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1	WHC-SD-EN-SPP-003		0	Soil Washwater Treatment Unit Operating Procedure	30 40	1/2	1	

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		Cog. Eng.	J. W. Green	11/1/93	H6-04	C. L. Manley			H6-04		
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Date Received: 10/25/1930	INFORMATION RELEASE REQUEST	Reference: WHC-CM-3-4
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Information conforms to all applicable requirements. The above information is certified to be correct.		INFORMATION RELEASE ADMINISTRATION APPROVAL STAMP
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J. W. Green <i>[Signature]</i> 10/21/93		
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5. Key Words Soil washing, waste treatment, water treatment APPROVED FOR PUBLIC RELEASE 11-1-93 [Signature]	6. Author Name: J. W. Green [Signature] Signature Organization/Charge Code 81351/P215A
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7. Abstract


Green, J. W., 1993, *Soil Washwater Treatment System Operating Procedure*, WHC-SD-EN-SPP-003, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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10. RELEASE STAMP

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DATE NOV 02 1993

Station # 12

9. Impact Level *30 4 ga*

**SOIL WASHWATER TREATMENT SYSTEM
OPERATING PROCEDURE**

1.0 Pre-Startup Check

NOTE

This check does not need to be done if the electrical power source has not been disconnected or changed, or the system moved or not been in use for a lengthy period of time (1 to 2 months).

1.1 Mechanical

1.1.1 Check the interiors of all tanks. Remove any debris or other foreign matter.

1.1.2 Check all flange bolts and unions for tightness and that all gaskets are in place. Rubber gaskets are recommended on all PVC to PVC and PVC to iron flanges.

1.1.3 Close all valves on the Clarifier Skid.

1.2 Electrical. After all field connections have been made and checked, make a preliminary test of the electrical system. This is done before energizing power and before any liquid is put into the system.

1.2.1 Turn all switches on the control panel door to the "off" position.

1.2.2 Open the panel door and verify that all circuit breakers are in the "off" position except the sludge rake drive on the clarifier.

1.2.3 When it is safe to supply power to the panel, energize the main disconnect switch at the power generator. Start the sludge rake drive and observe the rotation of the sludge rake, it should rotate clockwise looking down on the rake from the bridge. If the rotation is incorrect, stop the sludge rake drive immediately and go to 1.2.4. If rotation is correct, skip 1.2.4.

1.2.4 Deenergize the main disconnect and following Lock and Tag Procedures; reverse two motor wire leads to reverse the rotation.

NOTE

After initial verification of proper rotation of all motors, and since electric power is supplied via a single power cable with a threaded raintight type plug and connector, once the clarifier rake is turning in the proper direction - all motors (that is, all supplied from this power source) will also be turning in the proper direction. See 1.2.5.

1.2.5 Check the other motors for proper rotation: verify that the main disconnect is off and locked out and tagged; open panel door and turn on the motor circuit breakers; shut the panel door; energize the main disconnect; then via the motor on-off switch - manually start each motor.

CAUTION

Do not operate the circuit breakers with the main power disconnect energized, or turn on motors with the panel door open. If the motors do not rotate in the proper direction, refer to 1.2.4 to correct. Return all breakers and switches to "off" position.

NOTE

An interlock will be installed on the panel door such that when power is on inside the panel, the door cannot be opened. A key-lock defeat switch will also be installed so that electricians can perform power system checks.

2.0 Chemical Makeup. Prior to startup, the following chemicals should be made up.

2.1 Ferric Chloride. Into the coagulant chemical feed tank add 24 gal of clean water; and into the water add 1 gal of liquid ferric chloride (always add ferric chloride to water, not water to ferric chloride), agitate well. Set metering pump at 10% when processing 35 gal/min, and 48% when processing 50 gal/min.

NOTE

Refer to MSDS # P10996VS for Health and Safety aspects of ferric chloride.

CAUTION

Do not adjust pump unless it is operating.

2.2 Cationic Polymer. Into the polymer chemical feed tank add 124 gal of clean water, then add 1 gal of liquid cationic polymer and slowly mix for 1 hr. Set pump at 0.5 gal/hr rate (or 0 setting) when processing 35 gal/min, and 0.72 gal/hr when processing 50 gal/min.

NOTE

Refer to MSDS Code: 0170-10-22-91 for Health and Safety aspects of the polymer.

- 2.3 Sand and Anthracite. Add to the top manhole of the Pressure Filter, 700 lb of sand. Then on top of this add 600 lb of anthracite coal.
- 2.4 Ion Exchange Resin: Add to the Downflow Adsorber, from the top, 62 to 63 ft³ of Dowex 21K (Dow Chemical Co., Midland, Michigan) ion exchange resin.
- 3.0 Startup and Operation
- 3.1 Perform a safety walkaround check of the two skids, and verify that all valves are closed. Verify that the main disconnect switch is off, and that all switches on the control panel doors are off, as well as the circuit breakers inside the panels.
- 3.2 Before starting operation, start the portable power generator, or if permanent power is available go to the next step.
- 3.3 Open the control panel door and position all circuit breakers to the "on" position; close panel door and secure with clips and screws.
- 3.4 To start operations, energize power to the control panel by actuating the main disconnect switch.
- 3.5 Open valve(s) from the wastewater feed ("Fract" Tank, or well), and open valves on the influent feed pump suction and open pump discharge valve (HV-2) approximately 1/2 open.
- 3.6 Turn the pump to "manual on" and fill the flash mix tank; then adjust HV-2 to set the desired flowrate. Turn the pump switch to "auto" for normal operation.
- 3.7 Start the flash mix agitator as soon as the flash mix tank is full.
- 3.8 Prime the chemical feed pumps, if required. Open the valves on the coagulant pump and start the pump and allow the ferric chloride to flow into the flash mix tank.
- 3.9 The wastewater mixed with coagulant will flow out of the flash mix tank into the flocculation tank. When the flocculator tank is approximately one-third full, start the variable speed flocculation agitator and adjust the speed to provide a gentle, but complete, mixing of the contents. Open valves and start the polymer feed pump. The polymer feed rate may be too low at the beginning, watch for a large pea sized floc to form and adjust polymer addition to achieve.
- 3.10 The flocculation tank will fill and overflow into the clarifier. After the clarifier is approximately one-third full then start the sludge rake drive. When the clarifier is nearly full to the point of overflowing into the weir trough, open the valves on the suction and discharge of the sludge pump and start the sludge pump. Position the recirculation valve so that there is total recycle of sludge.

3.11 The clarified supernatant will overflow the clarifier and either be pumped or flow by gravity to the "Fract" tank, or to the Filter Surge Tank for further processing. Note that initial processing of the soil washwater will only use the clarifier skid. Connect a hose between the clarifier discharge pump and the "Fract" tank; start pump and adjust flows as desired.

3.12 If the clarified effluent is to be treated further, connect a hose between the clarifier discharge to the pipe header leading to the Filter Surge Tank. Open the manual valves on the suction and discharge lines of the Pressure Filter feed pump. Verify that valving is positioned so that liquid will pass through the Pressure Filter into the Effluent Surge Tank.

NOTE

Turn the backwash control cam timer on and adjust it so that inlet and outlet valves to the Pressure Filter are open and the backwash valves are closed.

3.13 If a pump is used, start the clarifier discharge pump; if the pump is not used, open the clarifier discharge and manually control the filling of the Filter Surge Tank. When the Filter Surge Tank is nearly full, start the Pressure Filter feed pump to transfer water from the Filter Surge Tank through the Pressure Filter and switch to automatic control.

3.14 Verify that valving from the Pressure Filter to the Effluent Surge Tank is properly aligned. Allow the liquid to flow into the Effluent Surge Tank until it is about two-thirds full and start the Effluent Discharge pump.

3.15 Note the flow on the totalizing water meter.

3.16 In the event liquids need to be pumped from the sump (sump that is formed in the liner to collect liquids), the system is to be turned off, the flocculator motor disconnected (pull the plug at the receptacle), plug in the sump pump cord into the flocculator receptacle and pump the liquid from the sump into the clarifier. Then disconnect the sump pump and reconnect the flocculator motor.

**PROCESS FLOW DESCRIPTION
SOIL WASHWATER TREATMENT SYSTEM**

The Met-Pro Physical Chemical Treatment System (Met-ProCorp., Harleysville, Pennsylvania) incorporates a number of integrated processes either physical or chemical in nature and include:

- Coagulation with chemicals such as ferric chloride.
- Rapid (flash) mixing to assure intimate contact of influent and coagulant.
- Controlled flocculation for maximum floc growth via addition of polymers.
- Extended time clarification for optimum settling of solids.
- Solids collection and disposal, and recycle for seeding
- Filtration for additional suspended solids removal
- Ion Exchange removal of uranium and heavy metals.

Referring to the *Met-Pro Phys-Chem Treatment Flowsheet*; the "Fract" tank transfer pump transfers soil washwater from the "Fract" tank to a flash mix tank at a controlled rate. At the flash mix tank the influent washwater is dosed with a coagulant chemical (ferric chloride). The flash mix tank is fitted with a high speed (1750 rpm) mixer to assure intimate mixing of the chemicals with the influent waste water. The residence time in the flash mix chamber is up to 3 min.

The wastewater then flows by gravity to the flocculation tank where a polymer is added for flocculation of the coagulated solids in the washwater. A slow speed variable controlled (variable by manual adjustment) mixer stirs the contents slowly to allow the coagulated floc to grow to optimum size. A recycle stream of sludge which has been raked from the bottom of the clarifier is added back into the flocculator as seed. The volume of this recycle stream is variable by manually adjusting the recirculation valve. The residence time in the flocculator is about 20 to 30 min.

The suspended floc flows into the distributor box of the clarifier and subsequently is distributed by the multi-outlet peripheral feed piping down and around the bottom of the clarifier. Residence time in the clarifier is about 120 min. The floc settles to the flat bottom of the clarifier and is gathered by the slow (3 to 6 revolutions per hour) moving rake toward the sludge hopper in the center of the clarifier. The rake is an arm with flights that are fitted with rubber wipers that wipe the bottom of the clarifier. The rake is driven by a triple reduction gear motor. The sludge is usually 2 or 3% solids as it is raked into the hopper. The hopper serves as a suction reservoir for a progressing cavity positive displacement sludge pump. This pump and motor are fitted with several different pulley combinations that can be use to vary the speed of the pump to vary the discharge rate by changing the drive belt to alternate pulleys. The sludge pump recirculates seed crystals of precipitated solids back to the flocculator and is used to pump solids out for disposal.

The supernatant (clarified effluent) has an overflow rate of about 640 gal/day/ft² and a weir rate of about 1,700 gal/day/ft. The clarified effluent flows over an adjustable "V" notched weir into the weir trough and an effluent box.

The clarified effluent is either pumped back to the "Fract" tank or to the Filter Surge Tank for further treatment. The Filter Surge Tank provides surge capacity for feeding the Pressure Filter. Liquid is pumped from the Filter Surge Tank through the Pressure Filter and through the Carbon Adsorbers/IX Columns to the Effluent Storage Tank, which serves as a reservoir for backwashing the Pressure Filter and for effluent discharge. Residence time in the Effluent Surge Tank is approximately 60 min. Flow is directed downward through the pressure filter and out the bottom. Flow is controlled by a flow control valve. The filtered water leaves the filter out the bottom through media retaining diffusers. The multimedia filter has a layer of filter sand and a layer of anthracite coal. The sand is American Water Works Association (AWWA) B100 medium 0.45- to 0.55-mm filter sand with a specific gravity of 2.65; on top of the sand is a layer of AWWA B100 No.1, 0.6- to 0.8-mm anthracite coal with a specific gravity of 1.6.

The effluent flow from the treatment system is measured by a water meter, which is a totalizing flowmeter with an instantaneous flowrate readout in gallons per minute and totalized flow in gallons.

PROCESS CONTROL

The control of flow through the system is by differential level (gravity flow) and by flow control valves. Level control of the tanks is provided by conductance type level electrodes. Flow is also varied by adjusting the recirculation rate on the Clarifier, the Filter Surge Tank, and the Effluent Surge Tank. The flowmeters are rotary type with battery-operated indicators, and ball valves are used for flow control.

The ferric chloride chemical feed pump is variable from 2.5 to 25.0 gal/hr, while the polymer feed pump is 0.5 to 5.0 gal/hr, and both are varied by manually adjusting a dial on the side of the pump while it is running.

Process control is provided by pH measurement and turbidity with sampling and analysis for uranium by the Pacific Northwest Laboratory (PNL) and Hanford Analytical Services Management (HASM).

LEVEL CONTROL

The level controls are electrodes a PVC body and control relay. The level controls for the various tanks are:

1. Clarifier
 - a. High level stops influent pump, ferric chloride and polymer pumps.
 - b. Low level stops discharge pump (#1 Booster Pump).
 - c. Low flow stops the influent pump after 15 seconds if no flow

- is sensed.
 - d. High sludge level starts Moyno sludge pump.
 - e. Low sludge level stops Moyno sludge pump.
2. Filter Surge Tank
 - a. High level stops clarifier discharge pump (#1 Booster Pump) which feeds the Filter Surge Tank.
 - b. Low level stops the Pressure Filter feed pump.
 3. Upflow Carbon Adsorber/IX Column
 - a. High level stops the Pressure Filter feed pump.
 4. Downflow Adsorber/IX Column
 - a. Low level stops the Pressure Filter (#2 Booster) feed pump.
 - b. Low level stops the Downflow Column discharge pump.
 5. Effluent Surge Tank
 - a. High level stops the Downflow Column (#2 Booster) discharge pump.
 - b. Low level stops the Effluent Surge Tank (#1 Backwash) discharge pump.
 6. Solids Surge Tank
 - a. High level stops Effluent Surge Tank (#1 Backwash) pump.

BACKWASH OPERATION

Backwash control is as follows (refer to drawing and the electrical description).

Timer TM-1 is a 24-hr clock which can be set to activate TM-2 one to four times daily. Usually backwashing is done once a day. The operator may set a convenient time for this to happen, either late at night when there is low flow to the equalization tank, or during the day when the operator is in attendance.

Timer TM-2 will run a full cycle in about 45 min then shut itself off not to be restarted until the 24 hour timer activates it. The following steps have been built into the timer. (Note that there are some manual steps required during the backwash cycle as noted below.)

1. Stops the influent, coagulant, and polymer feed pumps; allows the system to drain down and other pumps stop due to low levels.
2. Stops the filter feed pump (or temporarily lock it out).
3. Closes the filter inlet and outlet valves.
4. Opens the backwash outlet valve.
5. Switch the air diverter valve to filter scour. Scours the filter for about 5 min, but this is adjustable.
6. Stop the air scour.

- *7. Manually open valves to allow flow from the Effluent Surge Tank to the Effluent Discharge pump to the Filter - the back washing is accomplished with clean water from the Effluent Surge Tank.
8. Opens backwash inlet valve to the filter.
9. Start Effluent Surge Tank pump for backwash operation. This operation cannot take place if a sufficient supply of water is not in the Effluent Surge Tank, but during normal operations there should always be a full tank of water.
10. Stop the Effluent Discharge pump after about 20 to 25 min if the low level in the Effluent Surge Tank has not stopped the pump.
11. Closes backwash inlet and outlet valve.
- *12. Manually close the valves between Filter and the Effluent Surge Tank.
- *13. Manually open filter pump suction valve between the pump and the Filter Surge Tank.
14. Opens the filter inlet and outlet valves.
15. Starts the influent, coagulant and polymer feed, and clarifier discharge pumps.
16. Start the filter feed pump.
17. Stop the timer TM-2.

*These operations are not programmed into the auto backwash timer and must be manually actuated.

ROUTINE OPERATION - NORMAL FLOW

CHEMICAL MAKEUP

Daily:

Coagulant - Ferric Chloride: 2 wt. % solution, 1 gal of liquid $FeCl_3$ to 24 gal of clean water.

Flocculant - Cationic polymer: 1 gal of liquid cationic polymer to 124 gal of clean water

Once a day a check of the various pieces of equipment should be made.

1. Pumps
 - a. Influent Pump
 - b. Sludge Pump
 - c. Clarifier Discharge Pump
 - d. Pressure Filter Feed Pump
 - e. Pressure Filter Backwash Pump
 - f. Chemical Pumps

Visually check for any leaking. Take corrective action if necessary.

1. Sludge Rake - visually check to see if rake is rotating.
2. Overflow headers
3. The operator should record the levels in the following tanks before and after making new supply of chemicals.
4. Valves - check all valve packing glands for leaks.
5. Chemical Usage - estimate the volume usage by comparing the level drop in the chemical feed tanks over an 8-hr period. Adjust the pumps to maintain proper chemical flow rates. The nominal feed rates are: ferric chloride pump - 10% when processing 35 gal/min and 48% when processing 50 gal/min; polymer metering pump - 0.5 gal/hr rate (or 0 setting) when processing 35 gal/min, and 0.72 gal/hr when processing 50 gal/min.

NOTE

Adjust chemical metering pumps only when running.

6. Total Flow - record daily the reading on the totalizing flow meter. Check level increase in sludge holding tank to determine daily withdrawal. Adjust sludge pump and/or recirculation valve as required.

MANUAL BACKWASH PROCEDURES - MET PRO

A. Backwash Procedure For Sand Filter

1. Shut effluent valve at the outlet of the water meter on the discharge of the Effluent Surge Tank. Effluent Surge Tank Must be at least 1/4 full to have sufficient water to backwash the filter.
2. Stop filter pump, and the influent pump.
3. Close filter back wash inlet, outlet valves.
4. Open filter inlet, outlet valves.
5. Open air pump valve to let air into the filter to scour the filter. Scour for 5 min.
6. Stop air pump and return air valve to absorber position.
7. Align valves to allow flow from the Effluent Storage Tank to the Filter.
8. Start Effluent Storage Discharge pump.
9. Backwash for 20 to 25 min or until low level is reached in Effluent Surge Tank.
10. Close back wash inlet, outlet valves.

B. Backwash Procedures For Adsorber Column, If Required (Manual)

1. Shut effluent valve at bottom of Effluent Surge Tank.
2. Effluent Surge Tank must have at least 1/4 tank of filtered or fresh water to backwash.
 - a. Run system (sand filter) OR
 - b. Fill with fire hose (1/4).
3. Stop filter pump.
4. Open adsorber back wash valve (lower left on panel).
5. Start backwash pump.
6. Observe back wash action (top of down flow adsorber) or back wash for about 5 min. When carbon starts to overflow into surge tank, stop backwash.
7. Stop back wash pump.
8. Close adsorber valve.
9. Start filter pump, and open effluent valve.

ELECTRICAL CONTROL (Refer to MET-PRO Effluent Treatment System Schematic (3 sheets))

All components inside the 36-in. wide by 60-in. long by 8-in. deep NEMA Type IV control box are industrial type magnetic relays/starters with level relays and timers.

All equipment, design, and fabrication are according to the National Electrical Code. Supply to Terminals A, B, and C on the panel box terminal board shall be through a customer-owned disconnect and protected at 100 amps and shall be 240 volts, 3 phase, 60 Hz AC.

Terminals ___ to ___ are for connection to the level probes. A description of the probes and the relays is contained in the vendor literature elsewhere.

Where a motor is to be controlled in its operation, the operator selector switch was chosen to provide for automatic or off or hand (manual) operation. Where not controlled, the other motors are provided with an on-off selector switch.

All motor starters are provided with an overload according to the recommendation of the manufacturer.

Operator switches which control a motorized valve have been selected to provide automatic or open (manual) and close (manual) operation. All switches are provided with legend plates noting the switch position.

The equalization tank level control is connected at Terminals designated. See electrical Control Schematic.

The conduit shall be rigid conduit with very short runs of sealtite flexible conduit at motor junction boxes. All wire will be THWN or THHN according to the National Electrical Code. All open type components will be enclosed in a NEMA IV enclosure. Operator selector switches shall be mounted on the door of the panel box and be operable from the outside.

