, Influent Storage Tank Level, "Low"
- LSH-2, Effluent Storage Tank Level, "High"
- LSHH-2, 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.

2.3.3 If running Influent Pump P-2A and the F-1 set of filters for extraction, Open:

BV-10, BV-30, BV-32, BV-33, BV-38, BV-39, BV-40, BV-41, BV-42, BV-43, BV-49, BV-50, BV-51, BV-52A, BV-53A, BV-55, BV-56, BV-60, BV-66A, BV-68B, BV-67, BV-65, BV-69, and BV-70.

- If Influent Pump P-2A and filters F-2 are to be used to establish process flow, Open:

  BV-10, BV-30, BV-32, BV-33, BV-42, BV-43, BV-45, BV-46, BV-47, BV-48, BV-49, BV-50, BV-51, BV-52A, BV-53A, BV-55, BV-56, BV-60, BV-66A, BV-68B, BV-67, BV-65, BV-69, and BV-70.

- If Influent Pump P-2A and filters F-1 and F-2 are to be used to establish process flow, Open:

  BV-10, BV-30, BV-32, BV-33, BV-38. BV-39, BV-40, BV-41, BV-42, BV-43, BV-45, BV-46, BV-47, BV-48, BV-49, BV-50, BV-51, BV-52A, BV-53A, BV-55, BV-56, BV-60, BV-66A, BV-68B, BV-67, BV-65, BV-69, and BV-70.

- If running Influent Pump P-2B and filters F-1 for process flow, Open:

  BV-10, BV-30, BV-34, BV-35, BV-38, BV-39, BV-40, BV-41, BV-42, BV-43, BV-49, BV-50, BV-51, BV-52A, BV-53A, BV-55, BV-56, BV-60, BV-66A, BV-68B, BV-67, BV-65, BV-69, and BV-70.

- If running Influent Pump P-2B and filters F-2 for process flow, Open:

  BV-10, BV-30, BV-34, BV-35, BV-42, BV-43, BV-45, BV-46, BV-47, BV-48, BV-49, BV-50, BV-51, BV-52A, BV-53A, BV-55, BV-56, BV-60, BV-66A, BV-68B, BV-67, BV-65, BV-69, and BV-70.

- If Influent Pump P-2B and filters F-1 and F-2 are to be used to establish process flow, Open:

  BV-10, BV-30, BV-34, BV-35, BV-38, BV-39, BV-40, BV-41, BV-42, BV-43, BV-45, BV-46, BV-47, BV-48, BV-49, BV-50, BV-51, BV-52A, BV-53A, BV-55, BV-56, BV-60, BV-66A, BV-68B, BV-67, BV-65, BV-69, and BV-70.

2.3.4 When the Influent Storage Tank liquid level is physically above the influent pumps, open **MBV-2** (if applicable) by setting MBV-2 "Open-Closed-Auto" switch to "Open."

2.3.5 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.

2.3.6 Switch **MBV-2** to "Auto" (if applicable) 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 IX Columns to the Effluent Storage Tank.

2.3.7 When flow starts to fill the Effluent Storage Tank, switch **MBV-5** (if applicable) to "Auto" which brings in the interlocks as described in the Interlock Checklist in Section 4.0 below.

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

- FS-2 No Flow From Influent Storage Tank
- FS-3 No Flow From Influent Pump Skid
- FS-4 No Flow From Process System

- When flow has been established through the system and is at steady state, take readings of: flow, pressure and pressure differential, of filters and IX Columns.

(Note: Verify that **BV's 42 & 43** at the Effluent Filters are open to allow pressure signal to the DP Transmitter).

Flow Readings:_____

Pressure Readings:(Not to exceed 80 psi)_____

Differential Pressure Readings:(Not to exceed 60 psi) _____
_____

Note: If pressure or differential pressure readings exceed parameters, press emergency stop button to stop all pumps and contact the cognizant engineer.

2.3.9 Table 2.3 is provided to document these steps.

Table 2.3 Process Flow Startup Checklist.

Date:_____

Operators:_____

	Process Flow Checklist	Verified/Date
1)	Verify that the following lights on the annunciator panel are not illuminated: LSL-2, Influent Storage Tank Level, "Low" LSH-2, Effluent Storage Tank Level, "High" LSHH-2, Effluent Storage Tank Level, "High High."	
2)	If Influent Pump P-2A and filters F-1 are to be used to establish process flow, Open: **BV-10, BV-30, BV-32, BV-33, BV-38, BV-39, BV-40, BV-41, BV-42, BV-43, BV-49, BV-50, BV-51, BV-52A, BV-53A, BV-55, BV-56, BV-60, BV-66A, BV-68B, BV-67,BV-65, BV-69,** and **BV-70.** If Influent Pump P-2A and filters F-2 are to be used to establish process flow, Open: **BV-10, BV-30, BV-32, BV-33, BV-42, BV-43, BV-45, BV-46, BV-47, BV-48, BV-49, BV-50, BV-51, BV-52A, BV-53A, BV-55, BV-56, BV-60, BV-66A, BV-68B, BV-67,BV-65, BV-69,** and **BV-70.** If Influent Pump P-2A and filters F-1 and F-2 are to be used to establish process flow, Open: **BV-10, BV-30, BV-32, BV-33, BV-38. BV-39, BV-40, BV-41, BV-42, BV-43, BV-45, BV-46, BV-47, BV-48, BV-49, BV-50, BV-51, BV-52A, BV-53A, BV-55, BV-56, BV-60, BV-66A, BV-68B, BV-67,BV-65, BV-69,** and **BV-70.** If running Influent Pump P-2B and filters F-1 for process flow, Open: **BV-10, BV-30, BV-34, BV-35, BV-38, BV-39, BV-40, BV-41, BV-42, BV-43, BV-49, BV-50, BV-51, BV-52A, BV-53A, BV-55, BV-56, BV-60, BV-66A, BV-68B, BV-67,BV-65, BV-69,** and **BV-70.** If running Influent Pump P-2B and filters F-2 for process flow, Open: **BV-10, BV-30, BV-34, BV-35, BV-42, BV-43, BV-45, BV-46, BV-47, BV-48, BV-49, BV-50, BV-51, BV-52A, BV-53A, BV-55, BV-56, BV-60, BV-66A, BV-68B, BV-67,BV-65, BV-69,** and **BV-70.** If Influent Pump P-2B and filters F-1 and F-2 are to be used to establish process flow, Open: **BV-10, BV-30, BV-34, BV-35, BV-38. BV-39, BV-40, BV-41, BV-42, BV-43, BV-45, BV-46, BV-47, BV-48, BV-49, BV-50, BV-51, BV-52A, BV-53A, BV-55, BV-56, BV-60, BV-66A, BV-68B, BV-67,BV-65, BV-69,** and **BV-70.**	

	Process Flow Checklist	Verified/Date
3)	When the Influent Storage Tank is at an adequate level, open MBV-2 (if applicable) by setting MBV-2 "Open-Closed-Auto" switch to "Open."	
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.	
5)	Switch MBV-2 to "Auto" when flow is established and open MBV-5 (if applicable) in the "Open" mode to allow flow from the Influent Pumps through the Filters and IX Columns to the Effluent Storage Tank.	
6)	When flow starts to fill the Effluent Storage Tank, switch MBV-5 (if applicable) to "Auto."	
7)	Verify that the following lights on the annunciator panel are not illuminated: FS-2, FS-3, and FS-4.	
8)	When flow has reached steady state, record readings on the daily data log sheets of flow, pressure and pressure differential on filters and IX Columns.	

2.4 Start Effluent Pump

When the Effluent Storage Tank has sufficient volume of treated effluent, an Effluent Pump is started to discharge the treated effluent into the effluent holding tank for transport to the disposal well site.

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

- LSH-3, Disposal Well Level, "High"
- LHL-2, 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 Effluent Pump P-5A and F-3 set of filters are to be used for pumping effluent to the purge truck, open:

  BV-72, BV-90, BV-92, BV-93, BV-98, BV-99, BV-100, BV-101, and BV-108.

- If Effluent Pump P-5A and F-4 set of filters are to be used for pumping effluent to the purge truck, open:

  BV-72, BV-90, BV-92, BV-93, BV-100, BV-101, BV-102,BV-103, and BV-108.

- If Effluent Pump P-5A and F-3 and F-4 sets of filters are to be used for pumping effluent to the purge truck, open:

  BV-72, BV-90, BV-92, BV-93, BV-98, BV-99, BV-100, BV-101, BV-102, BV-103,

and **BV-108.**

- If Effluent Pump P-5B and F-3 set of filters are to be used for pumping effluent to the purge truck, open:

  BV-72, BV-90, BV-94, BV-95, BV-98, BV-99, BV-100, BV-101, and **BV-108.**

- If Effluent Pump P-5B and F-4 set of filters are to used for pumping effluent to the purge truck, open:

  BV-72, BV-90, BV-94, BV-95, BV-100, BV-101, BV-102, BV-103, and **BV-108.**

- If Effluent Pump P-5B and F-3 and F-4 sets of filters are to be used for pumping effluent to the purge truck, open:

  BV-72, BV-90, BV-94, BV-95, BV-98, BV-99, BV-100, BV-101, BV-102, BV-103, and **BV-108.**

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.

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 No Flow From Effluent Storage Tank

2.4.7 When flow reaches steady state, take readings of: flow, pressure and pressure differential, on the filters.

(Note: Verify that **BV's 100 & 101** at the Effluent Filters are open to allow pressure signal to the DP Transmitter).

Flow Readings:_____

Pressure Readings:(Not to exceed 80 psi)_____

Differential Pressure Readings:(Not to exceed 60 psi)_____

_____

Note: Pressure differential alarm is set to alarm (illuminate annunciator light) at 30 psi differential.

Note: If pressure or differential pressure readings exceed parameters, press emergency stop button to stop all pumps and contact the cognizant engineer.

2.4.8 Table 2.4 is provided to document these steps.

2.4.9 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.

2.4.10 Metering Pump, Caustic

Note: See discussion on need in 2.4.9.

2.4.11 Metering Pump, Oxygen Scavenger Chemical

Note: See discussion on need in 2.4.9.

Table 2.4 Effluent Pump Startup Checklist.

Date:_____

Operators:_____

	Effluent Pump Checklist	Verified/Date
1)	Verify that the following alarm lights on the annunciator panel are not illuminated: LSH-3, Disposal Well Level, "High" LSL-2, Effluent Storage Tank Level, "Low"	
2)	If Effluent Pump P-5A and F-3 set of filters are to be used for pumping effluent to the purge truck, open: **BV-72, BV-90, BV-92, BV-93, BV-98, BV-99, BV-100, BV-101,** and **BV-108.** If Effluent Pump P-5A and F-4 set of filters are to be used for pumping effluent to the purge truck, open: **BV-72, BV-90, BV-92, BV-93, BV-100, BV-101, BV-102, BV-103,** and **BV-108.** If Effluent Pump P-5A and F-3 and F-4 sets of filters are to be used for pumping effluent to the purge truck, open: **BV-72, BV-90, BV-92, BV-93, BV-98, BV-99, BV-100, BV-101, BV-102, BV-103,** and **BV-108.** If Effluent Pump P-5B and F-3 set of filters are to be used for pumping effluent to the purge truck, open: **BV-72, BV-90, BV-94, BV-95, BV-98, BV-99, BV-100,** BV-101, and **BV-108.** If Effluent Pump P-5B and F-4 set of filters are to used for pumping effluent to the purge truck, open: **BV-72, BV-90, BV-94, BV-95, BV-100, BV-101, BV-102, BV-103,** and **BV-108.** If Effluent Pump P-5B and F-3 and F-4 sets of filters are to be used for pumping effluent to the purge truck, open: **BV-72, BV-90, BV-94, BV-95, BV-98, BV-99, BV-100, BV-101, BV-102, BV-103,** and **BV-108.**	
3)	Open MBV-6 (if applicable) by setting MBV-6 "Open-Closed-Auto" switch to "Open."	
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 make-up of FS-5.	
5)	After flow is established, switch MBV-6 (if applicable) to the "Auto" position.	
6)	Verify that the following alarm lights on the annunciator panel are not illuminated: FS-5 No Flow From Effluent Tank	
7)	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.	

2.5 Process Water Tank

The Process Water Tank is an 8,200 gallon 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 IX resin is loaded into the IX columns and before it 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 shutdown. 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, it may also be used for backwashing. 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):

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 IX Column to be backwashed.

2.6.3 The backwash solution will be sent through the Influent Filters to remove the solids and then back to the Influent Storage Tank. Connect a hose from a quick disconnect at the top of the IX Column being backwashed to **BV-37** at the top of the Influent Filters and a hose from **BV-49** to the inlet to the Influent Storage Tank at **BV-15**.

2.6.4 A portable rotameter will need to be temporarily installed in the hose from the IX column being backwashed to the Influent Filters. This is needed for controlling flow, and watching for disappearance of color and whether any resin escapes the column.

2.6.5 An alternative to that described in 2.6.3 and 2.6.4 would be to use the inlet manifold on the Influent Storage Tank. Disconnect the hose coming from the well to the Influent Tank inlet manifold, then connect the hose from **BV-49** 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-72** at the Effluent Storage Tank outlet manifold and disconnect the hose to the Effluent Pump Skid. Then connect a hose from that disconnect to the bottom of the IX column being backwashed. Then follow either 2.6.3 and 2.6.4, or 2.6.5 above for conducting the backwash.

2.6.7 Backwash new media in each IX column until the colored backwash solution turns clear (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.

2.6.9 Table 2.5 is provided to document these steps.

Table 2.5. Backwash of IX 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 IX Column to be backwashed.	
3)	Connect a hose from a quick disconnect at the top of the IX Column being backwashed to the top of the Influent Filters at BV-37 and connect a hose from **BV-49** to the Influent Storage Tank at **BV-15**.	
4)	Connect a portable rotameter, temporarily, in the hose from the IX column being backwashed to the Influent Filter. This is used for controlling flow, and watching for disappearance of color and whether any resin 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. Disconnect the hose coming from the well to the Influent Tank inlet manifold, then connect the hose from **BV-49** to that inlet manifold. This will provide flow control and a rotameter for monitoring backwashing as described above.	
6)	If treated water is to be used as the water supply for the backwash, close **BV-72** at the Effluent Storage Tank outlet manifold and disconnect the hose to the Effluent Pump Skid. Then connect a hose from that quick disconnect to the bottom of the IX column being backwashed. Then follow either step 3 and 4, or 5 above for conducting the backwash.	
7)	Backwash new media in each IX column until the colored backwash solution turns clear (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.**	
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.**

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, " ")	Stop P2A/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, " 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	_____	_____

3.6 Table 3.1 is provided to document these steps.

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

(Note: These valves are not yet available, therefore this part of the procedure is not applicable)

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 as noted in the Logic Description, and will close on loss of power. The failsafe feature of Motor Operated Ball Valves **MBV-1, MBV-2, MBV-5** and **MBV-6** 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 (if applicable)

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 (if applicable)

4.2.1 Set **MBV-1** "Open-Close-Auto" switch to "Auto."

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 (if applicable)

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 (if applicable)

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.

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

4.5.1 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.

4.6 MBV-5, Manual Mode (if applicable)

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

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

4.6.3 Verify closure of valve on loss of power.

4.7 MBV-5, Automatic Mode (if applicable)

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

4.7.2 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.

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

4.7.4 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.

4.8 MBV-6, Manual Mode (if applicable)

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

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

4.8.3 Verify closure of valve on loss of power.

4.9 MBV-6, Automatic Mode (if applicable)

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

4.9.2 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.

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

4.9.4 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.

4.9.5 Table 4.1 is provided to document these steps.

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."	
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

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 if applicable). The emergency shutdown system will be tested quarterly. Note: The emergency shutdown switches are not to be used for routine starting-stopping of pumps/equipment; use the normal start-stop pushbuttons for this.

5.1 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.

5.2 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

5.3 Table 5.1 is provided to document these steps.

Table 5.1. Emergency Stop Switch Verification Checklist.

DATE: _____

OPERATOR: _____

INFLUENT EMERGENCY STOP SWITCH

Pump	Verified/Date
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

	Verified/Date
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.

Table 5.1. Emergency Stop Switch Verification Checklist (cont.)

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

6.1.1 Extraction Well Pump will not operate

- Influent Storage Tank level is "High" or "High-High."
- Extraction Well level is low.
- Flowswitch, FS-1 not satisfied - There is no flow in the line from the well to the Influent Storage Tank.
- Contact the cognizant engineer if the pump is still inoperable.

6.1.2 Either Pump P-2A or P-2B will not operate

- 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.
- Influent Storage Tank level is "Low."
- Effluent Storage Tank level is "High."
- Contact the cognizant engineer if the pump is still inoperable.

6.1.3 Either Pump P-5A or P-5B will not operate

- Disposal Well level is "High."
- Effluent Storage Tank level is "Low."
- Flowswitch FS-5 is 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.
- Contact the cognizant engineer if the pump is still inoperable.

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, and operate the Treatment System 6-8 hours during day shift to fill the Effluent Storage Tank. Due to the long distance (2000 ft) to the disposal well, the treated effluent will be pumped from the Effluent Storage Tank via the Effluent Pump(s) to an effluent holding tank. A tanker truck will transfer the effluent holding tank contents to another holding tank at the disposal well site for gravity draining to the 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 shutdown 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). 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 <u>not</u> to be drained from the system, secure Motorized Ball Valve, **MBV-2** (if applicable) and ball valves **BV-10** and **BV-70.** Close all ball valves between the Influent and Effluent Storage Tanks, including sight glass ball valves.

7.3 If Extraction Well Pump P-1 is to be shutdown, stop the pump by pushing in the "Stop" button. Watch for flow to cease on FIT-1 and FS-1.

7.4 If water is not to be drained from the system, secure Motorized Ball Valve, **MBV-1** (if applicable) and ball valve **BV-9**. Close all ball valves between the Extraction Well and Influent Storage Tank including the Sight Glass valves.

7.5 If either Effluent Pump P-5A or P-5B are to be shutdown, stop the pump by pushing in the "Stop" button, Watch for flow to cease on FIT-3 and FS-5.

7.6 If water is not to be drained form the system, close ball valve **BV-72** and **BV-108**. Close all ball valves between the Effluent Storage Tank and the end of the Effluent Pumping Skid.

7.7 If water is to be drained from the system, leave **MBV-2** (if applicable) and **BV-10** 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 and the Influent Pump Skid perform the following:

7.7.1 Close **BV-32** and **BV-34**, and verify that **BV-30** is open.

7.7.2 Start compressor and slowly open ball valve at AC-2 to allow air to push the water back towards the Influent Storage Tank(s).

7.7.3 After water is removed, secure **BV-10**, turn compressor off. Bleed off the pressure in the air line before disconnecting the air hose. Close the ball valve at AC-2 as well as **MBV-2** and **BV-30.**

7.8 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:

7.8.1 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 was being run when the system was shut down.

7.8.2 Verify that inlet and outlet valves of the Filter that was on-line are open.

7.8.3 Verify that valve **BV-50** is open and the IX column valves are open, start compressor and slowly open the ball valve at AC-2 to allow air to push the water towards the IX Columns.

7.8.4 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 IX 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 7.9.1, 7.9.2 and 7.9.3 below, except the air hose will be connected/disconnected at AC-2 instead of AC-7.

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

7.9.1 Verify that **BV-67, BV-65, BV-69** and **BV-70** are open, close **BV-60**, start the compressor and slowly open the ball valve at AC-7 to allow air to push the water towards the Effluent Storage Tank.

7.9.2 After the water is removed, secure **BV-70**, turn compressor off.

7.9.3 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-65, BV-67, and BV-69** and disconnect air hose from AC-7. Note: Ear plugs shall be worn to perform this pressure bleed operation.

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

7.10.1 Push water from the Effluent Pump Skid to the Effluent Storage Tank by closing **BV-92** and **BV-94**, verify that **BV-72** and **BV-90** are open.

7.10.2 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.

7.10.3 After the water is removed from that section, secure **BV-72**, turn compressor off, and open **BV-92** and **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.

7.10.4 Connect a hose from the end of the Effluent Skid to the Effluent Tank Inlet by **BV-76**.

7.10.5 Open ball valves **BV-76, BV-93, BV-95, BV-98, BV-99, BV-102, BV-103,** and **BV-108.** Verify that valves **BV-92** and **BV-94** are open and that **BV-100, BV-101** and **BV-104** are closed.

7.10.6 Start the compressor and slowly open the ball valve at AC-9 to allow air to push the water towards the Effluent Storage Tank.

7.10.7 After water is removed, turn compressor off, and let the pressure bleed off to the Effluent Storage Tank.

7.10.8 Open **BV-90** to relieve the pressure in the line.

7.10.9 After pressure has bled off, secure **BV-76, BV-90, BV-92, BV-93, BV-94, BV-95, BV-98, BV-99, BV-102, BV-103,** and **BV-108**, close valve at AC-9 and disconnect air hose.

7.10.10 Table 7.1 is provided to document these steps.

Table 7.1 System Shutdown Checklist

Date: _____

Operators: _____

	System Shutdown Checklist	Verified/Date
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 for FS-2 and FS-3 to illuminate.	
2)	If water is not to be drained from the system, secure Motorized Ball Valve, **MBV-2** (if applicable) and ball valves **BV-10** and **BV-70.** Close all ball valves between the Influent and Effluent Storage Tanks.	
3)	If Extraction Well Pump P-1 is to be shutdown, stop the pump by pushing in the "Stop" button. Watch for flow to cease on FIT-1 and FS-1.	
4)	If water is not to be drained from the system, secure Motorized Ball Valve, **MBV-1** (if applicable) and ball valve **BV-9.** Close all ball valves between the Extraction Well and Influent Storage Tank including the Sight Glass valves.	
5)	If either Effluent Pump P-5A or P-5B are to be shutdown, stop the pump by pushing in the "Stop" button. Watch for flow to cease on FIT 3 and FS-5.	
6)	If water is not to be drained from the system, close ball valve **BV-72** and **BV-108.** Close all ball valves between the Effluent Storage Tank and the end of the Effluent Pumping Skid.	
7)	If water is to be drained from the system, leave **MBV-2** (if applicable) and **BV-10** open. Connect air compressor hose to air connection AC-2 (on influent Pump Skid). To remove water from the hose between the Influent Tank and the Influent Pump Skid perform the following: • Close **BV-32** and **BV-34**, and verify that **BV-30** is open. • Start compressor and slowly open ball valve at AC-2 to allow air to push the water back towards the Influent Storage Tank. • After water is removed, close **BV-10** and turn compressor off. Bleed off the pressure in the air line before disconnecting the air hose. Close the ball valve at AC-2 as well as **MBV-2** and **BV-30**.	

System Shutdown Checklist	Verified/Date
8) 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: • 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 was being run when the system was shut down. • Verify that inlet and outlet valves of the filter that was on-line are open. • Verify that valve **BV-49** is open to the process system hose. • Verify that valves **BV-50, BV-51, BV-55, BV-56, BV-60, BV-67, BV-65, BV-69, BV-70** are open. • Start the air compressor and slowly open the ball valve at AC-2 to allow air to push the water towards the IX columns. • 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. <u>Note</u>: If the water is to be removed from the IX 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 9), below.	
9) To remove water from the hose between the Process Skid and the Effluent Storage Tank, connect the air compressor to air connection AC-7 and perform the following: • Verify that **BV-67, BV-65, BV-69** and **BV-70** are open, close **BV-60**, start the compressor and slowly open the ball valve at AC-7 to allow air to push the water towards the Effluent Storage Tank. • After the water is removed, secure **BV-70,** turn compressor off. • 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 **BV-65, BV-67,** and **BV-69** and disconnect air hose from AC-7.	

System Shutdown Checklist	Verified/Date
10) If no treated water is to be drained from the Effluent Storage Tank, and freezing conditions exist, remove the water from the hoses and equipment between the Effluent Storage Tank and the Effluent Pump Skid, connect the air compressor to the air connection AC-9 and perform the following: • Push water from the Effluent Pump Skid to the Effluent Storage Tank by closing **BV-92** and **BV-94**. Verify that **BV-72** and **BV-90** are open. • Start the air compressor and slowly open that ball valve at AC-9 to allow air to push the water back towards the Effluent Storage Tank. • After the water is removed from that section, secure **BV-72** and **BV-90**, turn compressor off, close the ball valve by AC-9, and open **BV-92** and **BV-94** to bleed the pressure off and start pushing water from the other end of the skid to the Effluent Storage Tank. • Connect a hose from the end of the Effluent Skid to the Effluent Tank Inlet by **BV-76**. • Open ball valves **BV-76, BV-93, BV-95, BV-98, BV-99, BV-102, BV-103,** and **BV-108.** Verify that valves **BV-92** and **BV-94** are open and that **BV-100, BV-101** and **BV-104** are closed. • Start the compressor and slowly open the ball valve at AC-9 to allow air to push the water towards the Effluent Storage Tank. • After water is removed, turn compressor off, and let the pressure bleed off to the top of the Effluent Tank. • Open **BV-90** to relieve the pressure in the line. • After pressure has bled off, secure **BV-76, BV-90, BV-92, BV-93, BV-94, BV-95, BV-98, BV-99, BV-99, BV-102, BV-103,** and **BV-108,** close ball valve at AC-9 and disconnect air hose.	

7.10 Electrical Shutdown Checklist

7.10.1 Verify that all pumps are turned off. De-energize the pumps by turning the disconnects to "Off."

7.10.2 De-energize power to the 110 volt system for level controls and PLC by turning the switch inside the instrument panel off.

7.10.3 De-energize power to the 480/110/220 transformer by switching the disconnect to "Off."

7.10.4 De-energize power to the main panel by switching the disconnect to "Off."

7.10.5 Turn off the main breaker at the generator and turn the generator off.

7.10.6 Table 7.2 is provided to document these steps.

Table 7.2 Electrical Shutdown Checklist

Date:_____

Operators:_____

	Electrical Power Shutdown Checklist	Verified/Date
1)	Verify that all pumps are turned off. De-energize the pumps by turning the disconnects to "Off."	
2)	De-energize power to the 110 volt system for level controls and PLC by turning the switch inside the instrument panel off.	
3)	De-energize power to the 480/110/220 transformer by switching the disconnect to "Off."	
4)	De-energize power to the main panel by switching the disconnect to "Off."	
5)	Turn off the main breaker at the generator and turn the generator off.	

8.0 FILTER CHANGEOUT

8.1 Influent Filter Changeout

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

8.1.1 Changing Influent Filters

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

- If the process is operating, follow procedures to shutdown the system.
- Verify that the following ball valves are closed: **BV-33, BV-35, BV-37, BV-42,** and **BV-43.**
- Verify that a hose is connected between ball valve **BV-49** and the inlet to the Influent Storage Tank at **BV-15.**
- Open ball valve **BV-15** and switch three-way valve **BV-49** so that flow will go into the Influent Storage Tank.

- Ensure flow is able to proceed from filters to Influent Storage Tank by opening: **BV-38, BV-39, BV-40, BV-41, BV-45, BV-46, BV-47,** and **BV-48.**

- Attach air compressor to air connect coming off of **BV-37**. Pressurize compressor to 30 psi, then open: **BV-37.**

- Allow air to blow through system for 1 minute, then close: **BV-47, BV-48, BV-45, BV-46, BV-40, and BV-41** in order to blow down filter F-1A.

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

- When all filters have been blown down, close: **BV-37, BV-49** and **BV-15.**

- Bleed pressure off of air compressor hose and disconnect.

- Attach sample hose to air connector off of **BV-37**, bleed off any pressure by opening: **BV-37.**

- When pressure is relieved, verify the following ball valves are closed: **BV-37, BV-38, BV-39, BV-40, BV-41, BV-45, BV-46, BV-47, and BV-48.**

- Double check system is isolated, then replace filters.

- Return three-way valve **BV-49** to flow towards the process skid.

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

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

Table 8.1 Influent Filter Changeout Checklist

Date:_____

Operators:_____

	Influent Filter Changeout Checklist	Verified/Date
1)	Verify that the treatment system is not operating. If system is operating, follow procedures to shutdown the system.	
2)	Verify that the following ball valves are closed: **BV-33, BV-35, BV-37, BV-42,** and **BV-43.**	
3)	Verify that a hose is connected between ball valve **BV-49** and the inlet to the Influent Storage Tank at **BV-15.**	
4)	Open ball valve **BV-15** and switch three-way valve **BV-49** so that flow will go into the Influent Storage Tank.	
5)	Ensure flow is able to proceed from filters to Influent Storage Tank by opening: **BV-38, BV-39, BV-40, BV-41, BV-45, BV-46, BV-47,** and **BV-48.**	
6)	Attach air compressor to air connect coming off of BV-37. Pressurize compressor to 30 psi, then open: **BV-37.**	
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** in order to blow down filter F-1A.	
8)	Blow each filter down separately for 10 minutes to ensure all water is purged from the system.	
9)	When all filters have been blown down, close: **BV-37, BV-49** and **BV-15.**	
10)	Bleed pressure off of air compressor hose and disconnect.	
11)	Attach sample hose to air connector off of **BV-37**, bleed off any pressure by opening: **BV-37.**	
12)	When pressure is relieved, verify the following ball valves are closed: **BV-37, 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.	
14)	Return three-way valve **BV-49** to flow towards the process skid.	

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

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

8.2 Changing Effluent Filters

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

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

8.2.2 Isolate Effluent Pump Skid from Effluent Storage Tank by verifying that the following valves are closed: **BV-72** and **BV-90.**

8.2.3 Attach a hose from the Effluent Pump Skid outlet to the Effluent Storage Tank Inlet at **BV-76**. Open **BV-76.**

8.2.4 Verify that the following ball valves are open: **BV-92, BV-93, BV-94, BV-95, BV-98, BV-99, BV-102, BV-103, and BV-108**

8.2.5 Start the air compressor and slowly open that ball valve at AC-9 to allow air to push the water back towards the Effluent Storage Tank.

8.2.6 After water is removed, turn compressor off, and let the pressure bleed off to the top of the Effluent Tank. Close the ball valve at AC-9.

8.2.7 Close the following ball valves: **BV-92, BV-93, BV-94, BV-98, BV-99, BV-102, BV-103 and BV-108**

8.2.8 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 Effluent Filter Changeout Checklist.

Date:_____

Operators:_____

	Effluent Filter Changeout Checklist	**Verified/Date**
1)	If the process is operating, follow procedures to shutdown the system.	
2)	Isolate Effluent Pump Skid from Effluent Storage Tank by verifying that ball valves **BV-72** and **BV-90** are closed.	
3)	Attach a hose from the Effluent Pump Skid outlet to the Effluent Storage Tank Inlet at **BV-76**. Open **BV-76.**	
4)	Verify that the following ball valves are open: **BV-92, BV-93, BV-94, BV-95, BV-98, BV-99, BV-102, BV-103, and BV-108**	
5)	Start the air compressor and slowly open that ball valve at AC-9 to allow air to push the water back towards the Effluent Storage Tank.	
6)	After water is removed, turn compressor off, and let the pressure bleed off to the top of the Effluent Tank. Close the ball valve at AC-9.	
7)	Close the following ball valves: **BV-92, BV-93, BV-94, BV-98, BV-99, BV-102, BV-103 and BV-108.** 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. 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 IX Column TNK-2A
AC-4	Bottom of IX Column TNK-2A
AC-7	Top of IX Column TNK-3
AC-8	Bottom of IX Column TNK-3
AC-9	Effluent Pump Skid
SC-9	Disposal Well Manifold

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 for sampling. Refer to the RWP for specific requirements.

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 for sampling. Refer to the RWP for specific requirements.

10.0 DAILY DATA LOG TABLES

The Daily Data Logs are to be completed on an hourly basis 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
200-BP-5, UNIT #2 INFLUENT PUMPING STATION DATA LOG

DATE:_____

OPERATORS:_____

Time	Rotameter Flow Rate FI-1	Flow Rate FIT-1 (gpm)	PI-1 (psi)	pHC-1	Total from FIT-1 (gal)	Well Head (ft)	Water Level Delta (ft)

Time	Flow Rate FIT-2 (gal)	PI-2 (psi)	PI-3 (psi)	PI-4 (psi)	pHC-2	pHC-3	DOI-1 (mg/l)

Table 10.2
200-BP-5, UNIT #2 INFLUENT AND PROCESS PUMPING STATION
DATA LOG

DATE:_____

OPERATORS:_____

Time	TIT-1 (deg F)	LI-1 (in)	LI-2 (in)	PDIT-1 (psi)	TNK-2A Inlet (psi)	TNK-2A Outlet (psi)	TNK-2B Inlet (psi)

Time	TNK-2B Outlet (psi)	TNK-3 Inlet (psi)	TNK-3 Outlet (psi)	DOI-2 (mg/l)	TIT-2 (deg F)	PDIT-2 (psi)	PDIT-3 (psi)

Table 10.3

200-BP-5, UNIT #2 EFFLUENT PUMPING STATION
DATA 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:_____

_____

_____

_____

_____

_____