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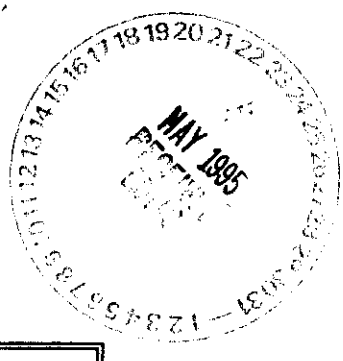


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# PILOT-SCALE GROUNDWATER TREATMENT SYSTEM UNIT #2/BY CRIB OPERATING PROCEDURES

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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, Figure 1, for performing the startup checklist. In addition, utilize the equipment list below for performing the equipment component check.

- o Extraction Well Pump
- o Feed Pumps
- o Effluent Pumps
- o Filters, Influent and Effluent
- o Ion Exchange Columns
- o Influent/Effluent Storage Tanks
- o Fail-Safe Motor Operated Ball Valve
- o Air Release Valves
- o Flowmeters
- o Flow Switches
- o Level Indicators/Controls
- o Pressure Indicators/Transmitters/Controllers
- o Differential Pressure Indicators/Transmitters
- o Temperature Indicators/Transmitters
- o Dissolved Oxygen Monitors
- o Turbidity Monitors
- o pH Indicators/Transmitters
- o Flex hose
- o 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. 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; 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 switches 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 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:**_____

**OPERATOR:**_____

| 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) | Process System Skid discharge manifold to the Effluent Storage Tank inlet | |
| 6) | 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 | |
| 7) | Outlet side of Process Manifold 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, then from an Influent Pump through one set of 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 one set of 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.

### 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.

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 V system for level controls and PLC.

2.1.6 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 connection from 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. | |

## 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, BV-2, BV-4** on the well manifold, valves **BV-6** or **BV-7 & 8**, and **BV-9** on the Influent Tank manifold .

2.2.3 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).

2.2.4 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 (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.

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

2.2.7 Table 2.2 is provided to document these steps.

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

**DATE:**_____

**OPERATOR:**_____

| Extraction Well Checklist | | Verified/Date |
|---|---|---|
| 1) | Verify the following lights on the annunciator panel are not illuminated:<br>- LSH-1, Influent Storage Tank Level, "High"<br>- LSL-1, Extraction Well Level, "Low"<br>- LSHH-1, Influent Storage Tank Level, "High High" | |
| 2) | Verify that all ball valves (BV) are closed except the following: **BV-1, BV-2, BV-4** on the well manifold, valves **BV-6 or BV-7 & 8, and BV-9** on the Influent Tank manifold. | |
| 3) | Open Motor Operated Ball Valve, MBV-1 (if applicable) 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" (if applicable). | |
| 6) | Verify the followng 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:

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 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-50, BV-51, BV-56, BV-60, BV-65, BV-69, and BV-70.**

- If running Influent Pump P-2B and F-2 set of filters for extraction, Open:

  **BV-10, BV-30, BV-34, BV-35, BV-45, BV-46, BV-47, BV-48, BV-50, BV-51, BV-56, BV-60, BV-65, BV-69, and BV-70.**

2.3.3 When the Influent Storage Tank is at an appropriate level, open **MBV-2** (if applicable) 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" (if applicable) 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 Columns to the Effluent Storage Tank.

2.3.6 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.

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

| | |
|---|---|
| FS-2 | Flow From Influent Tank |
| FS-3 | Flow From Influent Pump |
| FS-4 | Flow From IX Vessels |

2.3.8 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 _____)_____

Differential Pressure Readings:(Not to exceed _____)_____

_____

_____

2.3.9 Table 2.3 is provided to document these steps.

**Table 2.3.** Process Flow Startup Checklist.

**DATE:** _____

**OPERATOR:** _____

| Process Flow Checklist | | Verified/Date |
|---|---|---|
| 1) | Verify that the following lights on the annunciator panel are not illuminated: Influent Storage Tank Level, "Low", Effluent Storage Tank Level, "High", and 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-50, BV-51, BV-56, BV-60, BV-65, BV-69, and BV-70.**<br>If running Influent Pump P-2B and filters F-2 for process flow, Open: **BV-10, BV-30, BV-34, BV-35, BV-45, BV-46, BV-47, BV-48, BV-50, BV-51, BV-56, BV-60, BV-65, BV-69, and BV-70.** | |
| 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.<br><br>Flow: _____<br>Pressure: _____<br>Diff. Pressure _____ | |

## 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:

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 and F-3 set of filters for pumping effluent to the effluent holding tank, Open:

  **BV-72, BV-90, BV-92, BV-93, BV-98, BV-99, and BV-110.**

- If running Effluent Pump P-5B and F-4 set of filters for pumping effluent to the effluent holding tank, Open:

  **BV-72, BV-90, BV-94, BV-95, BV-102, BV-103, and BV-110.**

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 Tank
FS-6 Flow From Effluent Pump

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 psi) _____

Differential Pressure Readings: (Not to exceed 30 psi) _____

_____

_____

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

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 2.4.7.

2.4.11 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 Checklist | Verified/Date |
|---|---|
| 1) Verify that the following alarm lights on the annunciator panel are not illuminated:<br>Disposal Well Level, "High"<br>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 disposal well, open: **BV-72, BV-90, BV-92, BV-93, BV-98, BV-99, and BV-110.**<br>If Effluent Pump P-5B and F-4 set of filters are to be used for pumping effluent to the disposal well, open: **BV-72, BV-90, BV-94, BV-95, BV-102, BV-103, and BV-110.** | |
| 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 and FS-6. | |
| 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:<br>FS-5 Flow From Effluent Tank<br>FS-6 Flow From Effluent Pump | |
| 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.<br><br>Flow: _____<br>Pressure: _____<br>Diff. Pressure: _____ | |

## 2.5 Process Water Tank

The Process Water Tank is a 4,200 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 back to the Influent Storage Tank for eventual processing back through the Influent Filters to remove the solids. Connect a hose from a quick disconnect at the top of the IX Column being backwashed 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 Storage Tank. 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 and to eliminate the need for a temporarily installed 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 the top of the IX 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-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 Influent Storage Tank at BV-15. | |
| 4) | Connect a portable rotameter, temporarily, in the hose from the IX 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 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 the top of the IX column 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. | |
| | | |

## 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 conditons and are to close on loss of power. The failsafe feature of Motor Operated Ball Valves **MBV-1, MBV-2, MBV-5** and **MBV-6** and are to prevent spilling of tank contents to the ground 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 open 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 "Open-Closed-Auto" switch to "Open".
4.3.2 Verify that valve is open, then open 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 "Open-Closed-Auto" switch to "Auto".
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 Open panelboard circuit breaker for MBV-2 and verify closure of valve on loss of power.

4.4.4 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.

**4.5 MBV-5, Manual Mode (if applicable)**

4.5.1 Set **MBV-5** "Open-Closed-Auto" switch to "Open".

4.5.2 Verify that valve is open, then open 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** "Open-Closed-Auto" switch to "Auto".

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

4.6.4 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.

**4.7 MBV-6, Manual Mode (if applicable)**

4.7.1 Set **MBV-6** "Open-Closed-Auto" switch to "Open".

4.7.2 Verify that valve is open, then open 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** "Open-Closed-Auto" switch to "Auto".

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 started at the same time) and watch for valve to open.

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

4.8.4 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.

4.8.5 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 started 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 started 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 started 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 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.

5.2 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

5.4 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**

| | Verfied/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 will not operate:

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

6.1.2 Extraction Well level is low.

6.1.3 Flowswitch, FS-1 not satisfied - There is no flow in the line from the well to the Influent Storage Tank.

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

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

6.2.2 Influent Storage Tank level is "Low".

6.2.3 Effluent Storage Tank level is "High".

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

6.3.1 Disposal Well level is "High".

6.3.2 Effluent Storage Tank level is "Low".

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

## 7.0 SYSTEM SHUT DOWN

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 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). 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-9**, **BV-50**, **BV-65**, **BV-70**, and the Effluent Tank Sight Glass valve: **BV-73** (the sight glass could break and dump the tank contents on the ground).

7.3 If water <u>is</u> to be drained from the system, leave **MBV-2** (if applicable) and **BV-9** 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:

7.3.1 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-9**, 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 was 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 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.

7.4.4 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 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 7.5.1, 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, connect the air compressor to air connection AC-8 and perform the following:

7.5.1 Verify that **BV-65, BV-69** and **BV-70** are open, close **BV-60**, start the compressor and slowly open the ball valve at AC-8 to allow air to push the water towards the Effluent Storage Tank.

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

7.5.3 To bleed pressure off, slowly open the valve at AC-7 holding a bucket to catch water; after pressure has bled off, close valves at AC-7 and AC-8, secure **BV-65 and BV-69** and disconnect air hose from AC-8.

7.6 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:

7.6.1 Push water from the Effluent Pump Skid to the Effluent Storage Tank by closing **BV-92/BV-94**, verify that **BV-72** 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.

7.6.3 After the water is removed from that section, secure **BV-72**, 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 Moniter.

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.

7.6.8 Table 7.1 is provided to document these steps.

**Table 7.1.** System Shutdown Checklist.

**DATE:** _____

**OPERATOR:** _____

| | System Shutdown Checklist | Verification/ 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 of FS-2 and FS-3. | |
| 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-9**, **BV-50**, **BV-65**, **BV-70**, and the Effluent Tank Sight Glass valves: **BV-73** (the sight glass could break and dump the tank contents on the ground). | |
| 3) | If water <u>is</u> to be drained from the system, leave **MBV-2 (if applicable)**, **BV-9** 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:<br>○ Close **BV-32** and **BV-34**, and verify that **BV-30** is open.<br>○ Start compressor and slowly open ball valve at AC-2 to allow air to push the water back towards the Influent Storage Tank(s).<br>○ After water is removed, secure **BV-9**, turn compressor off. To bleed pressure off, open either **BV-32** or **BV-34**, then secure **MBV-2** and **BV-30**. | |

| System Shutdown Checklist | Verification/ Date |
|---|---|
| 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:<br>o 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.<br>o Verify that inlet and outlet valves of the Filter that was on-line are open.<br>o Verify that valve **BV-50** is open (and the IX 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.<br>o 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.<br><br>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 the steps in 5), below, except the air hose will be connected or disconnected at AC-2 instead of AC-8. | |
| 5) To remove water from the hose between the Process Skid and the Effluent Storage Tank, connect the air compressor to air connection AC-8 and perform the following:<br>o Verify that **BV-65**, **BV-69**, and **BV-70** are open, close **BV-60**, start the compressor and slowly open the ball valve at AC-8 to allow air to push the water towards the Effluent Storage Tank.<br>o After the water is removed, secure **BV-70**, turn compressor off.<br>o To bleed pressure off, slowly open the valve at AC-7 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 and BV-69** and disconnect air hose from AC-8. | |

| System Shutdown Checklist | Verification/ Date |
|---|---|
| 6) If 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:<br>o **Push water from the Effluent Pump Skid to the Effluent Storage Tank by closing BV-92/BV-94**, verify that **BV-72**, **BV-90** are open.<br>o 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.<br>o After the water is removed from that section, secure **BV-72**, 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.<br>o 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-hold** and **BV-hold** are open, and close **BV-hold** and **BV-hold** to protect the Turbidity Moniter.<br>o Start the compressor and slowly open the ball valve at AC-9 to allow air to push the water towards the disposal well.<br>o After water is removed, turn compressor off, and let the pressure bleed off to the well.<br>o After pressure has bled off, secure **BV-92** and **BV-94**, close valve at AC-9 and disconnect air hose. | |

## 8.0 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 8.1), the Treatment System Data Log (Table 8.2), the Effluent Pumping Station Log (Table 8.3), and the Weekly Operational Status Log (Table 8.4).

**Table 8.1**

# 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 8.2

# TREATMENT SYSTEM
# DATA LOG

200-BP-5, UNIT #2 OPERATIONAL LOG

DATE:_____

OPERATORS _____

**COLUMNS IN USE: TNK-2 TNK-3 TNK-4**

| TIME | FLOW RATE (GPM) FROM FIT-2 | TNK-2 INLET (PSI) | TNK-2 OUTLET (PSI) | TNK-3 INLET (PSI) | TNK-3 OUTLET (PSI) | TNK-4 INLET (PSI) | TNK-4 OUTLET (PSI) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Table 8.3

# EFFLUENT PUMPING STATION
# DATA LOG

200-BP-5, UNIT #2 OPERATIONAL LOG

DATE: _____

OPERATORS _____

FITERS 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 8.4**

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: _____

_____

_____

_____

_____

_____

**APPENDIX**

Figure 1. Process Flow Diagram, Pilot Groundwater Treatment System. 200-BP-5, Unit #1.