NETL Life Cycle Inventory Data
Process Documentation File

Process Name: Nulcear Power Plant, Decommissioning

Reference Flow: 1 piece/MWh of Nuclear Power Plant

Brief Description: This process encompasses the energy use for decommissioning of a nuclear power plant and the corresponding emissions.

Section I: Meta Data

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

Year Data Best Represents: 1997

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:

Concrete, ready mix, R-5-0 [Concrete_Cement]	*Concrete mix used for the decommissioning of the nuclear power plant*
Steel plate, BF (85% Recovery Rate) [Metals]	*Steel plate used for the decommissioning of the nuclear power plant, assumes 85% recycled steel*

Diesel [Crude oil products]	*Diesel used for the decommissioning of the nuclear power plant*
Locomotive Transport of Waste [Non-material systems]	*Locomotive transport used for the decommissioning of the nuclear power plant*

Tracked Output Flows:

Nuclear Power Plant, Decommissioning [Construction]	*Decommissioning of a nuclear power plant*

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage3_C_Nuclear_Power_Plant_Decommissioning_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 raw materials, energy requirements, and transport necessary to decommission a nuclear power plant. The process is based on the reference flow of one piece of nuclear power plant per MWh electricity output, as described below and shown in **Figure 1**. This process is combined with other construction and operation processes to build LC Stage #3 to the Nuclear Power LCA.

Boundary and Description

The decommissioning of a nuclear power plant is based on the 1997 decommissioning of the Yankee Rowe reactor, when it was shipped to a low-level waste disposal facility (YAEC 1997). Decommissioning materials included steel for shipping containers, steel rope for manipulation of the containers, and concrete for sealing of radioactive contaminated material in the containers.

Power plant decommissioning energy (diesel use by construction vehicles) was assumed to be 10% of installation energy. Air emissions from combustion of this diesel are included in the decommissioning unit process, as well as fugitive road dust from operation of the vehicles.

Figure 1 provides an overview of the boundary of this unit process. Emissions related to the physical decommissioning of a nuclear power plant, aside from the diesel combustion (e.g., particle matter that is created while deconstructing the components of the power plant, including all disposal transportation emissions of these components), are not included in this study. Upstream emissions from the

production of raw materials used for the decommissioning of the power plant (e.g., concrete) are calculated outside the boundary of this unit process, based on proprietary profiles available within the GaBi model.

Table 1 shows relevant properties and assumptions used to calculate the amount of steels and concrete in decommissioning one nuclear power plant. **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

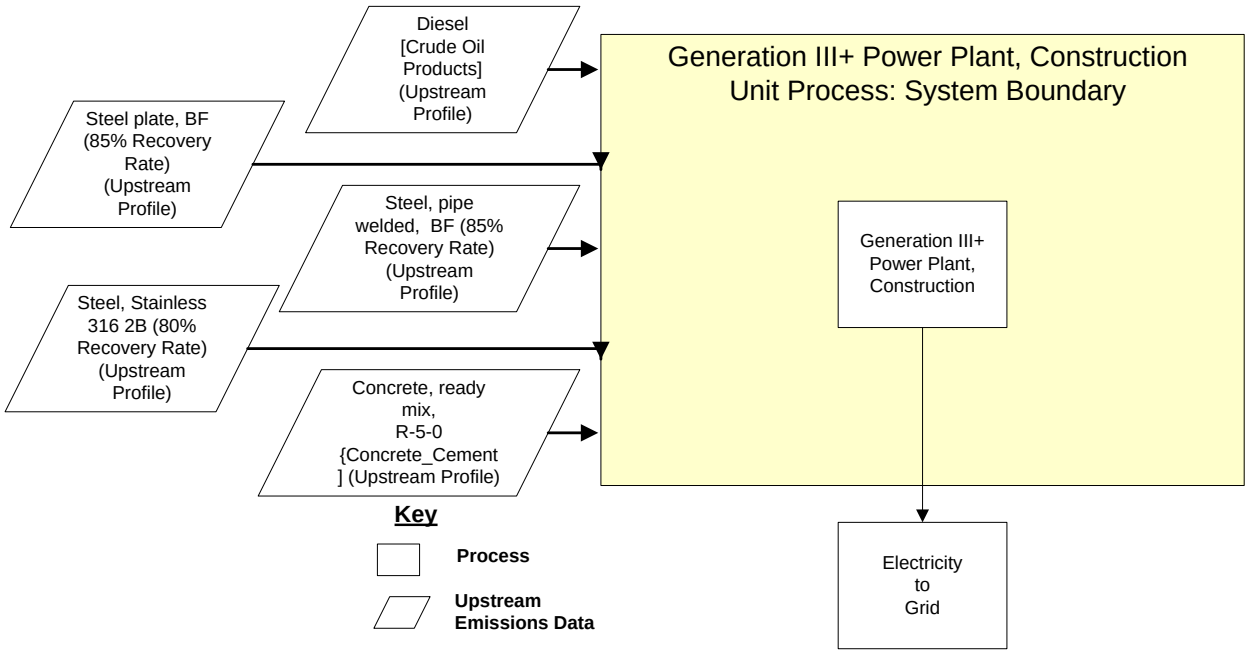

Table 1: Properties of Process

Material Composition and Weights		
Material	**Weight**	**Reference**
Steel Container	90 tons/ reactor	YAEC 1997
Steel Rope	20 tons/ reactor	YAEC 1997
Concrete	80 tons/ reactor	YAEC 1997

Table 2: Unit Process Input and Output Flows

Flow Name	Value	Units (Per Reference Flow)
Inputs		
Steel plate, BF (85% Recovery Rate) [Metals]	**3.024E-03**	**kg/MWh**
Concrete, ready mix, R-5-0 [Concrete_Cement]	**2.199E-03**	**kg/MWh**
Locomotive Transport	**1.776E+01**	**kg-km/MWh**

Diesel [Crude oil product]	**3.453E-01**	**kg/MWh**
Outputs		
Nuclear Power Plant, Decommissioning [Construction]	1.00E+00	Piece/MWh
Mixed Waste (Hazardous or Radioactive)	1.00E-02	kg/MWh
Dust (PM10) [Particles to air]	6.02E-03	kg/MWh
Nitrogen dioxide [Inorganic emissions to air]	2.94E-02	kg/MWh
Carbon monoxide [Inorganic emissions to air]	6.33E-03	kg/MWh
Sulphur dioxide [Inorganic emissions to air]	1.93E-03	kg/MWh
Carbon dioxide [Inorganic emissions to air]	1.09E+00	kg/MWh
Volatile Organic Carbons [Organic emissions to air]	2.40E-03	kg/MWh

* **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

YAEC 1997 Yankee Atomic Electric Company (YAEC), 1997. *Large Component Removal/ Shipping*. http://www.yankeerowe.com/decommissioning_removal.html (Accessed July 29, 2010)

Section III: Document Control Information

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