NETL Life Cycle Inventory Data
Process Documentation File

Process Name: Nuclear Enrichment Facility, Construction

Reference Flow: 1 kg of Enriched Uranium

Brief Description: Materials requirements, energy use, and vehicle combustion emissions for the construction of a nuclear enrichment facility.

Section I: Meta Data

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

Year Data Best Represents: 2005

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:

Bitumen [Organic intermediate products]	*Amount of asphalt required for construction of the enrichment facility*
Concrete, ready mix, R-5-0 [Concrete_Cement]	*Amount of ready mix concrete required for construction of the enrichment facility*

Copper (99.999%; electrolyte copper) [Metals]	*Amount of copper required for the construction of the enrichment facility*
Aluminum sheet [Metals]	*Amount of aluminum sheet required for the construction of the enrichment facility*
Steel, pipe welded, BF (85% Recovery Rate) [Metals]	*Amount of steel welded pipes required for the construction of the enrichment facility*
Steel plate, BF (85% Recovery Rate) [Metals]	*Amount of steel plate required for the construction of the enrichment facility, assumes 85% recovery rate*
Water (unspecified) [Water]	*Amount of water required for the construction of the enrichment facility*
Diesel [Crude oil products]	*Amount of diesel required for the installation of the enrichment facility*

Tracked Output Flows:

Enriched Uranium [Installation]	*Enriched uranium produced in the enrichment facility*

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage1_C_Nuclear_Enrichment_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 enrichment facility, to be used for increasing the concentration of 235Uranium in nuclear power plant

fuel. The process is based on the reference flow of 1 kg of enriched uranium, as described below and shown in **Figure 1**. The enrichment facility is assumed to be constructed of asphalt, concrete, copper, aluminum, and steel pipes and sheets. All other materials are considered negligible.

Boundary and Description

Construction of the nuclear enrichment facility is based on material list provided in the environmental impact statement for the proposed centrifuge enrichment facility in Lea County, New Mexico (NRC 2005). Selected commodities and resources needed for construction include asphalt paving, chain link fencing, concrete and concrete paving, copper and aluminum wiring, crushed stone, and carbon and stainless steel piping and ductwork. The document also reports air emissions from construction vehicles as well as fugitive dust from installation activity.

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 nuclear enrichment facility are not included. The upstream emission from the production of the raw materials used for the construction of the enrichment facility (e.g., steel and concrete) 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 enrichment facility constructed in this unit process will be used for both gaseous and centrifuge enrichment. It is assumed that there will not be drastic differences between the construction materials of the two types and that overall the construction of the facility will not be overly significant especially in comparison to the energy usage during the facilities operations.

The weights for a selection of materials were readily available. The materials include: asphalt, concrete, copper, aluminum, and steel plates and pipes. While it is agreed that there must be additional materials, there is no readily available data to add that information so it is assumed that it will be negligible in comparison to the materials given. All materials are calculated based on the number of kilograms of enriched uranium 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

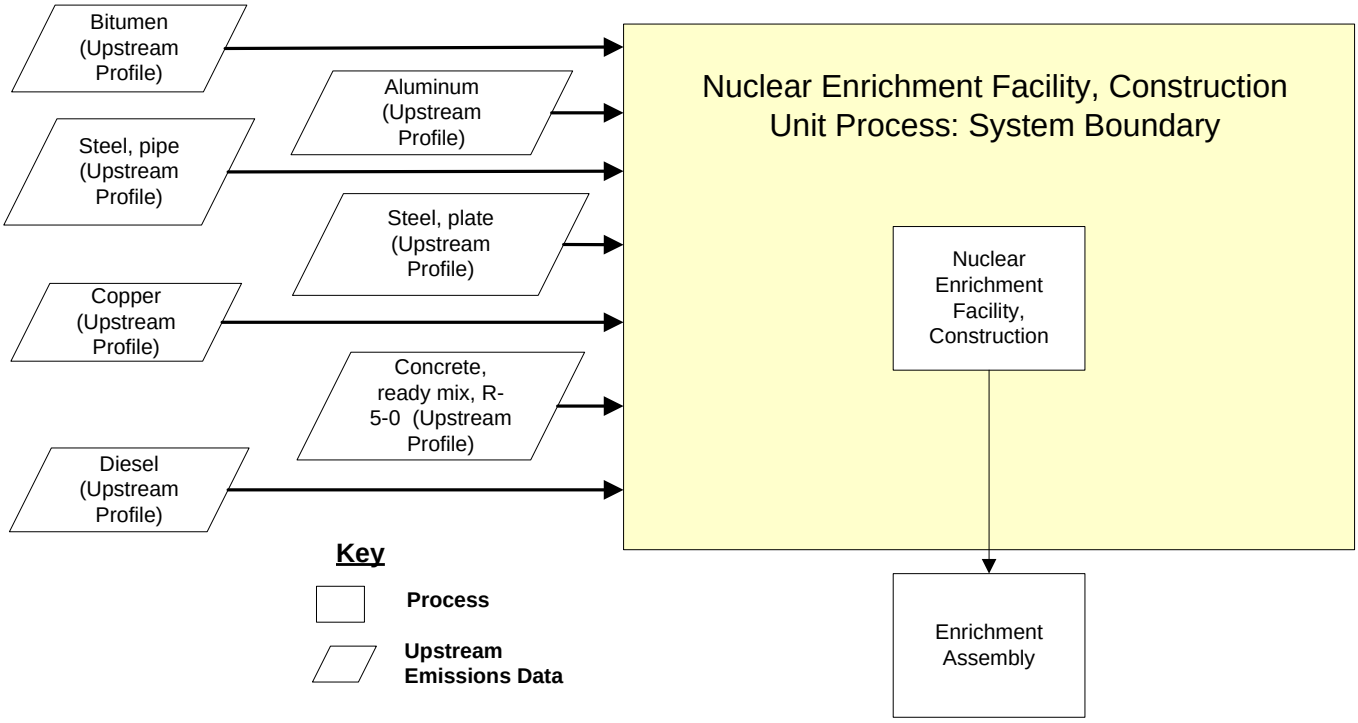

Table 1: Unit Process Input and Output Flows

Flow Name	Value	Units (Per Reference Flow)
Inputs		
Bitumen [Organic intermediate products]	**7.21**	**kg/kg UF_6**
Concrete, ready mix, R-5-0 [Concrete_Cement]	**14.05**	**kg/kg UF_6**
Copper (99.999%; electrolyte copper) [Metals]	**1.71E-02**	**kg/kg UF_6**
Aluminum sheet [Metals]	**2.90E-01**	**kg/kg UF_6**
Steel, pipe welded, BF (85% Recovery Rate) [Metals]	**1.56E-04**	**kg/kg UF_6**
Steel plate, BF (85% Recovery Rate) [Metals]	**5.09E-05**	**kg/kg UF_6**
Water (Unspecified) [Water]	7.49E-01	kg/kg UF_6
Diesel [Crude oil products]	**1.32**	**kg/kg UF_6**
Outputs		
Enriched Uranium [Construction and Deconstruction]	1	kg/kg UF_6
Carbon dioxide [Inorganic emissions to air]	4.1	kg/kg UF_6
Carbon monoxide [Inorganic emissions to air]	2.63E-02	kg/kg UF_6
Nitrogen oxides [Inorganic emissions to air]	1.49E-02	kg/kg UF_6
Sulphur oxides [Inorganic emissions to air]	5.34E-03	kg/kg UF_6
Dust (PM10) [Particles to air]	2.08E-02	kg/kg UF_6
NMVOC (unspecified) [Group NMVOC to air]	4.15E-03	kg/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

NRC 2005 — U.S. Nuclear Regulatory Commission, 2005. Environmental Impact Statement for the Proposed National Enrichment Facility in Lea County, New Mexico: Chapters 1 - 10 and Appendices A - G. U.S. Nuclear Regulatory Commission, Washington, D.C. 2005. http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1790/v1/ (Accessed June 18, 2010).

Section III: Document Control Information

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