NETL Life Cycle Inventory Data
Process Documentation File

Process Name: UF_6 Conversion Facility Construction

Reference Flow: 1 piece (pcs) of Conversion Facility/kg UF_6

Brief Description: This unit process models the material inputs required for the construction of a generic Uranium Hexafluoride Conversion Facility. Materials considered are concrete, cast iron, aluminum, copper, and steel.

Section I: Meta Data

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

Year Data Best Represents: 1983

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:

N/A

Tracked Input Flows:

Cast iron [Metals]	*Amount of cast iron required for construction of the conversion facility, per the reference flow*
Concrete, ready mix, R-5-0 [Concrete_Cement]	*Amount of ready mix concrete required for construction of the conversion facility, per the reference flow*

Copper [Non renewable elements]	*Amount of copper required for the construction of the conversion facility, per the reference flow*
Aluminum [Metals]	*Amount of aluminum required for the construction of the conversion facility, per the reference flow*
Steel cold rolled (St) [Metals]	*Amount of steel required for the construction of the conversion facility, per the reference flow*

Tracked Output Flows:

Conversion Facility/kg UF6 [Construction]	*Reference flow: construction of a conversion facility per kg output*

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage1_C_Conversion_Facility_UF6_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 and weights of those materials necessary to construct a conversion facility, to be used for converting the incoming yellowcake (U_3O_8) to uranium hexafluoride (UF_6). The process is based on the reference flow of 1 piece of conversion facility construction per kg of UF_6, as described below and shown in **Figure 1**. The fuel assembly facility is assumed to be constructed of concrete, copper, aluminum, cast iron, and steel. All other materials are considered negligible.

Boundary and Description

The purpose of a uranium conversion facility is to convert milled yellowcake (U_3O_8) into a gaseous state for subsequent fuel enrichment. Because uranium hexafluoride (UF_6) is gaseous at low temperatures, a conversion facility uses strong acids and alkalis to remove impurities and combine uranium with fluorine. The UF_6 is then pressurized and slow cooled to a solid state for transport to an enrichment facility.

Honeywell International Inc. operates the only U.S. conversion facility, located in Metropolis, Illinois. A single Canadian facility is operated by Cameco in Port Hope, Canada. The construction process for this conversion 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. Newer facilities have not been constructed in the U.S. since this time period, and therefore the construction materials data presented in this unit process represent the best available data. This is noted as a data limitation.

Figure 1 provides an overview of the boundary of this unit process. The input flows and emissions produced while physically assembling the components (e.g., construction related energy use and emissions) for the conversion facility are not included. The upstream emissions 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 the materials usage rates noted in this unit process, and using proprietary profiles available within the GaBi model.

The following materials were assumed to be used in construction: concrete, copper, aluminum, cast iron, and steel. While it is known that other materials would likely be used in construction of a conversion facility, the completeness of these 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 UF_6 produced during the lifetime of the facility.

Table 1 shows relevant properties and assumptions used to calculate the amounts of each of the construction materials needed for one kilogram of UF_6. **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 sheet.

Figure 1. Unit Process Scope and Boundary

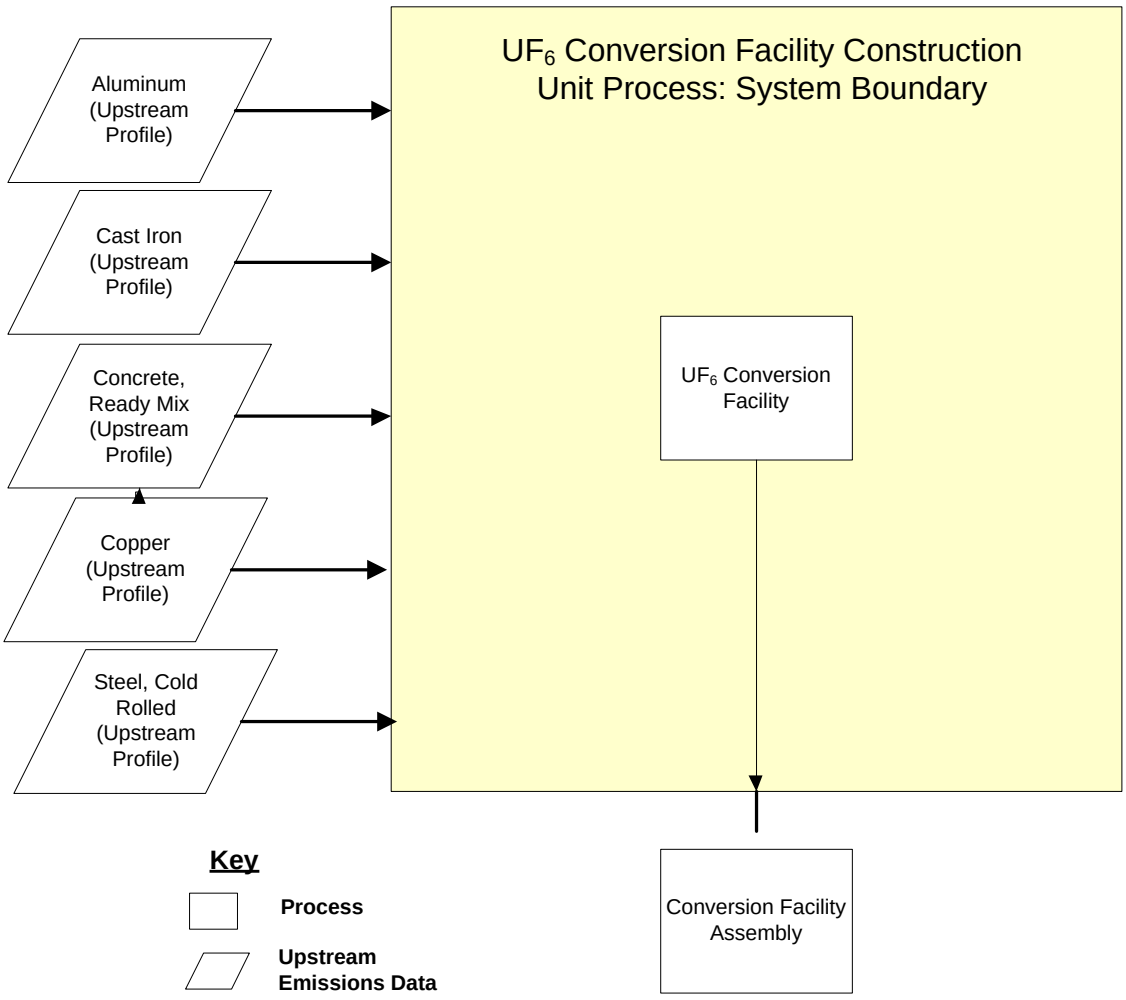

Table 2: Unit Process Input and Output Flows

Flow Name	Value	Units (Per Reference Flow)
Inputs		
Aluminum [Metals]	**3.60E-04**	**kg/ kg UF_6**
Cast iron [Metals]	**8.90E-04**	**kg/ kg UF_6**
Concrete, ready mix, R-5-0 [Concrete_Cement]	**2.35E+00**	**kg/ kg UF_6**
Copper [Non renewable elements]	**1.10E-03**	**kg/ kg UF_6**
Steel cold rolled (St) [Metals]	**7.43E-02**	**kg/ kg UF_6**
Outputs		
Conversion Facility/kg UF_6	1.00	piece/kg UF_6

* **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.

Section III: Document Control Information

Date Created: November 2, 2010

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: Conversion Facility, UF_6, Construction.* U.S. Department of Energy, National Energy Technology Laboratory. Last Updated: November 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.