Response to NPPD Questions on Materials of Construction Paper

## Introduction

This paper is an addendum to the original materials of construction report that was prepared for NPPD in 2009 (NPPD-SL-0237). This addendum defines what will be specified in the Gerald Gentleman Station (GGS) wet FGD system specification.

Currently the GGS wet FGD specification includes absorbers constructed of 2205. The industry initially expected that an FGD system constructed of this material would have an operating limitation where the recycle slurry stream [$Cl^-$] would be maintained below 12,000 ppm. However, even at 12,000 ppm [$Cl^-$] this material is not corrosion free. Since the original report, Sargent & Lundy (S&L) has become aware of many 2205 absorbers experiencing corrosion. There are a significant number of absorbers in the United States that are constructed of 2205, and many of them have had corrosion problems. EPRI is currently doing an evaluation at these installations to determine the root cause of the corrosion. To date, the issue with 2205 corrosion has not been resolved therefore, S&L would no longer recommend the absorbers be constructed of this material.

S&L recommends that the FGD specification be written based on the use of a tile-lined absorber with a maximum [$Cl^-$] limit between 30,000 to 50,000 ppm, with the exact value derived by the FGD vendors during the bid process. Since the original report, NPPD has decided that the plant will not discharge any wastewater other than what is being discharged currently. Therefore, any wastewater (blowdown) generated from the wet FGD system will either have to be disposed of within the plant or treated with a Zero Liquid Discharge (ZLD) system. Specifying a tile-lined absorber will offer the advantage of potentially having zero blowdown and therefore no wastewater treatment equipment. The original report also evaluated the features of the various solids disposal methods, including gypsum stack, drum filters and belt filters. Since then, NPPD and S&L have set the philosophy for specifying the mechanical dewatering of gypsum via belt filters and disposal of the gypsum byproduct in a landfill. This will give NPPD the flexibility to sell the gypsum byproduct if a market for this material opens up in the future.

## Capacity of Tile Suppliers

Both Stebbins and Universal Blastco, two of the tile suppliers in the industrial and power industries were contacted to determine what their current and expected capacity is for supplying tile-lined absorbers. Stebbins responded that in the 2007-2008 timeframe, they installed 11 tile-lined absorbers with no problems. Both Stebbins and Universal Blastco said they did not foresee any issue with the availability of raw materials or field personnel in the 2015-2016 timeframe. If for some reason the tile market becomes saturated in the future and NPPD cannot get the material specified, S&L would recommend a flake-glass lined carbon steel absorber. A discussion of flake-glass lined absorbers was provided in the original 2009 report.

It should be noted that Universal Blastco currently does not have any tile-lined absorber installations at 30,000 ppm [$Cl^-$] in the power industry. They have installed tile-lined Hydrodesulfurization (HD) Towers, which are similar to scrubbers except they are built upside down with a design of up to 70,000 ppm [$Cl^-$]. Universal Blastco's main contribution in the power industry has been installations of tile-lined tanks in FGD application.

## Stebbins Cracking

S&L is aware of a few Stebbins installations that have been subject to cracking. There are 9 installations (all Southern Company) that S&L is aware of where the cracking occurred. All of the Southern Company plants where the cracking occurred were Advatech systems with large rectangular concrete shells in lieu of the traditional round towers. Stebbins was contacted in order to understand more fully why the cracking occurred at these installations. It appears that the reason for the cracking is due to shrinkage in the long rectangular flat concrete wall. This shrinkage is normal for concrete, however, Stebbins has concluded that it is more susceptible in long flat walls.

All of these installations also saw "damp" areas on the outside of the wall during the initial startup of the system, however there were no leaks reported. The damp areas seemed to have developed due to the temperature differential in the concrete and the internal liquid as the absorber was being filled during startup. Some damp areas are due to the concrete curing which goes away within a few weeks and no action is required. Other damp ares, as mentioned above is

due to scrubber slurry migrating through the vessel during startup. According to Stebbins, these damp areas typically go away within 30 days of startup.

Even though the cracking is more susceptible in long rectangular concrete sections, Ameren's Sioux Station also experienced cracking. However, the cracking did not occur in the carbon steel shell, rather the internal tiles in a localized spot around the large access door. The initial design, including the shear stress limits, of the absorbers at Sioux Station were not based on using Stebbins tile. Stebbins was contracted later in the project when a large part of the design was already completed. One of the main differences between Sioux and the Southern Company installations is that Southern Company had wide spread cracking along the exterior of the rectangular wall, however at Sioux, the crack was localized to around the access door and was internal to the absorber.

## Capital Cost

FGD vendors were contacted to determine the current-day material and equipment cost of a tile-lined absorber for GGS. The budgetary quotes received averaged approximately $110M for both GGS Units. To put this cost into perspective, FGD vendors were contacted to determine how this present day cost changed from 2009. The budget prices for the FGD system have decreased by approximately 10% from 2009 to current day, for the Stebbins design absorbers. Therefore, S&L believes that the tile-lined absorber is still a cost-effective approach for the wet FGD system. For comparison purposes, S&L also asked for the delta material and equipment cost of a flake-glass lined absorber. The flake-glass lined absorber budget price is also approximately 10% less from 2009 to current day. However, as stated in the original study, there are other maintenance costs associated with the flake-glass lining such as replacement every 10 years and associated outage costs that would tend to increase the overall cost. There have been some poor installations of flake-glass that have led to increased O&M costs to repair and replace.

## Conclusion

The use of a tile-lined absorber and an operating [$Cl^-$] level of 30,000 ppm is still the recommended option for the wet FGD specification for GGS. The tile-lined absorber is the lowest risk approach when compared to a flake-glass lined absorber. However, it should be noted that the cost of the tile absorber may currently be experiencing a soft market and there is potential

for the market to become hot, which would result in a shift in the material costs and change the results of the analyses provided.

In addition, a belt filter along with a 30,000 ppm operating [$Cl^-$] level can eliminate the need for wastewater treatment for most of the coal sulfur contents. The lowest sulfur coal with the highest chlorine content would require the greatest amount of blowdown (~ 5 gpm per Unit). However, S&L believes that this minimal amount of blowdown could be disposed of within the plant itself. S&L will be preparing a plant water balance in the near future that will incorporate the wet FGD system water streams to determine if this small waste stream can be disposed of with no additional wastewater treatment equipment.