I. Approvals

Signing below indicates agreement that the protocol is ready for execution of the Installation, Operational, and Performance Qualification for the ACS filter press, located at 102 Commerce Street at the Main Plant production facility.

Project Member	Functional Area	Signature	Date
Patrick Owen	Engineering		5/15/17
Kenneth Basehore	Engineering		5/10/17
Sammy Henson	Maintenance		5/15/17
Jason Bumgarner	Production		5-15-17
Matt Haynes	Operations		5-15-17
Deborah Durbin	Quality		5-15-17

A final summary report that consists of results and conclusions based on the data collected after protocol execution will be written and approved. The executed protocol will be attached behind the report.

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II. Purpose

The purpose of this protocol is to certify with documented evidence that ACS filter press functions as intended throughout its anticipated operating ranges. This protocol sets forth the objectives, methodology, documentation, and test activities needed to complete the Installation Qualification (IQ), Operational Qualification (OQ) and Process Qualification (PQ) for the filter press, located at 102 Commerce Street at the Main Plant production facility.

III. Background

The ACS filter press was installed on site by contractors during late 2007. It is intended to receive a $MgSO_4$ solution from the digesters. The solution is known as 'mud'. The mud is pumped through a series of filter screens pressed together with a hydraulic pump. The screens filter out insoluble impurities. The waste stream from the filter press is caked and hauled to a land fill. The product stream from the filter press (known as 'brine') is pumped to a storage tank, and is fed to the crystallizers to produce solid $MgSO_4$ salt.

IV. Overview

No other departments or systems will be affected by the installation of use or this equipment.

The following tests will be performed during this qualification:

- The unit is installed correctly, and with access to all required points
- The squeeze pressure is appropriate
- The associated pumps are installed correctly, with the correct rotation
- The filter cloths do not have creases or folds
- Brine clarity matches current filter press production

V. System Description

1. The filter press is operated through a series of preprogrammed steps in a control interface.
2. The steps control the squeeze pressure, the product flow and flush timing.
3. Mud flows into the press, and brine is separated from insoluble impurities.

VI. Scope

The IQ, OQ and PQ contained within this protocol is intended to certify with documented evidence that the ACS filter press is installed, operates and functions as intended throughout its anticipated operating ranges.

The product affected by this equipment is all salt produced in the Main Plant at 102 Commerce Street, Waynesville, NC.

VII. Roles and Responsibilities

1. Engineering
    - Write and issue the protocol

- Investigate protocol deviation reports
- Execute the IQ, OQ and PQ portions of the validation
- Review the data and originate the interim notification to Quality Assurance
- Write and route the final report

2. Quality Assurance
   - Review and approve the protocol
   - Review and approve the raw data and notifications
   - Review, approve and store the final report
3. Maintenance
   - Provide equipment manuals needed to execute the validation
   - Review and approve the protocol
   - Review and approve the raw data and notifications
   - Review and approve the final report
4. Production
   - Review and approve the protocol
   - Review and approve the raw data and notifications
   - Review and approve the final report
   - Assist, as needed with the execution of the IQ, OQ and PQ

VIII. Test Program

1. Installation Qualification (IQ)

a. Objective

The objective of the installation verification is to document that the ACS filter press is installed correctly.

b. Equipment and Materials

- ACS filter press
- Mud Feed Pump model MTX3196 (s/n 68401)
- Preheat pump model PC196 (s/n 6178)
- Squeeze pump model DVPF 6/6 B (s/n 290062362060GN)
- Cake wash pump model 3657 (J1402076)

c. Procedure

- Verify that the press is situated to allow sufficient room around the machine for access
- Verify that all pumps are situated to allow sufficient room for access
- Verify that the press is level
- Verify that the pumps are level
- Verify that the electrical utilities fall within the manufacturers required ranges

d. Acceptance Criteria

Ensure that the installation is correct.

2. *Operational Qualification (OQ)*

a. Objective

The objective of the operational qualification is to ensure that the ACS filter press operates as intended by the manufacturer. The controls will be operated to test the ability of the vessel to start and stop as the circulation flow rate varies above and below the alarm limits.

b. Equipment and Materials

- ACS filter press
- Mud Feed Pump model MTX3196 (s/n 68401)
- Preheat pump model PC196 (s/n 6178)
- Squeeze pump model DVPF 6/6 B (s/n 290062362060GN)
- Cake wash pump model 3657 (J1402076)

c. Procedure

- Verify that the squeeze pressure is appropriate
- Verify that the associated pumps work properly
- Verify that the pumps have the correct rotation direction
- Verify that the cloths do not have creases or folds

d. Acceptance Criteria

Verification that the tested operations operate as indicated by the designer's specifications.

3. *Performance Qualification (PQ)*

a. Objective

The objective of the performance testing is to document that the ACS filter press performs the functions required by Giles Chemical. This protocol will verify the following:

b. Equipment and Materials

- ACS filter press
- Mud Feed Pump model MTX3196 (s/n 68401)
- Preheat pump model PC196 (s/n 6178)
- Squeeze pump model DVPF 6/6 B (s/n 290062362060GN)
- Cake wash pump model 3657 (J1402076)

c. Procedure

- Verify that the press proceeds through the programmed steps correctly
- Verify that the brine clarity is not different than existing press brine clarity

d. Acceptance Criteria

The PQ will be accepted if the brine clarity is not different than existing press brine clarity, and if the press proceeds through the programmed steps correctly.

IX. Calibration

Verify that all instruments used are within the calibration dates.

- Calibrated multimeter

X. References

None

Installation Qualification (IQ)

1. *Equipment*

Device	Calibration Date	Calibration Expiration	Verified By	Date
Multimeter Model: Fluke 114 S/N: 36250117WS				

Expected	Actual	Pass/Fail	Verified By	Date
ACS Press Filter				
Mud Feed Pump Model: MTX3196 S/N: 68401				
Preheat Pump Model: PC196 S/N: 6178				
Squeeze Pump Model: DVPF 6/6 B S/N: 290062362060GN				
Cake Wash Pump Model: 3657 S/N: J1402076				

2. *Acceptance Testing*

Expected	Actual	Pass/Fail	Verified By	Date
There is sufficient room around the press to allow access doors and panels to be opened	There ____ sufficient room around the press to allow access doors and panels to be opened.			
There is sufficient room around the mud feed pump to allow maintenance	There ____ sufficient room around the mud feed pump to allow maintenance			
There is sufficient room around the preheat pump to allow maintenance	There ____ sufficient room around the preheat pump to allow maintenance			
There is sufficient room around the squeeze pump to allow maintenance	There ____ sufficient room around the squeeze pump to allow maintenance			

There is sufficient room around the cake wash pump to allow maintenance	There ____ sufficient room around the cake wash pump to allow maintenance			
The press is level	The press _____ level			
The mud feed pump is level	The mud feed pump ____ level			
The preheat pump is level	The preheat pump ____ level			
The squeeze pump is level	The squeeze pump ____ level			
The cake wash pump is level	The cake wash pump ____ level			
All four pumps are 230 VAC 3PH	All four pumps _____ 230 VAC 3PH			

3. *Acceptance of Testing and Review*

Expected	Actual	Pass/Fail	Verified By	Date
All actual results match the expected values.	All actual results _____ the expected values.			
The relevant standard working procedures are approved	The relevant standard working procedures _____ approved			
List the procedure numbers				
Results reviewed and accepted by				

XI. Operational Qualification (OQ)

1. *Equipment*

Expected	Actual	Pass/Fail	Verified By	Date
ACS Press Filter				
Mud Feed Pump Model: MTX3196 S/N: 68401				
Preheat Pump Model: PC196 S/N: 6178				
Squeeze Pump Model: DVPF 6/6 B S/N: 290062362060GN				
Cake Wash Pump Model: 3657 S/N: J1402076				

2. *Acceptance Testing*

Expected	Actual	Pass/Fail	Verified By	Date
The press is stopped	The press ____ stopped			
Press open filter	The press _____.			
Ensure that none of the clothes have creases or folds	The cloths _____ have creases or folds			
Press close filter	The press _____.			
From the Main Screen, press the 'Go to Advanced' button	The button _____ pressed			
The program steps are displayed	The program steps _____ displayed			

Record the program steps				
Navigate to the 'Filter Setpoints' screen	The 'Filter Setpoints' screen ___ displayed			
Change the 'Feed Low Flow to End' setpoint to 50 GPM	The setpoint _____ changed			
Change the 'Feed Low Flow to End' setpoint to 30 GPM	The setpoint _____ changed			
Record the 'Final Squeeze Pressure'	_____ psi			
Press start conveyor	The conveyor _____.			
Press stop conveyor	The conveyor _____.			

3. *Acceptance of Testing and Review*

Expected	Actual	Initials	Date
All actual results match the expected values.	All actual results _____ the expected values.		
The IQ section is complete with no deviations	The IQ section ____ complete with no deviations		
Results reviewed and accepted by			

XII. Performance Qualification (PQ)

1. *Equipment*

Expected	Actual	Pass/Fail	Verified By	Date
ACS Press Filter				
Mud Feed Pump Model: MTX3196 S/N: 68401				
Preheat Pump Model: PC196 S/N: 6178				
Squeeze Pump Model: DVPF 6/6 B S/N: 290062362060GN				
Cake Wash Pump Model: 3657 S/N: J1402076				

2. *Acceptance Testing*

Expected	Actual	Pass/Fail	Verified By	Date
The press is stopped	The press _____ stopped			
Press open filter	The press _____.			
Ensure that none of the clothes have creases or folds	The cloths _____ have creases or folds			
Press close filter	The press _____.			
From the Main Screen, press the 'Go to Advanced' button	The button _____ pressed			
The program steps are displayed	The program steps _____ displayed			

Record the program steps				
Navigate to the 'Filter Setpoints' screen	The 'Filter Setpoints' screen ___ displayed			
Record the 'Final Squeeze Pressure'	_____ psi			
Press start conveyor	The conveyor _____			
Press 'Start Filter'	The press _____ started			
The press progresses through the program steps	The press _____ through the program steps			
The mud feed pump has the correct rotation, and is working correctly	The mud feed pump _____ the correct rotation, and is working correctly			
The preheat pump has the correct rotation, and is working correctly	The preheat pump _____ the correct rotation, and is working correctly			
The squeeze pump has the correct rotation, and is working correctly	The squeeze pump _____ the correct rotation, and is working correctly			
The cake wash pump has the correct rotation, and is working correctly	The cake wash pump _____ the correct rotation, and is working correctly			
Collect a beginning brine sample for lab analysis	The sample _____ collected			
Collect a middle brine sample for lab analysis	The sample _____ collected			

Collect an ending brine sample for lab analysis	The sample _____ collected			
Collect a BME brine sample from a different filter press	The sample _____ collected Press s/n:			
The six samples show no difference in clarity	The six samples _____ difference in clarity			
The press is stopped	The press _____ stopped			
Ensure that none of the clothes have creases or folds	The cloths _____ have creases or folds			

3. *Acceptance of Testing and Review*

Expected	Actual	Initials	Date
All actual results match the expected values.	All actual results _____ the expected values.		
The IQ section is complete with no deviations	The IQ section ____ complete with no deviations		
The OQ section is complete with no deviations	The OQ section ____ complete with no deviations		
The relevant standard working procedures are effective	The relevant standard working procedures _____ effective		
List the procedure numbers			

Results reviewed and accepted by		

XIII. Protocol Deviation Report Log

Log each protocol deviation report in the table below. Attach PDRs to this protocol.

PDR #	Description	Protocol Section	Date Initiated	Date Resolved

XIV. Signature Identification Log

Identify in the table below any personnel involved in the execution of this protocol.

Name	Affiliation	Signature	Initials	Date