NETL Life Cycle Inventory Data
Process Documentation File

Process Name: Coal Cleaning Facility, Construction

Reference Flow: 1 piece (pcs) of Coal Cleaning Facility

Brief Description: Construction process that includes material requirements for the construction of a coal cleaning facility, which is a steel building used to house coal cleaning equipment.

Section I: Meta Data

Geographical Coverage: United States **Region:** N/A

Year Data Best Represents: 2009

Process Type: Manufacturing Process (MP)

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

Allocation Applied: No

Completeness: Individual Relevant Flows Captured

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	☐ Other
Releases to Water:	☐ Inorganic	☐ Organic Emissions	☐ Other
Water Usage:	☐ Water Consumption	☐ Water Demand (throughput)	
Releases to Soil:	☐ Inorganic Releases	☐ Organic Releases	☐ Other

Adjustable Process Parameters:

Concrete	*[kg] Concrete cement for construction of cleaning facility*
Rebar	*[kg] Rebar wire installed for construction of cleaning facility*
Steel	*[kg] Stainless steel, cold-rolled, required for construction of cleaning facility*
Zinc	*[kg] Zinc required for galvanized steel in the construction of cleaning facility*

Facility	*[pcs] Material required in the construction of a cleaning facility*

Tracked Input Flows:

Concrete, ready mix, R-5-0 [Concrete_Cement]	*[Technosphere]*
Rebar Wire Rod [Installation]	*[Technosphere]*
Stainless steel (cold rolled) [Metals]	*[Technosphere]*
Zinc [Metals]	*[Technosphere]*

Tracked Output Flows:

Cleaning Facility [Construction]	*Reference flow*

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage1_C_Coal_Cleaning_Facility_2014.01.xlsx*, which provides additional details regarding relevant calculations, data quality, and references.

Goal and Scope

This unit process provides a summary of relevant input and output flows associated with the construction of a steel building to be used to house coal cleaning equipment; a steel building with a reinforced concrete slab as a foundation. This process encompasses all of the materials that are required for construction. Input flows include concrete cement, rebar wire, cold-rolled stainless steel, and zinc for the use of zinc-galvanized steel panels. The reference flow of this unit process is: 1 piece (pcs) of Coal Cleaning Facility

Boundary and Description

This process encompasses all of the materials that are required in the construction of a steel building to be used to house coal cleaning equipment; a steel building with a reinforced concrete slab as a foundation. The concrete slab will also serve as the first floor of the building. Carbon steel I-beams (high-strength, low alloy) will form the exterior frame of the buildings as well as each of the other five floors, plus the roof (Saginaw, 2009). The walls and roof of the facility will be constructed out of zinc-

galvanized steel panels (Bay Area Rapid Transit, 2004; Buildings Direct, 2009; Steel Building, 2009; Engineers Edge, 2009).

The exterior of the building will be 100 ft. long × 60 ft. wide (NETL, 2010). Vertical I-beams will be spaced every 20 ft. along all four walls. Horizontal I-beams will form the floors from the second level up to and including the roof (six total levels). Each level will be 14 ft. tall, for a total building height of 84 ft (NETL, 2010). The I-beams for the floor will be spaced every 20 ft., running horizontally both the length and width of the building. The weight of the steel for the I-beams will be determined by taking the average of four beams with a depth of 12 in.

The exterior of the building, all four walls and the roof, will be clad in 26-gauge zinc-galvanized carbon steel panels (Buildings Direct, 2009; Engineers Edge, 2009; Steel Building, 2009). The zinc is a layer with a volume of approximately 1.25 ounces per square ft (oz/ft^2) of steel panel (Bay Area Rapid Transit, 2004).

The foundation of the building, which will also serve as the ground floor, will be constructed using a 4,000 psi mix of concrete (NETL, 2010). The concrete foundation will be reinforced by size #4 carbon steel rebar running horizontally over both the length and the width of the concrete. The rebar will be evenly spaced every 12 in. in both directions, and has a cross-sectional area of 0.20 in^2 (CRSI, 2008). The perimeter of the slab must be located below the frost line, which is located 21 in. below ground level at the mine location (Weather Bureau, 2008). The exterior of the concrete slab will extend an additional 6 in. below the frost line and will be 18 in. thick around the perimeter. The interior of the concrete slab will be 1 in. thick.

The flooring for each level of the building is assumed to consist of steel grating. This weight is excluded from these calculations due to the assumption they will be balanced by the sections of the interior I-beams that will be removed for stairways and to accommodate large pieces of equipment.

The weight of each material used in the coal cleaning facility was calculated separately. The materials were cold-rolled steel for the I-beams and the exterior paneling, zinc for the galvanization of the paneling, rebar for reinforcing the concrete foundation, and concrete for the building foundation. The input and output flows for the construction of the coal cleaning facility is illustrated in **Figure 1** below.

Figure 1: Unit Process Scope and Boundary

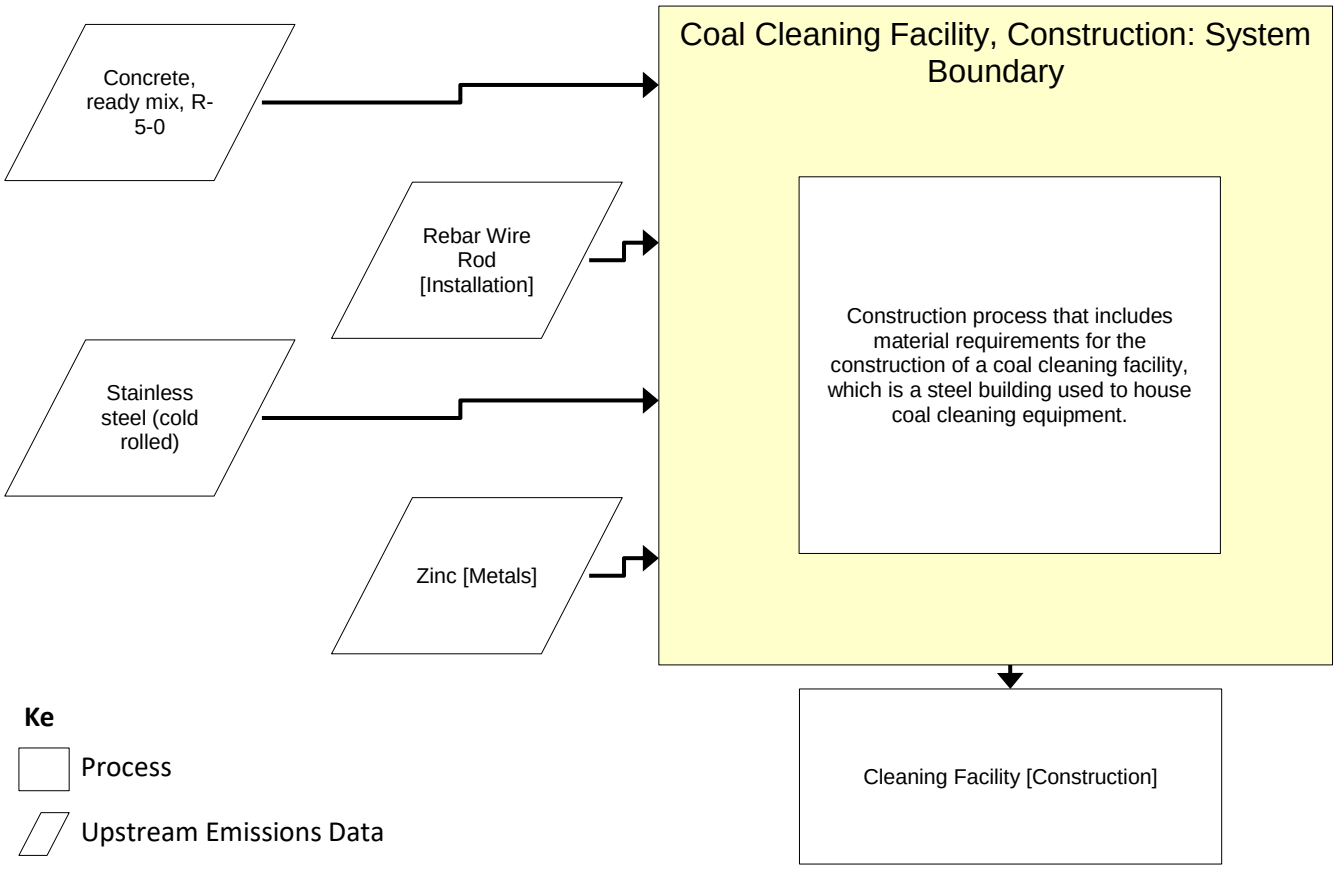

Table 1: Conversion Factors Utilized in Calculating Construction Material Requirements

Conversion Factor	Value	Units	Reference
Cold-rolled steel density	0.284	lb/in^3	Steel Building, (2009)
4,000 psi concrete density	145	lb/ft^3	NETL, (2010)
I-beam weight	39.4	lb/ft	Saginaw, (2009)
Steel sheet thickness	0.0179	in/sheet	Engineers Edge, (2009)
Zinc coating thickness	1.25	oz/ft^2	Bay Area Rapid Transit, (2004)

Table 2: Unit Process Input and Output Flows

Flow Name	Value	Units (Per Reference Flow)
Inputs		
Concrete, ready mix, R-5-0 [Concrete_Cement]	**4.49E+05**	**kg**
Rebar Wire Rod [Installation]	**3.61E+03**	**kg**
Stainless steel (cold rolled) [Metals]	**1.16E+05**	**kg**
Zinc [Metals]	**1.17E+03**	**kg**
Outputs		
Cleaning Facility [Construction]	**1.00**	**kg**

* **Bold face** clarifies that the value shown *does not* include upstream environmental flows.

Embedded Unit Processes

None.

References

Bay Area Rapid Transit (2004) — Bay Area Rapid Transit (2004). BART Facilities Standards, Section 07 60 00 [cited November 10, 2008] Available from: http://www.bart.gov/docs/STD_SPEC/076000.pdf.

Buildings Direct (2009) — Buildings Direct (2009). Paneling System. Buildingsdirect.net [cited February 17, 2009] Available from: http://buildingsdirect.net/building-products_paneling.html.

CRSI (2008) — CRSI, Concrete Reinforcing Steel Institute. (2008). "ASTM Standard Inch-Pound Reinforcing Bars". http://www.crsi.org/rebar/metric.html.

Engineers Edge (2009) — Engineers Edge (2009). Sheet Metal Gauge Sizes. Engineersedge.com [cited February 17, 2009] Available from: http://www.engineersedge.com/gauge.htm

NETL (2010) — NETL. (2010). Life Cycle Analysis: Supercritical Pulverized Coal (SCPC) Power Plant. (DOE/NETL-403/110609). Pittsburgh, PA: National Energy Technology Laboratory, Retrieved May 9, 2014, from http://www.netl.doe.gov/File%20Library/Research/Energy%20Analysis/Life%20Cycle%20Analysis/SCPC-LCA-Final-Report---Report---9-30-10---Final---Rev-1.pdf

Saginaw (2009)	Saginaw (2009). Steel Reference Handbook. Saginawpipe.com [cited February 19, 2009] Available from: http://www.saginawpipe.com/Saginaw_Steel_Reference_Handbook.pdf.
Steel Building (2009)	Steel Building (2009). General Specification for Steel Buildings. Steelbuilding.com [cited February 17, 2009] Available from: http://www.steelbuilding.com/buildings/panel_specifications.htm.
Weather Bureau (2008)	Weather Bureau,(2008). Frostline Map [cited November 10, 2008] Available from: http://www.nextlevelsolutionz.com/images/Frostline_Map.jpg.

Section III: Document Control Information

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