ESCO Plant 3 Phenol Reduction Demonstration

Summary of Results

ESCO's Title V Permit requires comparing phenol emissions at Plant 3 before and after the binder substitution made by ESCO in July 2013. The total Plant 3 phenol emissions are shown in Table 1 below.

Table 1: Phenol Emissions Before and After the Binder Substitution

		Phenol Emissions (tons/yr)	
Source	**Production**	**After Binder Substitution**	**Before Binder Substitution**
PCS	18,700 tmp/yr	0.86	1.83
Pug Mill/Sand Coater	514 tons resin/yr	1.04	3.69
Mold & Core Making	514 tons resin/yr	0.22	1.65
	Total	2.114	7.165

There is a 5.05 ton/yr phenol reduction achieved as a result of implementing the low phenol binder system. The resulting reduction equates to a **70.5% reduction** in phenol emissions [% reduction = (5.05/7.165) x 100%].

The substitution of the low phenol binder system at Plant 3 has successfully met the Title V permit requirement in Condition 53.b.i for achieving at least a 35% to 40% phenol emission reduction.

Background Information

The Best Work Practices section of the Oregon Title V Operating Permit (Permit Number 26-2068) requires ESCO to reduce emissions of phenol from Plant 3 by one of two methods. The permit specifies that ESCO may elect to reduce phenol emissions by installing add-on air pollution control on the pug mill or by using a substitute low phenol binder system, as stated in the following excerpted language from the permit:

> *Condition 53. Control phenol emissions from Plant 3 by electing either 53.a or 53.b.*
>
> 53.a If this option is chosen, ESCO must install and operate thermal oxidation or alternative control technology on the sand coating pug mill, ….
>
> *53.b. If this option is chosen, ESCO must substitute a low phenol binder system for the binder system on which the phenol emissions factors in the Detail Sheets described in Condition 69.c are based.*

ESCO elected to substitute a low phenol binder system and performed the required source tests [Title V Permit Condition 53.b.ii and Condition 72] on all of the significant Plant 3 phenol sources including the pug mill exhaust, mold and core making vent, and the pouring, cooling and shakeout (PCS) exhaust to demonstrate the effectiveness of the binder substitution. The results

of the August 2013 source testing are presented in the October 2013 source test report prepared by Horizon Engineering.

The methodology to be used in the phenol reduction demonstration is defined in Condition 53.b.i of the Title V permit:

> *Condition 53.b.i The new low phenol binder system must achieve a combined reduction in phenol emissions from all Plant 3 sources of at least 35 to 40% compared to emissions calculated using the 2006 and 2007 pug mill source tests and the other emissions levels described in the Detail Sheets. To ensure consistency in the comparison, the calculation shall be made using the same production levels set forth in the Detail Sheets, and taking into account any changes in binder use as a result of the change in binders.*

The emission factors from the recent source tests, from the 2006/2007 pug mill source tests and from the Detail Sheets are presented in Table 2.

Table 2: Phenol Emission Factors

		Phenol Emission Factors			
Source	**Units**	**August 2013 Test**	**Permit Detail Sheets**	**2006 Test**	**2007 Test**
PCS	lb/tmp	0.087	0.186		
Pug Mill/Sand Coater	lb/T resin	4.03		15.1	13.6
Mold & Core Making	lb/T resin	0.64	5.76		

The phenol emissions from Plant 3 after the low phenol binder system was implemented were calculated using the production rates from the permit Detail Sheets and the August 2013 source test emission factors. As directed by the permit (Condition 53.b.i) the estimate of phenol emissions before the low phenol binder system substitution was made using the same production rates from the permit Detail Sheets, the average of the 2006 and 2007 emission factors from the tests on the pug mill, and the emission factors used in the permit Detail Sheets for the PCS and Mold & Core Making sources. The resulting total phenol emissions are presented in Table 1 in the summary above.

An example of an emission calculation is:

Pug Mill Emissions before the Binder Substitution

Emissions (tons/yr) = $\mathbf{514}\ \frac{tons\ resin}{yr} \times \left(\frac{15.1+13.6}{2}\right) \frac{lbs\ phenol}{tons\ resin} \times \frac{ton\ phenol}{2000\ lbs\ phenol}$

Emissions (tons/yr) = $\mathbf{514}\ \frac{tons\ resin}{yr} \times \mathbf{14.35} \frac{lbs\ phenol}{tons\ resin} \times \frac{ton\ phenol}{2000\ lbs\ phenol}$

Emissions (tons/yr) = $\mathbf{7376}\ \frac{lbs\ phenol}{yr} \times \frac{ton\ phenol}{2000\ lbs\ phenol} = \mathbf{3.69}\ \frac{tons\ phenol}{yr}$

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