

## MEMORANDUM

City of Springfield, Missouri  
Department of Environmental Services  
SWCWP Standard Operating Procedures (SOP), Phase One Services  
SOP Audit

B&V PN 185907  
B&V File Number 40.000  
February 12, 2015

To: Steve Meyers, Errin Kemper

From: Neil Massart, Black & Veatch Operations Specialist

Black & Veatch has been tasked with auditing the standard operating procedures (SOPs) for the Springfield, Missouri Southwest Clean Water Plant (SWCWP). The intent of the audit is to 1) establish, in collaboration with the City, a template or list of standard information that should be included in the SOP, 2) review how the current SOPs compare to the list, and 3) provide recommendations on how to proceed with the overall goal of capturing institutional knowledge and creating a consistent, manageable, and comprehensive library of SOPs. The following memorandum summarizes our review and comments on the SOPs. The plant staff provided the SOPs listed below which were reviewed by the Operations group at Black & Veatch.

- Centrifuge Operation
- Grease Dumping
- North Plant Solids Hauling
- SOP OPS-102 High Flow
- SOP OPS-110 Primary Sludge Pump Rate
- SOP OPS-308 Thickened Sludge Pump Start
- SOP OPS-309 Ozone Emergency Bypass
- SOP OPS-310 Ozone First Out Alarm
- SOP OPS-311 Ambient Ozone Override
- SOP OPS-404 Digester Operating Level
- SOP OPS-405 Digester Operating Temperature
- SOP OPS-406 Digester Circulating Pumps and Mixers
- SOP OPS-407 Digester Draft Tube Mixers
- SOP OPS-408 Digester Loading Rate
- SOP OPS-410 GBT Thickening
- SOP OPS-411 Centrifuge Truck

B&V PN 185907  
B&V File 40.000  
February 12, 2015

- SOP OPS-412 Centrifuge Sampling
- SOP OPS-501 Equipment Check Sheet
- SOP OPS-502 Receiving Loads of Chemicals
- SOP OPS-503 Composite Samplers
- SOP OPS-510 Sampling for Effluent Phosphorus
- SOP OPS-511 Soluble Phosphorus - Alum Control
- Acetylene Testing
- SOP OPS-602 High Point Switching O.C. Notification

Initial review of the SOPs revealed that the documents included document control information and basic instructions for completing the tasks. Based on our experience and discussions with the City, we recommend that the following list of items serve as a framework for updating the current SOPs and for development of future SOPs:

1. Document control information (revised date, reviewer, revision number).
2. Title of SOP.
3. Statement of purpose.
4. Required materials.
5. Required personal protective equipment (PPE).
6. Reference documentation.
7. Associated steps for the SOP (normal procedures, startup, shutdown).
8. Associated steps are complete and accurate.
9. Pictures (if applicable) to better illustrate SOP steps.
10. Troubleshooting (i.e., what actions to take if the procedure is unsuccessful).
11. Appendix (applicable drawings or schematics).

An example SOP has been attached for reference. This example SOP includes most if not all the items mentioned previously.

B&V PN 185907  
B&V File 40.000  
February 12, 2015

### Description of SOP Components

Each component of the SOP provides useful information to the Operations staff. Additional information describing the SOP components is included in the subsequent paragraphs.

An SOP should be reviewed once per year and revised as necessary, as the SOP is a “living document.” Since these documents are reviewed often, document control information is a critical factor of the SOP. An SOP requires a title to identify the system, process, or equipment; the steps within the SOP provide specific steps to complete the procedure. A statement of purpose should be provided in the document following the title. The statement of purpose provides the Operator with the concise reason for the necessity of the SOP.

Required materials should include, but not be limited to, tools, consumables, or sample equipment needed by the Operator to complete the steps within the SOP. The availability of these items ensures the Operator has the items necessary to complete the steps within the SOP. Personal protective equipment (PPE) is essential for most procedures. Proper PPE is critical, especially when handling chemicals and/or wastewater.

Reference documents should be included within the SOP. The reference documents can be vendor procedures and manufacturer/vendor operations, Safety Data Sheets, and maintenance (O&M) manuals. The Operator can use these reference documents to identify additional resources available to perform the task. A chronological order of steps should be included within the SOP to provide the Operator with the exact order in which to perform the task. These steps help the Operator perform the same task the same way every time, as well as aid in avoiding injuries, damage to equipment, or errors in execution of the task which can, for example, affect the analysis of samples or result in erroneous recordkeeping.

The SOP is used to develop consistency throughout the operations staff. SOP steps which are complete and accurate help provide this consistency. The SOPs are “living documents” which should be modified if the document does not reflect the actual steps of the procedure. An SOP can easily become too detailed; therefore, it is critical for the expectations to be understood regarding the amount of detail within an SOP such that the document does not become too cumbersome to use in the field.

Pictures are a key element of a good SOP, as words do not always convey the intended message or necessary visuals. A photograph or illustration supplements the written SOP to clarify the necessary instructions. For instance, the addition of a couple of pictures in a sampling SOP can provide an at-a-glance correct sampling location.

A troubleshooting section should also be included in each SOP. This section does not have to be complicated or all-inclusive, but rather a simple table listing some typical problems encountered, usual cause(s), and some remedial measures. For example, in the event a pump does not start, the Operator should check to ensure the pump is not out of service for maintenance or, if the pump is locked out, the Operator should start the redundant or standby pump.

Finally, an appendix should be used to provide the Operator with simple reference information. The appendix section should include information an experienced Operator may not need to complete

B&V PN 185907  
B&V File 40.000  
February 12, 2015

the steps within the procedure but, make available important information a less experienced Operator may need or an Operator who performs this task infrequently. For instance, an appendix could include a sample of a properly completed Chain of Custody form. Another example could be a simplified process flow diagram used to verify all valves are in the normal operating positions prior to starting a pump.

#### **Summary and Recommendations**

Each SOP reviewed was compared to each of the eleven items listed previously. A table was developed in which the eleven items were listed across the columns, and the SOPs were listed in each row. If the SOP included the item, an "x" was entered in the box (see attached table).

The SOPs reviewed have a good cover page, which contains most of the pertinent information one would expect for an SOP, such as number, revision date, purpose, references, etc. However, in general, the SOPs which have been completed lacked some detail that would increase the overall benefit to the Operations staff. The intent is that the increased detail would allow Operators with the required level of certification to complete the referenced procedure from start to finish, even though the Operator may not work in the particular area the SOP is written to support.

It our recommendation that additional detail be added to the existing SOPs, such as pictures, references, appendices, and more concise, step-by-step instructions. These details will provide enhanced instructions for current Operators and newly hired Operators. In addition SOPs should be created for each process, system, and area within the facility. The next step in development of the SOP library would be to work with the plant staff to establish a comprehensive list of existing and recommended SOPs for the SWCWP and initiate creation of the SOPs.

**Washer/Compactor SCB-SCN-WC01 Startup SOP**

**Procedure summary** The SOP outlines the steps for conducting a startup of Washer/Compactor SCB-SCN-WC01.

**Start** When the washer/compactor must be started.

**Materials** • Process control computer

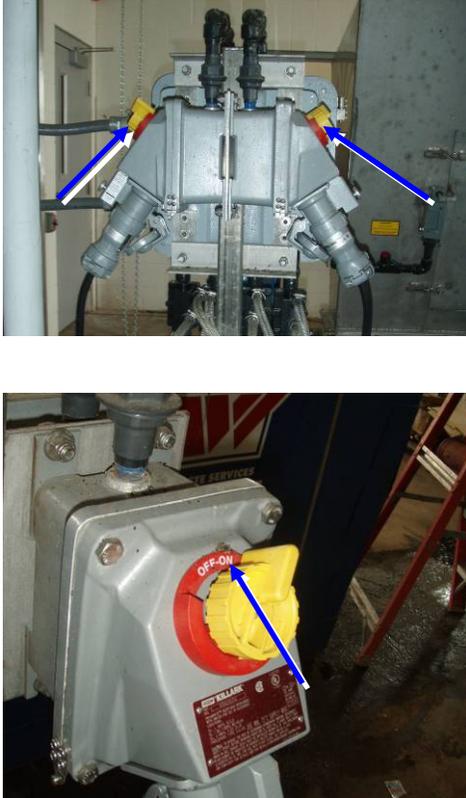
**PPE** • Goggles • Steel Toe/Non-slip Boots  
 • Work Gloves

**References** • Washer/Compactor Vendor O&M Manual

Actions:	Do This:
1. Notify plant personnel.	a. Notify plant personnel that the washer/compactor is going online.
2. Open water supply valve.	a. Open 1-inch lever operated isolation ball valve in the water supply connection to the washer/compactor wash water supply solenoid valve manifold at washer/compactor local control station.  
3. Check landfill container is in place.	a. Check landfill container is in place to collect the compacted screenings from the washer/compactor.
4. Turn power on to the washer/compactor at MCC.	a. Place the circuit breaker for the washer/compactor in the <b>On</b> position at Motor Control Center MCC1E.  

Actions:	Do This:
<p>5. Turn washer/compactor main disconnect switch <b>On</b> at main control panel.</p>	<p>a. Place main disconnect switch in the <b>On</b> position at the washer/compactor main control panel (CP-SCB-SCN-WC01).</p> 

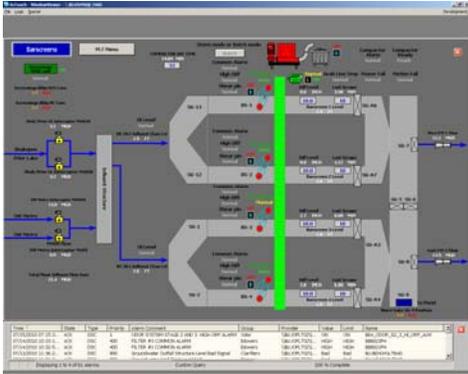
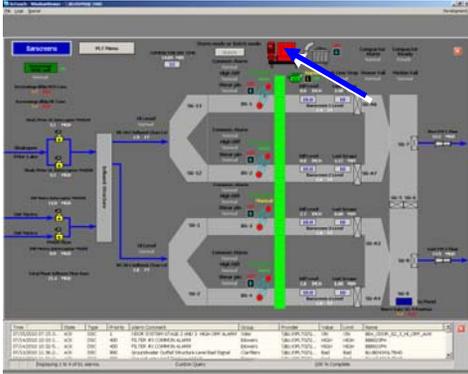
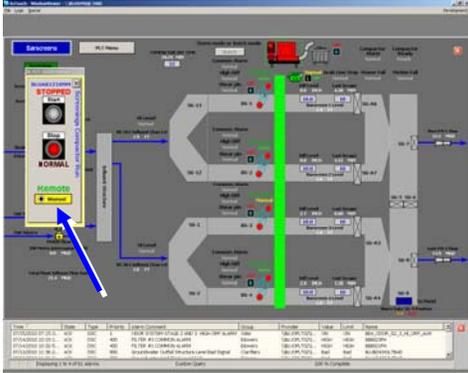
Actions:	Do This:
<p>6. Switch power on to washer/compactor controls.</p>	<p>a. Place Control Power <b>On-Off</b> switch on the washer/compactor main control panel (CP-SCB-SCN-WC01) in the <b>On</b> position.</p> 

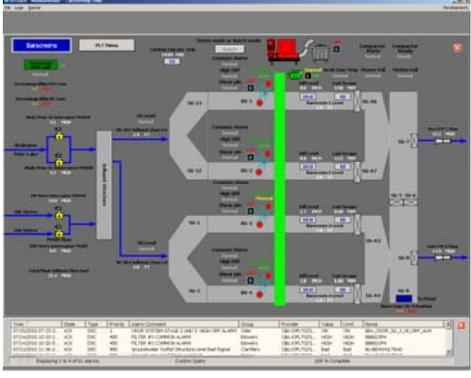
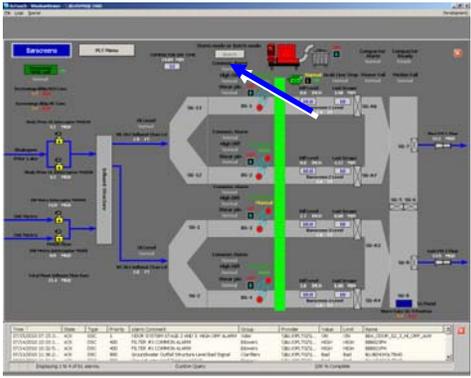
Actions:	Do This:
<p>7. Close local washer/compactor disconnect switches.</p>	<p>a. Place local disconnect switches in the <b>On</b> position at the washer/compactor.</p> 
<p>8. Pull out <b>E-Stop</b> push button at washer/compactor local control panel.</p>	<p>a. Pull out <b>Emergency Stop</b> push button on washer/compactor local control panel.</p> 

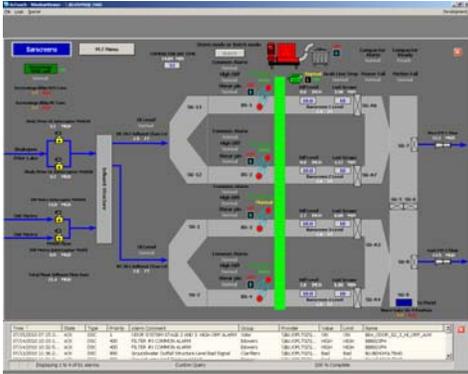
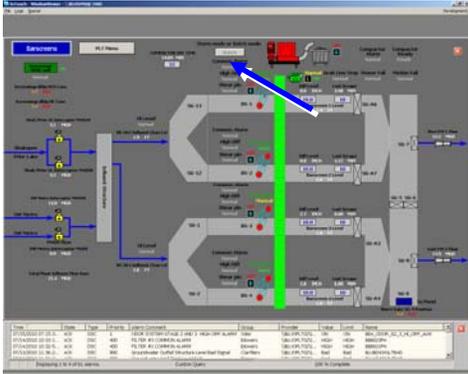
Actions:	Do This:
<p>9. Place washer/compactor in <b>Local</b> mode.</p>	<p>a. Place <b>Local-Off-Remote</b> switch in the <b>Local</b> position at the washer/compactor local control panel.</p> 

Actions:	Do This:
<p>10. Check washer/compactor for smooth operation and unusual noises.</p>	<p>a. Place <b>Forward-Off-Reverse</b> switch in the <b>Forward (Fwd)</b> position at the washer/compactor local control panel.</p>  <p>b. Check washer/compactor for smooth forward operation and unusual noises.</p> <p>c. Return <b>Forward-Off-Reverse</b> switch to the <b>Off</b> position.</p>  <p>d. Hold <b>Forward-Off-Reverse</b> switch in the <b>Reverse (Rev)</b> position long enough to check the washer/compactor for smooth operation and unusual noises. Then release the switch and let it spring return to the <b>Off</b> position.</p> 

Actions:	Do This:
<p>11. Place washer/compactor in <b>Remote</b> mode.</p>	<p>a. If the washer/compactor is operating smoothly, place the <b>Local-Off-Remote</b> switch in the <b>Remote (Rem)</b> position at the local washer/compactor control panel.</p> 

Actions:	Do This:
<p>12. If manual operation is desired, control the washer/compactor manually from the washer/compactor Control popup on the control screen at the PCS HMI. Continue to <b>Step 15</b>.</p>	<p>a. Open up the washer/compactor control screen at the Plant Control System (PCS) HMI.</p>  <p>b. Double click on washer/compactor to bring up Control popup.</p>  <p>c. Click on <b>Manual</b> button on the Control popup.</p>  <p>d. Click on <b>Start</b> button on the Control popup to run the washer/compactor continuously. Click on the <b>Stop</b> push button on the Control popup to stop the washer/compactor. Continue to Step 15.</p>
<p><b>Note:</b></p> <p>If <b>Batch Mode</b> of operation is desired, go to <b>Step 13</b> and skip <b>Step 12</b>.</p> <p>If <b>Storm Mode</b> of operation is desired, go to <b>Step 14</b> and skip <b>Step 12</b> and <b>Step 13</b>.</p>	

Actions:	Do This:
<p><b>13.</b> If <b>Batch Mode</b> of operation is desired, place washer/compactor in <b>Batch Mode</b> from PCS and continue to <b>Step 15</b>.</p> <p><b>Note:</b></p> <p>If <b>Manual</b> mode of operation is desired, go to <b>Step 12</b> and skip <b>Step 13</b> and <b>Step 14</b>.</p> <p>If <b>Storm</b> mode of operation is desired, go to <b>Step 14</b> and skip <b>Step 12</b> and <b>Step 13</b>.</p>	<p><b>a.</b> Open up washer/compactor control screen at the Plant Control System (PCS) HMI.</p>  <p><b>b.</b> Check <b>Storm</b> mode or <b>Batch</b> mode indicator button on the control screen.</p>  <p><b>c.</b> If <b>Storm</b> mode or <b>Batch</b> mode indicator button already indicates <b>Batch</b>, the washer/compactor is already in <b>Batch</b> mode and nothing needs to be set. Continue to Step 15 and ignore item “d” that follows.</p> <p><b>d.</b> If <b>Storm</b> mode or <b>Batch</b> mode indicator button indicates <b>Storm</b>, click on the button to bring up a <b>Storm?</b> popup box that reads “Click OK to Switch to Batch.” Click on <b>OK</b> button to allow the washer/compactor to run in <b>Batch</b> mode. Continue to Step 15.</p> 

Actions:	Do This:
<p><b>14.</b> If <b>Storm</b> mode of operation is desired, place washer/compactor in <b>Storm</b> mode from PCS and continue to <b>Step 15</b>.</p> <p><b>Note:</b></p> <p>If <b>Manual</b> mode of operation is desired, go to <b>Step 12</b> and skip <b>Step 13</b> and <b>Step 14</b>.</p> <p>If <b>Batch Mode</b> of operation is desired, go to <b>Step 13</b> and skip <b>Step 12</b> and <b>Step 14</b>.</p>	<p><b>a.</b> Open up washer/compactor control screen at the Plant Control System (PCS) HMI.</p>  <p><b>b.</b> Check the <b>Storm</b> mode or <b>Batch</b> mode indicator button on the control screen.</p>  <p><b>c.</b> If <b>Storm</b> mode or <b>Batch</b> mode indicator button already says <b>Storm</b>, the washer/compactor is already in <b>Storm</b> mode and nothing needs to be set. Continue to Step 15 and ignore item “d” that follows.</p> <p><b>d.</b> If <b>Storm</b> mode or <b>Batch</b> mode indicator button indicates <b>Batch</b>, click on the button to bring up a <b>Storm?</b> popup box that reads “Click OK to Switch to Storm.” Click on <b>OK</b> button to allow the washer/compactor to run in <b>Storm</b> mode. Continue to Step 15.</p> 
<p><b>15.</b> Check washer/compactor for proper operation</p>	<p><b>a.</b> Check washer/compactor for proper operation. Notify Supervisor of any unusual observations.</p>

Actions:	Do This:
<b>Result</b>	Washer/compactor has been successfully started up.
<b>Task standards</b>	<ul style="list-style-type: none"> <li>• Washer/compactor has been energized.</li> <li>• Washer/compactor has been placed in <b>Remote</b> mode to allow control from the PCS HMI.</li> <li>• Washer/compactor has been placed in the desired mode of operation.</li> </ul>

		Standard Operating Procedure Requirements										
Number	SOP Title	Document control information	Title	Statement of purpose	Required materials	Required PPE	Reference documentation	Steps are included for Task	Steps are complete	Pictures	Troubleshooting	Appendix
1	Centrifuge operation		x									
2	Grease Dump		x									
3	North plant hauling of solids		x									
4	SOP OPS-102 High Flow	x	x	x			x	x				
5	SOP OPS-110 Primary sludge pump rate	x	x	x			x	x				
6	SOP OPS-308 Thickened Sludge Pump Start	x	x					x	x			
7	SOP OPS-309 Ozone Emergency Bypass	x	x	x				x				
8	SOP OPS-310 Ozone First Out Alarm	x	x	x	x		x					
9	SOP OPS-311 Ambient Ozone Over Ride	x	x	x				x	x			
10	SOP OPS-404 Digester operating level	x	x	x	x							
11	SOP OPS-405 Digester Operating Temperature	x	x	x			x	x				
12	SOP OPS-406 Digester circulating pumps and mixers	x	x	x			x				x	
13	SOP OPS-407 Digester draft tube mixers	x	x	x			x	x				
14	SOP OPS-408 Digester loading rate	x	x	x			x					
15	SOP OPS-410 GBT Thickening		x									
16	SOP OPS-411 Centrifuge Truck	x	x	x				x				
17	SOP OPS-412 Centrifuge Sampling	x	x	x	x			x				
18	SOP OPS-501 Equipment check sheet	x	x	x	x			x	x			
19	SOP OPS-502 Receiving Loads of Chemicals	x	x	x	x	x	x	x				
20	SOP OPS-503 Composite Samplers	x	x	x				x				
21	SOP OPS-510 Sampling for Effluent Phos.	x	x	x	x			x				
22	SOP OPS-511 Sol Phos - Alum Control	x	x	x			x	x				
23	SOP Acetylene test	x	x	x			x					
24	SOP OPS-602 High Point Switching O.C. Notification	x	x	x								

Note: A "x" in the box indicates this is included in the SOP.