NETL Life Cycle Inventory Data
Process Documentation File

Process Name: Water use and quality from surface mining of coal

Reference Flow: 1 kg of coal

Brief Description: Water use and quality from surface mining of coal, based on data for PRB mines.

Section I: Meta Data

Geographical Coverage: US **Region:** US

Year Data Best Represents: 2008

Process Type: Extraction Process (EP)

Process Scope: Cradle-to-Gate Process (CG)

Allocation Applied: No

Completeness: All 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:

Water_Consumed	*[L/kg coal] L of water consumed during mining per kg coal produced*
pct_fresh_srf	*[dimensionless] Fraction of water consumption that is from fresh surface water*
usr_fresh_gnd	*[dimensionless] Fraction of water consumption that is from fresh ground water*
usr_sal_gnd	*[dimensionless] Fraction of water consumption that is from saline ground water*

auto_calc_wtr	*[dimensionless] Variable to determine if fresh and saline ground water are automatically calculated. If 0, user is responsible for ensuring fractions add up to 1.*
water_pct_total	*[dimensionless] Sum of water fractions (for user verification of water fractions)*
Water_Produced	*[L/kg coal] L of water produced during mining per kg coal produced*
EF_w_Al	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_arsenic	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_barium	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_BOD	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_Boron	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_Cadmium	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_Calcium	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_C_TOC	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_COD	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_Cr	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_Cu	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_Cn	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_F	*[kg/L water] kg of water quality constituent per L of water produced*

EF_w_Iron	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_Lead	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_Mg	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_Mn	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_Hg	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_Ni	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_nitrxte	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_N_amm	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_N_total	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_P	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_Selenium	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_Na	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_TDS	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_TSS	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_Stront	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_sulfate	*[kg/L water] kg of water quality constituent per L of water produced*
EF_w_Zinc	*[kg/L water] kg of water quality constituent per L of water produced*

Tracked Input Flows:

none

Tracked Output Flows:

Coal, water	*Reference flow of coal, used to scale water flows per unit of coal extracted*

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage1_O_Surface_Coal_Mine_Water_2013.02.xlsx*, which provides additional details regarding calculations, data quality, and references as relevant.

Goal and Scope

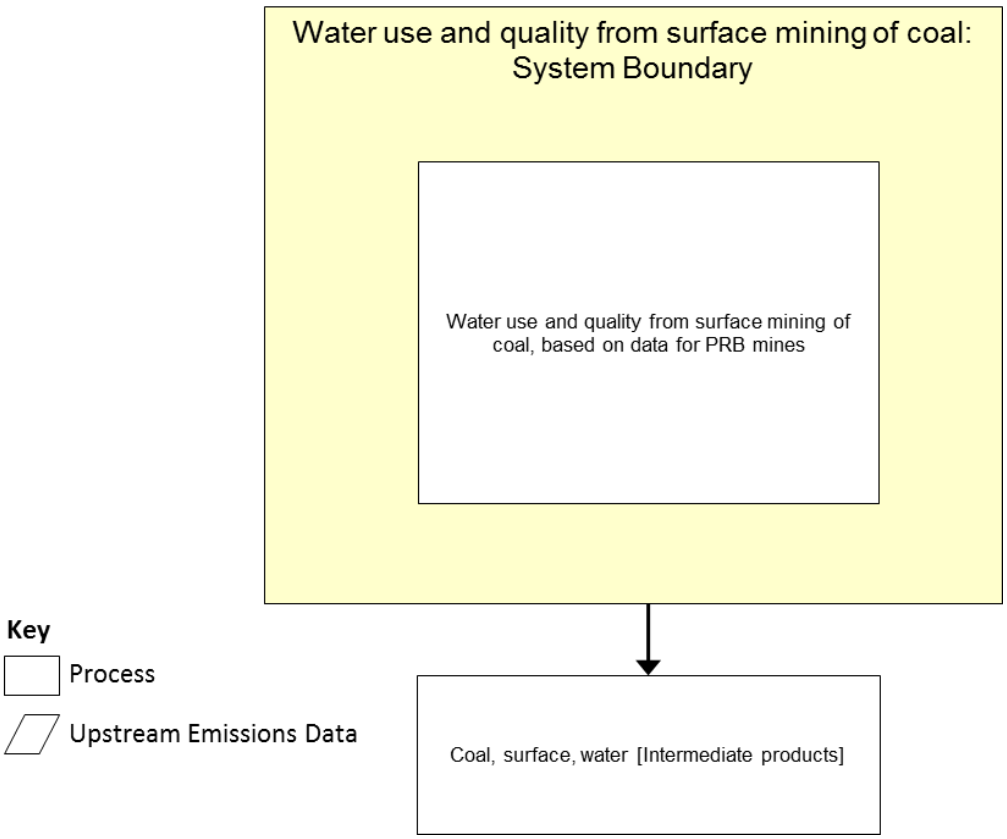
The scope of this process covers the water use and water quality for surface mining of coal. The process is based on the reference flow of 1 kg of cleaned, crushed coal, as shown in **Figure 1.** Water flows include water required for mining and cleaning operations and wastewater flows. Storm water is included in the inventory for wastewater flows.

Boundary and Description

This unit process is based on water data for the surface mining of coal in the Powder River Basin. It is assumed that all surface mines have similar water use and quality profiles.

Figure 1 provides an overview of the boundary of this unit process.

Figure 1: Unit Process Scope and Boundary



Water use was estimated based on an environmental impact study completed on West Antelope II mine located in the Powder River Basin of Wyoming (BLM 2008). Water emissions, including flows and concentrations of relevant inorganic constituents and solids entering the waterstream, were taken from available National Pollutant Discharge Elimination System permit reporting documentation (NPDES 2009).

Table 1 shows the input and output flows of this unit process. Additional details regarding input and output flows, including calculation methods, are contained in the associated DS sheet.

Table 1: Unit Process Input and Output Flows

Flow Name	Value	Units (Per Reference Flow)
Inputs		
Water (ground water, fresh) [Water]	1.44E-02	L
Water (ground water, saline) [Water]	1.09E-02	L
Water (surface water, fresh) [Water]	5.08E-03	L
Outputs		
Coal, surface, water [Intermediate product]	**1.00**	**kg**
Aluminium [Heavy metals to fresh water]	2.51E-10	kg
Arsenic (+V) [Heavy metals to fresh water]	3.53E-11	kg
Barium [Inorganic emissions to fresh water]	8.88E-10	kg
Biological oxygen demand (BOD) [Analytical measures to fresh water]	7.97E-08	kg
Boron [Inorganic emissions to fresh water]	4.86E-09	kg
Cadmium (+II) [Heavy metals to fresh water]	1.59E-12	kg
Calcium (+II) [Inorganic emissions to fresh water]	1.14E-06	kg
Total organic carbon, TOC (Ecoinvent) [ecoinvent long-term to fresh water]	9.65E-08	kg
Chemical oxygen demand (COD) [Analytical measures to fresh water]	2.69E-07	kg
Chromium (unspecified) [Heavy metals to fresh water]	1.59E-10	kg
Copper (+II) [Heavy metals to fresh water]	1.13E-10	kg
Cyanide [Inorganic emissions to fresh water]	1.79E-10	kg
Fluoride [Inorganic emissions to fresh water]	1.36E-08	kg
Iron [Heavy metals to fresh water]	1.61E-09	kg
Lead (+II) [Heavy metals to fresh water]	1.62E-11	kg
Magnesium (+III) [Inorganic emissions to fresh water]	1.40E-06	kg
Manganese (+II) [Heavy metals to fresh water]	2.51E-09	kg
Mercury (+II) [Heavy metals to fresh water]	1.59E-13	kg
Nickel (+II) [Heavy metals to fresh water]	1.59E-10	kg
Nitrate (as total N) [Inorganic emissions to fresh water]	9.20E-09	kg
Ammonia, as N [Inorganic emissions to fresh water]	4.77E-09	kg
Nitrogen (as total N) [Inorganic emissions to fresh water]	2.39E-08	kg
Phosphorus [Inorganic emissions to fresh water]	2.96E-10	kg
Selenium [Heavy metals to fresh water]	2.93E-11	kg
Sodium (+I) [Inorganic emissions to fresh water]	3.46E-06	kg
Total Dissolved Solids [Analytical measures to fresh water]	2.38E-05	kg
Total Suspended Solids [Analytical measures to fresh water]	1.62E-07	kg
Strontium [Heavy metals to fresh water]	4.97E-08	kg
Sulfates [Inorganic emissions to fresh water]	1.08E-05	kg
Zinc (+II) [Heavy metals to fresh water]	1.59E-10	kg
Water (wastewater) [Water]	1.59E-02	L

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

Embedded Unit Processes

None.

References

BLM 2008 — BLM. 2008. *Draft Environmental Impact Study, West Antelope II Coal Lease Application, Chapter 4: Cumulative Environmental Consequences*. U.S. Department of the Interior, Bureau of Land Management. WYW163340. http://www.blm.gov/pgdata/etc/medialib/blm/wy/information/NEPA/cfodocs/westantelope.Par.18077.File.dat/008ch4.pdf (Accessed December 21, 2009).

EPA. 2009. National Pollutant Discharge Elimination System Permit, Water Quality Reporting Documentation. U.S. Environmental Protection Agency. http://www.epa-echo.gov/echo/compliance_report_water.html (Accessed December 21, 2009).

Section III: Document Control Information

Date Created: July 30, 2013

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Revision History:

24JUNE2014 Corrected cell referencing error in the DS

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