# Nuclear Fuel Cycle

*NUGN506 - Homework*

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CHAPTER 1

# NUCLEAR FUEL FABRICATION

Several problems related to the fuel fabrication are tackled in this fourth homework. These are the problems 4-3 and 4-4 from the textbook.

## 1.1 Problem 4-3

### 1.1.1 Problem

*Calculate the cost of nuclear fuel fabricated and delivered on-site using the following data: Cost of natural uranium, 60$/lb; U3O8 enrichment, 4.2%; conversion, $11.50/kgU; tails, 0.25%; price of SWU, $110; conversion loss, 0.6%; fabrication and transportation cost, $230/kgU; fabrication loss, 0.7%.*

### 1.1.2 Solution

Equation 4.1 in the book states that:

$$FF = \left[\frac{PU}{(1-l_c)(1-l_f)} + \frac{PC}{(1-l_f)}\right]\frac{F}{P} + \frac{PS}{(1-l_f)} * SF + PF \tag{1.1}$$

In the data, $PU$ is given in \$/lbU3O8. $PU = \$60/lbU3O8 = \$156/kgU$.

Plugging the numbers in, we obtain the cost of nuclear fuel fabricated and delivered on-site $FF = \$2375$.

## 1.2 Problem 4-4

### 1.2.1 Problem

*If the enrichment changes by 0.4%, that is, goes from 4.2% to 4.6%, by what percentage does the cost of fuel in problem 4-3 change?*

### 1.2.2 Solution

We can change the enrichment to 4.6% in Equation 4.1 (present in the factor $F/P$, itself present in the factor $SF$. This causes the cost of nuclear fuel fabricated and delivered on-site to increase to $FF$ = \$2615. This represents a change of 10.1%.

# Bibliography