NETL Life Cycle Inventory Data
Process Documentation File

Process Name: Milling Facility, Construction

Reference Flow: 1 piece of Milling Facility Construction/ kg

Brief Description: This process encompasses the materials and installation energy required for the construction of a representative milling facility.

Section I: Meta Data

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

Year Data Best Represents: 1983

Process Type: Installation Process (IP)

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:

Polyvinylchloride-tube (PVC) [Plastic parts]	*Amount of plastic required for construction of the milling facility*
Concrete, ready mix, R-5-0 [Concrete_Cement]	*Amount of ready mix concrete required for construction of the milling facility*
Copper [Non renewable elements]	*Amount of copper required for the construction of the milling facility*
Aluminum [Metals]	*Amount of aluminum required for the construction of the milling facility*

Steel cold rolled (St) [Metals]	*Amount of steel required for the construction of the milling facility*
Power [electric power]	*Amount of power required for the construction of the milling facility*
Thermal Energy from Diesel Combusted in Construction Vehicles [Valuable substances]	*Amount of thermal energy from construction vehicles powered by diesel fuel required for the construction of the milling facility*
Timber pine (65% humidity / 40% moisture content) [Materials from renewable raw materials]	*Amount of wood required for the construction of the milling facility*

Tracked Output Flows:

Uranium Conversion Construction [construction processes]	*Construction of a conversion facility*

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage1_C_Milling_Facility_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 materials inputs necessary to construct a uranium milling facility used for triuranium octoxide (U_3O_8), also known as yellowcake, from uranium ore. The process is based on the reference flow of 1 piece of milling facility construction per kg of U_3O_8, as described below and shown in **Figure 1**. The milling facility is assumed to be constructed of concrete, aluminum, copper, polyvinylchloride, steel, and wood.

Boundary and Description

The purpose of a milling facility is to separate uranium from uranium ore to produce a fine powder called yellowcake (U_3O_8) for transport to the conversion facility. Raw uranium or is passed through crushers, leached with acid or alkali solution, dryed, and filtered.

The high relative mass of uranium ore to produced yellowcake results in milling facilities being co-located with the mine or at the nearest possible neighboring site. Co-location also allows the tailings and waste rock from the milling process to be stored near the extraction point and disposed of in evacuated mines.

The construction process for this milling facility is based on a construction material list provided in the "Energy Technology Characterizations Handbook" (ETCH 1983). Source data for the material list dates from between 1974 and 1976.

The energy requirements for the installation of the milling facility were available from the Rotty Report (1975). The Rotty Report provides values for electricity and fossil energy consumed during milling facility installation. It is assumed that all fossil energy is consumed as diesel in a construction vehicle. The emissions from combustion of diesel in construction vehicles are calculated in a process external to this unit process, entitled "Thermal Energy from Diesel Combusted in Construction Vehicles."

Figure 1 provides an overview of the boundary of this unit process. The emissions produced while physically assembling the components (e.g., any dust particles which are released during the mixing of cement) for the conversion facility are not included. The upstream emission from the production of the raw materials used for the construction of the conversion facility (e.g., steel and concrete) are calculated outside the boundary of this unit process, based on proprietary profiles available within the GaBi model.

The mass for a selection of materials were used in construction: concrete, copper, aluminum, polyvinylchloride, wood, and steel. While it is known that other materials would likely be used in construction of a milling facility, the completeness of this data is considered sufficient for the low significance of this process in the lifecycle emissions of nuclear power (determined by life cycle screening of relative greenhouse gas emissions for all unit processes). All materials are calculated based on the number of kilograms of yellowcake which will be produced during the lifetime of the facility.

Table 1 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 sheet.

Figure 1. Unit Process Scope and Boundary

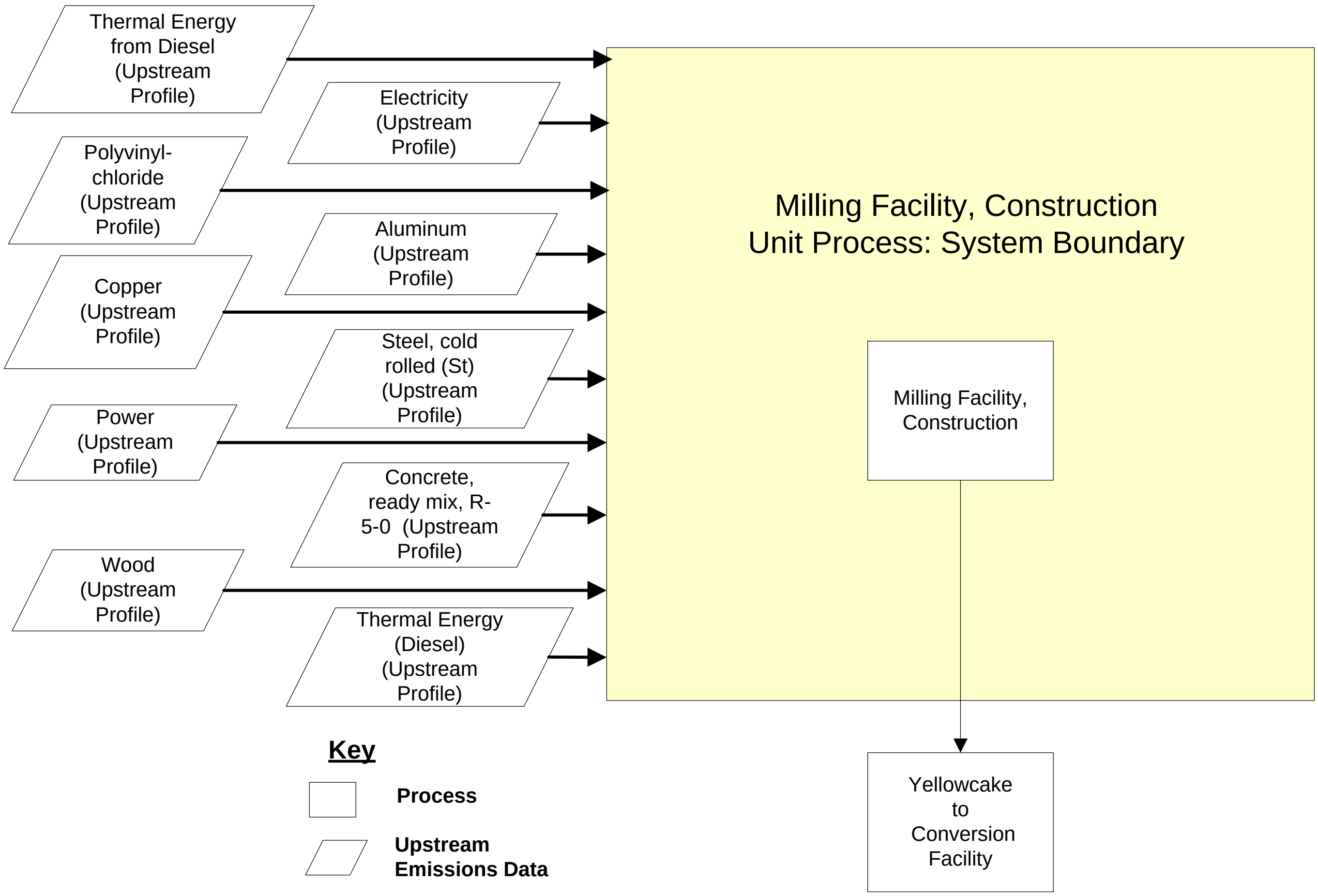

Table 1: Unit Process Input and Output Flows

Flow Name	Value	Units (Per Reference Flow)
Inputs		
Aluminum [Metals]	**3.78E-03**	**kg/kg yellowcake**
Concrete, ready mix, R-5-0 [Concrete_Cement]	**1.85E+00**	**kg/kg yellowcake**
Copper [Non renewable elements]	**1.62E-03**	**kg/kg yellowcake**
Polyvinylchloride-tube (PVC) [Plastic parts]	**1.84E-03**	**kg/kg yellowcake**
Power [Electric power]	**6.57E-02**	**MWh/kg yellowcake**
Steel cold rolled (St) [Metals]	**1.84E-01**	**kg/kg yellowcake**
Thermal Energy from Diesel Combusted in Construction Vehicles [Valuable substances]	**4.14E+00**	**MJ/kg yellowcake**
Timber pine (65% humidity / 40% moisture content) [Materials from renewable raw materials]	**1.84E-03**	**kg/kg yellowcake**
Outputs		
Uranium Mill Construction [construction process]	1	piece/kg yellowcake

* **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

ETCH 1983 The Aerospace Corporation and Mueller Associates, Inc. 1983. Energy Technology Characterizations Handbook. Department of Energy. Washington, D.C.

Rotty 1975 *Net Energy from Nuclear Power*; Rotty, R. M., Perry, A. M., Reister, D. B.; Institute for Energy Analysis IEA-75-3 IEA Report, November 1975

Section III: Document Control Information

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