



# NETL Life Cycle Inventory Data

## Process Documentation File

**Process Name:** Coal-Loading Silo, 12,000 Tons, Powder River Basin (PRB), Construction

**Reference Flow:** 1 piece (pcs) of Coal-Loading Silo, 12,000 Tons, PRB

**Brief Description:** Based on specifications for a Powder River Coal Corp, 12,000-ton coal silo, used for railcar loading of PRB sub-bituminous coal at the mine site. Assumes silo constructed of steel and concrete, with negligible amounts of other materials.

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### Section I: Meta Data

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**Geographical Coverage:** US      **Region:** Wyoming

**Year Data Best Represents:** 2006

**Process Type:** Manufacturing Process (MP)

**Process Scope:** Gate-to-Gate Process (GG)

**Allocation Applied:** No

**Completeness:** Individual Relevant Flows Recorded

**Flows Aggregated in Data Set:**

Process       Energy Use       Energy P&D       Material P&D

**Relevant Output Flows Included in Data Set:**

Releases to Air:     Greenhouse Gases     Criteria Air Pollutants     Other

Releases to Water:  Inorganic Emissions     Organic Emissions     Other

Water Usage:       Water Consumption       Water Demand (throughput)

Releases to Soil:     Inorganic Releases     Organic Releases     Other

**Adjustable Process Parameters:**

**Tracked Input Flows:**

Steel Plate, BF (85% Recovery Rate) [Metals]      *Steel plate from blast furnace (BF) used to construct shearer, assumes 85% recycled/recovery rate*

Concrete, ready mix, R-5-0 [Concrete\_Cement]      *Mixed concrete used for the construction of the silo*



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### Tracked Output Flows:

Steel Coal-Loading Silo,  
12,000 tons, PRB

*Construction of a single, 12,000-ton, coal-loading silo*

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## Section II: Process Description

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### Associated Documentation

This unit process is composed of this documentation and the data sheet (DS) *DS\_Stage1\_C\_Coal\_Loading\_Silo\_PRB\_2010.01.xls*, which provides additional details regarding relevant calculations, data quality, and references.

### Goal and Scope

The scope of this unit process covers the materials required for the construction of a single, 12,000-ton, steel-and-concrete, coal-loading silo, used to load PRB sub-bituminous coal into railcars. The unit process is based on the reference flow of 1 piece of coal-loading silo under Life Cycle (LC) Stage #1, as described below and shown in **Figure 1**. The coal-loading silo is assumed to be constructed of steel plate and concrete; other materials are assumed to be negligible.

This coal-loading silo construction unit process, along with other construction unit processes for PRB sub-bituminous coal preparation equipment, is combined in a separate assembly process for PRB sub-bituminous coal processing, *DF\_Stage1\_C\_Assembly\_PRB\_Coal\_Surface\_Mine\_2010.01.doc*. This assembly unit process quantifies the fraction of each piece of equipment needed under LC Stage #1 to produce 1 kg of PRB sub-bituminous coal ready for transport (LC Stage #2) to the energy conversion facility (LC Stage #3). Surface coal mine operations are modeled in *DS\_Stage1\_O\_CoalMine\_PRB\_2010.01.xls*, which quantifies the extraction and preparation of 1 kg of coal.

### Boundary and Description

Construction of the coal-loading silo is based on available data for the construction of a PRB coal-loading silo. Heights for PRB coal loading silos range between 220 and 240 feet tall, while the width appears to be a third of the height (PRC 2009). It is assumed that the thickness of the walls and ceiling is two feet, while the base of the structure is eight feet thick. The coal-loading silo is used to load coal into individual rail cars at the PRB sub-bituminous coal mine site.

**Figure 1** provides an overview of the boundary of this unit process. Emissions related to the physical assembly of the loading silo (e.g., emitted when putting together the components of the silo, including transport of the components) are not considered in this study. Upstream emission from the production of raw materials used in the construction of the loading silo (e.g., steel plate) are calculated outside the boundary of this process, based on proprietary profiles available within the GaBi model. As shown

in **Figure 1** and discussed above, the loading silo constructed in this unit process is incorporated into the construction assembly process for LC Stage #1.

The weight of the silo was not readily available. Based on the dimensions of the loading silo discussed above, weights were calculated. The silo is assumed to be 15% steel plate, with the remaining 85 percent assumed to be concrete.

The dimensions and weights of materials for the silo are provided in **Table 1**. The shape of the silo is a cylinder with a hole at the bottom for the trains to pull under, to facilitate loading into the railcars. **Table 2** summarizes the modeled input and output flows of the unit process. Additional details regarding input and output flows, including calculation methods, are contained in the associated DS.

**Figure 1: Unit Process Scope and Boundary**

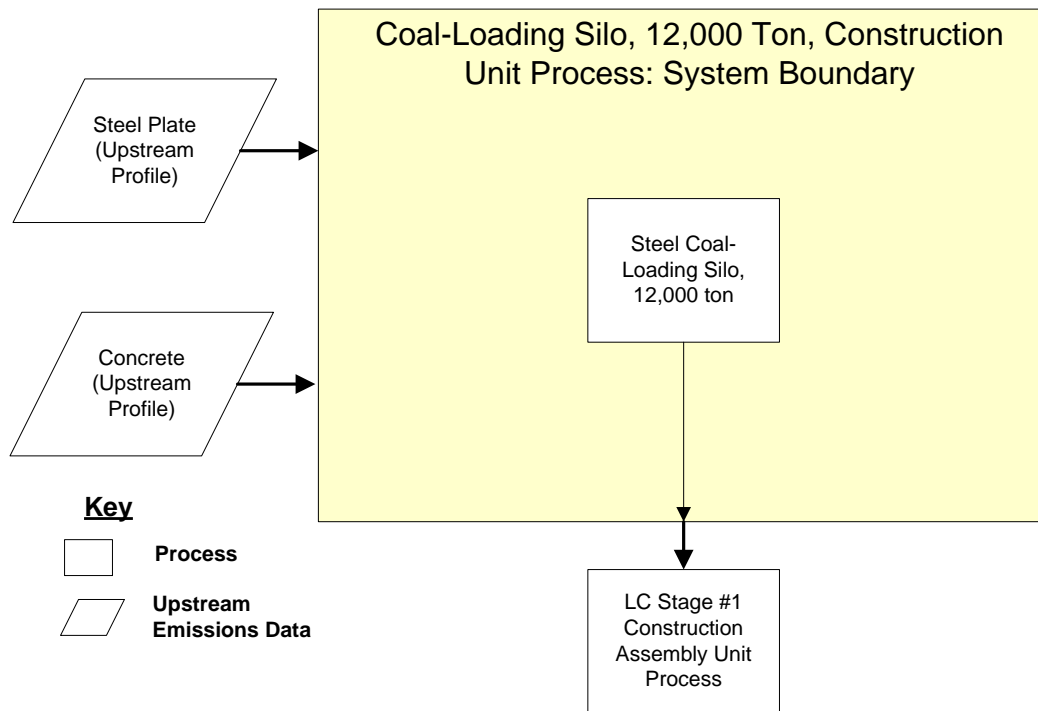


Table 1. Properties of the Steel Coal-Loading Silo

Property	Value	Reference
Silo Height, m (ft)	70.1 (230)	PRC 2009
Silo Diameter, m (ft)	23.4 (76.7)	NETL Engineering Judgment
Wall/Ceiling Thickness, m (ft)	0.6 (2)	NETL Engineering Judgment
Base Thickness m (ft)	2.4 (8)	NETL Engineering Judgment
Steel Volume, m <sup>3</sup> (ft <sup>3</sup> )	667 (23,544)	NETL Engineering Calculation
Concrete Volume, m <sup>3</sup> (ft <sup>3</sup> )	3778 (133,414)	NETL Engineering Calculation

Table 2: Unit Process Input and Output Flows

Flow Name*	Value	Units (Per Reference Flow)
<b>Inputs</b>		
<b>Steel cold-rolled (St) [Metals]</b>	<b>5,220,113</b>	<b>kg</b>
<b>Concrete, ready mix, R-5-0 [Concrete_Cement]</b>	<b>5,689,456</b>	<b>kg</b>
<b>Outputs</b>		
Steel Coal-Loading Silo, 12000 tons, PRB [Construction]	1.00	piece

\* **Bold face** clarifies that the value shown *does not* include upstream environmental flows. Upstream environmental flows were added during the modeling process using GaBi modeling software, as shown in Figure 1.

### Embedded Unit Processes

None.

### External References

PRC 2009 Powder River Coal Company. 2009. Powder River Coal Company, Gillette, Wyoming. <http://www.ccsd.k12.wy.us/mines/PR/Silos.html> (Accessed December 18, 2009).

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**Section III: Document Control Information**

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**Date Created:** February 11, 2010  
**Point of Contact:** Timothy Skone (NETL), Timothy.Skone@NETL.DOE.GOV  
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