NETL Life Cycle Inventory Data
Process Documentation File

Process Name: Hydraulic Shield, 28.2 Tons, 2 Meter, Construction

Reference Flow: 1 piece (pcs) of Hydraulic Shield, 28.2 Tons, 2 Meter

Brief Description: Based on specifications for a 2 meter wide hydraulic shield. Assumes shield constructed entirely of steel plate with negligible amounts of other materials.

Section I: Meta Data

Geographical Coverage: US **Region:** N/A

Year Data Best Represents: 2004

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 shield, assumes 85% recycled/recovery rate*

Tracked Output Flows:

Hydraulic Shield, 28.2 Tons, 2 Meter [Construction]	*Construction of a single, 28.2-ton, 2-meter wide hydraulic shield*

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage1_C_Hydraulic_Shield_28.2_Tons_2_Meter_2010.01.xls*, which provides additional details regarding relevant calculations, data quality, and references.

Goal and Scope

The scope of this unit process encompasses the weight of materials necessary to construct a single 28.2 short ton, 2 meter wide hydraulic shield, to be used during the longwall underground mining of coal. The process is based on the reference flow of 1 piece of shield, as described below, and as shown in **Figure 1.** The shield is assumed to be constructed entirely of steel; other materials are assumed to be negligible. By default, all steel within this study was assumed to be steel plate, based on available GaBi profiles, unless other steel types were specified per available data, or a higher grade of steel would be required, per NETL engineering judgment. Therefore, all steel considered in this unit process was assumed to be steel plate.

This unit process is used during Life Cycle (LC) Stage #1 to assist in the mining of Illinois No. 6 bituminous coal from an underground coal mine. It is combined with other longwall mining system equipment construction unit processes in an individual assembly unit processes for underground mining, DS_Stage1_C_Assembly_Longwall_Miner_System_2010.01.xls. This assembly unit process quantifies the fraction of each piece of underground mining equipment needed under LC Stage #1 to produce 1 kg of Illinois No. 6 bituminous coal ready for transport (LC Stage #2) to the energy conversion facility (LC Stage #3).

Boundary and Description

Construction of the shield is based on specifications for 2-meter shields installed in 2004 at the Cumberland Mine, an underground coal mine located in Waynesburg, PA. The shield supports the roof of the mine at the mine face to prevent it from collapsing.

Figure 1 provides an overview of the boundary of this unit process. Emissions related to the physical assembly of the shield (e.g., emitted while putting together the components of a shield, including transport of those components) are not considered in this study. Upstream emissions from the production of raw materials used for the construction of the shield (e.g., steel plate) are calculated outside the boundary of this unit process, based on proprietary profiles available within the GaBi model. As shown in Figure 1 and discussed above, the shield constructed in this unit process is incorporated into the longwall mining system assembly processes for LC Stage #1 for Illinois No. 6 bituminous coal mining.

The total weight of a shield was readily available, but reliable data for the material breakdown of shield subcomponents were not. Therefore, the shield

was assumed to be composed entirely of steel plate (Steel plate, BF (85% Recovery Rate) [Metals]).

Table 1 shows relevant properties and assumptions used to calculate the amount of steel plate contained in a single shield. The specifications gave a weight of approximately 25,583 kg (56,400 lbs) for one shield (Bryja 2004). Based on the assumption that the shield is constructed entirely out of steel plate, the total weight is assigned to this material. **Table 2** provides a summary of modeled input and output flows. Additional details regarding input and output flows, including calculation methods, are contained in the associated DS.

Figure 1: Unit Process Scope and Boundary

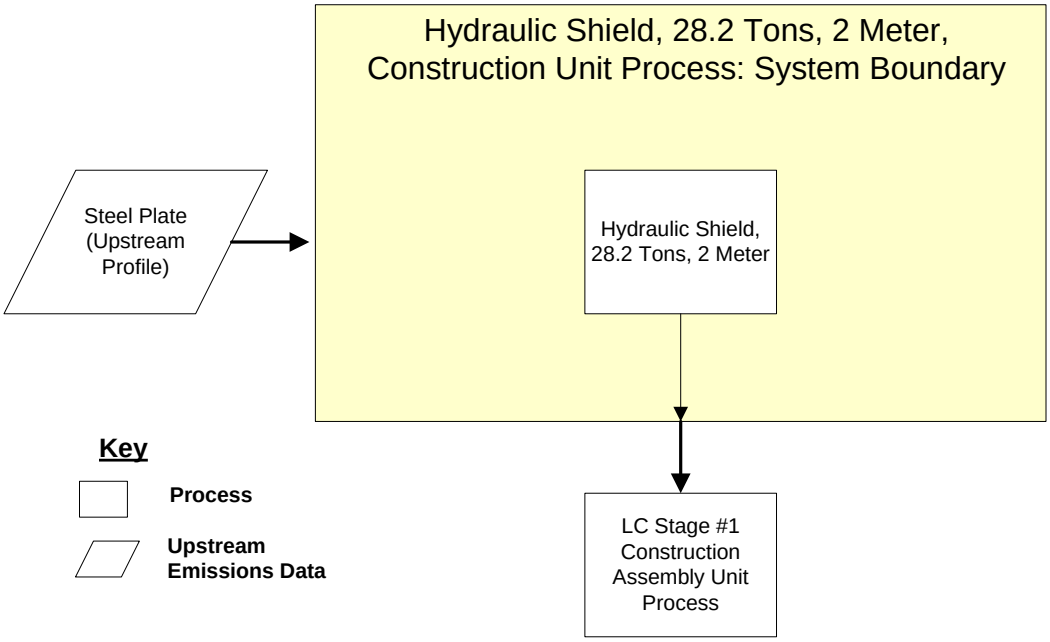

Table 1: Properties of the 28.2-Ton, 2-Meter Hydraulic Shield

Total Weight of Single Shield	Weight	Reference
One Shield Weight, kg (lbs)	25,583 (56,400)	Bryja 2004
Total Steel Plate in One Shield, kg (lbs)	25,583 (56,400)	NETL Engineering Judgment

Table 2: Unit Process Input and Output Flows

Flow Name*	Value	Units (Per Reference Flow)
Inputs		
Steel Plate, BF (85% Recovery Rate) [Metals]	**25,582.6**	**kg**
Outputs		
Hydraulic Shield, 28.2 Tons, 2 Meter [Construction]	1	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.

References

Bryja 2004 — Bryja, J.J., Conklin, D.R., Robinson, R.L., O'Neil, K. 2004. "Two Meter Shields: From Vision to Reality." *Engineering and Mining Journal*. Mining Media. http://findarticles.com/p/articles/mi_qa5382/is_200408/ai_n21354951/?tag=content;col1 (Accessed December 14, 2009).

Section III: Document Control Information

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