# DETAILED TEST PLAN FOR THE DESIGN SULFUR COAL TEST OF THE S-H-U SCRUBBER AT THE NYSEG MILLIKEN STATION

## I. Introduction

The Saarberg-Hölter Umwelttechnik GmbH (S-H-U) flue gas desulfurization (FGD) process began operating at Milliken Station Unit 2 in January 1995 and at Unit 1 in June 1995. The 1.6% sulfur coal parametric tests of the S-H-U process were performed on Unit 2 from October 11 to November 21, 1995. The parametric testing with the design sulfur coal (nominally 3% S) is scheduled to begin on May 13, 1996 and continue for approximately five months. This test plan for the design coal tests includes suggestions by the project participants and incorporates recommendations based on the results from the 1.6% sulfur coal parametric test.

## II. Test Plan

### A. Process Variables

Parametric tests will be performed on Unit 2 to define the performance limits of the S-H-U FGD system with the design sulfur coal. Boiler load will not be a variable in the parametric tests; the test plan was designed for full load on Unit 2 in all tests. As in the 1.6% sulfur coal parametric tests, Milliken Station load changes during the S-H-U test period will be assigned to Unit 1 to keep Unit 2 at constant full load. Occasionally, low load demand may require that Unit 2 load be reduced; when this occurs, testing will be suspended, unless otherwise specified, until Unit 2 full load is restored and the FGD system is lined out. The same coal will be fed to both boilers. As a point of reference, the average gross load in Unit 2 ranged from 154.9 MW to 160.2 MW during the 1.6% sulfur coal parametric testing. The slurry chloride concentration will be maintained at a constant value of 40,000 ppm for the program except for the 0 ppm formic acid guarantee tests (G-D-0-1 through G-D-0-3), in which the chloride concentration will be maintained at 30,000 ppm. The slurry pH during the parametric tests will be maintained at a pH of 5.0 for tests without formic acid and 4.2 for tests with formic acid. The FGDPRISM model calibration tests will be performed using a target range of 3.5 to 5.0 pH; this range is subject to change depending on the scrubber performance.

The following is a discussion of the parameters to be varied.

1. Formic Acid Concentration

Formic acid concentrations of 0, 400, 800 and 1600 ppm will be tested to demonstrate the effects of formic acid concentration on $SO_2$ removal and scrubber operability during the short-term parametric tests and on gypsum crystal morphology, calcium and sulfur balance, and formic acid consumption rate in the long-term tests.

2. Spray Header Combination

Various combinations of spray headers will be tested in the cocurrent and countercurrent sections to generate data for optimization of $SO_2$ removal and scrubber energy consumption. The results of these tests will also be used to determine the mass transfer coefficients individually for the cocurrent and countercurrent sections. The scrubber L/G ratio will be varied by changing the number of spray headers in operation at constant flue gas flow. Data collected will include the scrubber pressure drop and $SO_2$ removal for each different header combination tested. The effects of process variables on gypsum crystal morphology will be determined for selected spray header combinations and formic acid concentrations during one-week tests.

3. Gas Velocity

The design gas velocity is 20 ft/sec in the cocurrent scrubber section and 12 ft/sec in the countercurrent section. Tests at higher velocity will be performed by shunting gas flow from Unit 1 to Unit 2. The maximum gas flow through the scrubber is limited by the mist eliminator design. The maximum gas flow in the 1.6% sulfur coal parametric tests was 32 ft/sec in the cocurrent section and 16 ft/sec in the countercurrent section. The 1.6% sulfur coal parametric tests showed that more $SO_2$ was removed during the high velocity tests than during the design velocity tests at an equivalent L/G basis. Therefore, the design sulfur coal test will use the same gas flows in the high gas velocity tests as used in the 1.6% sulfur coal tests (i.e., 32 ft/sec and 16 ft/sec, respectively, in the cocurrent and countercurrent sections). Two formic acid concentrations (0 and 800 ppm) will be used for evaluation during the high gas velocity tests. The pressure drop and $SO_2$ removal will be measured for several spray header combinations. The gypsum crystal morphology, calcium and sulfur balance and formic acid consumption rate will be determined with the design gas velocity in the long-term tests only.

4. Limestone Grind Size

The design limestone grind size is 90% -170 mesh when using formic acid and 90% -325 mesh without formic acid. As in the 1.6% sulfur coal parametric testing, selected tests will be conducted for comparison using 90% -170 mesh limestone without formic acid and using 90% -325 mesh limestone with formic acid. Three to four days are allotted after the grind size has been changed for the system to line out; this represents approximately ten times the average residence time of solids in the scrubber.

B. Proposed Test Plan

The Unit 1 scrubber will be operated continuously at the design conditions while parametric tests are performed on Unit 2. Because they are identical modules, Unit 1 will provide baseline information.

It is important that all of the tests be performed with tight pH control to provide a constant basis for comparison of the $SO_2$ removal results. The fresh limestone slurry feed rate for the design sulfur coal test will be based on the $SO_2$ removal and not on the $SO_2$ concentration at the scrubber inlet, per recommendations from the previous 1.6% sulfur coal test. The duration of each short-term parametric test is four hours and that of each long-term test is five days.

There are four cocurrent spray headers (Headers A through D) and three countercurrent spray headers (Headers E through G) in each S-H-U module. To protect the Stebbins tile-lined scrubber from high flue gas temperature, the following restrictions apply to the use of the headers: at least one of the top two headers on the cocurrent side (A and B) must be operating at all times; at least two total headers should be operating at all times; if only one cocurrent header is on, at least two countercurrent headers should be on. With these restrictions, the possible combinations of operating headers are:

| Cocurrent | Countercurrent | Total Operating |
|---|---|---|
| 4 | 3 | 7 |
| 4 | 2 | 6 |
| 4 | 1 | 5 |
| 4 | 0 | 4 |
| 3 | 3 | 6 |
| 3 | 2 | 5 |
| 3 | 1 | 4 |
| 3 | 0 | 3 |
| 2 | 3 | 5 |
| 2 | 2 | 4 |
| 2 | 1 | 3 |
| 2 | 0 | 2 |
| 1 | 3 | 4 |
| 1 | 2 | 3 |

For each combination, the uppermost headers will be used. In this document, the header configurations are represented as a pair of numbers designating the number of cocurrent and countercurrent headers in operation. For example, (4,3) means four cocurrent and three countercurrent spray headers in operation. The results from tests using no countercurrent sprays (4,0; 3,0; 2,0) will be used to determine the mass transfer in the cocurrent section. The mass transfer in the countercurrent section will be determined by comparing these results with those from the tests in which countercurrent sprays are operating.

For long-term tests, a seven spray header configuration and a four spray header configuration will be compared. The purpose is to determine if the number of recycle pumps affects the gypsum crystal morphology. The combination of operating headers are:

| Cocurrent | Countercurrent | Total Operating |
|---|---|---|
| 4 | 3 | 7 |
| 2 | 2 | 4 |

For each combination, the uppermost headers will be used.

The test order is listed in the attached Schedule and may be changed by NYSEG. Before the test program begins, the formic acid concentration will be reduced to zero by shutting off the formic acid metering pump two weeks before the start of testing. Four one-day guarantee tests (G-D-0-1A and G-D-0-1 through G-D-0-3) with chloride concentration of 30,000 ppm and zero formic acid will be conducted first. After that, the chloride concentration will be increased and maintained at 40,000 ppm throughout the remaining tests. Tests without formic acid addition will be performed first, followed by tests with 400 ppm, 800 ppm, and 1600 ppm formic acid. Tests without formic acid will be performed at two pH levels (5.0 and 4.2). High gas velocity tests will be conducted with zero formic acid and with 800 ppm formic acid. The S-H-U scrubber design calls for different limestone grind sizes depending upon whether or not formic acid is used. Without formic acid additive, the design limestone grind size is 90% -325 mesh; with formic acid additive the design calls for 90% -170 mesh. The parametric tests will be performed using the design limestone grind sizes. To determine the effect of grind size on performance, several tests will be performed using 90% -325 mesh with formic acid and 90% -170 mesh without formic acid.

The test program is designed to determine the effects of formic acid concentration, L/G ratio and mass transfer on scrubber performance and the quality of the gypsum produced. Ideally, all parameters should be randomized; however, the large capacity (240,000 gal) in the scrubber sump makes it impractical to change the formic acid concentration frequently. Therefore, the program is set up in test blocks in which the formic acid concentration is kept constant for periods of 14 to 66 days. L/G will be varied by varying the number of cocurrent and countercurrent spray headers operating at constant gas flow. The spray headers operate in an on/off mode (i.e., there is no flowrate control on the headers). The flow rate will be measured at the suction side of each spray header pump at least twice during the test program using an ultrasonic method; additional flow measurement methods may be attempted for comparison. Mass transfer will be varied by varying the number of cocurrent and countercurrent sprays in operation at the same L/G ratio.

1. S-H-U Scrubber Guarantee Tests

These one-day tests will measure the scrubber performance at the design conditions. The tests include four tests using 90% -325 mesh limestone without formic acid at a slurry chloride concentration of 30,000 ppm (G-D-0-1A and G-D-0-1 through G-D-0-3), and three tests using 90% -170 mesh limestone at 40,000 ppm chloride and 800 ppm formic acid (G-D-2-1 through G-D-2-3). The design gas velocity will be used. The 800 ppm formic acid tests coincide with two parametric tests (S-D-2-04, S-D-2-17 and S-D-2-27).

2. FGDPRISM Model Tests

These tests will be conducted by NYSEG and EPRI to calibrate the FGDPRISM model. The scrubber slurry pH will be varied between 3.5 and 5.0, subject to scrubber response to pH changes. The limestone grind size will be 90% -170 mesh for all of the FGDPRISM model tests; results from tests using 90% -325 mesh limestone will be used to validate the model. Tests using the design gas velocity will be conducted without formic acid (P-1-1 through P-3-1 and P-5-1 through P-7-1) and with 1600 ppm formic acid (P-4-1 and P-8-1). Tests using high gas velocity will be conducted without formic acid (P-9-1 through P-11-1 and P-13-1 through P-15-1) and with 800 ppm formic acid (P-12-1 and P-16-1). NYSEG and EPRI will oversee the test operation and collection of samples for the FGDPRISM model tests.

3. Parametric Tests Using Design Gas Velocity

Tests will be conducted with the design gas velocity and the design limestone grind size at formic acid concentrations of zero ppm (S-D-0-01 through S-D-0-28), 400 ppm (S-D-1-01 through S-D-1-28), 800 ppm (S-D-2-01 through S-D-2-28) and 1,600 ppm (S-D-3-01 through S-D-3-28). The scrubber slurry pH will be 5.0 in tests without formic acid and 4.2 in tests with formic acid.

As indicated in the attached schedule, tests include all of the spray header combinations listed above. Each test will be repeated, giving twenty-eight tests total at each formic acid concentration. The twenty-eight tests will be run in the order shown in the attached schedule, subject to changes by NYSEG. These tests include long-term tests with spray header configurations of (4,3) and (2,2) at zero formic acid (S-D-0-01 and -02) and 800 ppm formic acid (S-D-2-04 and -28).

In addition to tests with the design limestone grind size, four tests each at zero ppm formic acid (S-D-0-29 through S-D-0-32), 400 ppm formic acid (S-D-1-29 through S-D-1-32), and 800 ppm formic acid (S-D-2-29 through S-D-2-32) will be conducted using an alternative limestone grind size at the design gas velocity. Included are two long-term tests using 800 ppm formic acid using the (4,3) and (2,2) spray header configurations (S-D-2-29 and -30).

Each short-term test is scheduled for four hours. Pressure drop and $SO_2$ removal will be measured after the $SO_2$ removal has lined out. If there is not sufficient time to perform all of the tests, the schedule will be adjusted by eliminating some repeat runs or some of the lower L/G runs.

Each long-term test is scheduled for five days. In addition to pressure drop and $SO_2$ removal, gypsum crystal morphology (particle size distribution, sulfate/sulfite ratio, and SEM micrographs), and formic acid consumption will be measured. $O_2$ consumption for sulfite oxidation will be measured if an on-line sulfite analyzer is available from EPRI. Sampling will begin after 10 turnovers (three days and 8 hours) have passed to insure solid phase lineout. Turnover time is calculated in the following manner: the scrubber slurry flow rate to the dewatering system is 30,000 gal/hr per module and each module's sump capacity is 240,000 gal. Thus, the solids turnover time in the scrubber is 240,000/30,000 = 8 hours; the solid residence time in the dewatering system is less than an hour.

4. Header Configuration Tests by NYSEG

At each of 0 ppm, 400 ppm, and 800 ppm formic acid concentrations, eight short-term tests (N-D-0-01 through -08, N-D-1-01 through -08, and N-D-2-01 through -08) will be conducted using the design gas velocity and design limestone size to determine the scrubber performance using header configurations of interest to NYSEG. The recycle slurry pH will be 5.0 without formic acid and 4.2 with formic acid in these tests.

5. Tests Using 4.2 pH Scrubber Slurry Without Formic Acid

Nine short-term tests (S-D-0-1A through S-D-0-9A) will be conducted without formic acid at a slurry pH of 4.2 using the design gas velocity limestone size to determine the effect of pH on $SO_2$ removal.

6. Tests Using High Gas Velocity

Fourteen tests will be conducted without formic acid (H-D-0-01 through H-D-0-14) and at 800 ppm formic acid concentration (H-D-2-01 through H-D-2-14) using a flue gas flow rate 50% higher than the scrubber design. Five of the tests are repeat tests. The tests will be run in the order shown in the attached schedule using the design limestone grind size. Each test is scheduled for four hours. Pressure drop and $SO_2$ removal will be measured after the $SO_2$ removal has lined out. Alternative limestone grind sizes will not be tested at high gas velocity. Gypsum crystal morphology will not be characterized in these tests.

During the high gas velocity tests, flue gas will be shunted from Unit 1 to mix with flue gas from Unit 2 before entering the Unit 2 scrubber. This will require a change in the process control software. The limestone slurry feed to the Unit 2 scrubber is normally controlled based on the temperature, flow rate, and $SO_2$ concentration of the gas (mass of $SO_2$) leaving the Unit 2 boiler. The instruments measuring these parameters are located upstream of the crossover duct between the two scrubber units. Therefore, the Unit 2 scrubber process control software must be changed during the high velocity tests to control the limestone slurry feed rate to the Unit 2 scrubber based on the $SO_2$ removal from the combined gas streams. This procedure was used during the high velocity tests in the 1.6% sulfur coal tests.

## III. Sampling and Analytical

In addition to the data collected electronically by the plant's data logging system, the following liquid, slurry, and solid samples will be collected by NYSEG plant personnel during the test period.

| | Sample | Collection Frequency |
|---|---|---|
| 1. | Scrubber solution samples for formic acid | Daily |
| 2. | Scrubber solution samples for chloride | Daily |
| 3. | Limestone slurry sample for particle size | Every 7 days plus 1 day after each change |
| 4. | Gypsum grab sample for gypsum purity | Every 3 days |
| 5. | Gypsum grab sample for gypsum crystal morphology analysis | Last long-term test day |

This sampling frequency will be adjusted as needed during the test program. It is assumed that the frequency of sampling the scrubber slurry for carbonate analysis will decrease when steady-state scrubber composition is demonstrated.

Sampling procedures are described in Appendix A of the data analysis report of the 1.6% sulfur coal tests.

## S-H-U Test Program for Design Coal

All tests to be 145 MWe or greater.

| Tentative Date | Test Number | Test Day | Time | Spray Headers Operating | | Limestone Grind Size | Formic Acid Level | pH | Gas Velocity | Samples to be Taken |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Cocurrent | Countercurrent | | | | | |
| Design gas velocity, no formic acid, pH 4.4, 90% -325 mesh limestone. Maintain chloride concentration at 30,000 ppm. | | | | | | | | | | |
| May 13 | G-D-0-1A | 1 | 7:00 to 19:00 | A,B,C,D | E,F,G | 90% -325 mesh | 0 ppm | 4.4 | Design | FA, Cl, LSPS, GP |
| May 14 0:00 | Raise scrubber slurry pH to 5.0 | | | | | | | | | |
| May 15 | G-D-0-1 | 2 | 7:00 to 19:00 | A,B,C,D | E,F,G | 90% -325 mesh | 0 ppm | 5.0 | Design | FA, Cl, LSPS, GP |
| May 16 | G-D-0-2 | 3 | 7:00 to 19:00 | A,B,C | E,F | 90% -325 mesh | 0 ppm | 5.0 | Design | FA, Cl, LSPS, GP |
| May 17 | G-D-0-3 | 4 | 7:00 to 19:00 | A,B | E,F,G | 90% -325 mesh | 0 ppm | 5.0 | Design | FA, Cl, LSPS, GP |
| May 18 0:00 | Increase chloride concentration to 40,000 ppm. | | | | | | | | | |
| May 20 12:00 | High Velocity Tests - Divert flow so that output from both boilers goes through one scrubber. Run using all seven headers for 20 hours to allow lineout. | | | | | | | | | |
| May 21 | H-D-0-01 | 5 | 8:00 to 12:00 | A,B,C | E | 90% -325 mesh | 0 ppm | 5.0 | High | FA, Cl, LSPS, GP |
| | H-D-0-02 | 5 | 12:00 to 16:00 | A,B,C | E,F | 90% -325 mesh | 0 ppm | 5.0 | High | |
| | H-D-0-03 | 5 | 16:00 to 20:00 | A,B,C,D | E | 90% -325 mesh | 0 ppm | 5.0 | High | |
| | H-D-0-04 | 5 | 20:00 to 24:00 | A,B,C,D | E,F,G | 90% -325 mesh | 0 ppm | 5.0 | High | |
| May 22 | H-D-0-05 | 6 | 0:00 to 4:00 | A,B | E,F,G | 90% -325 mesh | 0 ppm | 5.0 | High | FA, Cl, GP |
| | H-D-0-06 | 6 | 4:00 to 8:00 | A,B,C,D | E | 90% -325 mesh | 0 ppm | 5.0 | High | |
| | H-D-0-07 | 6 | 8:00 to 12:00 | A,B,C,D | E,F | 90% -325 mesh | 0 ppm | 5.0 | High | |
| | H-D-0-08 | 6 | 12:00 to 16:00 | A,B,C | E,F,G | 90% -325 mesh | 0 ppm | 5.0 | High | |
| | H-D-0-09 | 6 | 16:00 to 20:00 | A,B,C | E,F | 90% -325 mesh | 0 ppm | 5.0 | High | |
| | H-D-0-10 | 6 | 20:00 to 24:00 | A,B | E,F,G | 90% -325 mesh | 0 ppm | 5.0 | High | |
| May 23 | H-D-0-11 | 7 | 0:00 to 4:00 | A,B,C,D | E,F | 90% -325 mesh | 0 ppm | 5.0 | High | FA, Cl, GP |
| | H-D-0-12 | 7 | 4:00 to 8:00 | A,B,C | E,F,G | 90% -325 mesh | 0 ppm | 5.0 | High | |
| | H-D-0-13 | 7 | 8:00 to 12:00 | A,B | E,F | 90% -325 mesh | 0 ppm | 5.0 | High | |
| | H-D-0-14 | 7 | 12:00 to 16:00 | A,B | none | 90% -325 mesh | 0 ppm | 5.0 | High | |
| May 23 16:00 | Change limestone grind size to 90% -170 mesh; allow at least 4 days to reach equilibrium. | | | | | | | | | |

Sampling codes: FA = Scrubber solution samples for formic acid analysis; Cl = Scrubber solution samples for chloride analysis; LSPS = Limestone slurry samples for particle size analysis; GP = Gypsum grab samples for gypsum purity analysis; GCM = Gypsum grab samples for gypsum crystal morphology analysis

## S-H-U Test Program for Design Coal

All tests to be 145 MWe or greater.

| Tentative Date | Test Number | Test Day | Time | Spray Headers Operating | | Limestone Grind Size | Formic Acid Level | pH | Gas Velocity | Samples to be Taken |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Cocurrent | Countercurrent | | | | | |
| May 27 19:00 | Reduce scrubber slurry pH to 3.5 and continue High Velocity Tests. | | | | | | | | | |
| May 28 | P-9-1 | 8 | 4:00 to 12:00 | A,B | E,F | 90% -170 mesh | 0 ppm | 3.5 | High | FA, Cl, LSPS, GP |
| | P-13-1 | 8 | 12:00 to 19:00 | A,B | none | 90% -170 mesh | 0 ppm | 3.5 | High | |
| May 28 19:00 | Raise scrubber slurry pH to 4.2 and continue High Velocity Tests. | | | | | | | | | |
| May 29 | P-10-1 | 9 | 4:00 to 12:00 | A,B | E,F | 90% -170 mesh | 0 ppm | 4.2 | High | FA, Cl, LSPS, GP |
| | P-14-1 | 9 | 12:00 to 19:00 | A,B | none | 90% -170 mesh | 0 ppm | 4.2 | High | |
| May 29 19:00 | Raise scrubber slurry pH to 5.0 and continue High Velocity Tests. | | | | | | | | | |
| May 30 | P-11-1 | 10 | 4:00 to 12:00 | A,B | E,F | 90% -170 mesh | 0 ppm | 5.0 | High | FA, Cl, LSPS, GP |
| | P-15-1 | 10 | 12:00 to 19:00 | A,B | none | 90% -170 mesh | 0 ppm | 5.0 | High | |
| May 30 19:00 | Restore gas flow to design conditions. | | | | | | | | | |
| June 3 | P-3-1 (S-D-0-29) | 11 | 4:00 to 12:00 | A,B | E,F | 90% -170 mesh | 0 ppm | 5.0 | Design | FA, Cl, LSPS, GP |
| | P-7-1 | 11 | 12:00 to 19:00 | A,B | none | 90% -170 mesh | 0 ppm | 5.0 | Design | |
| June 4 | S-D-0-30 | 12 | 7:00 to 11:00 | A,B,C | E,F | 90% -170 mesh | 0 ppm | 5.0 | Design | FA, Cl, GP |
| | S-D-0-31 | 12 | 11:00 to 15:00 | A,B | E | 90% -170 mesh | 0 ppm | 5.0 | Design | |
| | S-D-0-32 | 12 | 15:00 to 19:00 | A,B,C,D | E,F,G | 90% -170 mesh | 0 ppm | 5.0 | Design | |
| June 4 19:00 | Reduce scrubber slurry pH to 4.2 | | | | | | | | | |
| June 5 | P-2-1 | 13 | 4:00 to 12:00 | A,B | E,F | 90% -170 mesh | 0 ppm | 4.2 | Design | FA, Cl, LSPS, GP |
| | P-6-1 | 13 | 12:00 to 19:00 | A,B | none | 90% -170 mesh | 0 ppm | 4.2 | Design | |
| June 5 19:00 | Reduce scrubber slurry pH to 3.5 | | | | | | | | | |
| June 6 | P-1-1 | 14 | 4:00 to 12:00 | A,B | E,F | 90% -170 mesh | 0 ppm | 3.5 | Design | FA, Cl, LSPS, GP |
| | P-5-1 | 14 | 12:00 to 19:00 | A,B | none | 90% -170 mesh | 0 ppm | 3.5 | Design | |
| June 6 19:00 | Change limestone grind size to 90% -325 mesh; allow 4 days to reach equilibrium | | | | | | | | | |
| June 10 00:00 | Raise scrubber slurry pH to 5.0 | | | | | | | | | |

Sampling codes: FA = Scrubber solution samples for formic acid analysis; Cl = Scrubber solution samples for chloride analysis; LSPS = Limestone slurry samples for particle size analysis; GP = Gypsum grab samples for gypsum purity analysis; GCM = Gypsum grab samples for gypsum crystal morphology analysis

## S-H-U Test Program for Design Coal

All tests to be 145 MWe or greater.

| Tentative Date | Test Number | Test Day | Time | Spray Headers Operating | | Limestone Grind Size | Formic Acid Level | pH | Gas Velocity | Samples to be Taken |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Cocurrent | Countercurrent | | | | | |
| June 10 to June 14 | S-D-0-01 | 15 to 19 | 7:00 June 10 to 19:00 June 24 | A,B,C,D | E,F,G | 90% -325 mesh | 0 ppm | 5.0 | Design | FA, Cl daily LSPS Mon. GP Wed. GCM Fri. |
| June 17 to June 21 | S-D-0-02 | 20 to 24 | 7:00 June 17 to 19:00 June 21 | A,B | E,F | 90% -325 mesh | 0 ppm | 5.0 | Design | FA, Cl daily LSPS Mon. GP Wed. GCM Fri. |
| June 24 | S-D-0-03 | 25 | 7:00 to 11:00 | A,B | E | 90% -325 mesh | 0 ppm | 5.0 | Design | FA, Cl, LSPS, GP |
| | S-D-0-04 | 25 | 11:00 to 15:00 | A,B,C,D | E,F | 90% -325 mesh | 0 ppm | 5.0 | Design | |
| | S-D-0-05 | 25 | 15:00 to 19:00 | A,B,C | E,F,G | 90% -325 mesh | 0 ppm | 5.0 | Design | |
| June 25 | S-D-0-06 | 26 | 7:00 to 11:00 | A | E,F,G | 90% -325 mesh | 0 ppm | 5.0 | Design | FA, Cl |
| | S-D-0-07 | 26 | 11:00 to 15:00 | A,B,C | E,F | 90% -325 mesh | 0 ppm | 5.0 | Design | |
| | S-D-0-08 | 26 | 15:00 to 19:00 | A,B | E,F,G | 90% -325 mesh | 0 ppm | 5.0 | Design | |
| June 26 | S-D-0-09 | 27 | 7:00 to 11:00 | A,B,C | E | 90% -325 mesh | 0 ppm | 5.0 | Design | FA, Cl |
| | S-D-0-10 | 27 | 11:00 to 15:00 | A,B,C,D | E | 90% -325 mesh | 0 ppm | 5.0 | Design | |
| | S-D-0-11 | 27 | 15:00 to 19:00 | A,B,C,D | none | 90% -325 mesh | 0 ppm | 5.0 | Design | |
| June 27 | S-D-0-12 | 28 | 7:00 to 11:00 | A,B | none | 90% -325 mesh | 0 ppm | 5.0 | Design | FA, Cl, GP |
| | S-D-0-13 | 28 | 11:00 to 15:00 | A | E,F | 90% -325 mesh | 0 ppm | 5.0 | Design | |
| | S-D-0-14 | 28 | 15:00 to 19:00 | A,B,C | none | 90% -325 mesh | 0 ppm | 5.0 | Design | |
| June 28 | S-D-0-15 | 29 | 7:00 to 11:00 | A,B | E,F | 90% -325 mesh | 0 ppm | 5.0 | Design | FA, Cl |
| | N-D-0-01 | 29 | 11:00 to 15:00 | A,C | E,F | 90% -325 mesh | 0 ppm | 5.0 | Design | |
| | N-D-0-02 | 29 | 15:00 to 19:00 | B,C | E,F | 90% -325 mesh | 0 ppm | 5.0 | Design | |
| July 1 | N-D-0-03 | 30 | 7:00 to 11:00 | B,D | E,G | 90% -325 mesh | 0 ppm | 5.0 | Design | FA, Cl, LSPS, GP |
| | N-D-0-04 | 30 | 11:00 to 15:00 | A,D | E,G | 90% -325 mesh | 0 ppm | 5.0 | Design | |
| | N-D-0-05 | 30 | 15:00 to 19:00 | B,D | E,G | 90% -325 mesh | 0 ppm | 5.0 | Design | |
| July 2 | N-D-0-06 | 31 | 7:00 to 11:00 | A,C | E,F | 90% -325 mesh | 0 ppm | 5.0 | Design | FA, Cl |
| | N-D-0-07 | 31 | 11:00 to 15:00 | A,D | E,G | 90% -325 mesh | 0 ppm | 5.0 | Design | |
| | N-D-0-08 | 31 | 15:00 to 19:00 | B,C | E,F | 90% -325 mesh | 0 ppm | 5.0 | Design | |

Sampling codes: FA = Scrubber solution samples for formic acid analysis; Cl = Scrubber solution samples for chloride analysis; LSPS = Limestone slurry samples for particle size analysis; GP = Gypsum grab samples for gypsum purity analysis; GCM = Gypsum grab samples for gypsum crystal morphology analysis

## S-H-U Test Program for Design Coal

All tests to be 145 MWe or greater.

| Tentative Date | Test Number | Test Day | Time | Spray Headers Operating | | Limestone Grind Size | Formic Acid Level | pH | Gas Velocity | Samples to be Taken |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Cocurrent | Countercurrent | | | | | |
| July 3 | S-D-0-16 | 32 | 7:00 to 11:00 | A,B,C,D | E,F,G | 90% -325 mesh | 0 ppm | 5.0 | Design | FA, Cl, GP |
| | S-D-0-17 | 32 | 11:00 to 15:00 | A,B,C,D | none | 90% -325 mesh | 0 ppm | 5.0 | Design | |
| | S-D-0-18 | 32 | 15:00 to 19:00 | A | E,F,G | 90% -325 mesh | 0 ppm | 5.0 | Design | |
| July 8 | S-D-0-19 | 33 | 7:00 to 11:00 | A,B,C,D | E | 90% -325 mesh | 0 ppm | 5.0 | Design | FA, Cl, LSPS, GP |
| | S-D-0-20 | 33 | 11:00 to 15:00 | A,B,C | none | 90% -325 mesh | 0 ppm | 5.0 | Design | |
| | S-D-0-21 | 33 | 15:00 to 19:00 | A,B | E | 90% -325 mesh | 0 ppm | 5.0 | Design | |
| July 9 | S-D-0-22 | 34 | 7:00 to 11:00 | A,B,C | E,F | 90% -325 mesh | 0 ppm | 5.0 | Design | FA, Cl |
| | S-D-0-23 | 34 | 11:00 to 15:00 | A,B | none | 90% -325 mesh | 0 ppm | 5.0 | Design | |
| | S-D-0-24 | 34 | 15:00 to 19:00 | A,B | E,F,G | 90% -325 mesh | 0 ppm | 5.0 | Design | |
| July 10 | S-D-0-25 | 35 | 7:00 to 11:00 | A,B,C,D | E,F | 90% -325 mesh | 0 ppm | 5.0 | Design | FA, Cl, GCM |
| | S-D-0-26 | 35 | 11:00 to 15:00 | A | E,F | 90% -325 mesh | 0 ppm | 5.0 | Design | |
| | S-D-0-27 | 35 | 15:00 to 19:00 | A,B,C | E | 90% -325 mesh | 0 ppm | 5.0 | Design | |
| July 11 | S-D-0-28 | 36 | 7:00 to 11:00 | A,B,C | E,F,G | 90% -325 mesh | 0 ppm | 5.0 | Design | FA, Cl, GP |
| July 11 11:00 | Reduce scrubber slurry pH to 4.2. | | | | | | | | | |
| July 12 | S-D-0-1A | 37 | 7:00 to 11:00 | A,B | none | 90% -325 mesh | 0 ppm | 4.2 | Design | FA, Cl, LSPS, GP |
| | S-D-0-2A | 37 | 11:00 to 15:00 | A,B,C | none | 90% -325 mesh | 0 ppm | 4.2 | Design | |
| | S-D-0-3A | 37 | 15:00 to 19:00 | A,B,C,D | none | 90% -325 mesh | 0 ppm | 4.2 | Design | |
| July 15 | S-D-0-4A | 38 | 7:00 to 11:00 | A,B | E,F | 90% -325 mesh | 0 ppm | 4.2 | Design | FA, Cl, GP |
| | S-D-0-5A | 38 | 11:00 to 15:00 | A,B,C,D | E,F,G | 90% -325 mesh | 0 ppm | 4.2 | Design | |
| | S-D-0-6A | 38 | 15:00 to 19:00 | A,B,C | E | 90% -325 mesh | 0 ppm | 4.2 | Design | |
| July 16 | S-D-0-7A | 39 | 7:00 to 11:00 | A | E,F,G | 90% -325 mesh | 0 ppm | 4.2 | Design | FA, Cl, LSPS, GP, GCM |
| | S-D-0-8A | 39 | 11:00 to 15:00 | A,B | E,F,G | 90% -325 mesh | 0 ppm | 4.2 | Design | |
| | S-D-0-9A | 39 | 15:00 to 19:00 | A,B,C | E,F,G | 90% -325 mesh | 0 ppm | 4.2 | Design | |
| July 16 19:00 | Increase formic acid concentration to 400 ppm. | | | | | | | | | |

Sampling codes: FA = Scrubber solution samples for formic acid analysis; Cl = Scrubber solution samples for chloride analysis
LSPS = Limestone slurry samples for particle size analysis; GP = Gypsum grab samples for gypsum purity analysis
GCM = Gypsum grab samples for gypsum crystal morphology analysis

## S-H-U Test Program for Design Coal

All tests to be 145 MWe or greater.

| Tentative Date | Test Number | Test Day | Time | Spray Headers Operating | | Limestone Grind Size | Formic Acid Level | pH | Gas Velocity | Samples to be Taken |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Cocurrent | Countercurrent | | | | | |
| July 22 | S-D-1-29 | 40 | 7:00 to 11:00 | A,B,C | E,F | 90% -325 mesh | 400 ppm | 4.2 | Design | FA, Cl, LSPS, GP |
| | S-D-1-30 | 40 | 11:00 to 15:00 | A,B,C,D | E,F,G | 90% -325 mesh | 400 ppm | 4.2 | Design | |
| | S-D-1-31 | 40 | 15:00 to 19:00 | A,B | E | 90% -325 mesh | 400 ppm | 4.2 | Design | |
| July 23 | S-D-1-32 | 41 | 8:00 to 12:00 | A,B | E,F | 90% -325 mesh | 400 ppm | 4.2 | Design | FA, Cl |
| July 23 12:00 | Change limestone grind size to 90% -170 mesh. Allow at least 4 days to reach equilibrium. | | | | | | | | | |
| July 29 | S-D-1-01 | 42 | 7:00 to 11:00 | A,B,C | none | 90% -170 mesh | 400 ppm | 4.2 | Design | FA, Cl, LSPS, GP |
| | S-D-1-02 | 42 | 11:00 to 15:00 | A | E,F,G | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| | S-D-1-03 | 42 | 15:00 to 19:00 | A,B,C | E | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| July 30 | S-D-1-04 | 43 | 7:00 to 11:00 | A,B | E | 90% -170 mesh | 400 ppm | 4.2 | Design | FA, Cl |
| | S-D-1-05 | 43 | 11:00 to 15:00 | A,B | E,F | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| | S-D-1-06 | 43 | 15:00 to 19:00 | A,B,C,D | E | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| July 31 | S-D-1-07 | 44 | 7:00 to 11:00 | A | E,F | 90% -170 mesh | 400 ppm | 4.2 | Design | FA, Cl |
| | S-D-1-08 | 44 | 11:00 to 15:00 | A,B,C,D | E,F | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| | S-D-1-09 | 44 | 15:00 to 19:00 | A,B | E,F,G | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| Aug. 1 | S-D-1-10 | 45 | 7:00 to 11:00 | A,B,C | E,F | 90% -170 mesh | 400 ppm | 4.2 | Design | FA, Cl, GP |
| | S-D-1-11 | 45 | 11:00 to 15:00 | A,B,C,D | E,F,G | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| | S-D-1-12 | 45 | 15:00 to 19:00 | A,B | none | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| Aug. 2 | S-D-1-13 | 46 | 7:00 to 11:00 | A,B,C | E,F,G | 90% -170 mesh | 400 ppm | 4.2 | Design | FA, Cl |
| | S-D-1-14 | 46 | 11:00 to 15:00 | A,B,C,D | none | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| | N-D-1-01 | 46 | 15:00 to 19:00 | A,C | E | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| Aug. 5 | N-D-1-02 | 47 | 7:00 to 11:00 | A,D | E | 90% -170 mesh | 400 ppm | 4.2 | Design | FA, Cl, LSPS, GP |
| | N-D-1-03 | 47 | 11:00 to 15:00 | B,D | E | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| | N-D-1-04 | 47 | 15:00 to 19:00 | B,C | E | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| Aug. 6 | N-D-1-05 | 48 | 7:00 to 11:00 | A,C | E | 90% -170 mesh | 400 ppm | 4.2 | Design | FA, Cl |
| | N-D-1-06 | 48 | 11:00 to 15:00 | B,C | E | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| | N-D-1-07 | 48 | 15:00 to 19:00 | A,D | E | 90% -170 mesh | 400 ppm | 4.2 | Design | |

Sampling codes: FA = Scrubber solution samples for formic acid analysis  Cl = Scrubber solution samples for chloride analysis
LSPS = Limestone slurry samples for particle size analysis  GP = Gypsum grab samples for gypsum purity analysis
GCM = Gypsum grab samples for gypsum crystal morphology analysis

## S-H-U Test Program for Design Coal

All tests to be 145 MWe or greater.

| Tentative Date | Test Number | Test Day | Time | Spray Headers Operating | | Limestone Grind Size | Formic Acid Level | pH | Gas Velocity | Samples to be Taken |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Cocurrent | Countercurrent | | | | | |
| Aug. 7 | N-D-1-08 | 49 | 7:00 to 11:00 | B,D | E | 90% -170 mesh | 400 ppm | 4.2 | Design | FA, Cl |
| | S-D-1-15 | 49 | 11:00 to 15:00 | A | E,F | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| | S-D-1-16 | 49 | 15:00 to 19:00 | A,B,C | E,F | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| Aug. 8 | S-D-1-17 | 50 | 7:00 to 11:00 | A,B,C,D | E,F | 90% -170 mesh | 400 ppm | 4.2 | Design | FA, Cl, GP |
| | S-D-1-18 | 50 | 11:00 to 15:00 | A,B | E | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| | S-D-1-19 | 50 | 15:00 to 19:00 | A,B,C,D | none | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| Aug. 9 | S-D-1-20 | 51 | 7:00 to 11:00 | A,B,C | E,F,G | 90% -170 mesh | 400 ppm | 4.2 | Design | FA, Cl |
| | S-D-1-21 | 51 | 11:00 to 15:00 | A,B | E,F,G | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| | S-D-1-22 | 51 | 15:00 to 19:00 | A,B,C | none | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| Aug. 12 | S-D-1-23 | 52 | 7:00 to 11:00 | A | E,F,G | 90% -170 mesh | 400 ppm | 4.2 | Design | FA, Cl, LSPS, GP |
| | S-D-1-24 | 52 | 11:00 to 15:00 | A,B | E,F | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| | S-D-1-25 | 52 | 15:00 to 19:00 | A,B,C | E | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| Aug. 13 | S-D-1-26 | 53 | 7:00 to 11:00 | A,B | none | 90% -170 mesh | 400 ppm | 4.2 | Design | FA, Cl, GP, GCM |
| | S-D-1-27 | 53 | 11:00 to 15:00 | A,B,C,D | E | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| | S-D-1-28 | 53 | 15:00 to 19:00 | A,B,C,D | E,F,G | 90% -170 mesh | 400 ppm | 4.2 | Design | |
| August 13 | 19:00 | Increase formic acid to 800 ppm. | | | | | | | | |
| Aug. 16 | S-D-2-01 | 54 | 7:00 to 11:00 | A,B,C | none | 90% -170 mesh | 800 ppm | 4.2 | Design | FA, Cl, LSPS, GP |
| | S-D-2-02 | 54 | 11:00 to 15:00 | A,B,C | E,F,G | 90% -170 mesh | 800 ppm | 4.2 | Design | |
| | S-D-2-03 | 54 | 15:00 to 19:00 | A,B,C | E | 90% -170 mesh | 800 ppm | 4.2 | Design | |
| Aug. 19 to Aug. 23 | S-D-2-04 (G-D-2-1) | 55 to 59 | 7:00 Aug. 19 to 19:00 Aug. 23 | A,B,C,D | E,F,G | 90% -170 mesh | 800 ppm | 4.2 | Design | FA, Cl daily LSPS Mon. GP Wed. GCM Fri. |
| Aug. 26 | S-D-2-05 | 60 | 7:00 to 11:00 | A,B,C | E,F | 90% -170 mesh | 800 ppm | 4.2 | Design | FA, Cl, LSPS |
| | S-D-2-06 | 60 | 11:00 to 15:00 | A | E,F | 90% -170 mesh | 800 ppm | 4.2 | Design | |
| | S-D-2-07 | 60 | 15:00 to 19:00 | A,B,C,D | none | 90% -170 mesh | 800 ppm | 4.2 | Design | |

Sampling codes: FA = Scrubber solution samples for formic acid analysis; Cl = Scrubber solution samples for chloride analysis; LSPS = Limestone slurry samples for particle size analysis; GP = Gypsum grab samples for gypsum purity analysis; GCM = Gypsum grab samples for gypsum crystal morphology analysis

## S-H-U Test Program for Design Coal

All tests to be 145 MWe or greater.

| Tentative Date | Test Number | Test Day | Time | Spray Headers Operating | | Limestone Grind Size | Formic Acid Level | pH | Gas Velocity | Samples to be Taken |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Cocurrent | Countercurrent | | | | | |
| Aug. 27 | S-D-2-08 | 61 | 7:00 to 11:00 | A,B | E,F,G | 90% -170 mesh | 800 ppm | 4.2 | Design | FA, Cl, GP |
| | S-D-2-09 | 61 | 11:00 to 15:00 | A,B | none | 90% -170 mesh | 800 ppm | 4.2 | Design | |
| | S-D-2-10 | 61 | 15:00 to 19:00 | A,B,C,D | E | 90% -170 mesh | 800 ppm | 4.2 | Design | |
| Aug. 28 | S-D-2-11 | 62 | 7:00 to 11:00 | A,B | E | 90% -170 mesh | 800 ppm | 4.2 | Design | FA, Cl |
| | S-D-2-12 | 62 | 11:00 to 15:00 | A | E,F,G | 90% -170 mesh | 800 ppm | 4.2 | Design | |
| | S-D-2-13 | 62 | 15:00 to 19:00 | A,B,C,D | E,F | 90% -170 mesh | 800 ppm | 4.2 | Design | |
| Aug. 29 | S-D-2-14 | 63 | 11:00 to 15:00 | A,B | E,F | 90% -170 mesh | 800 ppm | 4.2 | Design | FA, Cl, GP |
| | S-D-2-15 | 63 | 7:00 to 11:00 | A,B | none | 90% -170 mesh | 800 ppm | 4.2 | Design | |
| | S-D-2-16 | 63 | 15:00 to 19:00 | A,B,C,D | none | 90% -170 mesh | 800 ppm | 4.2 | Design | |
| Aug. 30 | S-D-2-17 (G-D-2-2) | 64 | 7:00 to 19:00 | A,B,C | E,F | 90% -170 mesh | 800 ppm | 4.2 | Design | FA, Cl, LSPS, GP |
| Sept. 3 | S-D-2-18 | 65 | 7:00 to 11:00 | A,B,C,D | E,F | 90% -170 mesh | 800 ppm | 4.2 | Design | FA, Cl, LSPS |
| | S-D-2-19 | 65 | 11:00 to 15:00 | A,B,C | E | 90% -170 mesh | 800 ppm | 4.2 | Design | |
| | S-D-2-20 | 65 | 15:00 to 19:00 | A | E,F | 90% -170 mesh | 800 ppm | 4.2 | Design | |
| Sept. 4 | S-D-2-21 | 66 | 7:00 to 11:00 | A,B,C,D | E,F,G | 90% -170 mesh | 800 ppm | 4.2 | Design | FA, Cl, GP |
| | S-D-2-22 | 66 | 11:00 to 15:00 | A,B,C | E,F,G | 90% -170 mesh | 800 ppm | 4.2 | Design | |
| | S-D-2-23 | 66 | 15:00 to 19:00 | A | E,F,G | 90% -170 mesh | 800 ppm | 4.2 | Design | |
| Sept. 5 | S-D-2-24 | 67 | 7:00 to 11:00 | A,B,C,D | E | 90% -170 mesh | 800 ppm | 4.2 | Design | FA, Cl, GCM |
| | S-D-2-25 | 67 | 11:00 to 15:00 | A,B | E | 90% -170 mesh | 800 ppm | 4.2 | Design | |
| | S-D-2-26 | 67 | 15:00 to 19:00 | A,B,C | none | 90% -170 mesh | 800 ppm | 4.2 | Design | |
| Sept. 6 | S-D-2-27 (G-D-2-3) | 68 | 7:00 to 19:00 | A,B | E,F,G | 90% -170 mesh | 800 ppm | 4.2 | Design | FA, Cl, LSPS, GP |
| Sept. 9 to Sept. 13 | S-D-2-28 | 69 to 73 | 7:00 Sept. 9 to 19:00 Sept. 13 | A,B | E,F | 90% -170 mesh | 800 ppm | 4.2 | Design | FA, Cl daily LSPS Mon. GP Wed. GCM Fri. |

Sampling codes: FA = Scrubber solution samples for formic acid analysis; Cl = Scrubber solution samples for chloride analysis; LSPS = Limestone slurry samples for particle size analysis; GP = Gypsum grab samples for gypsum purity analysis; GCM = Gypsum grab samples for gypsum crystal morphology analysis

## S-H-U Test Program for Design Coal

All tests to be 145 MWe or greater.

| Tentative Date | Test Number | Test Day | Time | Spray Headers Operating | | Limestone Grind Size | Formic Acid Level | pH | Gas Velocity | Samples to be Taken |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Cocurrent | Countercurrent | | | | | |
| Sept. 15 8:00 | High Velocity Tests - Divert flow so that output from both boilers goes through one scrubber. Run using all seven headers for 20 hours to allow lineout. | | | | | | | | | |
| Sept. 16 | P-12-1 (H-D-2-01) | 74 | 4:00 to 14:00 | A,B | E,F | 90% -170 mesh | 800 ppm | 4.2 | High | FA, Cl, LSPS, GP |
| | P-16-1 (H-D-2-02) | 74 | 14:00 to 24:00 | A,B | none | 90% -170 mesh | 800 ppm | 4.2 | High | |
| Sept. 17 | H-D-2-03 | 75 | 0:00 to 4:00 | A,B,C | E | 90% -170 mesh | 800 ppm | 4.2 | High | FA, Cl, GP |
| | H-D-2-04 | 75 | 4:00 to 8:00 | A,B,C | E,F | 90% -170 mesh | 800 ppm | 4.2 | High | |
| | H-D-2-05 | 75 | 8:00 to 12:00 | A,B,C,D | E | 90% -170 mesh | 800 ppm | 4.2 | High | |
| | H-D-2-06 | 75 | 12:00 to 16:00 | A,B,C,D | E,F,G | 90% -170 mesh | 800 ppm | 4.2 | High | |
| | H-D-2-07 | 75 | 16:00 to 20:00 | A,B | E,F,G | 90% -170 mesh | 800 ppm | 4.2 | High | |
| | H-D-2-08 | 75 | 20:00 to 24:00 | A,B,C,D | E | 90% -170 mesh | 800 ppm | 4.2 | High | |
| Sept. 18 | H-D-2-09 | 76 | 0:00 to 4:00 | A,B,C,D | E,F | 90% -170 mesh | 800 ppm | 4.2 | High | FA, Cl, GP |
| | H-D-2-10 | 76 | 4:00 to 8:00 | A,B,C | E,F,G | 90% -170 mesh | 800 ppm | 4.2 | High | |
| | H-D-2-11 | 76 | 8:00 to 12:00 | A,B,C | E,F | 90% -170 mesh | 800 ppm | 4.2 | High | |
| | H-D-2-12 | 76 | 12:00 to 16:00 | A,B | E,F,G | 90% -170 mesh | 800 ppm | 4.2 | High | |
| | H-D-2-13 | 76 | 16:00 to 20:00 | A,B,C,D | E,F | 90% -170 mesh | 800 ppm | 4.2 | High | |
| | H-D-2-14 | 76 | 20:00 to 24:00 | A,B,C | E,F,G | 90% -170 mesh | 800 ppm | 4.2 | High | |
| Sept. 19 & Sept. 20 | Mist Eliminator and Wet Stack Tests. | | | | | | | | | |
| Sept. 21 0:00 | Restore gas flow to design conditions. | | | | | | | | | |
| Sept. 23 | N-D-2-01 | 77 | 7:00 to 11:00 | A,C | E | 90% -170 mesh | 800 ppm | 4.2 | Design | FA, Cl, LSPS, GP |
| | N-D-2-02 | 77 | 11:00 to 15:00 | A,D | E | 90% -170 mesh | 800 ppm | 4.2 | Design | |
| | N-D-2-03 | 77 | 15:00 to 19:00 | B,D | E | 90% -170 mesh | 800 ppm | 4.2 | Design | |
| Sept. 24 | N-D-2-04 | 78 | 7:00 to 11:00 | B,C | E | 90% -170 mesh | 800 ppm | 4.2 | Design | FA, Cl |
| | N-D-2-05 | 78 | 11:00 to 15:00 | B,D | E | 90% -170 mesh | 800 ppm | 4.2 | Design | |
| | N-D-2-06 | 78 | 15:00 to 19:00 | A,D | E | 90% -170 mesh | 800 ppm | 4.2 | Design | |

Sampling codes: FA = Scrubber solution samples for formic acid analysis; Cl = Scrubber solution samples for chloride analysis; LSPS = Limestone slurry samples for particle size analysis; GP = Gypsum grab samples for gypsum purity analysis; GCM = Gypsum grab samples for gypsum crystal morphology analysis

## S-H-U Test Program for Design Coal

All tests to be 145 MWe or greater.

| Tentative Date | Test Number | Test Day | Time | Spray Headers Operating | | Limestone Grind Size | Formic Acid Level | pH | Gas Velocity | Samples to be Taken |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Cocurrent | Countercurrent | | | | | |
| Sept. 25 | N-D-2-07 | 79 | 7:00 to 11:00 | A,C | E | 90% -170 mesh | 800 ppm | 4.2 | Design | FA, Cl, GP |
| | N-D-2-08 | 79 | 11:00 to 15:00 | B,C | E | 90% -170 mesh | 800 ppm | 4.2 | Design | |
| September 26 0:00 | Change limestone grind size to 90% -325 mesh; allow 4 days to reach equilibrium | | | | | | | | | |
| Sept. 30 to Oct. 4 | S-D-2-29 | 80 to 84 | 7:00 Sept. 30 to 19:00 Oct. 4 | A,B,C,D | E,F,G | 90% -325 mesh | 800 ppm | 4.2 | Design | FA, Cl daily LSPS Mon. GP Wed. GCM Fri. |
| Oct. 7 to Oct. 11 | S-D-2-30 | 85 to 89 | 7:00 Oct. 7 to 19:00 Oct. 11 | A,B | E,F | 90% -325 mesh | 800 ppm | 4.2 | Design | FA, Cl daily LSPS Mon. GP Wed. GCM Fri. |
| Oct. 15 | S-D-2-31 | 90 | 9:00 to 13:00 | A,B,C | E,F | 90% -325 mesh | 800 ppm | 4.2 | Design | FA, Cl, LSPS, GP |
| | S-D-2-32 | 90 | 13:00 to 17:00 | A,B | E | 90% -325 mesh | 800 ppm | 4.2 | Design | |
| October 15 17:00 | Increase formic acid to 1600 ppm. | | | | | | | | | |
| October 15 17:00 | Change limestone grind size to 90% -170 mesh. Allow three days to reach equilibrium. | | | | | | | | | |
| Oct. 18 | S-D-3-01 | 91 | 7:00 to 11:00 | A,B,C,D | E,F | 90% -170 mesh | 1600 ppm | 4.2 | Design | FA, Cl, LSPS |
| | S-D-3-02 | 91 | 11:00 to 15:00 | A,B,C | E | 90% -170 mesh | 1600 ppm | 4.2 | Design | |
| | S-D-3-03 | 91 | 15:00 to 19:00 | A,B,C,D | none | 90% -170 mesh | 1600 ppm | 4.2 | Design | |
| Oct. 21 | P-4-1 (S-D-3-04) | 92 | 4:00 to 12:00 | A,B | E,F | 90% -170 mesh | 1600 ppm | 4.2 | Design | FA, Cl, LSPS, GP |
| | P-8-1 (S-D-3-05) | 92 | 12:00 to 19:00 | A,B | none | 90% -170 mesh | 1600 ppm | 4.2 | Design | |
| Oct. 22 | S-D-3-06 | 93 | 7:00 to 11:00 | A,B,C,D | E | 90% -170 mesh | 1600 ppm | 4.2 | Design | FA, Cl |
| | S-D-3-07 | 93 | 11:00 to 15:00 | A,B,C | E,F | 90% -170 mesh | 1600 ppm | 4.2 | Design | |
| | S-D-3-08 | 93 | 15:00 to 19:00 | A,B,C | E,F,G | 90% -170 mesh | 1600 ppm | 4.2 | Design | |
| Oct. 23 | S-D-3-09 | 94 | 7:00 to 11:00 | A | E,F | 90% -170 mesh | 1600 ppm | 4.2 | Design | FA, Cl |
| | S-D-3-10 | 94 | 11:00 to 15:00 | A,B | E | 90% -170 mesh | 1600 ppm | 4.2 | Design | |
| | S-D-3-11 | 94 | 15:00 to 19:00 | A | E,F,G | 90% -170 mesh | 1600 ppm | 4.2 | Design | |

Sampling codes: FA = Scrubber solution samples for formic acid analysis; Cl = Scrubber solution samples for chloride analysis
LSPS = Limestone slurry samples for particle size analysis; GP = Gypsum grab samples for gypsum purity analysis
GCM = Gypsum grab samples for gypsum crystal morphology analysis

**S-H-U Test Program for Design Coal**

All tests to be 145 MWe or greater.

| Tentative Date | Test Number | Test Day | Time | Spray Headers Operating | | Limestone Grind Size | Formic Acid Level | pH | Gas Velocity | Samples to be Taken |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Cocurrent | Countercurrent | | | | | |
| Oct. 24 | S-D-3-12 | 95 | 7:00 to 11:00 | A,B,C,D | E,F,G | 90% -170 mesh | 1600 ppm | 4.2 | Design | FA, Cl, GP |
| | S-D-3-13 | 95 | 11:00 to 15:00 | A,B,C | none | 90% -170 mesh | 1600 ppm | 4.2 | Design | |
| | S-D-3-14 | 95 | 15:00 to 19:00 | A,B | E,F,G | 90% -170 mesh | 1600 ppm | 4.2 | Design | |
| Oct. 25 | S-D-3-15 | 96 | 7:00 to 11:00 | A | E,F | 90% -170 mesh | 1600 ppm | 4.2 | Design | FA, Cl |
| | S-D-3-16 | 96 | 11:00 to 15:00 | A,B,C | none | 90% -170 mesh | 1600 ppm | 4.2 | Design | |
| | S-D-3-17 | 96 | 15:00 to 19:00 | A,B | E,F | 90% -170 mesh | 1600 ppm | 4.2 | Design | |
| Oct. 28 | S-D-3-18 | 97 | 7:00 to 11:00 | A,B,C | E,F | 90% -170 mesh | 1600 ppm | 4.2 | Design | FA, Cl, LSPS, GP |
| | S-D-3-19 | 97 | 11:00 to 15:00 | A,B,C | E | 90% -170 mesh | 1600 ppm | 4.2 | Design | |
| | S-D-3-20 | 97 | 15:00 to 19:00 | A,B,C,D | none | 90% -170 mesh | 1600 ppm | 4.2 | Design | |
| Oct. 29 | S-D-3-21 | 98 | 7:00 to 11:00 | A,B,C,D | E,F | 90% -170 mesh | 1600 ppm | 4.2 | Design | FA, Cl |
| | S-D-3-22 | 98 | 11:00 to 15:00 | A,B,C | E,F,G | 90% -170 mesh | 1600 ppm | 4.2 | Design | |
| | S-D-3-23 | 98 | 15:00 to 19:00 | A,B | E,F,G | 90% -170 mesh | 1600 ppm | 4.2 | Design | |
| Oct. 30 | S-D-3-24 | 99 | 7:00 to 11:00 | A,B | E | 90% -170 mesh | 1600 ppm | 4.2 | Design | FA, Cl, GCM |
| | S-D-3-25 | 99 | 11:00 to 15:00 | A,B,C,D | E | 90% -170 mesh | 1600 ppm | 4.2 | Design | |
| | S-D-3-26 | 99 | 15:00 to 19:00 | A | E,F,G | 90% -170 mesh | 1600 ppm | 4.2 | Design | |
| Oct. 31 | S-D-3-27 | 100 | 7:00 to 11:00 | A,B | none | 90% -170 mesh | 1600 ppm | 4.2 | Design | FA, Cl, LSPS, GP |
| | S-D-3-28 | 100 | 11:00 to 15:00 | A,B,C,D | E,F,G | 90% -170 mesh | 1600 ppm | 4.2 | Design | |
| October 31 15:00 End of design coal test program | | | | | | | | | | |

Sampling codes: FA = Scrubber solution samples for formic acid analysis; Cl = Scrubber solution samples for chloride analysis; LSPS = Limestone slurry samples for particle size analysis; GP = Gypsum grab samples for gypsum purity analysis; GCM = Gypsum grab samples for gypsum crystal morphology analysis