NETL Life Cycle Inventory Data
Process Documentation File

Process Name: Electric Shovel, 120 Tons Payload, Construction

Reference Flow: 1 piece (pcs) of Electric Shovel, 120 Tons Payload

Brief Description: The amount of steel used in the construction of one 120 short ton payload electric shovel, used to haul overburden and extract coal at a large surface mine. The shovel was assumed to be composed entirely of steel plate.

Section I: Meta Data

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

Year Data Best Represents: 2008

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 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), assumes 85 percent recovered/recycled steel, to construct an electric shovel*

Tracked Output Flows:

Electric Shovel, 120 Tons Payload [Construction]	*Construction of a single, 120 short ton payload electric shovel*

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage1_C_Electric_Shovel_120_Tons_Payload_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, 120 short ton payload electric shovel needed to haul overburden to a stockpile and to extract coal and load it into a truck at a large surface coal mine, as described below. The electric shovel is assumed to be composed entirely of steel plate. This process is based on the reference flow of 1 piece of electric shovel, as described below and shown in **Figure 1**.

This unit process is used under Life Cycle (LC) Stage #1 to assist in the movement of overburden and the extraction of coal from the coal mine. It is combined with other relevant equipment for LC Stage #1 in a separate construction assembly process, DF_Stage1_C_Assembly_PRB_Surface_Coal_Mine_2010.01.doc. The assembly process quantifies the fraction of each piece of equipment needed under LC Stage #1 to produce 1 kg of coal.

Boundary and Description

The total weight for one electric shovel was estimated to be 1,365,728 kg (3,011,000 lbs). This figure represents manufacturer specifications for the working weight of an electric shovel (Bucyrus 2008). The total weight of an electric shovel was readily available from published sources, but only minimal data for the material breakdown of shovel subcomponents were found. Therefore, the electric shovel was assumed to be composed entirely of steel plate, according to the amount indicated above.

Figure 1 provides an overview of the boundary of this unit process. Emissions related to the physical assembly of the electric shovel (e.g., emitted while assembling the components of a shovel, 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 electric shovel (e.g., steel plate) are calculated outside of the boundary of this unit process, based on proprietary profiles available within the GaBi model. As shown in Figure 1 and discussed above, the electric shovel constructed in this unit process is incorporated into the assembly process for removal of overburden and the acquisition of surface-mined Powder River Basin sub-bituminous coal under LC Stage #1.

Table 1 summarizes the relevant properties and assumptions used to calculate the amount of steel plate contained in a single electric shovel. **Table 2** provides a summary of modeled input and output flows. Additional detail regarding input and output flows, including calculation methods, is contained in the associated DS.

Figure 1: Unit Process Scope and Boundary

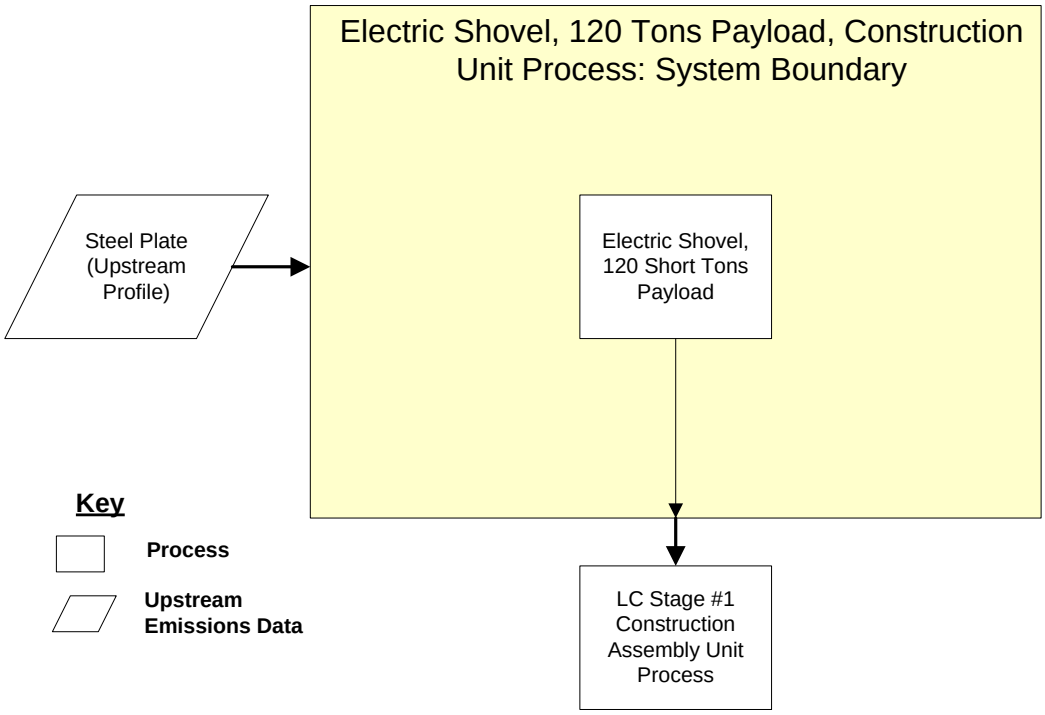

Table 1: Properties of a Single Electric Shovel

Material Composition and Weights		
Material	**Weight**	**Reference**
Average Weight of 1 Electric Shovel, kg (lbs)	1,365,728 (3,011,000)	Bucyrus 2008
Steel Plate, kg (lbs)	1,365,728 (3,011,000)	NETL Engineering Calculation

Table 2: Unit Process Input and Output Flows

Flow Name*	Value	Units (Per Reference Flow)
Inputs		
Steel Plate, BF (85% Recovery Rate) [Metals]	**1,365,728.00**	**kg**
Outputs		
Electric Shovel, 120 Tons Payload [Installation]	1	pcs

* **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

Bucyrus 2008 — Bucyrus International. 2008. *Electric Mining Shovels: The range*. Bucyrus International. http://www.bucyrus.com/media/23533/shovels%20trifold%200105.pdf (Accessed December 18, 2009).

Section III: Document Control Information

Date Created: February 15, 2009

Point of Contact: Timothy Skone (NETL), Timothy.Skone@NETL.DOE.GOV

Revision History:

Original/no revisions

How to Cite This Document: This document should be cited as:

NETL (2010). *NETL Life Cycle Inventory Data – Unit Process: Electric Shovel, 120 Tons Payload, Construction.* U.S. Department of Energy, National Energy Technology Laboratory. Last Updated: February 2010 (version 01). www.netl.doe.gov/energy-analyses (http://www.netl.doe.gov/energy-analyses)

Section IV: Disclaimer

Neither the U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) nor any person acting on behalf of these organizations:

A. Makes any warranty or representation, express or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this document, or that the use of any information, apparatus, method, or process disclosed in this document may not infringe on privately owned rights; or

B. Assumes any liability with this report as to its use, or damages resulting from the use of any information, apparatus, method, or process disclosed in this document.

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by NETL. The views and opinions of the authors expressed herein do not necessarily state or reflect those of NETL.