



NETL Life Cycle Inventory Data

Process Documentation File

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage1_C_Diesel_Motor_Grader_213_HP_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 6-cylinder, diesel-powered, 213 horsepower (HP) motor grader, to be used during the land preparation phase of biomass cultivation, specifically switchgrass. This process is based on the reference flow of 1 piece of motor grader, as described below and shown in **Figure 1**. The grader 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 process is used during Life Cycle (LC) Stage #1 to assist in the cultivation of biomass feedstocks. It is combined with other cultivation equipment construction unit processes in an individual assembly cultivation unit process for switchgrass, *DS_Stage1_C_Assembly_SG_Cultivate_2010.01.xls*. This assembly unit process quantifies the fraction of each piece of equipment needed under LC Stage #1 to produce 1 kg of biomass ready for transport (LC Stage #2) to the energy conversion facility (LC Stage #3).

Boundary and Description

Construction of the grader is based on manufacturer specifications for a diesel-powered, 213 HP, Caterpillar motor grader. The cultivation of switchgrass biomass requires a motor grader, which is used after a bulldozer for fine grading of the land and to establish a satisfactory planting surface.

Figure 1 provides an overview of the boundary of this unit process. Emissions related to the physical assembly of the grader (e.g., that are emitted while putting together the components of a grader, 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 grader (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 grader constructed in this unit process is incorporated into the cultivation assembly process for LC Stage #1 for switchgrass.

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

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 motor grader. Total weight for one grader is estimated to be approximately 15,903 kg (35,060 lbs) (Caterpillar 2009). Based on the assumption that the grader 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

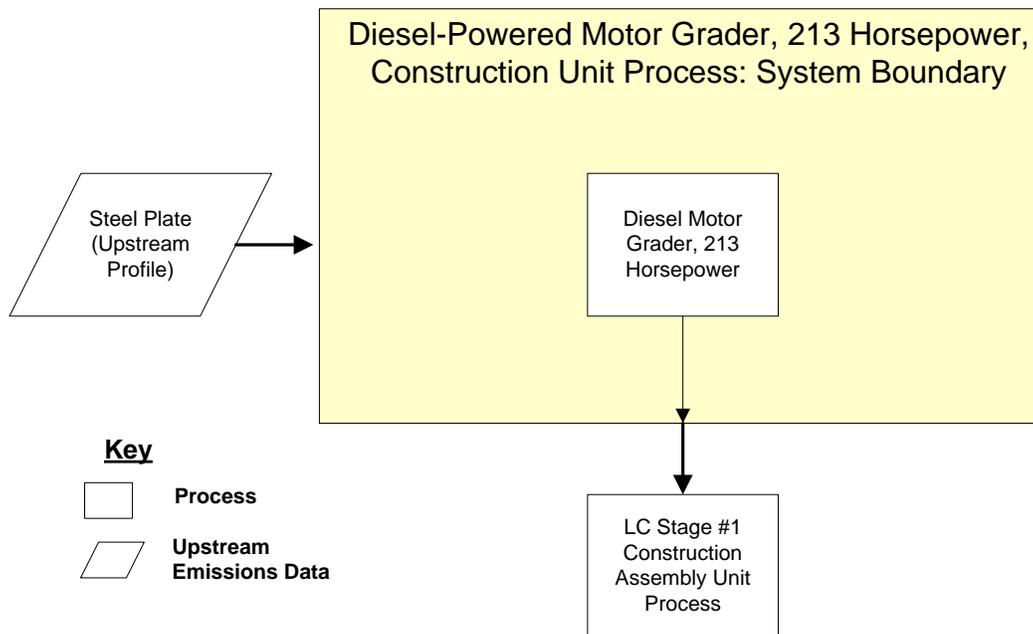


Table 1: Properties of the 213-HP, Diesel Motor Grader

Total Weight of Single Grader	Weight	Reference
One Grader Weight, kg (lbs)	15,903 (35,060)	Caterpillar 2009
Total Steel Plate in One Grader, kg (lbs)	15,903 (35,060)	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]	15,903	kg
Outputs		
Diesel Motor Grader, 213 HP [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

Caterpillar 2009

Caterpillar. 2009. *Caterpillar Products and Applications: 160M Motor Grader*. Caterpillar. <http://www.cat.com/cda/layout?m=308645&x=7> (Accessed May 28, 2009).

Section III: Document Control Information

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