NETL Life Cycle Inventory Data
Process Documentation File

Process Name: Burning Stemwood in Slash Piles

Reference Flow: 1 kg of Stemwood, burned in slash piles

Brief Description: Air emissions from the combustion of stemwood burned in slash piles

Section I: Meta Data

Geographical Coverage: United States **Region:** Inland West

Year Data Best Represents: N/A

Process Type: Auxiliary Process (AP)

Process Scope: Gate-to-Grave (End-of-Life) Process (GE)

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:

stem_flame	*[dimensionless] Fraction of stem that combusts in flame phase*
stem_smolder	*[dimensionless] Fraction of stem that combusts in smoldering phase*
stem_residual	*[dimensionless] Fraction of stem that combusts in residual phase*

ef_pm_flame	*[kg/kg] Emission factor for PM in flame phase*
ef_pm10_flame	*[kg/kg] Emission factor for PM10 in flame phase*
ef_pm25_flame	*[kg/kg] Emission factor for PM2.5 in flame phase*
ef_co_flame	*[kg/kg] Emission factor for CO in flame phase*
ef_co2_flame	*[kg/kg] Emission factor for CO_2 in flame phase*
ef_ch4_flame	*[kg/kg] Emission factor for CH_4 in flame phase*
ef_nmhc_flame	*[kg/kg] Emission factor for non-methane hydrocarbons in flame phase*
ef_ec_flame	*[kg/kg] Emission factor for elemental carbon in flame phase*
ef_oc_flame	*[kg/kg] Emission factor for organic carbon in flame phase*
ef_nox_flame	*[kg/kg] Emission factor for NOx in flame phase*
ef_nh3_flame	*[kg/kg] Emission factor for NH_3 in flame phase*
ef_voc_flame	*[kg/kg] Emission factor for VOCs in flame phase*
ef_so2_flame	*[kg/kg] Emission factor for SO_2 in flame phase*
ef_meth_flame	*[kg/kg] Emission factor for methanol in flame phase*
ef_form_flame	*[kg/kg] Emission factor for formaldehyde in flame phase*
ef_pm_smold	*[kg/kg] Emission factor for PM in smoldering or residual phases*
ef_pm10_smold	*[kg/kg] Emission factor for PM10 in smoldering or residual phases*
ef_pm25_smold	*[kg/kg] Emission factor for PM2.5 in smoldering or residual phases*

ef_co_smold	*[kg/kg] Emission factor for CO in smoldering or residual phases*
ef_co2_smold	*[kg/kg] Emission factor for CO_2 in smoldering or residual phases*
ef_ch4_smold	*[kg/kg] Emission factor for CH_4 in smoldering or residual phases*
ef_nmhc_smold	*[kg/kg] Emission factor for non-methane hydrocarbons in smoldering or residual phases*
ef_ec_smold	*[kg/kg] Emission factor for elemental carbon in smoldering or residual phases*
ef_oc_smold	*[kg/kg] Emission factor for organic carbon in smoldering or residual phases*
ef_nox_smold	*[kg/kg] Emission factor for NOx in smoldering or residual phases*
ef_nh3_smold	*[kg/kg] Emission factor for NH_3 in smoldering or residual phases*
ef_voc_smold	*[kg/kg] Emission factor for VOCs in smoldering or residual phases*
ef_so2_smold	*[kg/kg] Emission factor for SO_2 in smoldering or residual phases*
ef_meth_smold	*[kg/kg] Emission factor for methanol in smoldering or residual phases*
ef_form_smold	*[kg/kg] Emission factor for formaldehyde in smoldering or residual phases*

Tracked Input Flows:

Tracked Output Flows:

Burning, Stemwood in Slash Piles, INW	*Reference flow*

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage1_O_Burning_Stemwood_in_Slash_ Piles_2013.01.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 burning stemwood in slash piles at the landing or in the woods. The reference flow of this unit process is: 1 kg of Stemwood, burned in slash piles

Boundary and Description

Stemwood that is burned in slash piles produces a number of atmospheric emissions that may cause human health and environmental impacts. Emissions depend on if the wood is burning with a flame or smoldering. Additionally, some fraction of the stemwood may not burn, and will end up as residue. For stemwood, 60 percent burns with a flame, 30 percent smolders, and 10 percent ends up as residual.

Figure 1: Unit Process Scope and Boundary

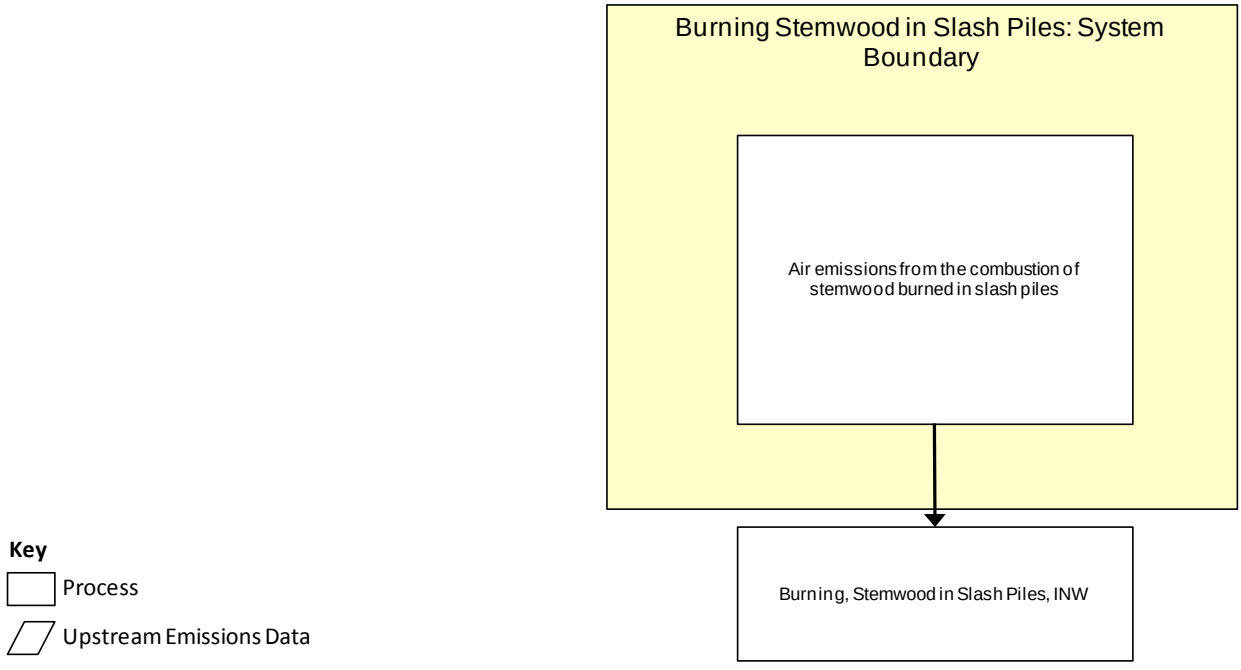

Table 1: Stemwood Combustion Factors

Emission Species	Flame (kg/dry kg)	Smolder (kg/dry kg)
PM	6.20E-03	9.95E-03
PM10	3.70E-03	8.00E-03
PM2.5	3.30E-03	7.00E-03
CO	2.63E-02	6.52E-02
CO2	1.57E+00	1.57E+00
CH4	1.64E-03	5.52E-03
NMHC	1.78E-03	3.39E-03
Elemental Carbon	2.38E-04	5.04E-04
Organic Carbon	1.78E-03	3.78E-03
NOx	2.50E-03	2.50E-03
NH3	1.92E-04	4.76E-04
VOC	2.24E-03	5.54E-03
SO2	8.30E-04	8.30E-04
Methanol	2.61E-04	6.45E-04
Formaldehyde	4.21E-04	1.04E-03

Table 2: Unit Process Input and Output Flows

Flow Name	Value	Units (Per Reference Flow)
Inputs		
Carbon dioxide [Inorganic emissions to air]	1.83	kg
Outputs		
Burning, Stemwood in Slash Piles, INW	**1.00**	**kg**
Carbon dioxide [Inorganic emissions to air]	1.57	kg
Methane [Organic emissions to air (group VOC)]	3.19E-03	kg
Carbon monoxide [Inorganic emissions to air]	1.57	kg
NMVOC (unspecified) [Group NMVOC to air]	2.42E-03	kg
Dust (unspecified) [Particles to air]	7.70E-03	kg
Dust (PM10) [Particles to air]	5.42E-03	kg
Dust (PM2.5) [Particles to air]	4.78E-03	kg
Elemental carbon [emission to air]	3.44E-04	kg
Organic carbon [emission to air	2.58E-03	kg
Nitrogen oxides [Inorganic emissions to air]	2.50E-03	kg
Ammonia [Inorganic emissions to air]	3.06E-04	kg
VOC (unspecified) [Organic emissions to air]	3.56E-03	kg
Sulphur dioxide [Inorganic emissions to air]	8.30E-04	kg
Methanol [Group NMVOC to air]	4.15E-04	kg
Formaldehyde (methanal) [Group NMVOC to air]	6.70E-04	kg

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

Embedded Unit Processes

None.

References

Johnson *et al.* 2012 — Johnson, L., Lippke, B., & Oneil, E. (2012). Modeling Biomass Collection and Woods Processing Life-Cycle Analysis. Forest Products Journal, 62(4), 258-272.

Battye *et al.* 2002 — Battye, W and R Battye. 2002. Development of Emissions Inventory Methods for Wildland Fire. Final Report for Environmental Protection Agency, Research Triangle Park, North Carolina. EPA Contract No 68-D-98-046. February. 77p.

Prichard *et al.* 2006 — Prichard, S, R Ottmar and G Anderson. 2006. Consume 3.0 User's Guide. Pacific Wildland Fire Sciences Laboratory, Pacific Northwest Research Station, USDA Forest Service. Seattle, Washington. 231p.

Section III: Document Control Information

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