

## **Extending The Lifespan & Improving The Efficiency Of Matured FGD Systems: Benefits & Challenges**

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### **ABSTRACT**

In January 2010 a project was undertaken to upgrade the existing flue gas desulfurization (FGD) systems and FGD waste handling systems at PacifiCorp Energy's Hunter and Huntington Stations in order to meet permitted SO<sub>2</sub> emission requirements and extend the life of the waste products landfill disposal site.

Hunter Station Units 1 and 2 are nominal net 430 MW coal-burning units. Each unit is equipped with General Electric Environmental Services Inc lime-based flue gas desulfurization (FGD) system with four absorber modules per unit, circa 1978. Huntington Station Unit 1 is a nominal net 445 MW coal-burning unit with General Electric Environmental Services Inc. lime-based FGD system. The Unit 1 FGD has four absorber modules per unit, circa 1977, similar to Hunter Station.



**Picture 1: Hunter Power Station**



**Picture 2: Huntington Power Station**

In less than 10 months for Huntington, and 15 months for Hunter Unit 2, Absorber Modifications were complete, whereby; the four absorber towers were thoroughly cleaned, and oxidation air blowers, new agitators and oxidation lances were installed and made operational, Absorber Liquid Redistribution Device (ALRD®) levels upgraded, and a new electrical system was engineered and installed for upgrades. In less than 15 months a new, fully operational dewatering system was engineered and constructed at Huntington which included a new building, hydroclones, drum filter, tanks, and numerous pumps. In addition, a new reagent preparation system common to Hunter Units 1 and 2 was also provided as part of the overall project. The entire Project was completed 1 year early and with less than 1% contract price change.

The presentation will provide an overview of the upgrade including project milestones and challenges on the Flue Gas Desulphurization Project executed by MET and PacifiCorp at Hunter and Huntington facilities in Utah. Particular emphasis will be given in the presentation to the project benefits, and by extension the benefits of similar projects.

## **INTRODUCTION**

In January 2010 a project was undertaken to upgrade the existing flue gas desulfurization (FGD) systems and FGD waste handling systems at PacifiCorp Energy's Hunter and Huntington Stations in order to meet permitted SO<sub>2</sub> emission requirements and extend the life of the waste products landfill disposal site. To fulfill these requirements the scope of work generally involved thoroughly cleaning the four absorber towers on each unit (12 total), providing five (5) new oxidation air blowers, new oxidation lances installed in the absorber towers (36 total), forty-four (44) new recycle pumps, thirty-six (36) new horizontal agitators, eleven (11) new Alloy 2205 tanks, three (3) new hydroclone clusters, four (4) new drum filters, many new slurry pumps, new gypsum conveyors, new gypsum stack-out pads, new electrical systems to power the new equipment, and five (5) new buildings at both Huntington and Hunter sites. In addition, at

Hunter, a new lime Reagent Preparation System (RPS) was also required which consisted of six (6) lime truck unloading blowers, two (2) new storage silos, two (2) new Metso Vertimill® Lime Slakers, two (2) hydroclone clusters, pumps, two (2) new Alloy 2205 tanks, a new instrument air system, a new electrical system, and a new building.

Despite the large scope of supply – over 600,000 feet of electric cable and 42,000 feet of pipe were installed in an operating power plant- the project was also extremely fast track. The contract was signed December 30, 2009, and by September 18, 2010 – only 8-months later - Huntington Unit 1 was in outage and all outage related work needed to be complete before November 22, 2010. Additionally, Hunter Unit 2 entered an outage on February 26, 2011, only 3-months later, with an outage completion date scheduled for April 30, 2011. The plan was to complete the new RPS work at the Hunter Plant in 2012 and then move on to the Hunter Unit 1 absorber upgrade work, which was to be complete by May 25, 2013.

## **PROJECT OVERVIEW**

### Huntington Unit 1

Upon receipt of the signed contract the engineering work began with a focused effort to address those items necessary for the Huntington Unit 1 Outage Work. A key point in the planning was at the end of the outage the FGD system would be brought back on-line in an oxidized state so as to minimize any potential scaling while the work on the new Dewatering System continued, as it was not possible to engineer, procure, and construct this system within the 11 months necessary to support the end of the planned outage.



**Picture 3: New Huntington Dewatering Building**

The plan for Huntington Unit 1 therefore required that the four absorber towers be thoroughly cleaned, and the new oxidation air blowers, new oxidation lances, new agitators, and new recycle pumps all be operational by outage end. It also required that the deficiencies in the existing ALRD®'s (original installation by others) be addressed in this time. Since the new Dewatering System was not scheduled to be operational until the end of March 2011, it was agreed to make use of the plant's existing thickener and waste byproduct handling system.

Although when using the thickener on gypsum there were some issues with the rake and pluggage, the plan was successful, with the new Dewatering System producing gypsum on March 28, 2011. The next item to be accomplished was to have been a Performance Test, however on May 8, 2011, operational issues with the Dewatering System appeared whereby the dewatered gypsum took on a thixotropic nature. That is, on the drum filters it appeared solid and dry, but with force applied it would liquefy. The root cause was never fully identified; however, the solution of more fully employing the Chloride bleed capabilities of the system and periodically changing the source waters being used for the absorber tower make-up did remedy the problem.

#### Hunter Unit 2

The plan for Hunter Unit 2 was ultimately to have been the same as that employed for Huntington; i.e. complete the work necessary for oxidized FGD operation by the end of the outage and use the plant's existing thickener and waste byproduct handling system while the new Dewatering System was completed.



**Picture 4: New Hunter Dewatering Building**

To this extent, it required that the four absorber towers be thoroughly cleaned, and the new oxidation air blowers, new oxidation lances, new agitators, and new recycle pumps all be operational by outage end. It also required that the deficiencies in the existing ALRD®'s (original installation by others) be addressed. As a result of what was learned at Huntington, it was possible to complete this work scope ten-days early. Unfortunately, unlike at Huntington, the existing thickener was never able to be placed into reliable service processing gypsum post-outage. As a result, the oxidation air blowers were taken off-line until the new Dewatering System was operational in August 2011.

### Hunter Unit 1

Based on the experience gained from the work upgrading the absorber towers for both Huntington Unit 1 and Hunter Unit 2 it was agreed to accelerate the work on Hunter Unit 1 from 2013 until 2012. The methodology to be used was one-tower at a time while the unit remained in operation. The work here went smoothly with the upgrade to the final tower completed on April 12, 2012.

### Hunter Unit 1 and Unit 2 Reagent Preparatory System

The Reagent Preparatory System (RPS) at Hunter was a common replacement and upgrade to the existing individual lime prep systems for Units 1 and 2. It made use of Metso Vertimill® Lime Slakers to create high quality lime slurry for use by the FGD absorbers.

The construction work started in March 2011 with site preparation and construction was complete on March 30, 2012, with the first production of slurry and began full operations on May 3, 2012, after issues with fiberglass pipe had been resolved. A further issue resulting from an insufficient Vertimill® ball charge prevented a demonstration of full system capability until September 2012, when slurry with a 97% passing a 325-mesh grind was produced.



**Picture 5: New Reagent Prep System**

### **Challenges**

The main challenges encountered in this project dealt primarily with those compromises necessitated by the fast-track nature of the schedule. An issue encountered on both the Huntington Unit 1 work and the Hunter Unit 2 work was operation of the existing thickener/waste by-product disposal system during the period of time from when the systems

were started up in oxidized mode until the start-up of the new dewatering systems at each site. At Huntington, although the plant was able to keep the existing system in operation during this interim period of time, it did so only with significant effort.

At Hunter on Unit 2, it was not possible to keep the existing thickener/waste by-product disposal system operating with the waste by-product being gypsum. Rather, the oxidation air blowers were shut down, returning the FGD unit to un-oxidized operation. As a result, once the new Dewatering System at Hunter was completed, it was necessary to re-perform the tower cleaning that had previously been completed during the outage, in advance of the Performance Test.

Another unforeseen challenge at Huntington was the issue that first manifested itself on May 8, 2011, with the Dewatering System. The gypsum “cake” produced by the drum filters took on thixotropic characteristics; i.e on the drum filters it appeared solid and dry, but with force applied it would liquefy. Testing indicated that the gypsum crystals being produced in the absorbers had a D50 as low as 13.9  $\mu\text{m}$ , when a D50 between 40 to 60  $\mu\text{m}$  typically would be expected. Efforts were made to identify the root cause of the problem, but once a remedy of more fully employing the Chloride bleed capabilities of the system to purge the fines coupled with periodically changing the source waters being used for the absorber tower make- up was identified, the search was stopped. However, this might be a subject of interest to someone looking at areas of future research.

The final challenge experienced on the project was in getting the RPS to meet the design guarantees for grind on the system. The initial issue was the result of an inadequate ball charge being supplied for the Vertimills® – an oversight that was the result of a recent design change. As this system had been designed with the flexibility of using either Raw Water, Cooling Tower Blowdown, and Filtrate Water from the Dewatering System, or a mixture of these as the process slaking water, it took some time to identify the proper source for process and operational needs. This was accomplished by September 2012, when the Performance Test was successfully completed.

## **Benefits**

Despite the challenges encountered, the benefits to the end client were significant, not being limited to:

- Extended life of 30+ year old scrubbers and included a new Reagent Preparation System which itself is designed to last for 30-years.
- The retrofit approach facilitated faster regulatory compliance and improved efficiency.
- More efficient use of lime resulting in lower operational costs.

## **SUMMARY**

In conclusion, in January 2010 a project was undertaken to upgrade the existing flue gas desulfurization (FGD) systems and FGD waste handling systems at PacifiCorp Energy’s Hunter and Huntington Stations in order to meet permitted SO<sub>2</sub> emission requirements and extend the life of the waste products landfill disposal site. To fulfill these requirements the scope of work

generally involved providing new oxidation air blowers, new oxidation lances installed in the absorber towers, new horizontal agitators, new tanks, new hydroclones, new drum filters, many new slurry pumps, new gypsum conveyors, new gypsum stack-out pads, new buildings, new electrical systems to power the new equipment, and new buildings at both Huntington and Hunter sites. In addition, at Hunter, a new lime Reagent Prep System (RPS) was also required which consisted of new storage silos, Metso Vertimill® Lime Slakers, pumps, tanks, and a new electrical system.

Despite the large scope of supply, the project was also extremely fast track. The signed contract was received on January 6, 2010 and by September 18, 2010 – only 8-months later– Huntington Unit 1 was in outage and all outage related work needed to be complete before November 22, 2010. Additionally, Hunter Unit 2 entered an outage on February 26, 2011, only 3-months later, with an outage completion date scheduled for April 30, 2011. The plan was to complete the new RPS work in 2012 and then move on to Hunter Unit 1, which was to be complete by May 25, 2013, but ultimately was completed on April 12, 2012.

The project overcame several challenges dealing with the fast-track schedule requirements, typical vendor quality issues, an unforeseen issue in the operation of the new Dewatering System at Huntington, and start-up issues on the RPS system to benefit the client. These benefits included, but were not limited to, extending the life of 30+ year old scrubbers, lower costs to retrofit vs. building new units, and facilitating faster regulatory compliance and improved efficiency.

## **KEYWORDS**

MET, PacifiCorp, Hunter Station, Huntington Station, flue gas desulfurization, lime-based flue gas desulfurization, FGD, SO<sub>2</sub>, absorber