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INTERIM REPORT

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## Fuel Cycle Cost Projections

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T. R. Batter

January 1978

NRC Research and Technical  
Assistance Report



**Battelle**

Pacific Northwest Laboratories

FUEL CYCLE COST PROJECTIONS

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January 1978

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FOREWORD

Our objective in preparing this report was to develop unit price forecasts for each component of the nuclear fuel cycle. In this report we deal only with processes in the front end of the fuel cycle. Subsequent reports will consider, in addition, the back end of the fuel cycle.

In making our price estimates we made assumptions about the growth of the nuclear industry and the choice of options for fuel cycle operations such as the availability of reprocessing, plutonium recycle and uranium tails assay. The fuel cycle options in this report are for use in determining the sensitivity of the fuel cycle unit prices to possible future developments. The particular assumptions we used for our estimations are not intended to imply favored options.

## FUEL CYCLE COST PROJECTIONS

### 1.0 THE NUCLEAR FUEL CYCLE

Presently, uranium enriched to 2-4% U-235 is the fuel used in light water reactors (LWR). The operations from uranium exploration through spent fuel handling constitute the LWR nuclear fuel cycle. The components of this fuel cycle are summarized below:

- Uranium mining and milling
- $UF_6$  conversion
- Isotopic enrichment
- $UO_2$  fuel fabrication
- LWR reactor
- Disposal and/or reprocessing of spent fuel

A schematic representation of the LWR fuel cycle is shown in Figure 1.1. In the following sections we will briefly describe the processes involved in the front end of the fuel cycle, that is processes before the nuclear reactor.

#### 1.1 MINING

There are two major mining methods, surface and underground mining. In surface mining, the ore is near enough to the surface so that the material overlying the ore, the overburden, can be excavated, and the ore mined directly from the pit. When the ore is located much deeper, underground mining is required. This entails sinking a mine shaft down to the ore deposit, blasting the ore bearing rock, and finally transporting the loose rock to the surface. In both mining methods, after the ore is removed from the ground, it is scanned for uranium concentration, blended, crushed, and transported to the mill.

#### 1.2 MILLING

Uranium ore is milled by either acid leaching with solvent extraction or alkaline leaching. Acid leaching is the predominant method used in the



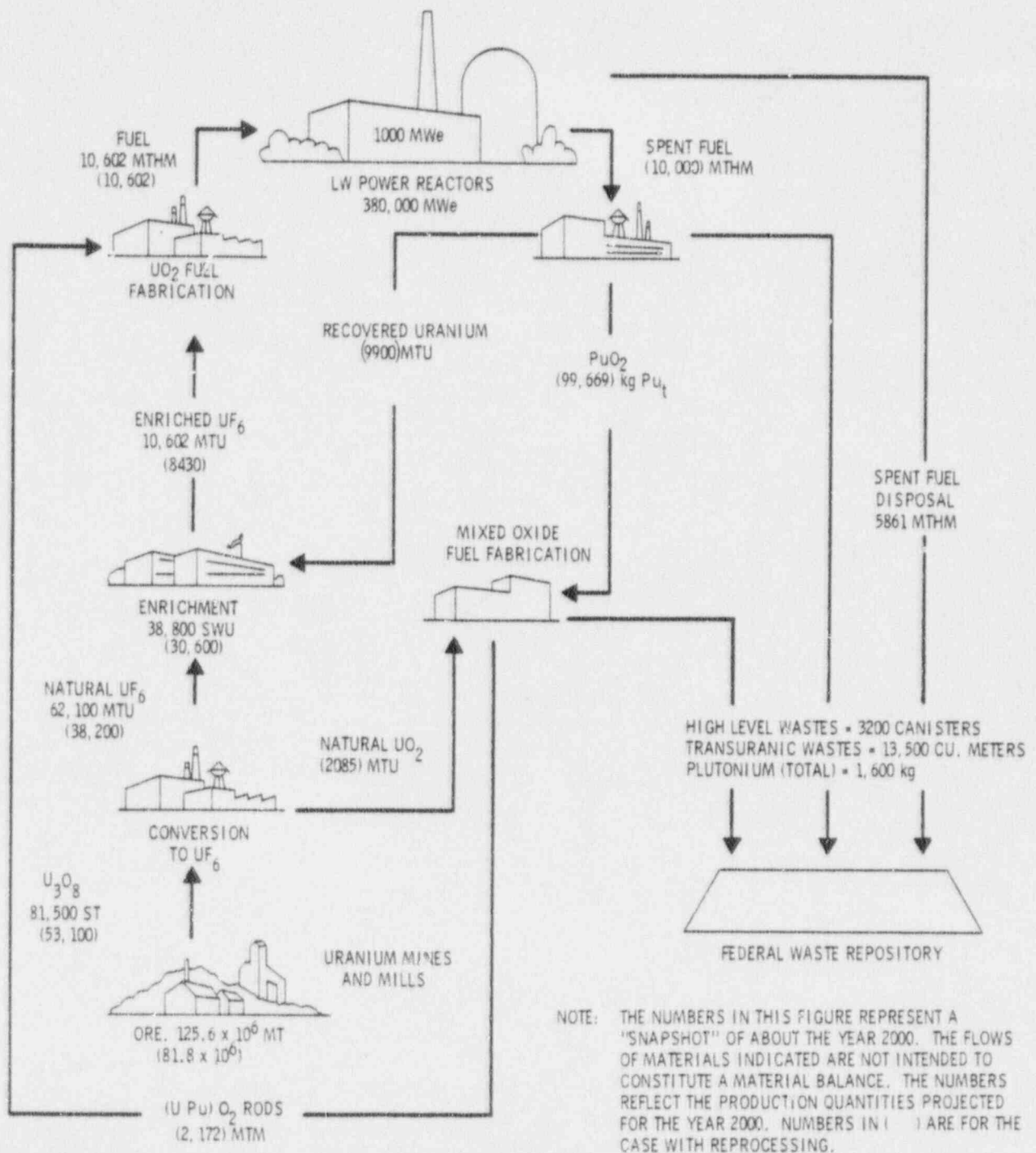


FIGURE 1.1. Annual United States Industrywide Fuel Cycle Requirements for Light Water Reactors for about Year 2000 with and Without Reprocessing

United States. The major unit operations involved are listed below:

- Conventional grinding of the ore to a 20-200 mesh size
- Batchwise leaching of the uranium from the rock with sulfuric acid and oxidizing agents.
- Countercurrent decantation of the uranium rich liquor.
- Purification and concentration of liquor
- Precipitation of yellowcake by the addition of ammonium hydroxide to raise the pH to 6.5-8.0.

### 1.3 CONVERSION OF YELLOWCAKE TO $UF_6$

Both isotopic enrichment processes presently used require a gaseous uranium compound. Uranium hexafluoride ( $UF_6$ ) is a compound that sublimes at  $56.2^\circ C$  at atmospheric pressure, i.e., it is transformed from the solid to the gaseous state without the formation of any liquid. Therefore, the yellowcake from the mill is converted to uranium hexafluoride so that the gaseous enrichment processes can be carried out at relatively low temperatures.

The major processes required to convert ammonium diuranate (yellowcake) to uranium hexafluoride are summarized below:

- Production of uranyl nitrate by digestion of the yellowcake with hot 40% nitric acid (batchwise).
- Countercurrent solvent extraction of uranyl nitrate with 30% tributylphosphate in hexane.
- Stripping uranyl nitrate into the aqueous phase.
- Concentration of uranyl nitrate by evaporation.
- Decomposition of uranyl nitrate to uranium trioxide by heating to  $274^\circ C$ .
- Reduction of uranium trioxide to uranium dioxide in a fluid bed reactor at  $538^\circ C$ .
- Production of uranium tetrafluoride by reaction with hydrogen fluoride at  $343 - 538^\circ C$ .

## 1.4

- Production of uranium hexafluoride by reaction with elemental fluorine in a continuous flame reactor.
- Cooling and solidification of  $UF_6$ .

The product,  $UF_6$ , is stored and shipped as a solid.

### 1.4 ENRICHMENT

The U-235 content of naturally occurring uranium is approximately 0.72%. Light water reactors require uranium fuel enriched to 2 - 4% U-235. Presently, there are two commercially feasible methods for uranium isotopic enrichment; namely, gaseous diffusion and gas centrifugation.

Gaseous diffusion is based on the principle that at a given temperature lighter molecules U-235 molecules are lighter than U-238 will move with a greater velocity than heavier molecules. When the uranium hexafluoride is pumped into a cylinder with porous walls, the faster moving, lighter molecule,  $U-235F_6$  will strike the porous walls more frequently than  $U-238F_6$ . If the pore diameters in the wall are properly sized, the U-235 molecule will diffuse through the wall at a faster rate resulting in a small incremental enrichment of U-235 molecules.

Gas centrifugation is based on the differences in densities between  $U-235F_6$  and  $U-238F_6$ . Centrifugal force applied to the  $UF_6$  throws the heavier  $U-238F_6$  outward. Slightly enriched  $U-235F_6$  can be withdrawn from the center.

In both enrichment processes, only small incremental enrichments are obtained in any one stage. Both processes require extremely large numbers of stages to enrich to the required concentration. However, the gaseous diffusion process also requires large quantities of electric energy to drive the compressors, while the gas centrifuge requires only approximately 4% of the energy required for gaseous diffusion.

### 1.5 $UO_2$ FUEL FABRICATION

$UO_2$  fuel fabrication requires two basic operations:

1. Chemical conversion of  $UF_6$  to  $UO_2$ .
2. Mechanical processing to produce finished fuel rods.

### 1.5.1 Chemical Conversion

The ammonium diuranate (ADU) process is the major commercial process for converting  $UF_6$  to  $UO_2$ . The major operations are as follows:

- Hydrolysis of  $UF_6$  in water to form uranyl fluoride ( $UO_2F_2$ ) and hydrofluoric acid (HF).
- Reaction of  $UO_2F_2$  with ammonium hydroxide ( $NH_4OH$ ) to precipitate ADU.\*
- Mechanical separation of ADU solid.
- Heating (calcining) the ADU in the presence of steam and hydrogen to form  $UO_2$ .

Another newer conversion method still being developed involves the direct conversion of  $UF_6$  to  $UO_2$  by reaction with steam and hydrogen at elevated temperatures ( $600^\circ C$ ). This method called the direct conversion fluidized bed (DCFB) method is passed the advanced development stages and is in the process of being introduced commercially.

### 1.5.2 Mechanical Processing

Production of the finished fuel rods involves:

- Pulverization of  $UO_2$  powder
- Production of  $UO_2$  pellets by high speed presses
- Sintering pellets in a hydrogen atmosphere
- Loading of zircaloy tubing with pellets
- Welding end caps on loaded fuel rod
- Assembly of fuel rods into completed fuel assembly.

In addition to chemical and mechanical processing, a third operation, scrap recovery, is employed. Waste and rejected fuel material is recovered at each step in the fabrication process and recycled to the appropriate areas.

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\* Ammonium diuranate (ADU) is a compound of variable composition, but is usually represented chemically as  $(NH_4)_2U_2O_7$ .

## 2.0 FUEL CYCLE PROCESS FLOW RATES

We determined the fuel cycle process flow rates using the computer model NUFUEL based on the current Department of Energy's (DOE) projected LWR electric generating capacity. DOE's projection along with our estimation of the high and low boundaries of the projection are listed in Table 2.1. Figure 2.1 shows a graphical representation of these projections.

TABLE 2.1 LWR Generating Capacity Schedule

| <u>Year</u> | <u>Capacity (GWe)</u> |             |            |
|-------------|-----------------------|-------------|------------|
|             | <u>Median (DOE)</u>   | <u>High</u> | <u>Low</u> |
| 1985        | 120                   | 125         | 110        |
| 1990        | 190                   | 210         | 170        |
| 1995        | 280                   | 320         | 200        |
| 2000        | 380                   | 460         | 210        |
| 2005        | 480                   | 610         | 210        |
| 2010        | 560                   | 760         | 210        |
| 2015        | 609                   | 879         | 179        |
| 2020        | 623                   | 993         | 143        |

The median growth scenario is based on adding about 19 GWe LWR capacity per year to the year 2000. After the year 2000 the rate of annual demand declines to about 10 GWe per year because of the introduction of the fast breeder reactor or other advanced systems to the market. The high growth scenario is our projection of what is feasible for the industry given the incentive to increase LWR capacity. In the high growth after 1990, additional LWR capacity is added on at the rate of 28 - 30 GWe/yr. In the low growth scenario we arbitrarily assume a declining rate of additional LWR capacity before year 2000, and no additions thereafter.

We generated the process flow rates for each case in Table 2.1 using the computer model NUFUEL. We ran a no reprocessing and a reprocessing beginning in 1986 (plutonium and uranium recycle) scenario for each case.

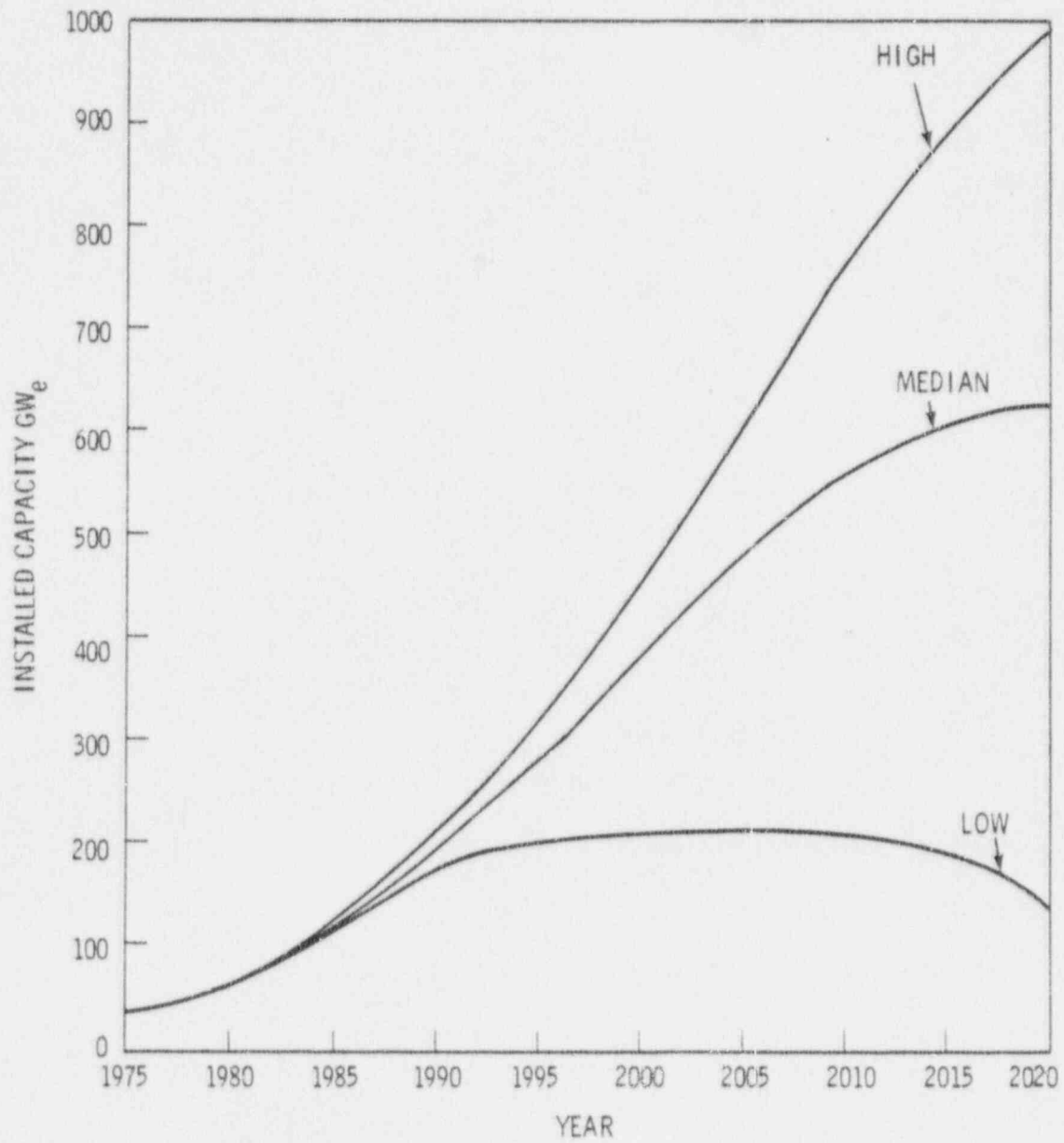


FIGURE 2.1. Forecast of LWR Capacity



## 2.3

We assumed a 500 MTHM/yr capacity in 1986 for the reprocessing scenario with an additional 500 MTHM/yr capacity each year thereafter until 1995. From 1995 to year 2002 we assumed an additional capacity of 1,000 MTHM/yr each year and an approximately constant rate thereafter. In all cases we assumed no breeder reactors will be available before the year 2000. For this report we used a constant enrichment tails assay of 0.25%.

The NUFUEL mode has detailed batch fuel loading characteristics for existing reactor supplied by the operating utilities. In addition, we used model PWRs and BWRs to represent forecasted plants. Table 2.2 summarizes the average reactor characteristic for the model plants. In Section 4 of this report, annual fuel cycle requirements are listed for PWR and BWR model plants over a 30-year expected life time with and without uranium and plutonium recycle. All plants are operated on a capacity factor scheduled as follows:

First year, 40%

Second year, 65%

Third year through 15th year, 70%

16th year and over, declining at 2% per year

The fuel cycle process flows generated by NUFUEL for the median growth scenario for both no reprocessing and reprocessing through the year 2000 are shown in Tables 2.3 and 2.4. We will use these process flow rates throughout this report as a basis for calculating levelized prices for individual components of the fuel cycle.

TABLE 2.2. Model Reactor Characteristics<sup>(1)</sup>

|  | BWR    | PWR    |
|--|--------|--------|
| Thermal Efficiency, %  | 34     | 33     |
| Specific Power, MWth/MT  | 26     | 38     |
| Initial Core, Average  |        |        |
| Irradiation Level, MWD/MT  | 17,000 | 24,000 |
| Fresh Fuel Assay, wt% U-235  | 2.00   | 2.38   |
| Spent Fuel Assay, wt% U-235  | 0.86   | 0.77   |
| Fissile Pu Recovered, kg/MT <sup>(2)</sup>   | 4.8    | 5.6    |
| Feed Required, ST U <sub>3</sub> O <sub>8</sub> /MWe <sup>(3)</sup>                                | 0.580  | 0.364  |
| Separative Work Requirements, SWU/MWe <sup>(3)</sup>   | 185    | 209    |
| Replacement Loadings, Annual Rate at Steady State and 70% Plant Factor; No Reprocessing            |        |        |
| Irradiation Level, MWD/MT  | 27,300 | 32,500 |
| Fresh Fuel Assay, wt% U-235  | 2.72   | 3.20   |
| Spent Fuel Assay, wt% U-235  | 0.83   | 0.90   |
| Fissile Pu Recovered, kg/MT <sup>(2)</sup>   | 5.6    | 6.5    |
| Feed Required, ST U <sub>3</sub> O <sub>8</sub> /MWe   | 0.192  | 0.198  |
| Separative Work Requirements, SWU/MWe <sup>(3)</sup>   | 90     | 100    |
| Replacement Loadings, Annual Rate at Steady State, 70% Plant Factor; Uranium and Plutonium Recycle |        |        |
| Fissile Pu Recycled, kg/MWe  | 0.195  | 0.197  |
| Fissile Pu Recovered, kg/MT <sup>(2)</sup>   | 7.4    | 7.5    |
| Feed Required, ST U <sub>3</sub> O <sub>8</sub> /MWe <sup>(3,4)</sup>                              | 0.120  | 0.125  |
| Separative Work Requirements, SWU/MWe <sup>(3)</sup>   | 67     | 76     |

- (1) MWth is thermal megawatts, MWe is electrical megawatts, MWDt is thermal megawatt days, MTU is metric tons (thousands of kilograms) of uranium, and ST U<sub>3</sub>O<sub>8</sub> is short tons of U<sub>3</sub>O<sub>8</sub> yellowcake from an ore processing mill. One SWU is equivalent to one kg of separative work.
- (2) After losses.
- (3) Based on operation of enriching facilities at a tails assay of 0.25%. For replacement loadings, the required feed and separative work are net, in that they allow for the use of uranium recovered from spent fuel. Allowance is made for fabrication and reprocessing losses.
- (4) Include natural uranium to be spiked with plutonium; 0.0087 ST U<sub>3</sub>O<sub>8</sub>/MWe for BWR and 0.0067 for PWR.

TABLE 2.3 Process Flows for No Reprocessing and Median Growth

| YEAR  | MINING<br>MILLING<br>1000 ST | UF6<br>CONVR<br>1000 MTU | ENRICHMENT<br>1000<br>MT-SMU | U FUEL<br>FAB<br>MTU | SPENT<br>FUEL TRAN<br>MT-HM | REPROCESS<br>MT-HM | PU<br>TRANS<br>KG-TOT | INCR PU<br>STORAGE<br>KG-TOT | MOX<br>FAB<br>MT-HM | INCR<br>FUEL<br>MT-HM | SPENT<br>FUEL STOR<br>MT-HM | WASTE<br>DISPOSAL<br>MT-HM<br>W/O PU | PU SALES<br>KG FISS | SPENT<br>FUEL DISP<br>MT-HM | TAILS<br>COMP<br>% |
|-------|------------------------------|--------------------------|------------------------------|----------------------|-----------------------------|--------------------|-----------------------|------------------------------|---------------------|-----------------------|-----------------------------|--------------------------------------|---------------------|-----------------------------|--------------------|
| 1977  | 13.0                         | 9.7                      | 5.8                          | 1681                 | 0.                          | 0.                 | 0.                    | 0.                           | 0.                  | 2050                  | 0.                          | 0.                                   | 0.                  | 0.                          | 0.250              |
| 1978  | 14.7                         | 11.0                     | 6.7                          | 1787                 | 0.                          | 0.                 | 0.                    | 0.                           | 0.                  | 3121                  | 0.                          | 0.                                   | 0.                  | 0.                          | 0.250              |
| 1979  | 16.1                         | 12.1                     | 7.4                          | 2193                 | 134.                        | 0.                 | 0.                    | 0.                           | 0.                  | 4153                  | 0.                          | 0.                                   | 134.                | 0.                          | 0.250              |
| 1980  | 18.0                         | 13.4                     | 8.0                          | 2259                 | 458.                        | 0.                 | 0.                    | 0.                           | 0.                  | 5023                  | 0.                          | 0.                                   | 458.                | 0.                          | 0.250              |
| 1981  | 20.5                         | 15.3                     | 9.2                          | 2670                 | 622.                        | 0.                 | 0.                    | 0.                           | 0.                  | 5887                  | 0.                          | 0.                                   | 622.                | 0.                          | 0.250              |
| 1982  | 23.0                         | 17.2                     | 10.3                         | 2941                 | 836.                        | 0.                 | 0.                    | 0.                           | 0.                  | 6756                  | 0.                          | 0.                                   | 836.                | 0.                          | 0.250              |
| 1983  | 25.7                         | 19.2                     | 11.6                         | 3368                 | 1074.                       | 0.                 | 0.                    | 0.                           | 0.                  | 7514                  | 0.                          | 0.                                   | 1074.               | 0.                          | 0.250              |
| 1984  | 28.6                         | 21.4                     | 12.9                         | 3700                 | 1163.                       | 0.                 | 0.                    | 0.                           | 0.                  | 8427                  | 0.                          | 0.                                   | 1163.               | 0.                          | 0.250              |
| 1985  | 31.4                         | 23.6                     | 14.4                         | 4091                 | 1328.                       | 0.                 | 0.                    | 0.                           | 0.                  | 9436                  | 0.                          | 0.                                   | 1328.               | 0.                          | 0.250              |
| 1986  | 34.2                         | 25.7                     | 15.7                         | 4443                 | 1486.                       | 0.                 | 0.                    | 0.                           | 0.                  | 10626                 | 0.                          | 0.                                   | 1486.               | 0.                          | 0.250              |
| 1987  | 36.9                         | 27.9                     | 17.1                         | 4791                 | 1705.                       | 0.                 | 0.                    | 0.                           | 0.                  | 11930                 | 0.                          | 0.                                   | 1705.               | 0.                          | 0.250              |
| 1988  | 40.4                         | 30.2                     | 18.5                         | 5147                 | 1832.                       | 0.                 | 0.                    | 0.                           | 0.                  | 13435                 | 0.                          | 0.                                   | 1832.               | 0.                          | 0.250              |
| 1989  | 44.0                         | 33.3                     | 20.4                         | 5716                 | 2076.                       | 0.                 | 0.                    | 0.                           | 0.                  | 15033                 | 0.                          | 0.                                   | 2076.               | 0.                          | 0.250              |
| 1990  | 47.1                         | 35.6                     | 21.9                         | 6187                 | 2337.                       | 0.                 | 0.                    | 0.                           | 0.                  | 16692                 | 0.                          | 0.                                   | 2337.               | 0.                          | 0.250              |
| 1991  | 50.3                         | 38.1                     | 23.5                         | 6552                 | 2676.                       | 0.                 | 0.                    | 0.                           | 0.                  | 18329                 | 0.                          | 0.                                   | 2676.               | 0.                          | 0.250              |
| 1992  | 53.7                         | 40.6                     | 25.1                         | 6977                 | 3009.                       | 0.                 | 0.                    | 0.                           | 0.                  | 19977                 | 0.                          | 0.                                   | 3009.               | 0.                          | 0.250              |
| 1993  | 57.3                         | 43.3                     | 26.7                         | 7412                 | 3337.                       | 0.                 | 0.                    | 0.                           | 0.                  | 21700                 | 0.                          | 0.                                   | 3337.               | 0.                          | 0.250              |
| 1994  | 61.1                         | 46.3                     | 28.7                         | 7939                 | 3674.                       | 0.                 | 0.                    | 0.                           | 0.                  | 23497                 | 0.                          | 0.                                   | 3674.               | 0.                          | 0.250              |
| 1995  | 64.5                         | 48.9                     | 30.4                         | 8418                 | 3996.                       | 0.                 | 0.                    | 0.                           | 0.                  | 25362                 | 0.                          | 0.                                   | 3996.               | 0.                          | 0.250              |
| 1996  | 67.9                         | 51.6                     | 32.0                         | 8840                 | 4313.                       | 0.                 | 0.                    | 0.                           | 0.                  | 27298                 | 0.                          | 0.                                   | 4313.               | 0.                          | 0.250              |
| 1997  | 71.4                         | 54.3                     | 33.8                         | 9289                 | 4657.                       | 0.                 | 0.                    | 0.                           | 0.                  | 29288                 | 0.                          | 0.                                   | 4657.               | 0.                          | 0.250              |
| 1998  | 74.9                         | 57.0                     | 35.5                         | 9740                 | 5060.                       | 0.                 | 0.                    | 0.                           | 0.                  | 31299                 | 0.                          | 0.                                   | 5060.               | 0.                          | 0.250              |
| 1999  | 78.2                         | 59.5                     | 37.2                         | 10175                | 5471.                       | 0.                 | 0.                    | 0.                           | 0.                  | 33325                 | 0.                          | 0.                                   | 5471.               | 0.                          | 0.250              |
| 2000  | 81.5                         | 62.1                     | 38.8                         | 10602                | 5861.                       | 0.                 | 0.                    | 0.                           | 0.                  | 35371                 | 0.                          | 0.                                   | 5861.               | 0.                          | 0.250              |
| 2001  | 84.7                         | 64.5                     | 40.4                         | 11018                | 6249.                       | 0.                 | 0.                    | 0.                           | 0.                  | 37432                 | 0.                          | 0.                                   | 6249.               | 0.                          | 0.250              |
| 2002  | 87.8                         | 66.9                     | 42.0                         | 11424                | 6647.                       | 0.                 | 0.                    | 0.                           | 0.                  | 39487                 | 0.                          | 0.                                   | 6647.               | 0.                          | 0.250              |
| 2003  | 90.1                         | 69.0                     | 43.5                         | 11819                | 7071.                       | 0.                 | 0.                    | 0.                           | 0.                  | 41500                 | 0.                          | 0.                                   | 7071.               | 0.                          | 0.250              |
| 2004  | 92.0                         | 70.3                     | 44.3                         | 11979                | 7497.                       | 0.                 | 0.                    | 0.                           | 0.                  | 43461                 | 0.                          | 0.                                   | 7497.               | 0.                          | 0.250              |
| 2005  | 94.4                         | 72.2                     | 45.6                         | 12219                | 7907.                       | 0.                 | 0.                    | 0.                           | 0.                  | 45375                 | 0.                          | 0.                                   | 7907.               | 0.                          | 0.250              |
| 2006  | 96.5                         | 73.8                     | 46.7                         | 12548                | 8310.                       | 0.                 | 0.                    | 0.                           | 0.                  | 47241                 | 0.                          | 0.                                   | 8310.               | 0.                          | 0.250              |
| 2007  | 98.3                         | 75.3                     | 47.6                         | 12799                | 8702.                       | 0.                 | 0.                    | 0.                           | 0.                  | 49025                 | 0.                          | 0.                                   | 8702.               | 0.                          | 0.250              |
| 2008  | 100.1                        | 76.7                     | 48.5                         | 13022                | 9084.                       | 0.                 | 0.                    | 0.                           | 0.                  | 50661                 | 0.                          | 0.                                   | 9084.               | 0.                          | 0.250              |
| 2009  | 101.8                        | 78.0                     | 49.4                         | 13248                | 9458.                       | 0.                 | 0.                    | 0.                           | 0.                  | 52132                 | 0.                          | 0.                                   | 9458.               | 0.                          | 0.250              |
| 2010  | 103.4                        | 79.2                     | 50.2                         | 13460                | 9821.                       | 0.                 | 0.                    | 0.                           | 0.                  | 53453                 | 0.                          | 0.                                   | 9821.               | 0.                          | 0.250              |
| 2011  | 104.9                        | 80.4                     | 51.0                         | 13667                | 10176.                      | 0.                 | 0.                    | 0.                           | 0.                  | 54607                 | 0.                          | 0.                                   | 10176.              | 0.                          | 0.250              |
| 2012  | 105.9                        | 81.3                     | 51.6                         | 13846                | 10486.                      | 0.                 | 0.                    | 0.                           | 0.                  | 55837                 | 0.                          | 0.                                   | 10486.              | 0.                          | 0.250              |
| 2013  | 105.6                        | 81.5                     | 52.0                         | 13965                | 10720.                      | 0.                 | 0.                    | 0.                           | 0.                  | 57577                 | 0.                          | 0.                                   | 10720.              | 0.                          | 0.250              |
| 2014  | 104.8                        | 80.6                     | 51.4                         | 13727                | 10929.                      | 0.                 | 0.                    | 0.                           | 0.                  | 59123                 | 0.                          | 0.                                   | 10929.              | 0.                          | 0.250              |
| 2015  | 104.7                        | 80.6                     | 51.5                         | 13618                | 11142.                      | 0.                 | 0.                    | 0.                           | 0.                  | 60574                 | 0.                          | 0.                                   | 11142.              | 0.                          | 0.250              |
| 2016  | 104.5                        | 80.4                     | 51.4                         | 13651                | 11330.                      | 0.                 | 0.                    | 0.                           | 0.                  | 61919                 | 0.                          | 0.                                   | 11330.              | 0.                          | 0.250              |
| 2017  | 103.8                        | 80.0                     | 51.2                         | 13593                | 11716.                      | 0.                 | 0.                    | 0.                           | 0.                  | 62632                 | 0.                          | 0.                                   | 11716.              | 0.                          | 0.250              |
| 2018  | 102.1                        | 79.1                     | 50.8                         | 13492                | 12460.                      | 0.                 | 0.                    | 0.                           | 0.                  | 62751                 | 0.                          | 0.                                   | 12460.              | 0.                          | 0.250              |
| 2019  | 99.9                         | 77.2                     | 49.7                         | 13142                | 12475.                      | 0.                 | 0.                    | 0.                           | 0.                  | 62483                 | 0.                          | 0.                                   | 12475.              | 0.                          | 0.250              |
| 2020  | 97.7                         | 75.7                     | 48.8                         | 12784                | 12593.                      | 0.                 | 0.                    | 0.                           | 0.                  | 62279                 | 0.                          | 0.                                   | 12593.              | 0.                          | 0.250              |
| TOTAL | 3037.5                       | 2320.3                   | 1459.0                       | 395939               | 251878.                     | 0.                 | 0.                    | 0.                           | 0.                  | 1445061               | 0.                          | 0.                                   | 251878.             | 0.                          | 0.250              |



### 3.0 FUEL CYCLE COST ESTIMATION

In this chapter we will summarize the procedures and assumptions used to calculate levelized unit prices for each component of the front end of the LWR fuel cycle. We will report changes made since the previous report. We will then show our most current price projections, along with comparisons to other researcher's projection, and our estimated range of uncertainty connected with our projections.

We used the UNICST computer model to calculate levelized price for each fuel cycle component. In Section 3.1 we will describe the procedure and capabilities connected with this model. Sections 3.2 through 3.5 will then summarize the specific calculations and assumptions required for input to the UNICST model for each component.

#### 3.1 UNICST COMPUTER MODEL

The UNICST model is set up to perform a discounted cash flow analysis to calculate a levelized price.\* The model can be run in two modes:

1. Plant cost flows are entered
2. Plant building schedules are used

In Mode 1 we enter dollar and production flows in each year for a specific plant. UNICST performs a discounted cash flow analysis on this data to calculate the levelized price for this particular plant. Mode 2 requires a demand schedule in addition to dollar and production flows. We then specify maximum and minimum capacities allowable in any year. We assume a scenario that will represent a vendor in the market and specify the market share that this vendor will receive. The program will then build plants and make additions to existing plants to satisfy the portion of the demand held by this vendor. As in Mode 1, a discounted cash flow analysis is performed and a levelized price calculated for each plant built. The average levelized price for a given year is taken as the weighted average of the levelized prices of all plants operating in that year. The program

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\* The levelized price refers to the price that must be charged to recover the original capital investment with the required rate of return by the end of the plant life.



then prints out the average levelized price versus years. UNICST has the added capability of using a factor for learning in generating the price forecast. The learning curve incorporated in UNICST is a technology learning curve which assumes an increase in productivity per unit capital due to technological advances as function time.

A typical example of a UNICST run using  $UO_2$  fuel fabrication as an example is shown in Appendix A. A learning effect of increasing production capacity per unit capital dollar by 1.5% per year is included in this sample run.

### 3.2 URANIUM MINING AND MILLING

#### 3.2.1 Cost Estimation Procedure

Based on historical information contained in Statistical Data of the Uranium Industry (1977),<sup>(1)</sup> we determined an average ore grade associated with each forward cost category. These values are shown in Table 3.1. From the statistical data we assumed a production facility size of 2000 T ore/day.

TABLE 3.1. Average Ore Grade Versus Forward Cost

| <u>Forward Cost</u> | <u>Average Ore Grade (% <math>U_3O_8</math>)</u> |                 |
|---------------------|--|-----------------|
|                     | <u>Underground</u>                               | <u>Open Pit</u> |
| \$10 Reserves       | 0.28   | 0.16            |
| \$15 Reserves       | 0.115  | 0.08            |
| \$30 Reserves       | 0.064  | 0.046           |
| \$50 Reserves       | 0.032  | 0.023           |

We determined scaling factors for the capital and operating costs versus plant size and ore grade based on Klemenic's data.<sup>(2)</sup> Required lead times and some cost information were used directly from Klemenic; however, more current information was used when it was available. We quote all costs in 1977 dollars. We scaled up capital costs from other years using the Marshall Stevens Construction Index for Mining and Milling.\*

\* Found monthly in Chemical Engineering, published by McGraw Hill.



Since mining is a labor intensive operation, we adjusted operating costs based on the average hourly earnings of metal miners.<sup>(3)</sup> We determined exploration costs from current statistics<sup>(1)</sup> and mill costs from a vendor's quote. We used the UNICST computer model to calculate a levelized price for each forward cost category. The assumptions used in the UNICST program are listed in Table 3.2. Only the reserve and probable uranium supplies

TABLE 3.2. Assumptions for Levelized Price Calculation

- 10-Year Total Lead Time
- 10-Year Mine Life
- 2000 Ton/Day Processed, 330 Days/yr
- Constant Mill Tailings of 0.0075%  $U_3O_8$
- 75% Equity Funding, 8% Bond Interest Rate
- 15% Required Internal Rate of Return
- 48% Federal Income Tax, 7% State Income Tax, 7% Investment Credit, 4% Property Tax
- A Depletion Allowance of the Lesser of 22% Gross Revenues or 50% Net Income

were considered. We assumed the probables were more expensive due to increased exploration costs. We estimated these increased costs by looking at the exploration cost trend required to add on the next reserves. These levelized prices from UNICST and the estimated quantities available at each levelized price were entered into NUCOST. NUCOST calculates a price forecast based on anticipated demand. The uranium demand data is shown graphically in Figure 3.1. We arrived at these demand schedules by methods discussed in Chapter 2. For our reference case we used the median growth, no reprocessing scenario. NUCOST will mine 1/10 of each price block per year until the yearly demand is met. The price will be set by the highest priced block mined. The next highest priced block will overshadow the lower priced blocks resulting in a gradual rising of the price to the level of the next uranium block to be mined. NUCOST accomplishes this effect by discounting the next highest priced block back to the lower priced block at 10%/yr and setting the price at the greater of the two values for each year.

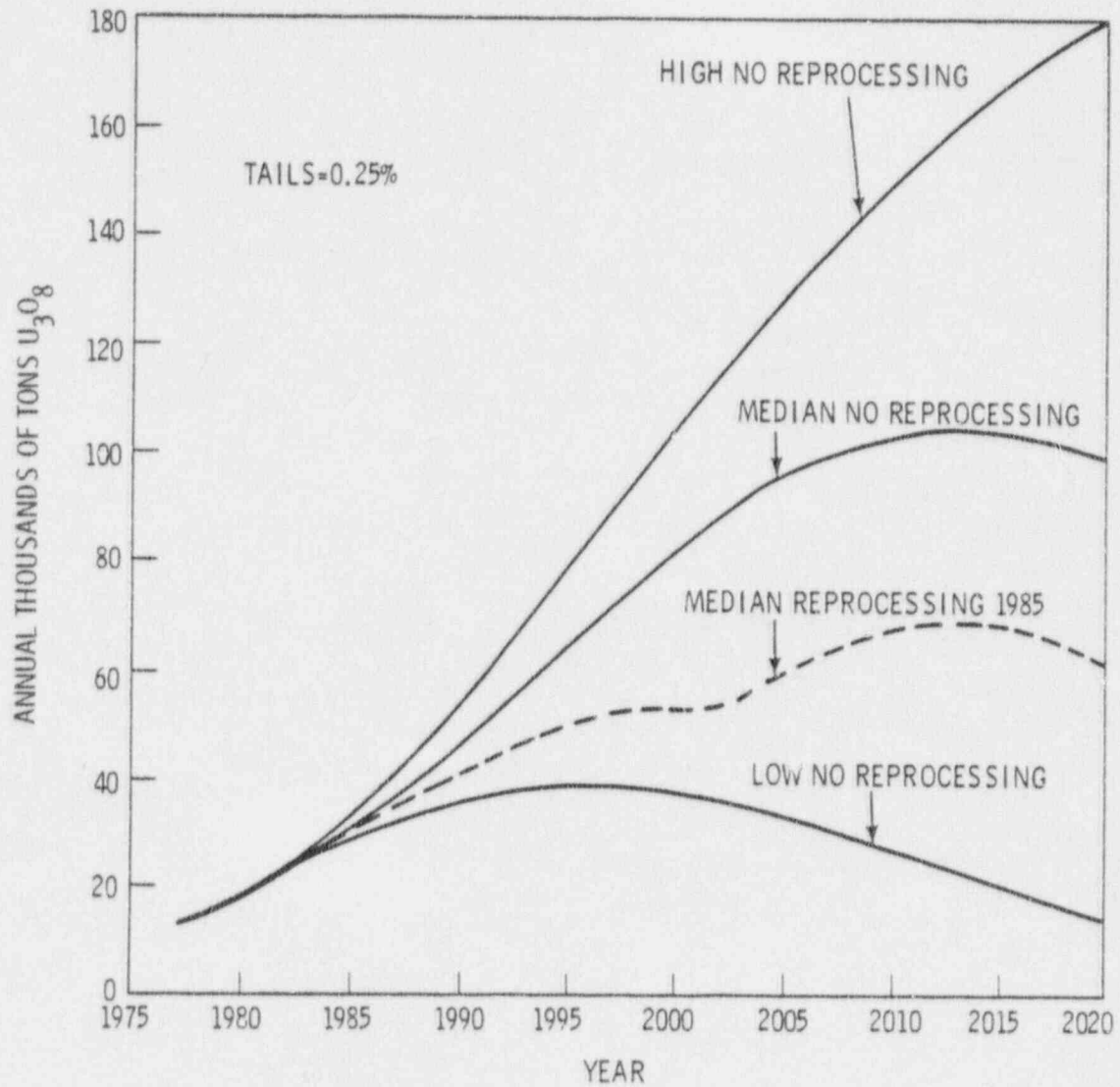


FIGURE 3.1. Uranium Requirements

After developing our price projection, we identified areas of uncertainty to estimate the range of uncertainty in our forecast.

### 3.2.2 Changes From Last Report

The price forecast we generated in this report will differ slightly from the previous forecast due to updating of the uranium demand schedule as discussed in Chapter 2 and the extension of uranium demand and price forecasts to the year 2020. The levelized prices for each forward cost category remained the same.

### 3.2.3 Comparative Results

The expenditures for our reference mines are shown in Tables 3.3 and 3.4. These costs were used in UNICST to develop the levelized prices for each forward cost category as shown in Table 3.5. We used ERDA's<sup>(1)</sup> uranium reserves and probables in the NUCOST model. The levelized prices

TABLE 3.5. Levelized Price Versus Forward Cost Category

| <u>Forward<br/>Cost Category</u> | <u>Levelized Price (\$/lb U<sub>3</sub>O<sub>8</sub>)</u> |                     |                             |
|----------------------------------|---|---------------------|-----------------------------|
|                                  | <u>Underground</u>  | <u>Open<br/>Pit</u> | <u>Weighted<br/>Average</u> |
| Reserves (\$)                    |   |                     |                             |
| 10                               | 26.06   | 26.78               | 26.30                       |
| 15                               | 31.71   | 40.71               | 34.40                       |
| 30                               | 48.28   | 59.07               | 51.60                       |
| 50                               | 78.03   | 111.94              | 88.20                       |
| Probables (\$)                   |   |                     |                             |
| 10                               | 48.48   | 40.23               | 46.20                       |
| 15                               | 43.20   | 48.25               | 44.70                       |
| 30                               | 60.87   | 76.76               | 65.80                       |
| 50                               | 81.32   | 114.85              | 91.38                       |

and quantities available are shown in Table 3.6. In Figure 3.2 we show our uranium price projection in comparison to other price projections. Note that all price estimates are lower than the current exchange price shown by the dashed line. It appears likely that the current exchange price will remain relatively constant until 1985 to 1990 at which time

TABLE 3.3. Expenditures for Underground Mining and Milling  
Basis: 2000 T Ore/Day

|   | Forward Cost Category, \$/lb |                      |                       |                     |                      |                       | Years*<br>Incurred |
|---|------------------------------|----------------------|-----------------------|---------------------|----------------------|-----------------------|--------------------|
|   | Reserves                     |                      |                       | Probables           |                      |                       |                    |
|   | \$10                         | \$15                 | \$30                  | \$10                | \$15                 | \$30                  |                    |
| Average Ore Grade (\$ U <sub>3</sub> O <sub>8</sub> ) | 0.28                         | 0.115                | 0.064                 | 0.28                | 0.115                | 0.064                 |                    |
| Throughput (lb U <sub>3</sub> O <sub>8</sub> /yr)     | 3.6x10 <sup>6</sup>          | 1.42x10 <sup>6</sup> | 0.746x10 <sup>6</sup> | 3.6x10 <sup>6</sup> | 1.42x10 <sup>6</sup> | 0.746x10 <sup>6</sup> |                    |
| Millions 1977 Dollars                                 |                              |                      |                       |                     |                      |                       |                    |
| Capital Costs   |                              |                      |                       |                     |                      |                       |                    |
| Field Expenses  | 26.03                        | 4.93                 | 1.65                  | 67.45               | 14.39                | 7.84                  | 1,2,3,4,5          |
| Property Acquisition                                  | 21.38                        | 4.95                 | 1.35                  | 55.40               | 11.82                | 6.44                  | 1,2,3,4,5          |
| Exploration Drilling                                  | 35.33                        | 6.69                 | 2.23                  | 91.53               | 19.52                | 10.63                 | 3,4,5,6            |
| Development Drilling                                  | 10.23                        | 1.94                 | 0.647                 | 26.50               | 5.65                 | 1.03                  | 5,6,7              |
| Mine Primary Development                              | 44.57                        | 32.76                | 26.74                 | 44.57               | 32.76                | 26.74                 | 8,9,10             |
| Mine Plant and Equipment                              | 8.18                         | 6.01                 | 4.91                  | 8.18                | 6.01                 | 4.91                  | 11,16              |
| Mill Construction                                     | 60.0                         | 60.0                 | 60.0                  | 60.0                | 60.0                 | 60.0                  | 9,10               |
| Total Capital Cost                                    | 205.70                       | 116.40               | 97.50                 | 353.63              | 150.15               | 119.64                |                    |
| Operating Costs (Annual)                              |                              |                      |                       |                     |                      |                       |                    |
| Mining  | 9.31                         | 5.82                 | 9.31                  | 9.31                | 5.82                 | 4.27                  | 11 + 20            |
| Hauling   | 0.65                         | 0.65                 | 0.65                  | 0.65                | 0.65                 | 0.65                  | 11 + 20            |
| Milling   | 3.85                         | 3.69                 | 3.85                  | 3.85                | 3.69                 | 3.59                  | 11 + 20            |
| Royalty   | 3.60                         | 2.13                 | 3.60                  | 3.60                | 2.13                 | 2.24                  | 11 + 20            |
| Total Operating Cost (Annual)                         | 17.41                        | 12.29                | 17.41                 | 17.41               | 12.29                | 10.75                 |                    |

Page

\* Production begins in the 11th year.

FIGURE 3.4. Expenditures for Open Pit Mining and Milling  
Basis: 2000 T Ore/Day

|  | Forward Cost Category, \$/lb |                      |                      |                      |                      |                      | Years*<br>Incurred |
|--|------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|--------------------|
|  | Reserves                     |                      |                      | Probables            |                      |                      |                    |
|  | \$10                         | \$15                 | \$30                 | \$10                 | \$15                 | \$30                 |                    |
| Average Ore Grade (% U <sub>3</sub> O <sub>8</sub> ) | 0.16                         | 0.08                 | 0.046                | 0.16                 | 0.08                 | 0.046                |                    |
| Throughput (lb U <sub>3</sub> O <sub>8</sub> /yr)    | 2.01x10 <sup>6</sup>         | 0.96x10 <sup>6</sup> | 0.51x10 <sup>6</sup> | 2.01x10 <sup>6</sup> | 0.96x10 <sup>6</sup> | 0.51x10 <sup>6</sup> |                    |
| Millions 1977 Dollars                                |                              |                      |                      |                      |                      |                      |                    |
| Capital Costs  |                              |                      |                      |                      |                      |                      |                    |
| Field Expenses                                       | 9.14                         | 2.5                  | 0.89                 | 23.69                | 7.29                 | 4.24                 | 1,2,3,4,5          |
| Property Acquisition                                 | 7.51                         | 2.05                 | 0.73                 | 19.46                | 5.99                 | 3.48                 | 1,2,3,4,5          |
| Exploration Drilling                                 | 12.40                        | 3.39                 | 1.21                 | 32.16                | 9.89                 | 5.75                 | 3,4,5,6            |
| Development Drilling                                 | 3.59                         | 0.98                 | 0.35                 | 9.31                 | 2.86                 | 1.66                 | 5,6,7              |
| Mine Primary Development                             | 54.36                        | 50.17                | 47.07                | 54.36                | 50.17                | 47.07                | 8,9,10             |
| Mine Plant and Equipment                             | 1.85                         | 1.71                 | 1.61                 | 1.85                 | 1.71                 | 1.61                 | 11,16              |
| Mill Construction                                    | 60.0                         | 60.0                 | 60.0                 | 60.0                 | 60.0                 | 60.0                 | 9,10               |
| Total Capital Cost                                   | 148.9                        | 120.8                | 111.9                | 200.83               | 137.91               | 123.82               |                    |
| Operating Costs (Annual)                             |                              |                      |                      |                      |                      |                      |                    |
| Mining   | 1.55                         | 0.97                 | 0.67                 | 1.55                 | 0.97                 | 0.67                 | 11 + 20            |
| Hauling  | 0.65                         | 0.65                 | 0.65                 | 0.65                 | 0.65                 | 0.65                 | 11 + 20            |
| Milling  | 3.75                         | 3.61                 | 3.53                 | 3.75                 | 3.61                 | 3.53                 | 11 + 20            |
| Royalty  | 2.01                         | 1.44                 | 1.53                 | 2.01                 | 1.44                 | 1.53                 | 11 + 20            |
| Total Operating Cost (Annual)                        | 7.96                         | 6.67                 | 6.38                 | 7.96                 | 6.67                 | 6.38                 |                    |

\* Production begins in the 11th year.

TABLE 3.6. Levelized Price of  $U_3O_8$  Versus Projected Quantity Available

| Levelized Price<br>(\$/lb $U_3O_8$ ) | Quantity<br>( $10^3$ Tons $U_3O_8$ ) | Cumulative |
|--------------------------------------|--------------------------------------|------------|
| 26.30                                | 250                                  | 250        |
| 34.40                                | 160                                  | 410        |
| 39.50                                | 150                                  | 560        |
| 44.70                                | 160                                  | 720        |
| 46.20                                | 275                                  | 995        |
| 51.60                                | 270                                  | 1,265      |
| 59.00                                | 266                                  | 1,525      |
| 65.80                                | 245                                  | 1,770      |
| 88.20                                | 160                                  | 1,930      |
| 91.38                                | 210                                  | 2,140      |

the price will rise to approximately \$60/kg  $U_3O_8$  by year 2000 (1977 dollars).

#### 3.2.4 Comparison with GESMO<sup>(6)</sup> Estimates

For the current estimates we used the same basic price calculation in NUCOST as was used for GESMO.<sup>(6)</sup> However, the following differences are incorporated in this report.

1. Only reserves and probables forward cost categories are used. All other forecasts used this procedure or only reserves.
2. Cost for \$10 reserves are virtually the same as in GESMO escalated to 1977 dollars. Variations in other categories are a result of a more detailed analysis than used in GESMO. A comparison of the values is shown in Table 3.7.

TABLE 3.7. Comparison of Uranium Cost Estimates

| Forward Cost | Reserves     |             | Probables    |             |
|--------------|--------------|-------------|--------------|-------------|
|              | GESMO (\$77) | This Report | GESMO (\$77) | This Report |
| 10           | 28           | 26          | 33           | 46          |
| 15           | 40           | 34          | 44           | 45          |
| 30           | 69           | 52          | 81           | 66          |



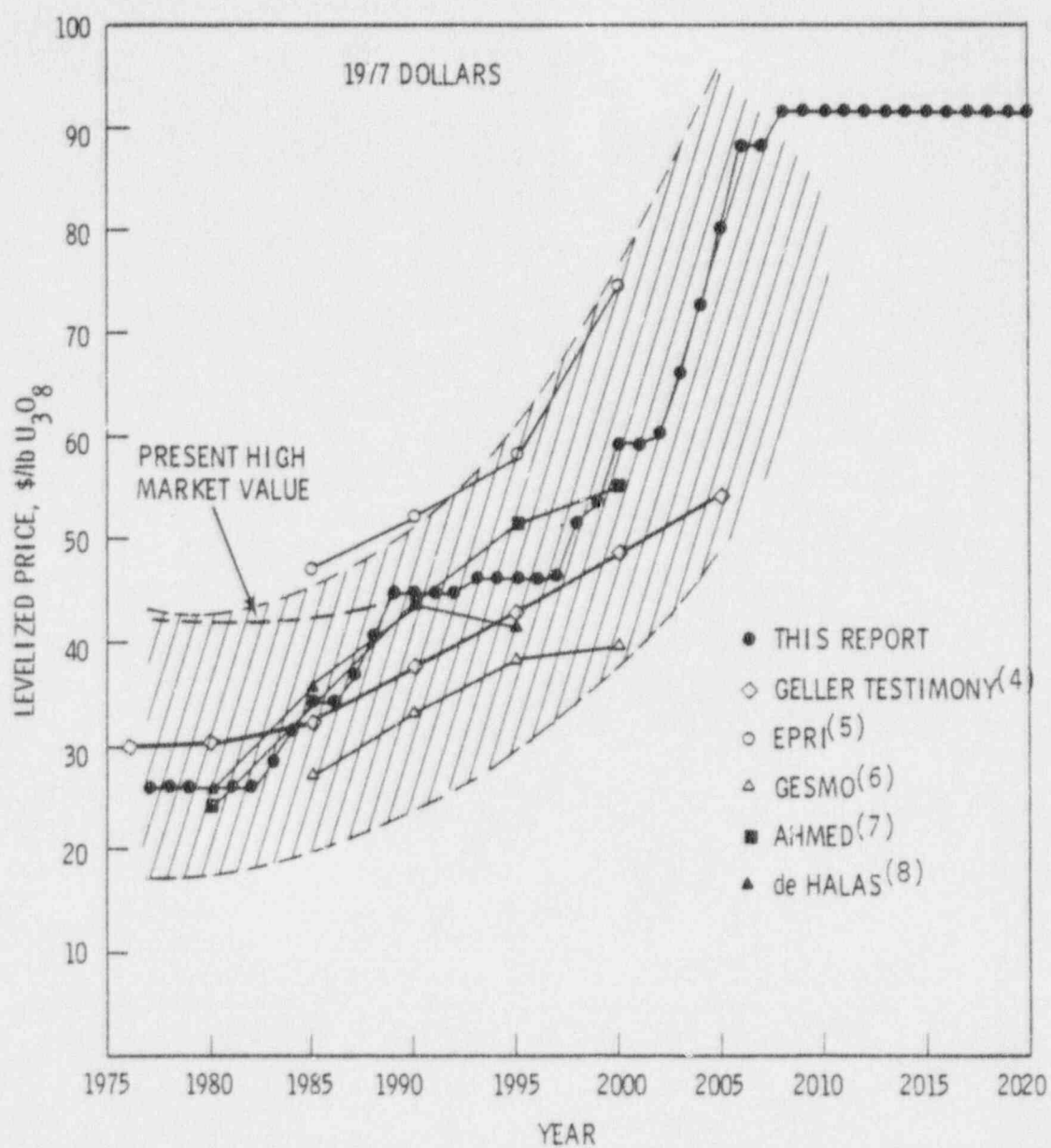


FIGURE 3.2. Uranium Price Forecast

3. Based on the fact that the reserves associated with existing mines are not available to the new price setting mine, the market price is based on a more expensive cost category. As a result, this revised formulation is sensitive to the annual rate of demand, whereas the GESMO model only considered the cumulative use.

### 3.2.5 Uncertainties of Price Projections

To ascertain the reliability of our forecast, we determined the factors that were most likely to vary in our price calculation and their effects on the calculated levelized price. The uranium prices are strongly dependent on the ore grade mined. The ore grades that will be discovered in the future can only be roughly estimated, and the costs of finding these future ores is not based on historical experience since the past data on the lower grade ores is limited. The demand for uranium will also have an effect on the uranium prices. Changes in government policy regarding tails assay, plutonium recycle, and the breeder reactor will all affect the net demand. Public acceptance or rejection of the nuclear alternative will also play a part in establishing the demand for uranium. In addition to these factors, mine operation and policy will change the price of uranium. For example, a change from 15 to 20% return on investment would result in an increase in the levelized price of 15%. Should the mine operate for 15 years instead of 10 years, a practice which is common, the levelized price would drop 12 to 14%. Reports in the literature of mill prices as low as \$15,000/ton ore/day<sup>(9)</sup> would decrease the levelized price by 5 to 20% depending on the ore grade being processed. Taking these factors into consideration collectively we estimated the variability of our estimates to be approximately plus or minus 20 to 30%. This was shown graphically in Figure 3.2 by the solid lines bounding the price projections.

## 3.3 UF<sub>6</sub> CONVERSION

### 3.3.1 Cost Estimation Procedure

The estimated demand for UF<sub>6</sub> conversion is shown in Figure 3.3 for the median growth scenario with and without reprocessing. Based on industry estimates<sup>(10)</sup> we chose a reference facility capacity of 10,000 MTU/yr at a capital cost of \$75 million (1977 dollars). Operating cost estimates by

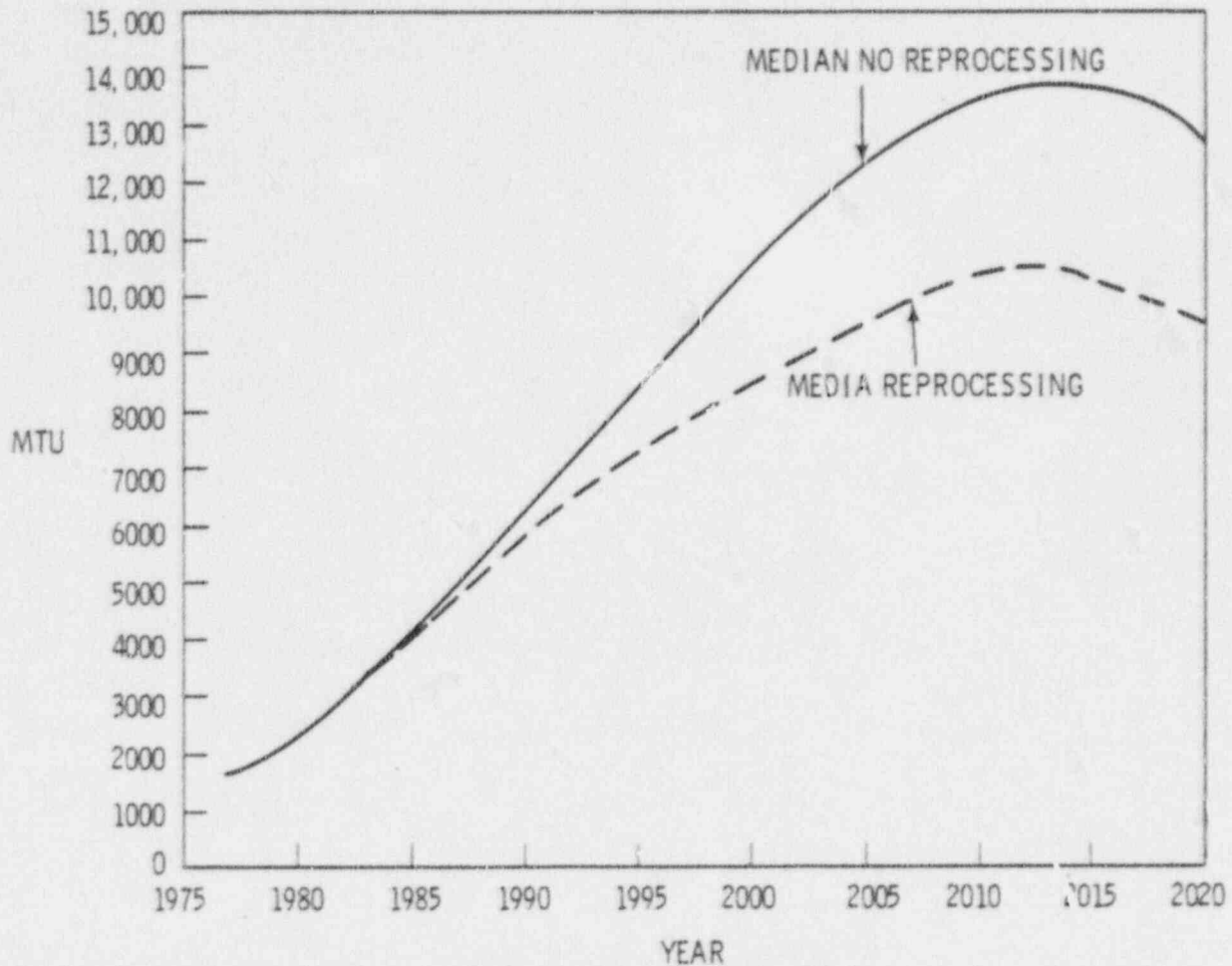


FIGURE 3.3.  $UF_5$  Conversion Requirements

Geller<sup>(4)</sup> were escalated to 1977 dollars at 6%/yr and used to calculate the levelized price. A breakdown of the expenditures is shown in Table 3.8. We used UNICST in Mode 1 as described in Section 3.1 to calculate the levelized price. The assumptions used in UNICST are listed below:

- 5-yr construction and design
- 70% capacity factor including startup
- 20-yr amortization
- 75% equity funded
- 12% return on investment
- 8% bond interest rate
- 48% federal income tax, 7% state income tax, 7% investment tax credit

The estimated capital and operating cost along with the assumptions listed above were used as input into UNICST to generate a levelized price.

TABLE 3.8.  $UF_6$  Conversion

Basis: 10,000 MTU/yr)

Capacity Factor: 70%

Lead Time: 5 Years

| <u>Expenditures (1977 Dollars)</u> |            |
|------------------------------------|------------|
| Capital Cost (\$ Millions)         | 75.        |
| Operating Costs (\$ MM/yr)         |            |
| Labor                              | 6.0        |
| Supplies                           | 12.7       |
| G&A (2% Price)                     | 0.7        |
| Sampling & Shipping (5% Price)     | 1.7        |
| TOTAL                              | 21.1 MM/yr |
| Levelized Price, \$5.12/kg U       |            |

### 3.3.2 Comparative Results

We estimate the price of  $UF_6$  conversion based on a plant constructed from 1977-1982 to be \$5.12/kg U (1977 dollars). We feel that conversion is an established chemical process in a competitive market so there will be little price change in constant dollars over time. However, should new processes be introduced such as the direct conversion fluidized bed process, improvements may result which would lower the levelized price.

Other literature estimates of conversion costs are listed in Table 3.9.

TABLE 3.9. Comparative UF<sub>6</sub> Conversion Estimates

|  | <u>\$/kg U*</u> |
|--|-----------------|
| This Report                            | 5.12            |
| Geller <sup>(4)</sup>                  | 4.97            |
| South Australian Gov't <sup>(11)</sup> | 4.90            |
| TRW <sup>(12)</sup>                    | 3.60            |

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\* Other years escalated to 1977 dollars at 6% per year.

### 3.4 ISOTOPIC ENRICHMENT

#### 3.4.1 Cost Estimation Procedure

Our projections of separative work unit requirements for the high, low, and median no reprocessing, and the median reprocessing scenarios are shown in Figure 3.4. The government recently decided to meet the growing demand for separative work by constructing an 8.75 million SWU/yr gas centrifuge facility. We assumed that this plant will be the price setting producer so we chose it as our reference facility. The Department of Energy's latest capital cost estimate for the project is \$4.5 billion (1978 dollars). ERDA<sup>(13)</sup> estimates for annual labor and supplies of \$104.2 million were used (1977 dollars). Power requirements were taken to be 4% of the 2400 kW-hr/SWU needed for gaseous diffusion plants. Power costs were assumed to be 1.6¢/kW-hr. A value of \$10.7 million per year was used to cover administration and R&D. Feed and flywheel cost estimates were calculated based on the interest carried on the feed and flywheel value for three months. Table 3.10 summarizes the cost data for the levelized price calculation.

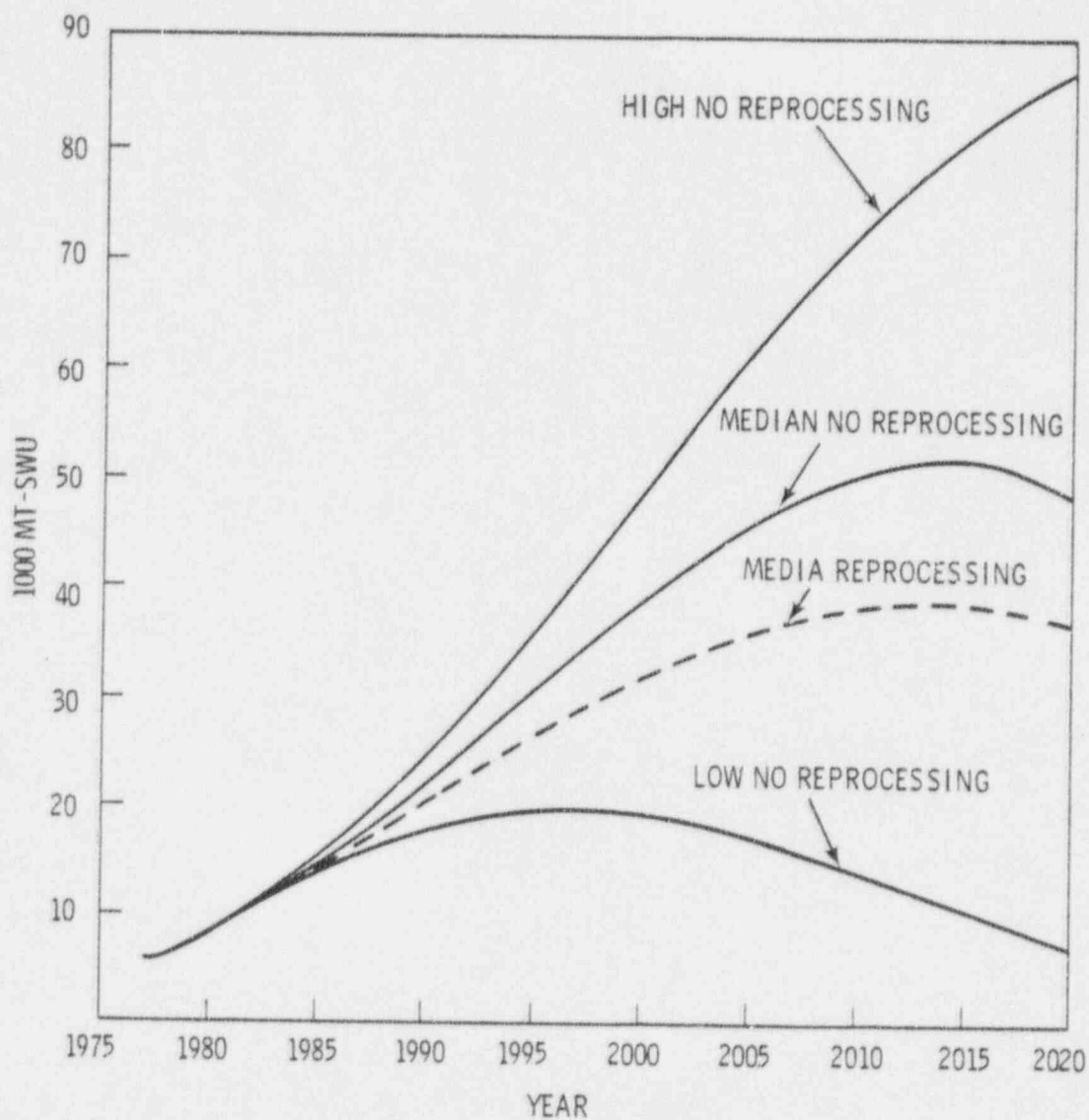


FIGURE 3.4. Enrichment Requirements



TABLE 3.10. Gas Centrifugation

Basis: 8.75 Million SWU/yr

Capacity: 95%

Lead Time: 8 Years

Expenditures (1977 Dollars)

Capital Cost (Billion \$) 4.2

## Operating Costs (\$ MM/yr)

|                 |      |
|-----------------|------|
| Labor           | 49.1 |
| Supplies        | 55.1 |
| Power           | 10.1 |
| Feed & Flywheel | 71.1 |
| R&D and G&A     | 13.4 |

TOTAL \$199.4 MM/yr3.4.2 Assumptions

For our reference price projection we assumed that DOE will begin using commercial pricing for this plant. We used conditions reported in the literature<sup>(14)</sup> for government commercial pricing. The conditions are:

- 12% return on equity
- Debt/equity ratio = 50/50
- 8% bonds
- 40% federal income tax

For our government owned pricing we used 6.5% as a cost of money with 100% equity funding. No allowances for taxes, business risks, etc. were allowed in the government owned calculation.

### 3.4.3 Comparative Results

Figure 3.5 shows our price projection for commercially priced separative work. We find the price to be \$100/SWU in 1986 when the gas centrifuge would come on line (1977 dollars). This agrees with DOE estimates for separative work. The dashed line represents a hypothetical path that the separative work price will follow from the present DOE<sup>(15)</sup> requirements contract charge of \$76.82/SWU to the commercial pricing value. The point at which the separative work price reaches \$100/SWU will vary depending on when the government adopts commercial pricing. The Stoller estimate on Figure 3.5 is considerably lower than ours since their estimates assumes typical government ownership without return on investment, taxes, etc. Other point estimates are also shown in Figure 3.5. The GESMO estimate is also based on government ownership.

Since gas centrifugation is a new process, we expect learning will result in price decreases as shown by the declining price projection after 1995.

### 3.4.4 Uncertainty

The upper limit for our projection shown in Figure 3.5 was developed based on higher labor and supply estimates by other researchers.<sup>(4)</sup> The lower limit is based on the present government ownership separative work price. This is the separative work price that would be charged if commercial pricing is not adopted.

## 3.5 UO<sub>2</sub> FUEL FABRICATION

### 3.5.1 Cost Estimation

The UO<sub>2</sub> fuel fabrication requirements developed in Chapter 2 are shown in Figure 3.6 for the median growth reprocessing and no reprocessing scenarios. The median growth no reprocessing scenario was used in this report to calculate the levelized price.

We assumed a reference size UO<sub>2</sub> fuel fabrication plant for production of PWR fuel elements to be 1500 MTU/yr, using the plant size suggested in GESMO.<sup>(6)</sup> Capital cost estimates found in the literature were escalated to

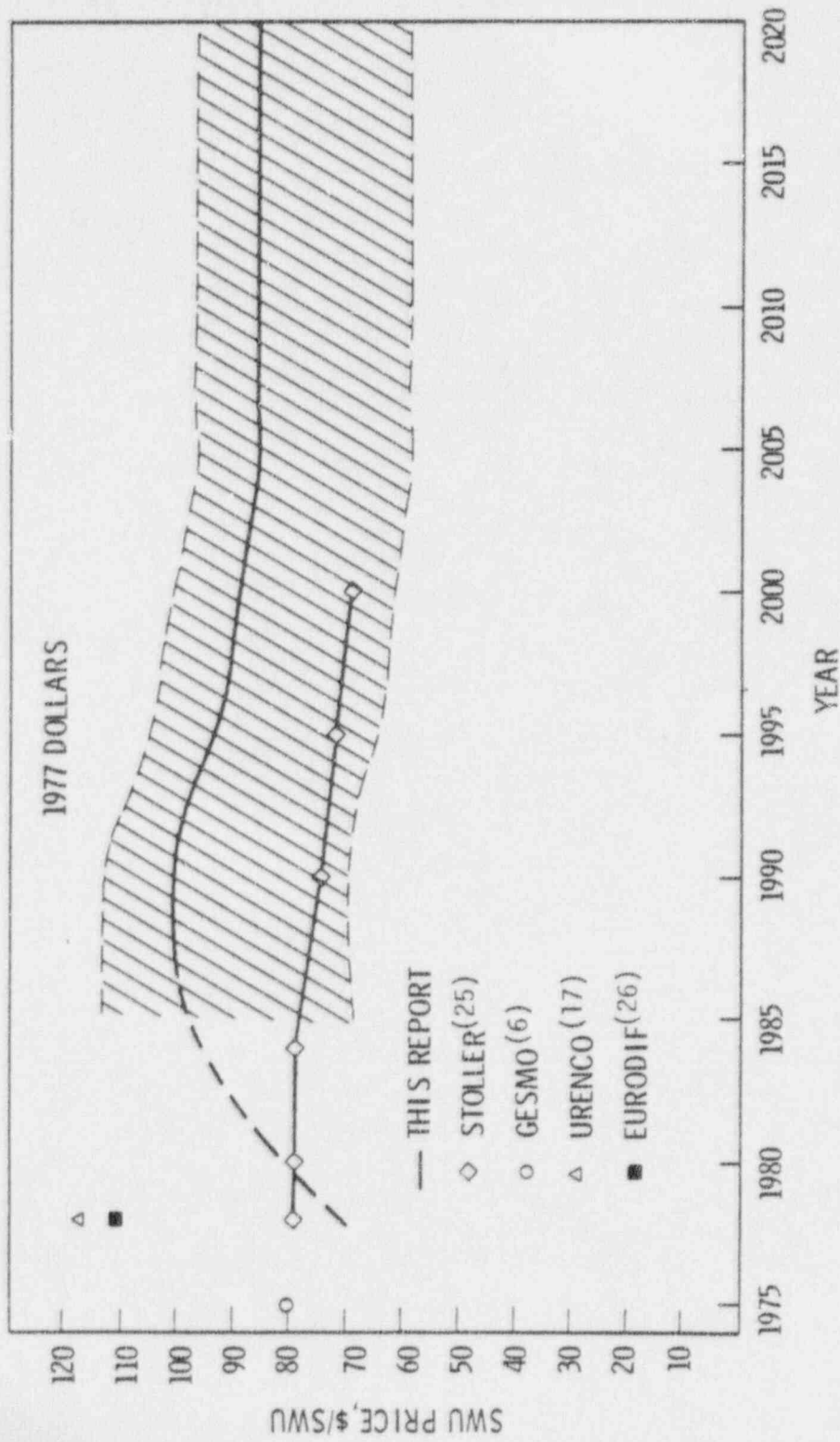


FIGURE 3.5. Enrichment Price Forecast

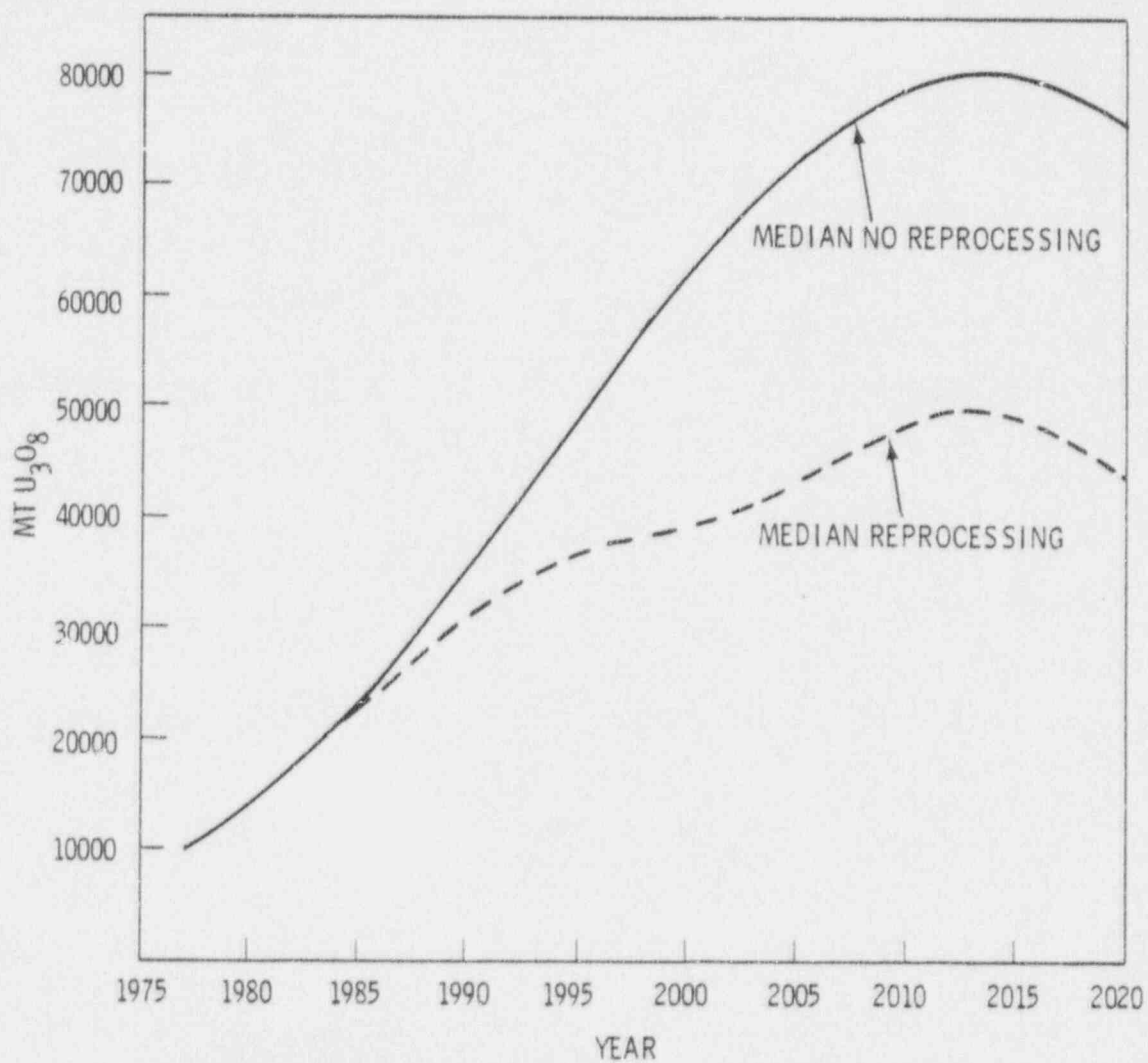


FIGURE 3.6.  $\text{UF}_6$  Conversion Requirements

1977 dollars using the Engineering News Record (ENR) Construction Cost Index,\* which includes factors for buildings, equipment, and labor.

Table 3.11 shows these costs. From this data we estimated our 1500 MTU/yr

TABLE 3.11. Capital Cost Estimates Versus Plant Size

| <u>Plant Size</u><br><u>(MTU/yr)</u> | <u>Reference</u><br><u>Number</u> | <u>Year</u> | <u>Base</u><br><u>Year</u><br><u>Cost</u><br><u>(\$MM)</u> | <u>1977</u><br><u>Cost</u><br><u>(\$MM)</u> |
|--------------------------------------|-----------------------------------|-------------|--|---|
| 260                                  | 16                                | 1968        | 4.9  | 10.5  |
| 1,000                                | 17                                | 1969        | 20   | 42.8  |
| 1,250                                | 18                                | 1975        | 50   | 61.4  |
| 1,500                                | 19                                | 1973        | 36   | 51.3  |
| 1,500                                | 20                                | 1975        | 110  | 135   |

reference facility to have a capital cost of \$62 million (1977 dollars).

Operating costs were estimated by determining material requirements, personnel requirements and miscellaneous expenses from various reports and documents. Table 3.12 is a summary of the manufacturing costs required for the 1500 MTU/yr reference facility.

The capital and operating cost estimated above were used to run UNICST in Mode 2. We assumed our vendor was one of the large producers (i.e., Westinghouse or General Electric) and, therefore, allotted a large share of the market. The UNICST model built fabrication plants through the year 2000 to satisfy the vendor's market share of  $UO_2$  fuel fabrication requirements outlined in Figure 3.6.

For the UNICST run we assumed a return on investment of 20% with a debt to equity ratio of 25/75.

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\* The Engineering News Record Construction Cost Index appears weekly in the Engineering News Record.

TABLE 3.12.  $\text{UO}_2$  Fuel Fabrication Operating Expenses

Basis: 1500 MTU/yr

I. MANUFACTURING COSTSA. DIRECT PRODUCT COSTS

| <u>Process Materials</u>       | <u>Million \$/Year</u> |
|--------------------------------|------------------------|
| Zircaloy Tubing                | 40.0                   |
| Zircaloy End Caps              | 4.5                    |
| Zirconium Hardware             | 9.7                    |
| Stainless Steel Hardware       | 8.4                    |
| TOTAL                          | 62.6                   |
| <u>Operating Labor*</u>        |                        |
| Supervisory                    | 1.6                    |
| Labor                          | 10.7                   |
| TOTAL                          | 12.3                   |
| <u>Utilities</u>               |                        |
| Electricity                    | 1.45                   |
| Natural Gas                    | 0.004                  |
| Process Water                  | 0.002                  |
| TOTAL                          | 1.5                    |
| <u>Maintenance and Repairs</u> | 3.7                    |
| <u>Miscellaneous Materials</u> | 0.6                    |
| <u>Patents and Royalties</u>   | 1.0                    |
| <u>Mechanical Warranties</u>   | 6.8                    |
| <hr/>                          |                        |
| TOTAL DIRECT PRODUCTION COST   | 88.5                   |

\* Laboratory expenses included.



TABLE 3.12. (Continued)

| B. <u>FIXED CHARGES*</u>          |       | <u>Million \$/Year</u> |
|-----------------------------------|-------|------------------------|
| <u>Plant Overhead</u>             |       | 9.6                    |
| <u>Administrative Costs</u>       |       |                        |
| Management                        |       | 4.6                    |
| Professional                      |       | 3.5                    |
| Technical                         |       | 1.7                    |
| Clerical                          |       | 0.6                    |
|                                   | TOTAL | 10.4                   |
| <u>Distribution and Marketing</u> |       | 6.8                    |
| <u>Research &amp; Development</u> |       | 4.1                    |
| Contingencies                     |       | 5.4                    |
| TOTAL FIXED CHARGES               |       | 36.3                   |
| TOTAL OPERATING EXPENSES          |       | 124.8                  |

\* The fixed charges such as depreciation, taxes, insurance, financing, and the gross earnings are incorporated into the total product cost by the UNICST computer program.

### 3.5.2 Changes From Last Report

Since the last report on fabrication we have modified UNICST to develop a technological learning described in Chapter 2. Based on a 1.5%/yr increase in productivity per capital dollar, the latest forecast shows a 5 - 10% lower price forecast than the initial report.

### 3.5.3 Comparative Results

We found that  $UO_2$  fuel fabrication is a material and labor intensive operation. Operating expenses are responsible for 82% of the levelized price with materials being 50% of the operating expenses and labor 18%.

In Figure 3.6 we show our price projection developed by UNICST in comparison with other forecasts. The UNICST results from this run are compiled in Appendix A. There is close agreement between all price forecasts. All forecasts, including ours, indicate a slight decrease of approximately 1%/yr in constant dollars due to learning effects.

### 3.5.4 Uncertainty

Since fabrication is so highly material intensive, changes in the capital cost estimate have little or no effect on the overall levelized price. We assumed an uncertainty in the price of materials and labor to be plus or minus 20%. This results in an overall range of uncertainty of plus or minus 15% indicated by the outer boundary lines in Figure 3.6.

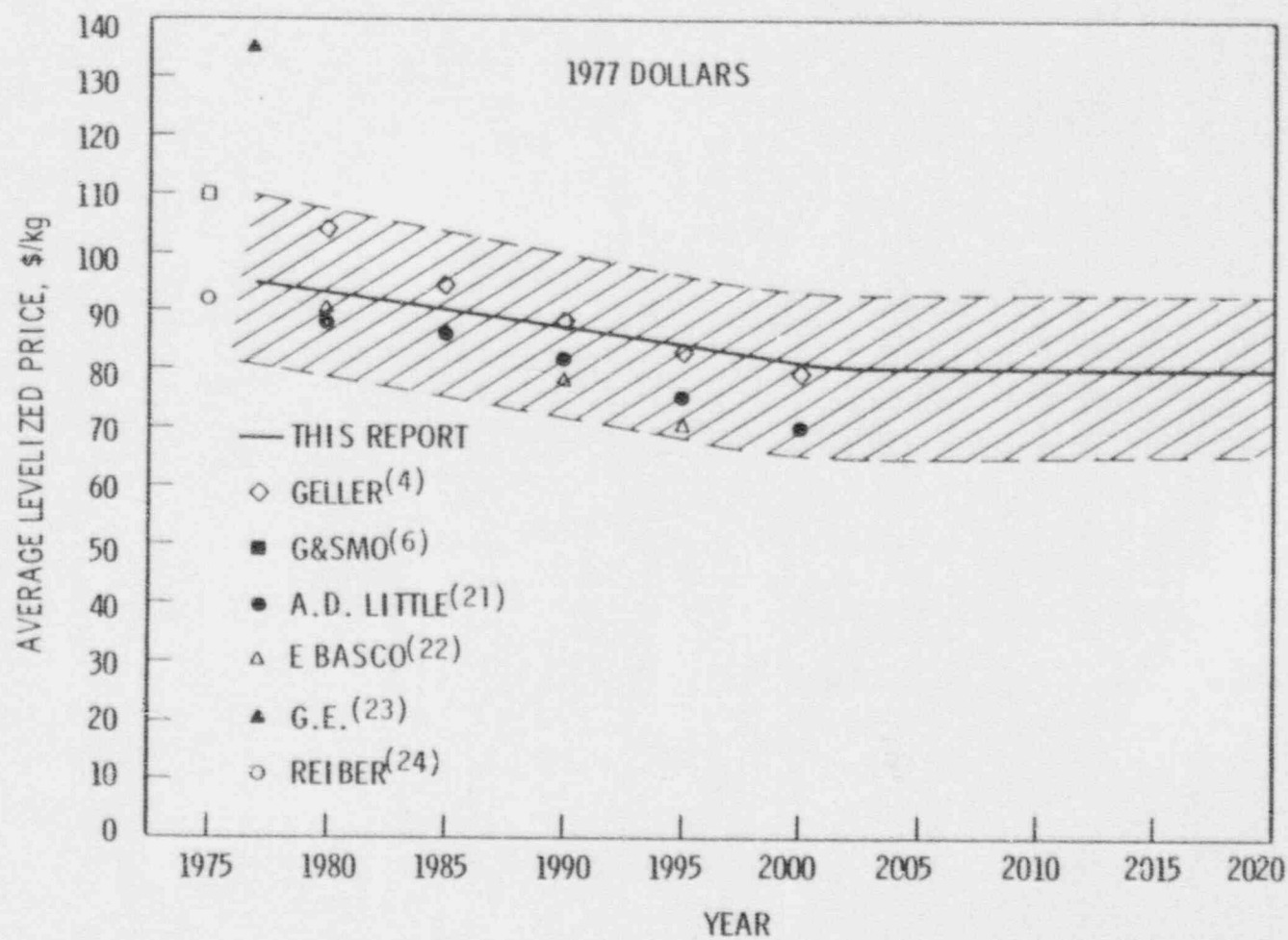


FIGURE 3.7.  $UO_2$  Fuel Fabrication Price Forecast

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#### 4.0 FUEL CYCLE COST SUMMARY

This section summarizes the impact of each of the foregoing unit cost estimates in terms of total fuel cycle cost. Fuel cycle costs are estimated for the entire LWR economy through year 2020 for cases with and without reprocessing. In addition, single reactor fuel cycle costs are estimated for 1,000 MWe PWRs and BWRs. A computer model developed as part of the GESMO project called NUCOST is utilized to calculate the fuel cycle cost for the LWR economy and for the single reactor cases.

##### 4.1 FUEL CYCLE FOR LWR ECONOMY

Fuel cycle costs are estimated for the LWR economy using the median growth projection for cases without reprocessing and with uranium and plutonium recycle. In the case of uranium and plutonium recycle, reprocessing is assumed to be available starting in 1986. Reprocessing capacity is expanded at approximately 500 MT/yr through 1995 when the rate increases to 1,000 MT/yr until the total capacity of approximately 12,000 MT/yr is achieved. It is assumed that recycling of uranium and plutonium occurs within one year of the recovery from reprocessing. Table 4.1 summarizes fuel cycle process flows for the median growth case with no reprocessing. By year 2020, 3 million short tons of  $U_3O_8$  are required to operate the system which exceeds the DOE known reserves and probable resource categories. In Table 4.2 the maximum uranium price of \$91.40 is achieved by year 2010 at which time it is assumed that additional material can be found at prices equal to or less than this from the possible and speculative categories. Unit cost presented in Table 4.2 for the front end of the fuel cycle steps are consistent with those projected in Section 3 of this report. The fuel cycle processes representing the back end of the fuel cycle were not investigated in this report; however, an update of the GESMO estimates including some information developed as part of the Generic Environmental Impact Statement for Commercial Wastes (GEIS-CW) is used. The resulting annual cost to utilities to operate the fuel cycle are summarized in Table 4.3. This table is derived by multiplying the process flows from Table 4.1 times the unit costs from Table 4.2 with appropriate



TABLE 4.1. Process Flows for Median Growth with No Reprocessing

| YEAR  | MINING<br>MILLING<br>1000 ST | UF6<br>CONVR<br>1000 NTU | ENRICHMT<br>1000<br>MT-SNU | U FUEL<br>FAB<br>MTU | SPENT<br>FUEL TRN<br>MT-HM | REPROCESS<br>MT-HM | PU<br>TRANS<br>KG-TOT | INCR PU<br>STORAGE<br>KG-TOT | MOX<br>FAB<br>MT-HM | INCR SPENT<br>FUEL STOR<br>MT-HM | WASTE<br>DISPOSAL<br>MT-HM<br>N/O PU | PU SALES<br>KG FISS | SPENT<br>FUEL DISP<br>MT-HM | TAILS<br>COMP<br>% |
|-------|------------------------------|--------------------------|----------------------------|----------------------|----------------------------|--------------------|-----------------------|------------------------------|---------------------|----------------------------------|--------------------------------------|---------------------|-----------------------------|--------------------|
| 1977  | 13.7                         | 9.7                      | 5.0                        | 1681                 | 0                          | 0                  | 0                     | 0                            | 0                   | 2050                             | 0                                    | 0                   | 0                           | 0.250              |
| 1978  | 14.7                         | 11.0                     | 6.7                        | 1782                 | 0                          | 0                  | 0                     | 0                            | 0                   | 3124                             | 0                                    | 0                   | 0                           | 0.250              |
| 1979  | 16.1                         | 12.1                     | 7.4                        | 2191                 | 134                        | 0                  | 0                     | 0                            | 0                   | 4152                             | 134                                  | 0                   | 134                         | 0.250              |
| 1980  | 18.0                         | 13.4                     | 9.0                        | 2259                 | 458                        | 0                  | 0                     | 0                            | 0                   | 5023                             | 458                                  | 0                   | 458                         | 0.250              |
| 1981  | 20.5                         | 15.3                     | 10.2                       | 2670                 | 622                        | 0                  | 0                     | 0                            | 0                   | 5957                             | 622                                  | 0                   | 622                         | 0.250              |
| 1982  | 23.0                         | 17.2                     | 11.6                       | 2941                 | 836                        | 0                  | 0                     | 0                            | 0                   | 6756                             | 836                                  | 0                   | 836                         | 0.250              |
| 1983  | 25.7                         | 19.2                     | 12.9                       | 3268                 | 1074                       | 0                  | 0                     | 0                            | 0                   | 7514                             | 1074                                 | 0                   | 1074                        | 0.250              |
| 1984  | 28.6                         | 21.4                     | 14.4                       | 3700                 | 1163                       | 0                  | 0                     | 0                            | 0                   | 8427                             | 1163                                 | 0                   | 1163                        | 0.250              |
| 1985  | 31.4                         | 23.6                     | 15.7                       | 4091                 | 1328                       | 0                  | 0                     | 0                            | 0                   | 9416                             | 1328                                 | 0                   | 1328                        | 0.250              |
| 1986  | 34.2                         | 25.7                     | 17.1                       | 4443                 | 1486                       | 0                  | 0                     | 0                            | 0                   | 10626                            | 1486                                 | 0                   | 1486                        | 0.250              |
| 1987  | 36.9                         | 27.9                     | 18.5                       | 4791                 | 1705                       | 0                  | 0                     | 0                            | 0                   | 11920                            | 1705                                 | 0                   | 1705                        | 0.250              |
| 1988  | 40.4                         | 30.2                     | 20.0                       | 5142                 | 1832                       | 0                  | 0                     | 0                            | 0                   | 13435                            | 1832                                 | 0                   | 1832                        | 0.250              |
| 1989  | 44.0                         | 32.3                     | 21.9                       | 5716                 | 2076                       | 0                  | 0                     | 0                            | 0                   | 15013                            | 2076                                 | 0                   | 2076                        | 0.250              |
| 1990  | 47.1                         | 35.6                     | 23.5                       | 6187                 | 2337                       | 0                  | 0                     | 0                            | 0                   | 16632                            | 2337                                 | 0                   | 2337                        | 0.250              |
| 1991  | 50.7                         | 38.1                     | 25.1                       | 6552                 | 2676                       | 0                  | 0                     | 0                            | 0                   | 18339                            | 2676                                 | 0                   | 2676                        | 0.250              |
| 1992  | 53.7                         | 40.6                     | 26.6                       | 6977                 | 3009                       | 0                  | 0                     | 0                            | 0                   | 20177                            | 3009                                 | 0                   | 3009                        | 0.250              |
| 1993  | 57.3                         | 43.3                     | 28.2                       | 7412                 | 3337                       | 0                  | 0                     | 0                            | 0                   | 22140                            | 3337                                 | 0                   | 3337                        | 0.250              |
| 1994  | 61.1                         | 46.3                     | 30.4                       | 7939                 | 3674                       | 0                  | 0                     | 0                            | 0                   | 24237                            | 3674                                 | 0                   | 3674                        | 0.250              |
| 1995  | 64.9                         | 48.6                     | 32.0                       | 8418                 | 3956                       | 0                  | 0                     | 0                            | 0                   | 26477                            | 3956                                 | 0                   | 3956                        | 0.250              |
| 1996  | 67.9                         | 51.6                     | 33.8                       | 8840                 | 4313                       | 0                  | 0                     | 0                            | 0                   | 28857                            | 4313                                 | 0                   | 4313                        | 0.250              |
| 1997  | 71.4                         | 54.3                     | 35.5                       | 9289                 | 4657                       | 0                  | 0                     | 0                            | 0                   | 31383                            | 4657                                 | 0                   | 4657                        | 0.250              |
| 1998  | 74.9                         | 57.2                     | 37.3                       | 9740                 | 5060                       | 0                  | 0                     | 0                            | 0                   | 34055                            | 5060                                 | 0                   | 5060                        | 0.250              |
| 1999  | 78.2                         | 59.5                     | 39.2                       | 10175                | 5471                       | 0                  | 0                     | 0                            | 0                   | 36871                            | 5471                                 | 0                   | 5471                        | 0.250              |
| 2000  | 81.5                         | 62.1                     | 40.4                       | 10602                | 5861                       | 0                  | 0                     | 0                            | 0                   | 39821                            | 5861                                 | 0                   | 5861                        | 0.250              |
| 2001  | 84.8                         | 64.5                     | 42.0                       | 11018                | 6249                       | 0                  | 0                     | 0                            | 0                   | 42911                            | 6249                                 | 0                   | 6249                        | 0.250              |
| 2002  | 87.9                         | 66.9                     | 43.5                       | 11424                | 6647                       | 0                  | 0                     | 0                            | 0                   | 46137                            | 6647                                 | 0                   | 6647                        | 0.250              |
| 2003  | 90.1                         | 69.0                     | 44.3                       | 11819                | 7071                       | 0                  | 0                     | 0                            | 0                   | 49500                            | 7071                                 | 0                   | 7071                        | 0.250              |
| 2004  | 92.0                         | 70.3                     | 45.6                       | 12215                | 7497                       | 0                  | 0                     | 0                            | 0                   | 53001                            | 7497                                 | 0                   | 7497                        | 0.250              |
| 2005  | 94.4                         | 72.2                     | 46.7                       | 12543                | 7907                       | 0                  | 0                     | 0                            | 0                   | 56641                            | 7907                                 | 0                   | 7907                        | 0.250              |
| 2006  | 96.3                         | 73.5                     | 47.6                       | 12899                | 8310                       | 0                  | 0                     | 0                            | 0                   | 60425                            | 8310                                 | 0                   | 8310                        | 0.250              |
| 2007  | 98.3                         | 75.3                     | 48.5                       | 13299                | 8702                       | 0                  | 0                     | 0                            | 0                   | 64351                            | 8702                                 | 0                   | 8702                        | 0.250              |
| 2008  | 100.1                        | 76.6                     | 49.4                       | 13622                | 9084                       | 0                  | 0                     | 0                            | 0                   | 68421                            | 9084                                 | 0                   | 9084                        | 0.250              |
| 2009  | 101.8                        | 77.9                     | 50.2                       | 13943                | 9458                       | 0                  | 0                     | 0                            | 0                   | 72641                            | 9458                                 | 0                   | 9458                        | 0.250              |
| 2010  | 103.4                        | 79.2                     | 51.0                       | 14260                | 9821                       | 0                  | 0                     | 0                            | 0                   | 77001                            | 9821                                 | 0                   | 9821                        | 0.250              |
| 2011  | 104.9                        | 80.4                     | 51.6                       | 14567                | 10176                      | 0                  | 0                     | 0                            | 0                   | 81511                            | 10176                                | 0                   | 10176                       | 0.250              |
| 2012  | 105.6                        | 81.3                     | 52.0                       | 14866                | 10486                      | 0                  | 0                     | 0                            | 0                   | 86161                            | 10486                                | 0                   | 10486                       | 0.250              |
| 2013  | 105.6                        | 81.5                     | 52.0                       | 15165                | 10720                      | 0                  | 0                     | 0                            | 0                   | 90957                            | 10720                                | 0                   | 10720                       | 0.250              |
| 2014  | 104.8                        | 80.6                     | 51.4                       | 15465                | 10929                      | 0                  | 0                     | 0                            | 0                   | 95901                            | 10929                                | 0                   | 10929                       | 0.250              |
| 2015  | 104.5                        | 80.4                     | 51.5                       | 15761                | 11142                      | 0                  | 0                     | 0                            | 0                   | 100991                           | 11142                                | 0                   | 11142                       | 0.250              |
| 2016  | 104.5                        | 80.4                     | 51.4                       | 16051                | 11330                      | 0                  | 0                     | 0                            | 0                   | 106121                           | 11330                                | 0                   | 11330                       | 0.250              |
| 2017  | 103.2                        | 80.0                     | 51.2                       | 16353                | 11516                      | 0                  | 0                     | 0                            | 0                   | 111391                           | 11516                                | 0                   | 11516                       | 0.250              |
| 2018  | 102.1                        | 79.1                     | 50.8                       | 16651                | 11716                      | 0                  | 0                     | 0                            | 0                   | 116791                           | 11716                                | 0                   | 11679                       | 0.250              |
| 2019  | 99.9                         | 77.2                     | 49.7                       | 16942                | 11915                      | 0                  | 0                     | 0                            | 0                   | 122301                           | 11915                                | 0                   | 12230                       | 0.250              |
| 2020  | 97.7                         | 75.7                     | 48.0                       | 17284                | 12093                      | 0                  | 0                     | 0                            | 0                   | 127921                           | 12093                                | 0                   | 12792                       | 0.250              |
| TOTAL | 3637                         | 2320                     | 1459                       | 395933               | 251878                     | 0                  | 0                     | 0                            | 0                   | 1445081                          | 251878                               | 0                   | 251878                      | 0.250              |

TABLE 4.2. Projected Unit Cost Median Growth with No Reprocessing  
(in 1977 Dollars)

| YEAR | U308<br>AS BURNED<br>\$/LB | U<br>CONVR<br>\$/KG-U | SEP WORK<br>\$/SHU | U FAB<br>\$/KG-U | SPENT<br>FUEL TRAN<br>\$/KG-HM | REPRO<br>\$/KG-HM | PU<br>TRAN<br>\$/G-TOT | INCR PU<br>STORAGE<br>\$/G-TOT | MOX<br>FAB<br>\$/KG-HM | INCR<br>FUEL STOR<br>\$/KG-HM-YR | SPENT<br>FUEL STOR<br>\$/KG-HM | WASTE<br>DISPOSAL<br>\$/KG-HM<br>W/O PU | PU VALUE<br>\$/G FISS | SPENT<br>FUEL DISP<br>\$/KG-HM |
|------|----------------------------|-----------------------|--------------------|------------------|--------------------------------|-------------------|------------------------|--------------------------------|------------------------|----------------------------------|--------------------------------|---|-----------------------|--------------------------------|
| ESCR | 0.02                       | 0.02                  | 0.02               | 0.02             | 0.02                           | 0.02              | 0.02                   | 0.02                           | 0.02                   | 0.02                             | 0.02                           | 0.02                                    | 0.00                  | 0.02                           |
| 1977 | 42.0                       | 4.6                   | 70.0               | 95.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1978 | 42.0                       | 4.6                   | 77.0               | 94.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1979 | 42.0                       | 4.6                   | 80.0               | 93.9             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1980 | 42.0                       | 4.6                   | 82.0               | 93.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1981 | 42.0                       | 4.6                   | 84.0               | 92.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1982 | 42.0                       | 4.6                   | 87.0               | 92.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1983 | 42.0                       | 4.6                   | 90.0               | 91.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1984 | 42.0                       | 4.6                   | 93.0               | 91.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1985 | 42.0                       | 4.6                   | 95.0               | 90.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1986 | 42.0                       | 4.6                   | 98.0               | 89.9             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1987 | 42.0                       | 4.6                   | 100.0              | 89.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1988 | 42.0                       | 4.6                   | 100.0              | 88.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1989 | 44.7                       | 4.6                   | 100.0              | 88.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1990 | 44.7                       | 4.6                   | 100.0              | 87.4             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1991 | 44.7                       | 4.6                   | 100.0              | 87.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1992 | 44.7                       | 4.6                   | 100.0              | 86.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1993 | 46.2                       | 4.6                   | 95.0               | 85.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1994 | 46.2                       | 4.6                   | 94.0               | 85.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1995 | 46.2                       | 4.6                   | 93.0               | 84.4             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1996 | 46.2                       | 4.6                   | 92.0               | 83.9             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1997 | 47.8                       | 4.6                   | 91.0               | 83.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1998 | 51.6                       | 4.6                   | 91.0               | 82.8             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 1999 | 54.6                       | 4.6                   | 90.0               | 82.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 2000 | 59.0                       | 4.6                   | 89.0               | 81.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 2001 | 60.0                       | 4.6                   | 88.0               | 81.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 2002 | 64.0                       | 4.6                   | 87.0               | 80.7             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 2003 | 70.0                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 2004 | 75.6                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 2005 | 81.7                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 2006 | 83.2                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 2007 | 83.2                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 2008 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 2009 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 2010 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 2011 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 2012 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 2013 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 2014 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 2015 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 2016 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 2017 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 2018 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 2019 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| 2020 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                           | 0.00                                    | 95.0                  | 95.0                           |
| HT   |                            |                       |                    |                  |                                |                   |                        |                                |                        |                                  |                                |   |                       |                                |
| Ave. | 72.7                       | 4.6                   | 88.5               | 82.3             | 15.0                           | 0.0               | 0.00                   | 0.00                           | 0.0                    | 5.0                              | 0.0                            | 0.00                                    | 95.0                  | 95.0                           |

TABLE 4.3. Projected Costs for Materials and Services  
for Median Growth with No Reprocessing  
(in Millions of 1977 Dollars)

| YEAR  | MINING<br>MILLING | UF6<br>CONVR | ENRICHMENT | U FUEL<br>FAB | SPENT<br>FUEL TRAN | REPRO | PU<br>TRANS | INCR PU<br>STORAGE | MOX<br>FAB | INCR<br>FUEL | SPENT<br>STOR | WASTE<br>DISPOSAL<br>M/O PU | PU SALES | SPENT<br>FUEL DISP | TOTAL  |
|-------|-------------------|--------------|------------|---------------|--------------------|-------|-------------|--------------------|------------|--------------|---------------|-----------------------------|----------|--------------------|--------|
| 1977  | 1092.7            | 44           | 487        | 160           | 0                  | 0     | 0.00        | 0.00               | 0          |              | 12            | 0                           | 0        | 49                 | 1765   |
| 1978  | 1234.7            | 51           | 516        | 169           | 0                  | 0     | 0.00        | 0.00               | 0          |              | 18            | 0                           | 0        | 63                 | 2051   |
| 1979  | 1352.4            | 56           | 590        | 206           | 2                  | 0     | 0.00        | 0.00               | 0          |              | 24            | 0                           | 0        | 69                 | 2298   |
| 1980  | 1514.9            | 62           | 658        | 211           | 7                  | 0     | 0.00        | 0.00               | 0          |              | 29            | 0                           | 0        | 78                 | 2559   |
| 1981  | 1723.5            | 71           | 777        | 247           | 9                  | 0     | 0.00        | 0.00               | 0          |              | 34            | 0                           | 0        | 88                 | 2949   |
| 1982  | 1932.6            | 79           | 898        | 271           | 13                 | 0     | 0.00        | 0.00               | 0          |              | 39            | 0                           | 0        | 101                | 3333   |
| 1983  | 2160.7            | 89           | 1042       | 309           | 16                 | 0     | 0.00        | 0.00               | 0          |              | 43            | 0                           | 0        | 108                | 3768   |
| 1984  | 2401.4            | 99           | 1203       | 337           | 17                 | 0     | 0.00        | 0.00               | 0          |              | 49            | 0                           | 0        | 122                | 4229   |
| 1985  | 2639.0            | 109          | 1367       | 370           | 20                 | 0     | 0.00        | 0.00               | 0          |              | 55            | 0                           | 0        | 138                | 4697   |
| 1986  | 2869.0            | 118          | 1542       | 399           | 22                 | 0     | 0.00        | 0.00               | 0          |              | 62            | 0                           | 0        | 158                | 5171   |
| 1987  | 3099.5            | 128          | 1709       | 426           | 26                 | 0     | 0.00        | 0.00               | 0          |              | 69            | 0                           | 0        | 177                | 5635   |
| 1988  | 3390.3            | 139          | 1845       | 456           | 27                 | 0     | 0.00        | 0.00               | 0          |              | 78            | 0                           | 0        | 197                | 6132   |
| 1989  | 3934.2            | 153          | 2040       | 503           | 31                 | 0     | 0.00        | 0.00               | 0          |              | 87            | 0                           | 0        | 217                | 6965   |
| 1990  | 4212.6            | 164          | 2191       | 541           | 35                 | 0     | 0.00        | 0.00               | 0          |              | 97            | 0                           | 0        | 236                | 7476   |
| 1991  | 4499.3            | 175          | 2345       | 570           | 40                 | 0     | 0.00        | 0.00               | 0          |              | 106           | 0                           | 0        | 254                | 7990   |
| 1992  | 4797.2            | 187          | 2509       | 600           | 45                 | 0     | 0.00        | 0.00               | 0          |              | 116           | 0                           | 0        | 275                | 8528   |
| 1993  | 5297.4            | 199          | 2541       | 634           | 50                 | 0     | 0.00        | 0.00               | 0          |              | 126           | 0                           | 0        | 298                | 9145   |
| 1994  | 5641.1            | 213          | 2694       | 675           | 55                 | 0     | 0.00        | 0.00               | 0          |              | 136           | 0                           | 0        | 323                | 9737   |
| 1995  | 5958.7            | 225          | 2823       | 710           | 60                 | 0     | 0.00        | 0.00               | 0          |              | 147           | 0                           | 0        | 346                | 10270  |
| 1996  | 6278.4            | 237          | 2948       | 742           | 65                 | 0     | 0.00        | 0.00               | 0          |              | 158           | 0                           | 0        | 369                | 10797  |
| 1997  | 6826.0            | 250          | 3073       | 773           | 70                 | 0     | 0.00        | 0.00               | 0          |              | 170           | 0                           | 0        | 392                | 11554  |
| 1998  | 7727.7            | 262          | 3231       | 806           | 76                 | 0     | 0.00        | 0.00               | 0          |              | 181           | 0                           | 0        | 417                | 12701  |
| 1999  | 8547.2            | 274          | 3346       | 834           | 82                 | 0     | 0.00        | 0.00               | 0          |              | 193           | 0                           | 0        | 442                | 13718  |
| 2000  | 9617.0            | 286          | 3454       | 864           | 88                 | 0     | 0.00        | 0.00               | 0          |              | 205           | 0                           | 0        | 466                | 14980  |
| 2001  | 10167.5           | 297          | 3556       | 892           | 94                 | 0     | 0.00        | 0.00               | 0          |              | 217           | 0                           | 0        | 490                | 15713  |
| 2002  | 11384.5           | 308          | 3651       | 922           | 100                | 0     | 0.00        | 0.00               | 0          |              | 229           | 0                           | 0        | 513                | 17107  |
| 2003  | 12614.2           | 317          | 3740       | 948           | 106                | 0     | 0.00        | 0.00               | 0          |              | 240           | 0                           | 0        | 536                | 18501  |
| 2004  | 13917.9           | 324          | 3812       | 961           | 112                | 0     | 0.00        | 0.00               | 0          |              | 252           | 0                           | 0        | 558                | 19936  |
| 2005  | 15414.8           | 332          | 3918       | 980           | 119                | 0     | 0.00        | 0.00               | 0          |              | 263           | 0                           | 0        | 579                | 21605  |
| 2006  | 17020.8           | 340          | 4014       | 1006          | 125                | 0     | 0.00        | 0.00               | 0          |              | 273           | 0                           | 0        | 600                | 23379  |
| 2007  | 17346.6           | 346          | 4097       | 1026          | 131                | 0     | 0.00        | 0.00               | 0          |              | 284           | 0                           | 0        | 619                | 23849  |
| 2008  | 18290.7           | 353          | 4171       | 1044          | 136                | 0     | 0.00        | 0.00               | 0          |              | 293           | 0                           | 0        | 632                | 24921  |
| 2009  | 18600.0           | 359          | 4245       | 1062          | 142                | 0     | 0.00        | 0.00               | 0          |              | 302           | 0                           | 0        | 645                | 25355  |
| 2010  | 18896.6           | 364          | 4315       | 1079          | 147                | 0     | 0.00        | 0.00               | 0          |              | 309           | 0                           | 0        | 657                | 25769  |
| 2011  | 19163.0           | 370          | 4383       | 1096          | 153                | 0     | 0.00        | 0.00               | 0          |              | 316           | 0                           | 0        | 668                | 26149  |
| 2012  | 19356.8           | 374          | 4439       | 1110          | 157                | 0     | 0.00        | 0.00               | 0          |              | 323           | 0                           | 0        | 691                | 26452  |
| 2013  | 19295.1           | 375          | 4473       | 1120          | 161                | 0     | 0.00        | 0.00               | 0          |              | 333           | 0                           | 0        | 735                | 26492  |
| 2014  | 19157.4           | 371          | 4424       | 1101          | 164                | 0     | 0.00        | 0.00               | 0          |              | 342           | 0                           | 0        | 736                | 26296  |
| 2015  | 19142.0           | 371          | 4428       | 1092          | 167                | 0     | 0.00        | 0.00               | 0          |              | 351           | 0                           | 0        | 743                | 26293  |
| 2016  | 19090.8           | 370          | 4421       | 1095          | 170                | 0     | 0.00        | 0.00               | 0          |              | 358           | 0                           | 0        | 748                | 26253  |
| 2017  | 18977.0           | 368          | 4403       | 1090          | 176                | 0     | 0.00        | 0.00               | 0          |              | 363           | 0                           | 0        | 733                | 26110  |
| 2018  | 18665.7           | 364          | 4368       | 1082          | 187                | 0     | 0.00        | 0.00               | 0          |              | 363           | 0                           | 0        | 742                | 25771  |
| 2019  | 18260.0           | 355          | 4270       | 1054          | 187                | 0     | 0.00        | 0.00               | 0          |              | 362           | 0                           | 0        | 720                | 25208  |
| 2020  | 17860.9           | 348          | 4199       | 1025          | 189                | 0     | 0.00        | 0.00               | 0          |              | 360           | 0                           | 0        | 731                | 24714  |
| TOTAL | 441370.5          | 10673        | 129074     | 32600         | 3778               | 0     | 0.00        | 0.00               | 0          |              | 8364          | 0                           | 0        | 18460              | 644320 |

unit conversions. To calculate total fuel cycle costs we must also take into account the lead and lag times relative to electric generation. The NUFUEL model has already accounted for the lead and lag times which are embodied in Table 4.1. Thus the remaining factor to account for is the cost of money which is assumed to be 8%/yr for electric utilities in the case of constant dollar analysis. Table 4.4 included the discounting of the annual cash flows from Table 4.3, plus an adjustment in the waste management expenses to the time of reprocessing so that all of the costs that are committed as a result of the LWR operation are included even though they may take place after year 2020. The total fuel cycle costs can be converted to mills/kW-hr by dividing the discounted cost of fuel cycle operation from Table 4.5 by the discounted kilowatt-hr generated over the same time interval. These costs will be summarized in a table later in this section. Table 4.5 through 4.8 summarize the same information for the case when uranium and plutonium recycle is allowed. In Table 4.5, the buildup of the reprocessing capacity can be seen in the reprocessing column. Uranium requirements of 2.1 million short tons of  $U_3O_8$  result under this option. Some plutonium sales are recorded beginning in year 2010 as light water reactors are being retired from operation. This treatment of the plutonium is necessary because the NUFUEL model does not have the capability to shut down reactors automatically. This approach allows the proper financial credits to be attributed to the reactor operations. Table 4.6 summarizes the unit costs including plutonium values after year 2010. These plutonium values in Table 4.6 are calculated based on 0.8 times the uranium and separative work values per gram U-235. Table 4.7 illustrates the cash flows and Table 4.8 illustrates the discounted flows.

Many current reports dealing with the nuclear fuel cycle used a current dollar basis for estimation. Table 4.9 represents the unit cost to be expected when 6% escalation is assumed for all of the fuel cycle steps. In the future it may be possible to provide different escalation rates for each of the individual processes. Table 4.9 is derived directly from Table 4.2 with 6% annual escalation.

The levelized fuel cycle costs are summarized in Table 4.10 for the cases with no reprocessing and cases with uranium and plutonium recycle. Comparing the constant dollar no reprocessing case with the recycle case



TABLE 4.4. Discounted Costs for Median Growth with No Reprocessing  
(in Millions of 1977 Dollars)

Discount Rate, 8%

| YEAR  | MINING<br>BILLING | UFG<br>CONVR | ENRICHMENT | U FUEL<br>FAB | SPENT<br>FUEL TRAN | REPRO | PU<br>TRANS | INCR PU<br>STORAGE | MOX<br>FAB | INCR<br>FUEL | SPENT<br>STOR | WASTE<br>DISPOSAL<br>W/O PU | PU SALES | SPENT<br>FUEL DISP | TOTAL |
|-------|-------------------|--------------|------------|---------------|--------------------|-------|-------------|--------------------|------------|--------------|---------------|-----------------------------|----------|--------------------|-------|
| 1977  | 1092.7            |              | 44         | 407           | 160                | 0     | 0.00        | 0.00               | 0          |              | 12            | 0                           | 0        | 49                 | 1765  |
| 1978  | 1143.2            |              | 47         | 477           | 156                | 0     | 0.00        | 0.00               | 0          |              | 17            | 0                           | 0        | 59                 | 1899  |
| 1979  | 1159.5            |              | 48         | 505           | 177                | 0     | 0.00        | 0.00               | 0          |              | 21            | 0                           | 0        | 59                 | 1970  |
| 1980  | 1202.6            |              | 49         | 522           | 167                | 0     | 0.00        | 0.00               | 0          |              | 23            | 0                           | 0        | 62                 | 2031  |
| 1981  | 1266.8            |              | 52         | 571           | 182                | 0     | 0.00        | 0.00               | 0          |              | 25            | 0                           | 0        | 64                 | 2167  |
| 1982  | 1315.3            |              | 54         | 611           | 184                | 0     | 0.00        | 0.00               | 0          |              | 27            | 0                           | 0        | 68                 | 2268  |
| 1983  | 1361.6            |              | 56         | 657           | 195                | 10    | 0.00        | 0.00               | 0          |              | 27            | 0                           | 0        | 68                 | 2375  |
| 1984  | 1401.2            |              | 58         | 702           | 196                | 10    | 0.00        | 0.00               | 0          |              | 28            | 0                           | 0        | 71                 | 2467  |
| 1985  | 1425.8            |              | 59         | 738           | 200                | 11    | 0.00        | 0.00               | 0          |              | 30            | 0                           | 0        | 74                 | 2538  |
| 1986  | 1435.2            |              | 59         | 771           | 209                | 11    | 0.00        | 0.00               | 0          |              | 31            | 0                           | 0        | 79                 | 2587  |
| 1987  | 1435.7            |              | 59         | 791           | 198                | 12    | 0.00        | 0.00               | 0          |              | 32            | 0                           | 0        | 82                 | 2610  |
| 1988  | 1454.0            |              | 60         | 791           | 195                | 12    | 0.00        | 0.00               | 0          |              | 33            | 0                           | 0        | 84                 | 2630  |
| 1989  | 1562.3            |              | 61         | 810           | 200                | 12    | 0.00        | 0.00               | 0          |              | 35            | 0                           | 0        | 86                 | 2766  |
| 1990  | 1549.0            |              | 60         | 806           | 199                | 13    | 0.00        | 0.00               | 0          |              | 36            | 0                           | 0        | 87                 | 2749  |
| 1991  | 1531.8            |              | 60         | 798           | 194                | 14    | 0.00        | 0.00               | 0          |              | 36            | 0                           | 0        | 87                 | 2720  |
| 1992  | 1512.3            |              | 59         | 791           | 189                | 14    | 0.00        | 0.00               | 0          |              | 36            | 0                           | 0        | 87                 | 2688  |
| 1993  | 1546.3            |              | 58         | 742           | 185                | 15    | 0.00        | 0.00               | 0          |              | 37            | 0                           | 0        | 87                 | 2669  |
| 1994  | 1524.6            |              | 58         | 728           | 182                | 15    | 0.00        | 0.00               | 0          |              | 37            | 0                           | 0        | 87                 | 2632  |
| 1995  | 1491.1            |              | 56         | 706           | 178                | 15    | 0.00        | 0.00               | 0          |              | 37            | 0                           | 0        | 87                 | 2570  |
| 1996  | 1454.8            |              | 55         | 683           | 172                | 15    | 0.00        | 0.00               | 0          |              | 36            | 0                           | 0        | 85                 | 2502  |
| 1997  | 1464.7            |              | 54         | 659           | 166                | 15    | 0.00        | 0.00               | 0          |              | 36            | 0                           | 0        | 84                 | 2479  |
| 1998  | 1535.2            |              | 52         | 642           | 160                | 15    | 0.00        | 0.00               | 0          |              | 36            | 0                           | 0        | 83                 | 2523  |
| 1999  | 1572.2            |              | 50         | 615           | 153                | 15    | 0.00        | 0.00               | 0          |              | 35            | 0                           | 0        | 81                 | 2523  |
| 2000  | 1637.9            |              | 49         | 588           | 147                | 15    | 0.00        | 0.00               | 0          |              | 35            | 0                           | 0        | 79                 | 2551  |
| 2001  | 1603.4            |              | 47         | 561           | 141                | 15    | 0.00        | 0.00               | 0          |              | 34            | 0                           | 0        | 77                 | 2478  |
| 2002  | 1662.3            |              | 45         | 533           | 135                | 15    | 0.00        | 0.00               | 0          |              | 33            | 0                           | 0        | 75                 | 2498  |
| 2003  | 1705.5            |              | 43         | 506           | 128                | 14    | 0.00        | 0.00               | 0          |              | 32            | 0                           | 0        | 72                 | 2501  |
| 2004  | 1742.3            |              | 40         | 477           | 120                | 14    | 0.00        | 0.00               | 0          |              | 31            | 0                           | 0        | 70                 | 2496  |
| 2005  | 1786.8            |              | 38         | 454           | 114                | 14    | 0.00        | 0.00               | 0          |              | 30            | 0                           | 0        | 67                 | 2504  |
| 2006  | 1826.8            |              | 36         | 431           | 108                | 13    | 0.00        | 0.00               | 0          |              | 29            | 0                           | 0        | 64                 | 2509  |
| 2007  | 1723.9            |              | 34         | 407           | 102                | 13    | 0.00        | 0.00               | 0          |              | 28            | 0                           | 0        | 61                 | 2370  |
| 2008  | 1683.0            |              | 32         | 384           | 96                 | 13    | 0.00        | 0.00               | 0          |              | 27            | 0                           | 0        | 58                 | 2293  |
| 2009  | 1584.7            |              | 31         | 362           | 91                 | 12    | 0.00        | 0.00               | 0          |              | 26            | 0                           | 0        | 55                 | 2160  |
| 2010  | 1490.7            |              | 29         | 340           | 85                 | 12    | 0.00        | 0.00               | 0          |              | 24            | 0                           | 0        | 52                 | 2033  |
| 2011  | 1399.8            |              | 27         | 320           | 80                 | 11    | 0.00        | 0.00               | 0          |              | 23            | 0                           | 0        | 49                 | 1910  |
| 2012  | 1309.2            |              | 25         | 300           | 75                 | 11    | 0.00        | 0.00               | 0          |              | 22            | 0                           | 0        | 47                 | 1789  |
| 2013  | 1208.3            |              | 23         | 280           | 70                 | 10    | 0.00        | 0.00               | 0          |              | 21            | 0                           | 0        | 46                 | 1659  |
| 2014  | 1110.9            |              | 22         | 257           | 64                 | 10    | 0.00        | 0.00               | 0          |              | 20            | 0                           | 0        | 43                 | 1525  |
| 2015  | 1027.7            |              | 20         | 238           | 59                 | 9     | 0.00        | 0.00               | 0          |              | 19            | 0                           | 0        | 40                 | 1412  |
| 2016  | 949.1             |              | 18         | 220           | 54                 | 8     | 0.00        | 0.00               | 0          |              | 18            | 0                           | 0        | 37                 | 1305  |
| 2017  | 873.5             |              | 17         | 203           | 50                 | 8     | 0.00        | 0.00               | 0          |              | 17            | 0                           | 0        | 34                 | 1202  |
| 2018  | 795.6             |              | 16         | 186           | 46                 | 8     | 0.00        | 0.00               | 0          |              | 15            | 0                           | 0        | 32                 | 1098  |
| 2019  | 720.6             |              | 14         | 169           | 42                 | 7     | 0.00        | 0.00               | 0          |              | 14            | 0                           | 0        | 28                 | 995   |
| 2020  | 652.7             |              | 13         | 153           | 37                 | 7     | 0.00        | 0.00               | 0          |              | 13            | 0                           | 0        | 27                 | 903   |
| TOTAL | 60932.4           | 1886         | 22895      | 6032          | 484                | 0     | 0.00        | 0.00               | 0          |              | 1216          | 0                           | 0        | 2876               | 96322 |

TABLE 4.5. Process Flows for Median Growth with U and Pu Recycle

| YEAR  | MINING<br>MILLING<br>1000 ST | UF6<br>CONVR<br>1000 MTU | ENRICHMT<br>1000<br>MT-SMU | U FUEL<br>FAB<br>MTU | SPENT<br>FUEL TRAN<br>MT-HM | REPROCESS<br>MT-HM | PU<br>TRANS<br>KG-TOT | INCR PU<br>STORAGE<br>KG-TOT | MOX<br>FAB<br>MT-HM | INCR<br>FUEL STOR<br>MT-HM | SPENT<br>WASTE<br>DISPOSAL<br>MT-HM | W/O PU | PU SALES<br>KG FISS | SPENT<br>FUEL DISP<br>MT-HM | TAILS<br>COMP<br>% |
|-------|------------------------------|--------------------------|----------------------------|----------------------|-----------------------------|--------------------|-----------------------|------------------------------|---------------------|----------------------------|-------------------------------------|--------|---------------------|-----------------------------|--------------------|
| 1977  | 13.0                         | 9.7                      | 5.8                        | 1681                 | 0.                          | 0.                 | 0.                    | 0.                           | 0.                  | 2050.                      | 0.                                  | 0.     | 0.                  | 0.                          | 0.250              |
| 1978  | 14.7                         | 11.0                     | 6.7                        | 1787                 | 0.                          | 0.                 | 0.                    | 0.                           | 0.                  | 3124.                      | 0.                                  | 0.     | 0.                  | 0.                          | 0.250              |
| 1979  | 16.1                         | 12.1                     | 7.4                        | 2193                 | 0.                          | 0.                 | 0.                    | 0.                           | 0.                  | 4287.                      | 0.                                  | 0.     | 0.                  | 0.                          | 0.250              |
| 1980  | 18.0                         | 13.4                     | 8.0                        | 2259                 | 0.                          | 0.                 | 0.                    | 0.                           | 0.                  | 5615.                      | 0.                                  | 0.     | 0.                  | 0.                          | 0.250              |
| 1981  | 20.5                         | 15.3                     | 9.2                        | 2670                 | 0.                          | 0.                 | 0.                    | 0.                           | 0.                  | 7101.                      | 0.                                  | 0.     | 0.                  | 0.                          | 0.250              |
| 1982  | 23.0                         | 17.2                     | 10.3                       | 2941                 | 0.                          | 0.                 | 0.                    | 0.                           | 0.                  | 8806.                      | 0.                                  | 0.     | 0.                  | 0.                          | 0.250              |
| 1983  | 25.7                         | 19.2                     | 11.6                       | 3368                 | 0.                          | 0.                 | 0.                    | 0.                           | 0.                  | 10638.                     | 0.                                  | 0.     | 0.                  | 0.                          | 0.250              |
| 1984  | 28.6                         | 21.4                     | 12.9                       | 3700                 | 0.                          | 0.                 | 0.                    | 0.                           | 0.                  | 12714.                     | 0.                                  | 0.     | 0.                  | 0.                          | 0.250              |
| 1985  | 31.1                         | 23.5                     | 14.4                       | 4091                 | 499.                        | 0.                 | 0.                    | 0.                           | 0.                  | 15051.                     | 0.                                  | 0.     | 0.                  | 0.                          | 0.250              |
| 1986  | 32.7                         | 24.9                     | 15.5                       | 4411                 | 999.                        | 499.               | 2390.                 | 0.                           | 32.                 | 17228.                     | 0.                                  | 0.     | 0.                  | 0.                          | 0.250              |
| 1987  | 34.0                         | 25.8                     | 16.5                       | 4670                 | 1499.                       | 999.               | 7187.                 | 0.                           | 121.                | 19238.                     | 0.                                  | 0.     | 0.                  | 0.                          | 0.250              |
| 1988  | 36.1                         | 27.0                     | 17.4                       | 4909                 | 1999.                       | 1499.              | 11996.                | 0.                           | 238.                | 21076.                     | 0.                                  | 0.     | 0.                  | 0.                          | 0.250              |
| 1989  | 38.3                         | 28.0                     | 19.0                       | 5387                 | 2498.                       | 1999.              | 16812.                | 0.                           | 329.                | 22751.                     | 0.                                  | 0.     | 0.                  | 0.                          | 0.250              |
| 1990  | 40.1                         | 30.0                     | 20.1                       | 5712                 | 2993.                       | 2498.              | 21638.                | 0.                           | 475.                | 24249.                     | 0.                                  | 0.     | 0.                  | 0.                          | 0.250              |
| 1991  | 42.1                         | 31.4                     | 21.4                       | 5989                 | 3491.                       | 2993.              | 24423.                | 0.                           | 563.                | 25569.                     | 499.                                | 0.     | 0.                  | 0.                          | 0.250              |
| 1992  | 43.9                         | 32.8                     | 22.7                       | 6317                 | 3996.                       | 3491.              | 28824.                | 0.                           | 661.                | 26735.                     | 999.                                | 0.     | 0.                  | 0.                          | 0.250              |
| 1993  | 46.0                         | 34.1                     | 23.8                       | 6612                 | 4496.                       | 3996.              | 35598.                | 0.                           | 801.                | 27799.                     | 1499.                               | 0.     | 0.                  | 0.                          | 0.250              |
| 1994  | 48.0                         | 35.7                     | 25.0                       | 6986                 | 4995.                       | 4496.              | 43539.                | 0.                           | 953.                | 28774.                     | 1999.                               | 0.     | 0.                  | 0.                          | 0.250              |
| 1995  | 49.7                         | 36.9                     | 26.1                       | 7334                 | 5997.                       | 4995.              | 50528.                | 0.                           | 1084.               | 29640.                     | 2498.                               | 0.     | 0.                  | 0.                          | 0.250              |
| 1996  | 50.5                         | 37.5                     | 27.2                       | 7520                 | 6997.                       | 5997.              | 57554.                | 0.                           | 1320.               | 29892.                     | 2993.                               | 0.     | 0.                  | 0.                          | 0.250              |
| 1997  | 51.2                         | 37.7                     | 27.9                       | 7777                 | 7998.                       | 6997.              | 68550.                | 0.                           | 1512.               | 29542.                     | 3491.                               | 0.     | 0.                  | 0.                          | 0.250              |
| 1998  | 52.5                         | 38.4                     | 29.1                       | 7980                 | 8998.                       | 7998.              | 76233.                | 0.                           | 1760.               | 28615.                     | 3996.                               | 0.     | 0.                  | 0.                          | 0.250              |
| 1999  | 52.5                         | 38.7                     | 30.3                       | 8210                 | 9999.                       | 8998.              | 83244.                | 0.                           | 1965.               | 27114.                     | 4496.                               | 0.     | 0.                  | 0.                          | 0.250              |
| 2000  | 53.1                         | 38.2                     | 30.6                       | 8430                 | 10995.                      | 9999.              | 99669.                | 0.                           | 2172.               | 25022.                     | 4995.                               | 0.     | 0.                  | 0.                          | 0.250              |
| 2001  | 52.2                         | 38.5                     | 32.1                       | 8444                 | 11997.                      | 10995.             | 105396.               | 0.                           | 2574.               | 22337.                     | 5997.                               | 0.     | 0.                  | 0.                          | 0.250              |
| 2002  | 51.1                         | 35.9                     | 30.1                       | 8395                 | 12000.                      | 11997.             | 141417.               | 0.                           | 3029.               | 19042.                     | 6997.                               | 0.     | 0.                  | 0.                          | 0.250              |
| 2003  | 53.9                         | 37.8                     | 31.2                       | 8706                 | 12001.                      | 12000.             | 142742.               | 0.                           | 3113.               | 16126.                     | 7998.                               | 0.     | 0.                  | 0.                          | 0.250              |
| 2004  | 57.4                         | 40.6                     | 33.2                       | 8976                 | 11997.                      | 12001.             | 131144.               | 0.                           | 3002.               | 13583.                     | 8998.                               | 0.     | 0.                  | 0.                          | 0.250              |
| 2005  | 59.4                         | 42.9                     | 35.0                       | 9458                 | 11999.                      | 11997.             | 125546.               | 0.                           | 2761.               | 11407.                     | 9999.                               | 0.     | 0.                  | 0.                          | 0.250              |
| 2006  | 60.6                         | 43.2                     | 34.3                       | 9511                 | 11999.                      | 11999.             | 142452.               | 0.                           | 3037.               | 9584.                      | 10995.                              | 0.     | 0.                  | 0.                          | 0.250              |
| 2007  | 62.4                         | 44.8                     | 35.2                       | 9671                 | 11999.                      | 11999.             | 145473.               | 0.                           | 3128.               | 8071.                      | 11997.                              | 0.     | 0.                  | 0.                          | 0.250              |
| 2008  | 63.9                         | 45.7                     | 35.4                       | 9729                 | 11999.                      | 11999.             | 154152.               | 0.                           | 3292.               | 6792.                      | 12000.                              | 0.     | 0.                  | 0.                          | 0.250              |
| 2009  | 65.0                         | 47.0                     | 36.5                       | 9984                 | 11999.                      | 11999.             | 152898.               | 0.                           | 3264.               | 5722.                      | 12001.                              | 0.     | 0.                  | 0.                          | 0.250              |
| 2010  | 67.5                         | 48.6                     | 37.7                       | 10182                | 11999.                      | 11999.             | 148713.               | 0.                           | 3278.               | 4865.                      | 11997.                              | 0.     | 0.                  | 0.                          | 0.250              |
| 2011  | 68.6                         | 49.5                     | 38.4                       | 10474                | 12244.                      | 11999.             | 150461.               | 0.                           | 3193.               | 4196.                      | 11999.                              | 0.     | 0.                  | 0.                          | 0.250              |
| 2012  | 69.3                         | 50.1                     | 39.0                       | 10601                | 12880.                      | 12244.             | 153999.               | 0.                           | 3245.               | 3668.                      | 11999.                              | 3374.  | 0.                  | 0.                          | 0.250              |
| 2013  | 68.8                         | 50.1                     | 38.6                       | 10670                | 12791.                      | 12880.             | 154980.               | 0.                           | 3295.               | 3248.                      | 11999.                              | 11372. | 0.                  | 0.                          | 0.250              |
| 2014  | 68.1                         | 49.2                     | 38.3                       | 10383                | 12810.                      | 12791.             | 155889.               | 0.                           | 3344.               | 2932.                      | 11999.                              | 10353. | 0.                  | 0.                          | 0.250              |
| 2015  | 68.0                         | 49.1                     | 38.2                       | 10284                | 12793.                      | 12810.             | 154925.               | 0.                           | 3333.               | 2715.                      | 11999.                              | 10430. | 0.                  | 0.                          | 0.250              |
| 2016  | 67.7                         | 49.0                     | 38.1                       | 10293                | 12504.                      | 12793.             | 154142.               | 0.                           | 3358.               | 2597.                      | 11999.                              | 10107. | 0.                  | 0.                          | 0.250              |
| 2017  | 67.1                         | 48.6                     | 38.6                       | 10305                | 12711.                      | 12504.             | 154614.               | 0.                           | 3288.               | 2522.                      | 12244.                              | 6786.  | 0.                  | 0.                          | 0.250              |
| 2018  | 65.3                         | 47.6                     | 38.3                       | 10199                | 12418.                      | 12711.             | 155195.               | 0.                           | 3292.               | 2390.                      | 12880.                              | 9639.  | 0.                  | 0.                          | 0.250              |
| 2019  | 63.1                         | 45.7                     | 37.0                       | 9819                 | 12667.                      | 12418.             | 156284.               | 0.                           | 3323.               | 2179.                      | 12791.                              | 5603.  | 0.                  | 0.                          | 0.250              |
| 2020  | 60.8                         | 44.1                     | 35.7                       | 9426                 | 12672.                      | 12667.             | 156756.               | 0.                           | 3357.               | 1901.                      | 12810.                              | 8642.  | 0.                  | 0.                          | 0.250              |
| TOTAL | 2122.4                       | 1548.7                   | 1159.8                     | 318444               | 324928.                     | 312256.            | 3565356.              | 0.                           | 77492.              | 598507.                    | 249163.                             | 76306. | 0.                  | 0.                          |                    |



TABLE 4.6. Projected Unit Cost for Median Growth with U and Pu Recycle  
(in 1977 Dollars)

| YEAR       | U308<br>AS BURNED<br>\$/LB | U<br>CONVR<br>\$/KG-U | SEP WORK<br>\$/SHU | U FAB<br>\$/KG-U | SPENT<br>FUEL TRAN<br>\$/KG-HM | REPRO<br>\$/KG-HM | PU<br>TRAN<br>\$/G-TOT | INCR PU<br>STORAGE<br>\$/G-TOT | NOX<br>FAB<br>\$/KG-HM | INCR SPENT<br>FUEL STOR<br>\$/KG-HM-YR | WASTE PU<br>DISPOSAL<br>\$/KG-HM<br>W/O PU | VALUE<br>\$/G FISS | SPENT<br>FUEL DISP<br>\$/KG-HM |
|------------|----------------------------|-----------------------|--------------------|------------------|--------------------------------|-------------------|------------------------|--------------------------------|------------------------|--|--|--------------------|--------------------------------|
| ESCR       | 0.02                       | 0.02                  | 0.02               | 0.02             | 0.02                           | 0.02              | 0.02                   | 0.02                           | 0.02                   | 0.02                                   | 0.02                                       | 0.00               | 0.02                           |
| 1977       | 42.0                       | 4.6                   | 70.0               | 95.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1978       | 42.0                       | 4.6                   | 77.0               | 94.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1979       | 42.0                       | 4.6                   | 80.0               | 93.9             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1980       | 42.0                       | 4.6                   | 82.0               | 93.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1981       | 42.0                       | 4.6                   | 84.0               | 92.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1982       | 42.0                       | 4.6                   | 87.0               | 92.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1983       | 42.0                       | 4.6                   | 90.0               | 91.8             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1984       | 42.0                       | 4.6                   | 93.0               | 91.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1985       | 42.0                       | 4.6                   | 95.0               | 90.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1986       | 42.0                       | 4.6                   | 98.0               | 89.9             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 346.2                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1987       | 42.0                       | 4.6                   | 100.0              | 89.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 335.9                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1988       | 42.0                       | 4.6                   | 100.0              | 88.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 322.8                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1989       | 44.7                       | 4.6                   | 100.0              | 88.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 313.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1990       | 44.7                       | 4.6                   | 100.0              | 87.4             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 297.8                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1991       | 44.7                       | 4.6                   | 100.0              | 87.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 289.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1992       | 44.7                       | 4.6                   | 100.0              | 86.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 279.6                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1993       | 44.7                       | 4.6                   | 95.0               | 85.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 266.6                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1994       | 44.7                       | 4.6                   | 94.0               | 85.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 253.1                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1995       | 44.7                       | 4.6                   | 93.0               | 84.4             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 242.1                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1996       | 44.7                       | 4.6                   | 92.0               | 83.9             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 223.4                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1997       | 44.7                       | 4.6                   | 91.0               | 83.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 209.3                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1998       | 46.2                       | 4.6                   | 91.0               | 82.8             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1999       | 46.2                       | 4.6                   | 90.0               | 82.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2000       | 46.2                       | 4.6                   | 89.0               | 81.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2001       | 46.2                       | 4.6                   | 88.0               | 81.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2002       | 47.8                       | 4.6                   | 87.0               | 80.7             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2003       | 51.6                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2004       | 51.6                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2005       | 51.6                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2006       | 52.2                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2007       | 56.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2008       | 60.9                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2009       | 65.8                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2010       | 65.8                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2011       | 65.8                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2012       | 70.0                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 52.42              | 95.0                           |
| 2013       | 75.6                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 55.41              | 95.0                           |
| 2014       | 81.7                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 58.65              | 95.0                           |
| 2015       | 88.2                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 62.13              | 95.0                           |
| 2016       | 88.2                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 62.13              | 95.0                           |
| 2017       | 88.2                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 62.13              | 95.0                           |
| 2018       | 88.2                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 62.13              | 95.0                           |
| 2019       | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 63.83              | 95.0                           |
| 2020       | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 203.1                  | 7.4                                    | 20.0                                       | 63.83              | 95.0                           |
| HT<br>AVE. | 59.4                       | 4.6                   | 88.8               | 82.7             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 208.4                  | 7.4                                    | 20.0                                       | 60.55              | 0.0                            |

TABLE 4.7. Projected Costs for Materials and Services  
for Median Growth with U and Pu Recycle  
(in Millions of 1977 Dollars)

SECTION 3. PROJECTED COSTS FOR MATERIALS AND SERVICES  
(IN MILLIONS OF 1977 DOLLARS)

| YEAR | MINING<br>MILLING | UF6<br>CONVR | ENRICHMENT | U FUEL<br>FAB | SPENT<br>FUEL TRN | REPRO  | PU<br>TRANS | INCR PU<br>STORAGE | MOX<br>FAB | INCR<br>FUEL | SPENT<br>STOR | WASTE<br>DISPOSAL<br>W/O PU | PU SALES | SPENT<br>FUEL DISP | TOTAL   |
|------|-------------------|--------------|------------|---------------|-------------------|--------|-------------|--------------------|------------|--------------|---------------|-----------------------------|----------|--------------------|---------|
| 1977 | 1092.7            | 44.          | 407.       | 160.          | 0.                | 0.     | 0.00        | 0.00               | 0.         | 15.          | 0.            | 0.                          | 0.       | 0.                 | 1719.   |
| 1978 | 1234.7            | 51.          | 516.       | 169.          | 0.                | 0.     | 0.00        | 0.00               | 0.         | 23.          | 0.            | 0.                          | 0.       | 0.                 | 1993.   |
| 1979 | 1352.4            | 56.          | 590.       | 206.          | 0.                | 0.     | 0.00        | 0.00               | 0.         | 32.          | 0.            | 0.                          | 0.       | 0.                 | 2236.   |
| 1980 | 1514.9            | 62.          | 658.       | 211.          | 0.                | 0.     | 0.00        | 0.00               | 0.         | 42.          | 0.            | 0.                          | 0.       | 0.                 | 2486.   |
| 1981 | 1723.5            | 71.          | 777.       | 247.          | 0.                | 0.     | 0.00        | 0.00               | 0.         | 53.          | 0.            | 0.                          | 0.       | 0.                 | 2870.   |
| 1982 | 1932.6            | 79.          | 898.       | 271.          | 0.                | 0.     | 0.00        | 0.00               | 0.         | 65.          | 0.            | 0.                          | 0.       | 0.                 | 3246.   |
| 1983 | 2160.7            | 89.          | 1042.      | 309.          | 0.                | 0.     | 0.00        | 0.00               | 0.         | 79.          | 0.            | 0.                          | 0.       | 0.                 | 3679.   |
| 1984 | 2401.4            | 99.          | 1203.      | 337.          | 0.                | 0.     | 0.00        | 0.00               | 0.         | 94.          | 0.            | 0.                          | 0.       | 0.                 | 4135.   |
| 1985 | 2608.2            | 108.         | 1367.      | 370.          | 7.                | 0.     | 0.00        | 0.00               | 0.         | 112.         | 0.            | 0.                          | 0.       | 0.                 | 4572.   |
| 1986 | 2747.4            | 114.         | 1523.      | 397.          | 15.               | 75.    | 0.05        | 0.00               | 11.        | 128.         | 6.            | 0.                          | 0.       | 0.                 | 5018.   |
| 1987 | 2858.9            | 119.         | 1649.      | 416.          | 22.               | 150.   | 0.14        | 0.00               | 41.        | 143.         | 12.           | 0.                          | 0.       | 0.                 | 5410.   |
| 1988 | 3030.6            | 124.         | 1744.      | 434.          | 30.               | 225.   | 0.24        | 0.00               | 77.        | 157.         | 19.           | 0.                          | 0.       | 0.                 | 5840.   |
| 1989 | 3424.8            | 132.         | 1899.      | 474.          | 37.               | 300.   | 0.34        | 0.00               | 103.       | 169.         | 25.           | 0.                          | 0.       | 0.                 | 6365.   |
| 1990 | 3586.8            | 138.         | 2011.      | 499.          | 45.               | 375.   | 0.43        | 0.00               | 141.       | 180.         | 31.           | 0.                          | 0.       | 0.                 | 7008.   |
| 1991 | 3759.7            | 144.         | 2141.      | 521.          | 52.               | 449.   | 0.49        | 0.00               | 163.       | 190.         | 37.           | 0.                          | 0.       | 0.                 | 7457.   |
| 1992 | 3927.8            | 151.         | 2266.      | 543.          | 60.               | 524.   | 0.58        | 0.00               | 185.       | 199.         | 43.           | 0.                          | 0.       | 0.                 | 7899.   |
| 1993 | 4109.6            | 157.         | 2258.      | 565.          | 67.               | 599.   | 0.71        | 0.00               | 214.       | 206.         | 50.           | 0.                          | 0.       | 0.                 | 8227.   |
| 1994 | 4295.0            | 164.         | 2353.      | 594.          | 75.               | 674.   | 0.87        | 0.00               | 241.       | 214.         | 56.           | 0.                          | 0.       | 0.                 | 8666.   |
| 1995 | 4440.3            | 170.         | 2430.      | 619.          | 90.               | 749.   | 1.01        | 0.00               | 262.       | 220.         | 62.           | 0.                          | 0.       | 0.                 | 9044.   |
| 1996 | 4515.3            | 172.         | 2500.      | 631.          | 105.              | 900.   | 1.15        | 0.00               | 295.       | 222.         | 74.           | 0.                          | 0.       | 0.                 | 9415.   |
| 1997 | 4580.3            | 173.         | 2543.      | 647.          | 120.              | 1050.  | 1.37        | 0.00               | 316.       | 219.         | 87.           | 0.                          | 0.       | 0.                 | 9738.   |
| 1998 | 4851.1            | 177.         | 2650.      | 661.          | 135.              | 1200.  | 1.52        | 0.00               | 358.       | 213.         | 99.           | 0.                          | 0.       | 0.                 | 10344.  |
| 1999 | 4848.2            | 178.         | 2731.      | 673.          | 150.              | 1350.  | 1.66        | 0.00               | 399.       | 201.         | 112.          | 0.                          | 0.       | 0.                 | 10644.  |
| 2000 | 4908.7            | 176.         | 2720.      | 687.          | 165.              | 1500.  | 1.99        | 0.00               | 441.       | 186.         | 124.          | 0.                          | 0.       | 0.                 | 10910.  |
| 2001 | 4825.7            | 177.         | 2824.      | 684.          | 180.              | 1649.  | 2.11        | 0.00               | 523.       | 166.         | 137.          | 0.                          | 0.       | 0.                 | 11167.  |
| 2002 | 4879.6            | 165.         | 2616.      | 677.          | 180.              | 1800.  | 2.83        | 0.00               | 615.       | 141.         | 149.          | 0.                          | 0.       | 0.                 | 11227.  |
| 2003 | 5559.4            | 174.         | 2682.      | 698.          | 180.              | 1800.  | 2.85        | 0.00               | 632.       | 120.         | 149.          | 0.                          | 0.       | 0.                 | 11998.  |
| 2004 | 5927.0            | 187.         | 2857.      | 720.          | 180.              | 1800.  | 2.62        | 0.00               | 610.       | 101.         | 149.          | 0.                          | 0.       | 0.                 | 12533.  |
| 2005 | 6125.6            | 198.         | 3008.      | 759.          | 180.              | 1800.  | 2.51        | 0.00               | 561.       | 85.          | 149.          | 0.                          | 0.       | 0.                 | 12866.  |
| 2006 | 6332.4            | 199.         | 2951.      | 763.          | 180.              | 1800.  | 2.85        | 0.00               | 617.       | 71.          | 149.          | 0.                          | 0.       | 0.                 | 13065.  |
| 2007 | 7045.1            | 206.         | 3023.      | 776.          | 180.              | 1800.  | 2.91        | 0.00               | 635.       | 60.          | 149.          | 0.                          | 0.       | 0.                 | 13877.  |
| 2008 | 7781.9            | 210.         | 3044.      | 790.          | 180.              | 1800.  | 3.08        | 0.00               | 669.       | 50.          | 149.          | 0.                          | 0.       | 0.                 | 14668.  |
| 2009 | 8655.6            | 216.         | 3136.      | 801.          | 180.              | 1800.  | 3.06        | 0.00               | 663.       | 43.          | 149.          | 0.                          | 0.       | 0.                 | 15646.  |
| 2010 | 8884.8            | 223.         | 3239.      | 817.          | 180.              | 1800.  | 2.97        | 0.00               | 666.       | 36.          | 149.          | 0.                          | 0.       | 0.                 | 15998.  |
| 2011 | 9026.0            | 228.         | 3301.      | 840.          | 184.              | 1800.  | 3.01        | 0.00               | 649.       | 31.          | 149.          | 0.                          | 0.       | 0.                 | 16210.  |
| 2012 | 9700.9            | 230.         | 3351.      | 850.          | 193.              | 1837.  | 3.08        | 0.00               | 659.       | 27.          | 152.          | -177.                       | 0.       | 0.                 | 16827.  |
| 2013 | 10409.7           | 230.         | 3321.      | 856.          | 192.              | 1932.  | 3.10        | 0.00               | 669.       | 24.          | 160.          | -630.                       | 0.       | 0.                 | 17167.  |
| 2014 | 11123.2           | 226.         | 3295.      | 833.          | 192.              | 1919.  | 3.12        | 0.00               | 679.       | 22.          | 159.          | -607.                       | 0.       | 0.                 | 17844.  |
| 2015 | 11995.4           | 226.         | 3286.      | 825.          | 192.              | 1922.  | 3.10        | 0.00               | 677.       | 20.          | 159.          | -648.                       | 0.       | 0.                 | 18657.  |
| 2016 | 11947.3           | 225.         | 3276.      | 825.          | 188.              | 1919.  | 3.08        | 0.00               | 682.       | 19.          | 159.          | -628.                       | 0.       | 0.                 | 18616.  |
| 2017 | 11820.3           | 224.         | 3322.      | 826.          | 191.              | 1876.  | 3.09        | 0.00               | 668.       | 19.          | 155.          | -422.                       | 0.       | 0.                 | 18690.  |
| 2018 | 11522.8           | 219.         | 3291.      | 818.          | 186.              | 1907.  | 3.10        | 0.00               | 669.       | 18.          | 158.          | -599.                       | 0.       | 0.                 | 18193.  |
| 2019 | 11527.9           | 210.         | 3179.      | 787.          | 190.              | 1863.  | 3.13        | 0.00               | 675.       | 16.          | 154.          | -358.                       | 0.       | 0.                 | 18249.  |
| 2020 | 11116.2           | 203.         | 3071.      | 756.          | 190.              | 1900.  | 3.14        | 0.00               | 682.       | 14.          | 157.          | -552.                       | 0.       | 0.                 | 17541.  |
| TOTL | 252120.5          | 7124.        | 102950.    | 26331.        | 4874.             | 46838. | 71.31       | 0.00               | 16148.     | 4446.        | 3878.         | -4620.                      | 0.       | 0.                 | 460161. |

TABLE 4.8. Discounted Process Costs for Materials and Services  
for Median Growth with U and Pu Recycle  
(in Millions of 1977 Dollars)

Discount Rate, 8%

SECTION 4. DISCOUNTED PROCESS COSTS  
(IN MILLIONS OF 1977 DOLLARS)

| YEAR  | MINING<br>MILLING | UF <sub>6</sub><br>CONVR | ENRICHANT | U FUEL<br>FAB | SPENT<br>FUEL TRAN | REPRO | PU<br>TRANS | INCR PU<br>STORAGE | MOX<br>FAB | INCR<br>FUEL | SPENT<br>STOR | WASTE<br>DISPOSAL<br>W/O PU | PU SALES | SPENT<br>FUEL DISP | TOTAL |
|-------|-------------------|--------------------------|-----------|---------------|--------------------|-------|-------------|--------------------|------------|--------------|---------------|-----------------------------|----------|--------------------|-------|
| 1977  | 1092.7            | 44.                      | 407       | 160           | 0                  | 0     | 0.00        | 0.00               | 0          |              | 15.           | 0                           | 0        | 0                  | 1719  |
| 1978  | 1143.2            | 47.                      | 477       | 156           | 0                  | 0     | 0.00        | 0.00               | 0          |              | 21.           | 0                           | 0        | 0                  | 1845  |
| 1979  | 1159.5            | 48.                      | 505       | 177           | 0                  | 0     | 0.00        | 0.00               | 0          |              | 27.           | 0                           | 0        | 0                  | 1917  |
| 1980  | 1202.6            | 49.                      | 522       | 167           | 0                  | 0     | 0.00        | 0.00               | 0          |              | 33.           | 0                           | 0        | 0                  | 1974  |
| 1981  | 1266.8            | 52.                      | 571       | 182           | 0                  | 0     | 0.00        | 0.00               | 0          |              | 39.           | 0                           | 0        | 0                  | 2110  |
| 1982  | 1315.3            | 54.                      | 611       | 184           | 0                  | 0     | 0.00        | 0.00               | 0          |              | 45.           | 0                           | 0        | 0                  | 2209  |
| 1983  | 1361.6            | 56.                      | 657       | 195           | 0                  | 0     | 0.00        | 0.00               | 0          |              | 50.           | 0                           | 0        | 0                  | 2319  |
| 1984  | 1401.2            | 58.                      | 702       | 196           | 0                  | 0     | 0.00        | 0.00               | 0          |              | 55.           | 0                           | 0        | 0                  | 2412  |
| 1985  | 1409.1            | 58.                      | 730       | 200           | 4.                 | 0     | 0.00        | 0.00               | 0          |              | 60.           | 0                           | 0        | 0                  | 2470  |
| 1986  | 1374.4            | 57.                      | 762       | 198           | 7.                 | 37.   | 0.02        | 0.00               | 6.         |              | 64.           | 3                           | 0        | 0                  | 2509  |
| 1987  | 1324.2            | 55.                      | 764       | 193.          | 10.                | 69    | 0.07        | 0.00               | 19.        |              | 66.           | 6                           | 0        | 0                  | 2506  |
| 1988  | 1299.0            | 53.                      | 748       | 186.          | 13.                | 96.   | 0.10        | 0.00               | 33.        |              | 67.           | 8                           | 0        | 0                  | 2505  |
| 1989  | 1360.0            | 53.                      | 754       | 188.          | 15.                | 119.  | 0.13        | 0.00               | 41.        |              | 67.           | 10                          | 0        | 0                  | 2607  |
| 1990  | 1318.9            | 51.                      | 740       | 184.          | 17.                | 138.  | 0.16        | 0.00               | 52.        |              | 66.           | 11                          | 0        | 0                  | 2577  |
| 1991  | 1280.0            | 49.                      | 729       | 177.          | 18.                | 153.  | 0.17        | 0.00               | 55.        |              | 65.           | 13                          | 0        | 0                  | 2539  |
| 1992  | 1238.2            | 48.                      | 714       | 171.          | 19.                | 165.  | 0.18        | 0.00               | 58.        |              | 63.           | 14                          | 0        | 0                  | 2490  |
| 1993  | 1199.5            | 46.                      | 659       | 165.          | 20.                | 175.  | 0.21        | 0.00               | 62.        |              | 60.           | 14                          | 0        | 0                  | 2402  |
| 1994  | 1160.8            | 44.                      | 636       | 160.          | 20.                | 182.  | 0.24        | 0.00               | 65.        |              | 58.           | 15                          | 0        | 0                  | 2342  |
| 1995  | 1111.2            | 42.                      | 608       | 155.          | 23.                | 187.  | 0.25        | 0.00               | 66.        |              | 55.           | 16                          | 0        | 0                  | 2263  |
| 1996  | 1046.2            | 40.                      | 579       | 146.          | 24.                | 200.  | 0.27        | 0.00               | 68.        |              | 51.           | 17                          | 0        | 0                  | 2182  |
| 1997  | 982.7             | 37.                      | 546       | 139.          | 26.                | 225.  | 0.29        | 0.00               | 68.        |              | 47.           | 19                          | 0        | 0                  | 2089  |
| 1998  | 963.7             | 35.                      | 526       | 131.          | 27.                | 238.  | 0.30        | 0.00               | 71.        |              | 42.           | 20                          | 0        | 0                  | 2055  |
| 1999  | 891.8             | 33.                      | 502       | 124.          | 28.                | 248.  | 0.31        | 0.00               | 73.        |              | 37.           | 21                          | 0        | 0                  | 1958  |
| 2000  | 836.0             | 30.                      | 463       | 117.          | 28.                | 255.  | 0.34        | 0.00               | 75.        |              | 32.           | 21                          | 0        | 0                  | 1858  |
| 2001  | 761.0             | 28.                      | 445       | 108.          | 28.                | 260.  | 0.33        | 0.00               | 82.        |              | 26.           | 22                          | 0        | 0                  | 1761  |
| 2002  | 712.5             | 24.                      | 382       | 99.           | 26.                | 263.  | 0.41        | 0.00               | 90.        |              | 21.           | 22                          | 0        | 0                  | 1639  |
| 2003  | 751.6             | 24.                      | 263       | 94.           | 24.                | 243.  | 0.39        | 0.00               | 86.        |              | 16.           | 20                          | 0        | 0                  | 1622  |
| 2004  | 742.0             | 23.                      | 358       | 90.           | 23.                | 225.  | 0.33        | 0.00               | 76.        |              | 13.           | 19                          | 0        | 0                  | 1569  |
| 2005  | 710.0             | 23.                      | 349       | 88.           | 21.                | 209.  | 0.29        | 0.00               | 65.        |              | 10.           | 17                          | 0        | 0                  | 1491  |
| 2006  | 679.6             | 21.                      | 317       | 82.           | 19.                | 193.  | 0.31        | 0.00               | 66.        |              | 8.            | 16                          | 0        | 0                  | 1462  |
| 2007  | 700.1             | 20.                      | 300       | 77.           | 18.                | 179.  | 0.29        | 0.00               | 63.        |              | 6.            | 15                          | 0        | 0                  | 1379  |
| 2008  | 716.1             | 19.                      | 280       | 72.           | 17.                | 166.  | 0.28        | 0.00               | 62.        |              | 5.            | 14                          | 0        | 0                  | 1350  |
| 2009  | 737.5             | 18.                      | 267       | 68.           | 15.                | 153.  | 0.26        | 0.00               | 56.        |              | 4.            | 13                          | 0        | 0                  | 1333  |
| 2010  | 700.9             | 18.                      | 256       | 64.           | 14.                | 142.  | 0.23        | 0.00               | 53.        |              | 3.            | 12                          | 0        | 0                  | 1262  |
| 2011  | 659.3             | 17.                      | 241       | 61.           | 13.                | 131.  | 0.22        | 0.00               | 47.        |              | 2.            | 11                          | 0        | 0                  | 1184  |
| 2012  | 656.1             | 16.                      | 227       | 58.           | 13.                | 124.  | 0.21        | 0.00               | 45.        |              | 2.            | 10                          | -12      | 0                  | 1138  |
| 2013  | 651.9             | 14.                      | 208       | 54.           | 12.                | 121.  | 0.19        | 0.00               | 42.        |              | 2.            | 10                          | -39      | 0                  | 1075  |
| 2014  | 645.0             | 13.                      | 191       | 48.           | 11.                | 111.  | 0.18        | 0.00               | 39.        |              | 1.            | 9                           | -35      | 0                  | 1035  |
| 2015  | 644.0             | 12.                      | 176       | 44.           | 10.                | 103.  | 0.17        | 0.00               | 36.        |              | 1.            | 9                           | -35      | 0                  | 1002  |
| 2016  | 593.9             | 11.                      | 163       | 41.           | 9.                 | 95.   | 0.15        | 0.00               | 34.        |              | 1.            | 8.                          | -31      | 0                  | 925   |
| 2017  | 544.5             | 10.                      | 153       | 38.           | 9.                 | 86.   | 0.14        | 0.00               | 31.        |              | 1.            | 7.                          | -19      | 0                  | 860   |
| 2018  | 491.1             | 9.                       | 140       | 35.           | 8.                 | 81.   | 0.13        | 0.00               | 29.        |              | 1.            | 7.                          | -26      | 0                  | 775   |
| 2019  | 454.9             | 8.                       | 125       | 31.           | 7.                 | 74.   | 0.12        | 0.00               | 27.        |              | 1.            | 6.                          | -14      | 0                  | 720   |
| 2020  | 406.2             | 7.                       | 112       | 28.           | 7.                 | 69.   | 0.11        | 0.00               | 25.        |              | 1.            | 6.                          | -20      | 0                  | 641   |
| TOTAL | 41697.9           | 1476                     | 19975     | 5332          | 604                | 5529  | 7.80        | 0.00               | 1866       |              | 1303          | 458                         | -232     | 0                  | 78022 |

TABLE 4.3. Projected Unit Cost for Median Growth with No Reprocessing  
(in Current Dollars with 6% Annual Escalation)

| YEAR | U308<br>AS BURNED<br>\$/LB | U<br>CONVR<br>\$/KG-U | SEP WORK<br>\$/SHU | U FAB<br>\$/KG | SPENT<br>FUEL TRAN<br>\$/KG-HM | REFRO<br>\$/KG-HM | PU<br>TRAN<br>\$/G-TOT | INCR PU<br>STORAGE<br>\$/G-TOT | MOX<br>FAB<br>\$/KG-HM | INCR<br>FUEL STOR<br>\$/KG-HM-YR | SPENT<br>FUEL STOR<br>\$/KG-HM-YR | WASTE PU<br>DISPOSAL<br>\$/KG-HM | VALUE<br>\$/G FISS | SPENT<br>FUEL DISP<br>\$/KG-HM |
|------|----------------------------|-----------------------|--------------------|----------------|--------------------------------|-------------------|------------------------|--------------------------------|------------------------|----------------------------------|-----------------------------------|----------------------------------|--------------------|--------------------------------|
| ESCR | 6.0%                       | 6.0%                  | 6.0%               | 6.0%           | 6.0%                           | 6.0%              | 6.0%                   | 6.0%                           | 6.0%                   | 6.0%                             | 6.0%                              | 6.0%                             |                    | 6.0%                           |
| 1977 | 42.0                       | 4.6                   | 70.0               | 95.0           | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.8                              | 20.0                              | 0.00                             | 0.00               | 95.0                           |
| 1978 | 44.5                       | 4.9                   | 81.6               | 100.2          | 15.9                           | 159.0             | 0.02                   | 0.00                           | 371.0                  | 6.1                              | 21.2                              | 0.00                             | 0.00               | 100.7                          |
| 1979 | 47.2                       | 5.2                   | 89.9               | 105.5          | 16.9                           | 168.5             | 0.02                   | 0.00                           | 393.3                  | 6.5                              | 22.5                              | 0.00                             | 0.00               | 106.7                          |
| 1980 | 50.0                       | 5.5                   | 97.7               | 111.0          | 17.9                           | 178.7             | 0.02                   | 0.00                           | 416.9                  | 6.9                              | 23.8                              | 0.00                             | 0.00               | 113.1                          |
| 1981 | 53.0                       | 5.8                   | 106.0              | 116.8          | 18.9                           | 189.4             | 0.03                   | 0.00                           | 441.9                  | 7.3                              | 25.2                              | 0.00                             | 0.00               | 119.9                          |
| 1982 | 56.2                       | 6.2                   | 116.4              | 123.1          | 20.1                           | 200.7             | 0.03                   | 0.00                           | 468.4                  | 7.7                              | 26.8                              | 0.00                             | 0.00               | 127.1                          |
| 1983 | 59.6                       | 6.5                   | 127.7              | 130.2          | 21.3                           | 212.8             | 0.03                   | 0.00                           | 496.5                  | 8.2                              | 28.4                              | 0.00                             | 0.00               | 134.8                          |
| 1984 | 63.2                       | 6.9                   | 139.8              | 136.8          | 22.6                           | 225.5             | 0.03                   | 0.00                           | 526.3                  | 8.7                              | 30.1                              | 0.00                             | 0.00               | 142.8                          |
| 1985 | 66.9                       | 7.3                   | 151.4              | 144.2          | 23.9                           | 239.1             | 0.03                   | 0.00                           | 557.8                  | 9.2                              | 31.9                              | 0.00                             | 0.00               | 151.4                          |
| 1986 | 71.0                       | 7.8                   | 165.6              | 151.9          | 25.3                           | 253.4             | 0.03                   | 0.00                           | 591.3                  | 9.8                              | 33.8                              | 0.00                             | 0.00               | 160.5                          |
| 1987 | 75.2                       | 8.2                   | 179.1              | 159.4          | 26.9                           | 268.6             | 0.04                   | 0.00                           | 626.8                  | 10.4                             | 35.8                              | 0.00                             | 0.00               | 170.1                          |
| 1988 | 79.7                       | 8.7                   | 189.8              | 168.0          | 28.5                           | 284.7             | 0.04                   | 0.00                           | 664.4                  | 11.0                             | 38.0                              | 0.00                             | 0.00               | 180.3                          |
| 1989 | 89.9                       | 9.2                   | 201.2              | 177.1          | 30.2                           | 301.8             | 0.04                   | 0.00                           | 704.3                  | 11.6                             | 40.2                              | 0.00                             | 0.00               | 191.2                          |
| 1990 | 95.3                       | 9.8                   | 213.3              | 186.4          | 32.0                           | 319.9             | 0.04                   | 0.00                           | 746.5                  | 12.3                             | 42.7                              | 0.00                             | 0.00               | 202.6                          |
| 1991 | 101.1                      | 10.4                  | 226.1              | 196.7          | 33.9                           | 339.1             | 0.05                   | 0.00                           | 791.3                  | 13.1                             | 45.2                              | 0.00                             | 0.00               | 214.8                          |
| 1992 | 107.1                      | 11.0                  | 239.7              | 206.1          | 35.9                           | 359.5             | 0.05                   | 0.00                           | 838.8                  | 13.9                             | 47.9                              | 0.00                             | 0.00               | 227.7                          |
| 1993 | 117.4                      | 11.7                  | 241.3              | 217.2          | 38.1                           | 381.1             | 0.05                   | 0.00                           | 889.1                  | 14.7                             | 50.8                              | 0.00                             | 0.00               | 241.3                          |
| 1994 | 124.4                      | 12.4                  | 253.1              | 228.9          | 40.4                           | 403.9             | 0.05                   | 0.00                           | 942.5                  | 15.6                             | 53.9                              | 0.00                             | 0.00               | 255.8                          |
| 1995 | 131.9                      | 13.1                  | 265.5              | 240.9          | 42.8                           | 428.2             | 0.06                   | 0.00                           | 999.0                  | 16.5                             | 57.1                              | 0.00                             | 0.00               | 271.2                          |
| 1996 | 139.8                      | 13.9                  | 278.4              | 253.0          | 45.4                           | 453.8             | 0.06                   | 0.00                           | 1059.0                 | 17.5                             | 60.5                              | 0.00                             | 0.00               | 287.4                          |
| 1997 | 148.2                      | 14.8                  | 291.8              | 266.8          | 48.1                           | 481.1             | 0.06                   | 0.00                           | 1122.5                 | 18.6                             | 64.1                              | 0.00                             | 0.00               | 304.7                          |
| 1998 | 175.4                      | 15.6                  | 309.4              | 281.5          | 51.0                           | 509.9             | 0.07                   | 0.00                           | 1189.8                 | 19.7                             | 68.0                              | 0.00                             | 0.00               | 323.0                          |
| 1999 | 186.5                      | 16.6                  | 324.3              | 295.5          | 54.1                           | 540.5             | 0.07                   | 0.00                           | 1261.2                 | 20.9                             | 72.1                              | 0.00                             | 0.00               | 342.3                          |
| 2000 | 225.4                      | 17.5                  | 340.0              | 311.3          | 57.3                           | 573.0             | 0.08                   | 0.00                           | 1336.9                 | 22.1                             | 76.4                              | 0.00                             | 0.00               | 362.9                          |
| 2001 | 238.9                      | 18.6                  | 356.3              | 328.0          | 60.7                           | 607.3             | 0.08                   | 0.00                           | 1417.1                 | 23.4                             | 81.0                              | 0.00                             | 0.00               | 384.6                          |
| 2002 | 253.2                      | 19.7                  | 373.4              | 346.4          | 64.4                           | 643.8             | 0.09                   | 0.00                           | 1502.2                 | 24.8                             | 85.8                              | 0.00                             | 0.00               | 407.7                          |
| 2003 | 278.8                      | 20.9                  | 391.2              | 364.9          | 68.2                           | 682.4             | 0.09                   | 0.00                           | 1592.3                 | 26.3                             | 91.0                              | 0.00                             | 0.00               | 432.2                          |
| 2004 | 327.3                      | 22.2                  | 414.7              | 386.8          | 72.3                           | 723.4             | 0.10                   | 0.00                           | 1687.8                 | 27.9                             | 96.4                              | 0.00                             | 0.00               | 458.1                          |
| 2005 | 395.5                      | 23.5                  | 439.6              | 410.0          | 76.7                           | 766.8             | 0.10                   | 0.00                           | 1789.1                 | 29.6                             | 102.2                             | 0.00                             | 0.00               | 485.6                          |
| 2006 | 477.9                      | 24.9                  | 466.0              | 434.6          | 81.3                           | 812.8             | 0.11                   | 0.00                           | 1896.4                 | 31.4                             | 108.4                             | 0.00                             | 0.00               | 514.7                          |
| 2007 | 506.6                      | 26.4                  | 493.9              | 460.6          | 86.2                           | 861.5             | 0.11                   | 0.00                           | 2010.2                 | 33.2                             | 114.9                             | 0.00                             | 0.00               | 545.6                          |
| 2008 | 556.3                      | 28.0                  | 523.6              | 488.3          | 91.3                           | 913.2             | 0.12                   | 0.00                           | 2130.8                 | 35.2                             | 121.8                             | 0.00                             | 0.00               | 578.4                          |
| 2009 | 589.7                      | 29.7                  | 555.0              | 517.6          | 96.8                           | 968.0             | 0.13                   | 0.00                           | 2258.7                 | 37.4                             | 129.1                             | 0.00                             | 0.00               | 613.1                          |
| 2010 | 625.1                      | 31.5                  | 588.3              | 548.6          | 102.6                          | 1026.1            | 0.14                   | 0.00                           | 2394.2                 | 39.6                             | 136.8                             | 0.00                             | 0.00               | 649.9                          |
| 2011 | 662.6                      | 33.4                  | 623.6              | 581.5          | 108.8                          | 1087.7            | 0.15                   | 0.00                           | 2537.9                 | 42.0                             | 145.0                             | 0.00                             | 0.00               | 688.8                          |
| 2012 | 702.4                      | 35.4                  | 661.0              | 616.4          | 115.3                          | 1152.9            | 0.15                   | 0.00                           | 2690.1                 | 44.5                             | 153.7                             | 0.00                             | 0.00               | 730.2                          |
| 2013 | 744.5                      | 37.5                  | 700.7              | 653.4          | 122.2                          | 1222.1            | 0.16                   | 0.00                           | 2851.5                 | 47.2                             | 162.9                             | 0.00                             | 0.00               | 774.0                          |
| 2014 | 789.2                      | 39.7                  | 742.7              | 692.6          | 129.5                          | 1295.4            | 0.17                   | 0.00                           | 3022.6                 | 50.0                             | 172.7                             | 0.00                             | 0.00               | 820.4                          |
| 2015 | 836.5                      | 42.1                  | 787.3              | 734.2          | 137.3                          | 1373.1            | 0.18                   | 0.00                           | 3204.0                 | 53.0                             | 183.1                             | 0.00                             | 0.00               | 869.7                          |
| 2016 | 886.7                      | 44.6                  | 834.5              | 778.2          | 145.6                          | 1455.5            | 0.19                   | 0.00                           | 3396.2                 | 56.2                             | 194.1                             | 0.00                             | 0.00               | 921.8                          |
| 2017 | 939.9                      | 47.3                  | 884.6              | 824.9          | 154.3                          | 1542.9            | 0.21                   | 0.00                           | 3600.0                 | 59.5                             | 205.7                             | 0.00                             | 0.00               | 977.1                          |
| 2018 | 996.3                      | 50.2                  | 937.6              | 874.1          | 163.5                          | 1635.4            | 0.22                   | 0.00                           | 3816.0                 | 63.1                             | 218.1                             | 0.00                             | 0.00               | 1035.8                         |
| 2019 | 1056.1                     | 53.2                  | 993.9              | 926.9          | 173.4                          | 1733.6            | 0.23                   | 0.00                           | 4045.0                 | 66.9                             | 231.1                             | 0.00                             | 0.00               | 1097.9                         |
| 2020 | 1119.4                     | 56.4                  | 1053.5             | 982.5          | 183.8                          | 1837.6            | 0.25                   | 0.00                           | 4287.6                 | 70.9                             | 245.0                             | 0.00                             | 0.00               | 1163.8                         |
| HT   |                            |                       |                    |                |                                |                   |                        |                                |                        |                                  |                                   |                                  |                    |                                |
| HVE  | 473.3                      | 26.8                  | 511.9              | 470.8          | 101.3                          | 0.0               | 0.00                   | 0.00                           | 0.0                    | 37.2                             | 0.0                               | 0.00                             | 0.00               | 641.4                          |



TABLE 4.10. Levelized Fuel Cycle Cost for Median Growth  
(Mills/kW-hr)

Discount Rate, 8%

(No Reprocessing, 1977 Dollars)

| YEAR  | MINING<br>MILLING | UFG<br>CONVR | ENRICHMENT | U FUEL<br>FAB | SPENT<br>FUEL TRAN | REPRO | PU<br>TRANS | INCR PU<br>STORAGE | MOX<br>FAB | INCR<br>FUEL STOR | SPENT<br>FUEL STOR | WASTE<br>DISPOSAL<br>H/O PU | PU SALES | SPENT<br>FUEL DISP | TOTAL |
|-------|-------------------|--------------|------------|---------------|--------------------|-------|-------------|--------------------|------------|-------------------|--------------------|-----------------------------|----------|--------------------|-------|
| 77-81 | 2 851             | 0 131        | 1 221      | 0 464         | 0 026              | 0 000 | 0 000       | 0 000              | 0 000      | 0 111             | 0 000              | 0 000                       | 0 000    | 0 285              | 5 088 |
| 82-86 | 2 762             | 0 127        | 1 449      | 0 437         | 0 036              | 0 000 | 0 000       | 0 000              | 0 000      | 0 111             | 0 000              | 0 000                       | 0 000    | 0 282              | 5 204 |
| 87-91 | 2 770             | 0 125        | 1 632      | 0 415         | 0 039              | 0 000 | 0 000       | 0 000              | 0 000      | 0 112             | 0 000              | 0 000                       | 0 000    | 0 267              | 5 359 |
| 92-96 | 2 990             | 0 124        | 1 620      | 0 398         | 0 043              | 0 000 | 0 000       | 0 000              | 0 000      | 0 112             | 0 000              | 0 000                       | 0 000    | 0 259              | 5 545 |
| 97-1  | 3 160             | 0 122        | 1 510      | 0 379         | 0 046              | 0 000 | 0 000       | 0 000              | 0 000      | 0 112             | 0 000              | 0 000                       | 0 000    | 0 251              | 5 580 |
| 2-6   | 4 094             | 0 121        | 1 440      | 0 363         | 0 049              | 0 000 | 0 000       | 0 000              | 0 000      | 0 112             | 0 000              | 0 000                       | 0 000    | 0 243              | 6 422 |
| 7-11  | 5 662             | 0 120        | 1 422      | 0 356         | 0 053              | 0 000 | 0 000       | 0 000              | 0 000      | 0 112             | 0 000              | 0 000                       | 0 000    | 0 242              | 7 968 |
| 12-16 | 6 218             | 0 121        | 1 438      | 0 359         | 0 056              | 0 000 | 0 000       | 0 000              | 0 000      | 0 117             | 0 000              | 0 000                       | 0 000    | 0 241              | 8 551 |
| 17-20 | 6 254             | 0 121        | 1 443      | 0 357         | 0 062              | 0 000 | 0 000       | 0 000              | 0 000      | 0 115             | 0 000              | 0 000                       | 0 000    | 0 213              | 8 565 |

Discount Rate, 8%

(U and Pu Recycle, 1977 Dollars)

|       |       |       |       |       |       |       |       |       |       |       |       |       |        |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|-------|
| 77-81 | 2 851 | 0 131 | 1 221 | 0 464 | 0 000 | 0 000 | 0 000 | 0 000 | 0 000 | 0 188 | 0 000 | 0 000 | 0 000  | 0 000 | 4 855 |
| 82-86 | 2 762 | 0 127 | 1 449 | 0 437 | 0 022 | 0 224 | 0 000 | 0 000 | 0 000 | 0 226 | 0 000 | 0 019 | 0 000  | 0 000 | 5 265 |
| 87-91 | 2 637 | 0 116 | 1 575 | 0 404 | 0 050 | 0 500 | 0 001 | 0 000 | 0 041 | 0 191 | 0 000 | 0 041 | 0 000  | 0 000 | 5 556 |
| 92-96 | 2 483 | 0 100 | 1 458 | 0 360 | 0 068 | 0 682 | 0 001 | 0 000 | 0 123 | 0 143 | 0 000 | 0 056 | 0 000  | 0 000 | 5 475 |
| 97-1  | 2 227 | 0 096 | 1 262 | 0 318 | 0 094 | 0 837 | 0 001 | 0 000 | 0 158 | 0 072 | 0 000 | 0 069 | 0 000  | 0 000 | 5 114 |
| 2-6   | 1 978 | 0 079 | 1 087 | 0 275 | 0 071 | 0 714 | 0 001 | 0 000 | 0 221 | 0 025 | 0 000 | 0 059 | 0 000  | 0 000 | 4 502 |
| 7-11  | 2 292 | 0 072 | 1 056 | 0 270 | 0 065 | 0 646 | 0 001 | 0 000 | 0 218 | 0 010 | 0 000 | 0 053 | -0 089 | 0 000 | 4 594 |
| 12-16 | 3 028 | 0 074 | 1 078 | 0 274 | 0 062 | 0 620 | 0 001 | 0 000 | 0 217 | 0 006 | 0 000 | 0 051 | -0 176 | 0 000 | 5 236 |
| 17-20 | 3 833 | 0 073 | 1 079 | 0 270 | 0 056 | 0 560 | 0 001 | 0 000 | 0 221 | 0 003 | 0 000 | 0 046 | -0 157 | 0 000 | 5 985 |

Discount Rate, 14%

(No Reprocessing, Current Dollars with 6% Annual Escalation)

|       |        |       |        |       |       |       |       |       |       |       |       |       |       |       |        |
|-------|--------|-------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| 77-81 | 2 887  | 0 136 | 1 262  | 0 481 | 0 033 | 0 000 | 0 000 | 0 000 | 0 000 | 0 149 | 0 000 | 0 000 | 0 000 | 0 382 | 5 329  |
| 82-86 | 3 494  | 0 170 | 1 943  | 0 586 | 0 061 | 0 000 | 0 000 | 0 000 | 0 000 | 0 200 | 0 000 | 0 000 | 0 000 | 0 507 | 6 960  |
| 87-91 | 4 669  | 0 223 | 2 917  | 0 742 | 0 087 | 0 000 | 0 000 | 0 000 | 0 000 | 0 267 | 0 000 | 0 000 | 0 000 | 0 638 | 9 543  |
| 92-96 | 6 733  | 0 295 | 3 867  | 0 950 | 0 129 | 0 000 | 0 000 | 0 000 | 0 000 | 0 357 | 0 000 | 0 000 | 0 000 | 0 827 | 13 157 |
| 97-1  | 9 446  | 0 389 | 4 815  | 1 208 | 0 185 | 0 000 | 0 000 | 0 000 | 0 000 | 0 477 | 0 000 | 0 000 | 0 000 | 1 071 | 17 590 |
| 2-6   | 15 417 | 0 515 | 6 133  | 1 544 | 0 264 | 0 000 | 0 000 | 0 000 | 0 000 | 0 637 | 0 000 | 0 000 | 0 000 | 1 385 | 25 895 |
| 7-11  | 29 458 | 0 684 | 8 088  | 2 025 | 0 379 | 0 000 | 0 000 | 0 000 | 0 000 | 0 859 | 0 000 | 0 000 | 0 000 | 1 843 | 43 337 |
| 12-16 | 44 589 | 0 920 | 10 931 | 2 732 | 0 539 | 0 000 | 0 000 | 0 000 | 0 000 | 1 192 | 0 000 | 0 000 | 0 000 | 2 452 | 63 356 |
| 17-20 | 58 488 | 1 196 | 14 306 | 3 539 | 0 771 | 0 000 | 0 000 | 0 000 | 0 000 | 1 522 | 0 000 | 0 000 | 0 000 | 2 823 | 82 645 |

Discount Rate, 14%

(U and Pu Recycle, Current Dollars with 6% Annual Escalation)

|       |        |       |        |       |       |       |       |       |       |       |       |        |       |       |        |
|-------|--------|-------|--------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|-------|--------|
| 77-81 | 2 887  | 0 136 | 1 262  | 0 481 | 0 000 | 0 000 | 0 000 | 0 000 | 0 000 | 0 253 | 0 000 | 0 000  | 0 000 | 0 000 | 5 018  |
| 82-86 | 3 494  | 0 170 | 1 943  | 0 586 | 0 038 | 0 403 | 0 000 | 0 000 | 0 000 | 0 405 | 0 033 | 0 000  | 0 000 | 0 000 | 7 074  |
| 87-91 | 4 444  | 0 206 | 2 814  | 0 721 | 0 113 | 1 195 | 0 001 | 0 000 | 0 074 | 0 458 | 0 099 | 0 000  | 0 000 | 0 000 | 10 127 |
| 92-96 | 5 591  | 0 238 | 3 479  | 0 858 | 0 206 | 2 181 | 0 003 | 0 000 | 0 294 | 0 458 | 0 181 | 0 000  | 0 000 | 0 000 | 13 488 |
| 97-1  | 6 697  | 0 273 | 4 022  | 1 012 | 0 337 | 3 572 | 0 005 | 0 000 | 0 505 | 0 307 | 0 296 | 0 000  | 0 000 | 0 000 | 17 026 |
| 2-6   | 7 899  | 0 297 | 4 627  | 1 170 | 0 384 | 4 070 | 0 006 | 0 000 | 0 942 | 0 143 | 0 337 | 0 000  | 0 000 | 0 000 | 19 876 |
| 7-11  | 11 998 | 0 407 | 6 006  | 1 536 | 0 464 | 4 917 | 0 008 | 0 000 | 1 240 | 0 076 | 0 407 | -0 644 | 0 000 | 0 000 | 26 414 |
| 12-16 | 21 040 | 0 565 | 8 193  | 2 082 | 0 595 | 6 310 | 0 010 | 0 000 | 1 648 | 0 062 | 0 522 | -1 799 | 0 000 | 0 000 | 39 228 |
| 17-20 | 35 347 | 0 726 | 10 691 | 2 675 | 0 700 | 7 424 | 0 013 | 0 000 | 2 189 | 0 042 | 0 615 | -2 092 | 0 000 | 0 000 | 58 331 |

indicates little difference in the first few years, but growing to a difference of 2 mills/kW-hr by year 2020. For the cases with escalation the discount rate is increased to reflect the higher cost of money associated with the rate of inflation. The resulting fuel cycle costs are, of course, substantially larger growing to 82 mills/kW-hr in the case of no reprocessing in year 2020.

In recent years many questions about the extent of uranium resources and their influence on uranium prices have developed. Table 4.11 summarizes the cumulative resource consumption for the median growth case with and without reprocessing. These values differ from a summation of the uranium requirements in Table 4.1 or Table 4.5 because adjustments are made for imports, exports and by-product production.

#### 4.2 SINGLE REACTOR FUEL CYCLE COSTS

Costs for fuel cycle operations for BWRs and PWRs over a 30-year life are reviewed in this section of the report. In the NUFUEL model the national fuel cycle flows are derived by summing up the fuel cycle flows of individual reactors. For plants which will start operation before about 1980, enough specific information is available on design and expected operating characteristics to enable the fuel cycle to be represented separately for each reactor. For reactors which start at later times, generalized, or model, plants data have been used. It is the model reactor characteristics that are most typical of future plant additions. These characteristics are based on submissions by vendors to DOE. The model reactor characteristics were summarized in Table 2.2 in Section 2 of this report in terms of averages while the more detailed annual requirements for fuel cycle services are summarized in Table 4.12 for PWRs and Table 4.16 for BWRs. The NUFUEL model adjusts the reload batch size each year to maintain annual refueling schedules. This is best illustrated by referring to the uranium fuel fabrication column in Table 4.12. In 1983, 114 MT are fabricated which constitute the initial core. Reloads begin in 1986 stabilizing by 1990 into an equilibrium pattern maintained until year 2003 when the capacity factor begins declining from 70% at 2% per year. In the reprocessing column the associated spent fuel reprocessing is indicated including the 111 kilograms of spent fuel from the final core. The projected unit costs are summarized in Table 4.13 in constant dollar terms; the costs are consistent with the case of median growth with uranium and plutonium recycle shown in Table 4.6.



TABLE 4.11. Cumulative Uranium Resource Consumption  
for Median Growth

| Year | U <sub>3</sub> O <sub>8</sub> , 1,000 ST |                      |
|------|--|----------------------|
|      | No<br>Reprocessing                       | With<br>Reprocessing |
| 1977 | 11                                       | 11                   |
| 1978 | 24                                       | 24                   |
| 1979 | 38                                       | 38                   |
| 1980 | 53                                       | 53                   |
| 1981 | 68                                       | 68                   |
| 1982 | 85                                       | 85                   |
| 1983 | 106                                      | 106                  |
| 1984 | 129                                      | 129                  |
| 1985 | 155                                      | 155                  |
| 1986 | 184                                      | 182                  |
| 1987 | 215                                      | 211                  |
| 1988 | 251                                      | 242                  |
| 1989 | 289                                      | 275                  |
| 1990 | 331                                      | 310                  |
| 1991 | 372                                      | 342                  |
| 1992 | 415                                      | 376                  |
| 1993 | 463                                      | 412                  |
| 1994 | 514                                      | 450                  |
| 1995 | 568                                      | 489                  |
| 1996 | 626                                      | 530                  |
| 1997 | 688                                      | 571                  |
| 1998 | 752                                      | 614                  |
| 1999 | 821                                      | 656                  |
| 2000 | 892                                      | 699                  |
| 2001 | 967                                      | 741                  |
| 2002 | 1,045                                    | 782                  |
| 2003 | 1,125                                    | 826                  |
| 2004 | 1,207                                    | 874                  |
| 2005 | 1,291                                    | 923                  |
| 2006 | 1,378                                    | 974                  |
| 2007 | 1,466                                    | 1,026                |
| 2008 | 1,556                                    | 1,080                |
| 2009 | 1,648                                    | 1,136                |
| 2010 | 1,741                                    | 1,193                |
| 2011 | 1,836                                    | 1,252                |
| 2012 | 1,932                                    | 1,311                |
| 2013 | 2,028                                    | 1,370                |
| 2014 | 2,122                                    | 1,425                |
| 2015 | 2,217                                    | 1,486                |
| 2016 | 2,312                                    | 1,486                |
| 2017 | 2,405                                    | 1,601                |
| 2018 | 2,498                                    | 1,565                |
| 2019 | 2,588                                    | 1,709                |
| 2020 | 2,675                                    | 1,760                |

TABLE 4.12. Process Flows for 1,000 MWe PWR Unlimited Reprocessing

| YEAR | MINING<br>MILLING<br>1000 ST | U/G<br>CONVR<br>1000 MTU | ENRICHMENT<br>1000<br>MT-SNU | U FUEL<br>FAB<br>MTU | SPENT<br>FUEL TRAN<br>MT-HM | REPROCESS<br>MT-HM | PU<br>TRANS<br>KG-TOT | INCR PU<br>STORAGE<br>KG-TOT | MOX<br>FAB<br>MT-HM | INCR<br>FUEL STOR<br>MT-HM | SPENT<br>STOR<br>MT-HM | WASTE<br>DISPOSAL<br>MT-HM<br>W PU | PU SALES<br>KG FISS | SPENT<br>FUEL DISP<br>MT-HM | TAILS<br>COMP<br>% |
|------|------------------------------|--------------------------|------------------------------|----------------------|-----------------------------|--------------------|-----------------------|------------------------------|---------------------|----------------------------|------------------------|------------------------------------|---------------------|-----------------------------|--------------------|
| 1983 | 0.24                         | 0.27                     | 0.21                         | 29                   | 0                           | 0                  | 0                     | 0                            | 0                   | 0                          | 0                      | 0                                  | 0                   | 0                           | 0.250              |
| 1984 | 0.12                         | 0.04                     | 0.00                         | 0                    | 0                           | 0                  | 0                     | 0                            | 0                   | 0                          | 0                      | 0                                  | 0                   | 0                           | 0.250              |
| 1985 | 0.23                         | 0.18                     | 0.12                         | 27                   | 26                          | 0                  | 0                     | 0                            | 0                   | 0                          | 0                      | 0                                  | 0                   | 0                           | 0.250              |
| 1986 | 0.19                         | 0.16                     | 0.11                         | 0                    | 0                           | 26                 | 0                     | 0                            | 0                   | 0                          | 0                      | 0                                  | 0                   | 0                           | 0.250              |
| 1987 | 0.14                         | 0.11                     | 0.09                         | 27                   | 26                          | 0                  | 185                   | 0                            | 0                   | 0                          | 0                      | 0                                  | 0                   | 0                           | 0.250              |
| 1988 | 0.13                         | 0.10                     | 0.08                         | 21                   | 24                          | 26                 | 235                   | 0                            | 4                   | 0                          | 0                      | 0                                  | 0                   | 0                           | 0.250              |
| 1989 | 0.13                         | 0.09                     | 0.08                         | 19                   | 22                          | 24                 | 244                   | 0                            | 5                   | 0                          | 0                      | 0                                  | 0                   | 0                           | 0.250              |
| 1990 | 0.13                         | 0.09                     | 0.08                         | 19                   | 22                          | 22                 | 232                   | 0                            | 5                   | 0                          | 0                      | 0                                  | 0                   | 0                           | 0.250              |
| 1991 | 0.13                         | 0.09                     | 0.08                         | 19                   | 22                          | 22                 | 232                   | 0                            | 5                   | 0                          | 0                      | 26                                 | 0                   | 0                           | 0.250              |
| 1992 | 0.13                         | 0.09                     | 0.08                         | 19                   | 22                          | 22                 | 232                   | 0                            | 5                   | 0                          | 0                      | 0                                  | 0                   | 0                           | 0.250              |
| 1993 | 0.12                         | 0.09                     | 0.08                         | 19                   | 22                          | 22                 | 282                   | 0                            | 5                   | 0                          | 0                      | 26                                 | 0                   | 0                           | 0.250              |
| 1994 | 0.13                         | 0.09                     | 0.08                         | 18                   | 22                          | 22                 | 296                   | 0                            | 6                   | 0                          | 0                      | 24                                 | 0                   | 0                           | 0.250              |
| 1995 | 0.13                         | 0.09                     | 0.08                         | 18                   | 22                          | 22                 | 298                   | 0                            | 6                   | 0                          | 0                      | 22                                 | 0                   | 0                           | 0.250              |
| 1996 | 0.13                         | 0.09                     | 0.08                         | 17                   | 22                          | 22                 | 295                   | 0                            | 6                   | 0                          | 0                      | 22                                 | 0                   | 0                           | 0.250              |
| 1997 | 0.13                         | 0.09                     | 0.08                         | 18                   | 22                          | 22                 | 295                   | 0                            | 6                   | 0                          | 0                      | 22                                 | 0                   | 0                           | 0.250              |
| 1998 | 0.12                         | 0.09                     | 0.08                         | 18                   | 22                          | 22                 | 295                   | 0                            | 6                   | 0                          | 0                      | 22                                 | 0                   | 0                           | 0.250              |
| 1999 | 0.12                         | 0.09                     | 0.07                         | 18                   | 22                          | 22                 | 309                   | 0                            | 6                   | 0                          | 0                      | 22                                 | 0                   | 0                           | 0.250              |
| 2000 | 0.12                         | 0.09                     | 0.07                         | 17                   | 22                          | 22                 | 312                   | 0                            | 7                   | 0                          | 0                      | 22                                 | 0                   | 0                           | 0.250              |
| 2001 | 0.11                         | 0.08                     | 0.07                         | 17                   | 22                          | 22                 | 313                   | 0                            | 7                   | 0                          | 0                      | 22                                 | 0                   | 0                           | 0.250              |
| 2002 | 0.11                         | 0.08                     | 0.07                         | 16                   | 21                          | 22                 | 307                   | 0                            | 7                   | 0                          | 0                      | 22                                 | 0                   | 0                           | 0.250              |
| 2003 | 0.11                         | 0.08                     | 0.07                         | 15                   | 21                          | 21                 | 300                   | 0                            | 7                   | 0                          | 0                      | 22                                 | 0                   | 0                           | 0.250              |
| 2004 | 0.10                         | 0.07                     | 0.06                         | 15                   | 20                          | 21                 | 294                   | 0                            | 6                   | 0                          | 0                      | 22                                 | 0                   | 0                           | 0.250              |
| 2005 | 0.10                         | 0.07                     | 0.06                         | 14                   | 19                          | 20                 | 291                   | 0                            | 6                   | 0                          | 0                      | 22                                 | 0                   | 0                           | 0.250              |
| 2006 | 0.09                         | 0.07                     | 0.06                         | 14                   | 19                          | 19                 | 285                   | 0                            | 6                   | 0                          | 0                      | 22                                 | 0                   | 0                           | 0.250              |
| 2007 | 0.09                         | 0.06                     | 0.06                         | 13                   | 18                          | 19                 | 279                   | 0                            | 6                   | 0                          | 0                      | 22                                 | 0                   | 0                           | 0.250              |
| 2008 | 0.09                         | 0.06                     | 0.05                         | 13                   | 17                          | 18                 | 271                   | 0                            | 6                   | 0                          | 0                      | 21                                 | 0                   | 0                           | 0.250              |
| 2009 | 0.08                         | 0.06                     | 0.05                         | 12                   | 17                          | 17                 | 262                   | 0                            | 6                   | 0                          | 0                      | 21                                 | 0                   | 0                           | 0.250              |
| 2010 | 0.08                         | 0.06                     | 0.05                         | 12                   | 16                          | 17                 | 254                   | 0                            | 6                   | 0                          | 0                      | 20                                 | 0                   | 0                           | 0.250              |
| 2011 | 0.08                         | 0.05                     | 0.05                         | 11                   | 16                          | 16                 | 246                   | 0                            | 5                   | 0                          | 0                      | 19                                 | 0                   | 0                           | 0.250              |
| 2012 | 0.07                         | 0.05                     | 0.04                         | 11                   | 15                          | 16                 | 239                   | 0                            | 5                   | 0                          | 0                      | 19                                 | 0                   | 0                           | 0.250              |
| 2013 | 0.07                         | 0.05                     | 0.04                         | 10                   | 14                          | 15                 | 231                   | 0                            | 5                   | 0                          | 0                      | 18                                 | 0                   | 0                           | 0.250              |
| 2014 | 0.02                         | 0.03                     | 0.04                         | 10                   | 77                          | 14                 | 224                   | 0                            | 5                   | 0                          | 0                      | 17                                 | 0                   | 0                           | 0.250              |
| 2015 | -0.01                        | -0.01                    | -0.13                        | 0                    | 0                           | 77                 | 1581                  | 0                            | 0                   | 0                          | 0                      | 17                                 | 0                   | 0                           | 0.250              |
| TOTL | 3.72                         | 2.81                     | 2.17                         | 552                  | 655                         | 655                | 9119                  | 0                            | 155                 | 0                          | 0                      | 518                                | 0                   | 0                           |                    |

TABLE 4.13. Projected Unit Cost for 1,000 MWe PWR with Unlimited Reprocessing  
(in Million of 1977 Dollars)

| YEAR       | U308<br>AS BURNED<br>\$/LB | U<br>CONVR<br>\$/KG-U | SEP WORK<br>\$/SMU | U FAB<br>\$/KG-U | SPENT<br>FUEL TRAN<br>\$/KG-HM | REPRO<br>\$/KG-HM | PU<br>TRAN<br>\$/G-TOT | INCR PU<br>STORAGE<br>\$/G-TOT | MOX<br>FAB<br>\$/KG-HM | INCR SPENT<br>FUEL STOR<br>\$/KG-HM-YR | WASTE PU<br>DISPOSAL<br>\$/KG-HM<br>W/O PU | PU VALUE<br>\$/G FISS | SPENT<br>FUEL DISP<br>\$/KG-HM |
|------------|----------------------------|-----------------------|--------------------|------------------|--------------------------------|-------------------|------------------------|--------------------------------|------------------------|--|--|-----------------------|--------------------------------|
| ESCR       | 0.02                       | 0.02                  | 0.02               | 0.02             | 0.02                           | 0.02              | 0.02                   | 0.02                           | 0.02                   | 0.02                                   | 0.02                                       |                       | 0.02                           |
| 1983       | 42.0                       | 4.6                   | 90.0               | 91.8             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 1984       | 42.0                       | 4.6                   | 93.0               | 91.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 1985       | 42.0                       | 4.6                   | 95.0               | 90.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 1986       | 42.0                       | 4.6                   | 98.0               | 89.9             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 1987       | 42.0                       | 4.6                   | 100.0              | 89.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 1988       | 42.0                       | 4.6                   | 100.0              | 88.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 1989       | 44.7                       | 4.6                   | 100.0              | 88.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 1990       | 44.7                       | 4.6                   | 100.0              | 87.4             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 1991       | 44.7                       | 4.6                   | 100.0              | 87.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 1992       | 44.7                       | 4.6                   | 100.0              | 86.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 1993       | 44.7                       | 4.6                   | 95.0               | 85.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 1994       | 44.7                       | 4.6                   | 94.0               | 85.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 1995       | 44.7                       | 4.6                   | 93.0               | 84.4             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 1996       | 44.7                       | 4.6                   | 92.0               | 83.9             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 1997       | 44.7                       | 4.6                   | 91.0               | 83.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 1998       | 46.2                       | 4.6                   | 91.0               | 82.8             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 1999       | 46.2                       | 4.6                   | 90.0               | 82.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 2000       | 46.2                       | 4.6                   | 89.0               | 81.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 2001       | 46.2                       | 4.6                   | 88.0               | 81.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 2002       | 46.9                       | 4.6                   | 87.0               | 80.7             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 2003       | 51.6                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 2004       | 51.6                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 2005       | 51.6                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 2006       | 51.6                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 2007       | 54.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 2008       | 59.8                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 2009       | 65.0                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 2010       | 65.0                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 2011       | 65.0                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 2012       | 66.3                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 2013       | 72.9                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 2014       | 80.2                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| 2015       | 83.2                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00                  | 95.0                           |
| HT<br>Ave. | 47.9                       | 4.6                   | 92.4               | 84.9             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 0.0                                    | 20.0                                       | 0.00                  | 0.0                            |

TABLE 4.14. Projected Costs for Materials and Services  
for 1,000 MWe PWR with Unlimited Reprocessing  
(in Millions of 1977 Dollars)

| YEAR | MINING<br>MILLING | UF6<br>CONVR | ENRICHMT | U FUEL<br>FAB | SPENT<br>FUEL TRAN | REPRO | PU<br>TRANS | INCR PU<br>STORAGE | MOX<br>FAB | INCR<br>FUEL | SPENT<br>STOR | WASTE<br>DISPOSAL<br>W/O PU | PU SALES | SPENT<br>FUEL DISP | TOTAL |
|------|-------------------|--------------|----------|---------------|--------------------|-------|-------------|--------------------|------------|--------------|---------------|-----------------------------|----------|--------------------|-------|
| 1983 | 19.9              |              | 1.       | 19.           | 7.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 47.   |
| 1984 | 9.7               |              | 0.       | 0.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 10.   |
| 1985 | 19.2              |              | 1.       | 11.           | 2.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 34.   |
| 1986 | 15.6              |              | 1.       | 11.           | 0.                 | 4.    | 0.00        | 0.00               | 0.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 32.   |
| 1987 | 11.8              |              | 1.       | 9.            | 2.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 24.   |
| 1988 | 10.8              |              | 0.       | 8.            | 2.                 | 4.    | 0.00        | 0.00               | 1.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 27.   |
| 1989 | 11.3              |              | 0.       | 8.            | 2.                 | 4.    | 0.00        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 27.   |
| 1990 | 11.4              |              | 0.       | 8.            | 2.                 | 3.    | 0.00        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 27.   |
| 1991 | 11.4              |              | 0.       | 8.            | 2.                 | 3.    | 0.00        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 27.   |
| 1992 | 11.3              |              | 0.       | 8.            | 2.                 | 3.    | 0.00        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 27.   |
| 1993 | 11.2              |              | 0.       | 7.            | 2.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 26.   |
| 1994 | 11.2              |              | 0.       | 7.            | 2.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 26.   |
| 1995 | 11.2              |              | 0.       | 7.            | 1.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 26.   |
| 1996 | 11.2              |              | 0.       | 7.            | 1.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 26.   |
| 1997 | 11.2              |              | 0.       | 7.            | 1.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 26.   |
| 1998 | 11.5              |              | 0.       | 7.            | 1.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 26.   |
| 1999 | 11.3              |              | 0.       | 7.            | 1.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 26.   |
| 2000 | 10.9              |              | 0.       | 6.            | 1.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 26.   |
| 2001 | 10.4              |              | 0.       | 6.            | 1.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 26.   |
| 2002 | 10.2              |              | 0.       | 6.            | 1.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 24.   |
| 2003 | 10.9              |              | 0.       | 6.            | 1.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 24.   |
| 2004 | 10.5              |              | 0.       | 5.            | 1.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 22.   |
| 2005 | 10.1              |              | 0.       | 5.            | 1.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 22.   |
| 2006 | 9.7               |              | 0.       | 5.            | 1.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 21.   |
| 2007 | 9.9               |              | 0.       | 5.            | 1.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 21.   |
| 2008 | 10.4              |              | 0.       | 5.            | 1.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 22.   |
| 2009 | 10.9              |              | 0.       | 4.            | 1.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 21.   |
| 2010 | 10.4              |              | 0.       | 4.            | 1.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 21.   |
| 2011 | 10.0              |              | 0.       | 4.            | 1.                 | 2.    | 0.00        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 20.   |
| 2012 | 9.6               |              | 0.       | 4.            | 1.                 | 2.    | 0.00        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 19.   |
| 2013 | 10.1              |              | 0.       | 4.            | 1.                 | 2.    | 0.00        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 19.   |
| 2014 | 3.4               |              | 0.       | 3.            | 1.                 | 2.    | 0.00        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 13.   |
| 2015 | -2.2              |              | -0.      | -11.          | 0.                 | 11.   | 0.03        | 0.00               | 0.         | 0.           | 0.            | 1.                          | 0.       | 0.                 | -1.   |
| TOTL | 356.4             |              | 13.      | 200.          | 47.                | 98.   | 0.18        | 0.00               | 54.        | 98.          | 8.            | 8.                          | 0.       | 0.                 | 787.  |

TABLE 4.15. Discounted and Levelized Process Costs for 1,000 MWe PWR with Unlimited Reprocessing  
(in Millions of 1977 Dollars)

Discount Rate, 8%

| YEAR | MINING<br>MILLING | UF6<br>CONVR | ENRICHMNT | U FUEL<br>FAB | SPENT<br>FUEL TRAN | REPRO | PU<br>TRANS | INCR PU<br>STORAGE | MOX<br>FAB | INCR<br>FUEL | SPENT<br>STOR | WASTE<br>DISPOSAL<br>W/O PU | PU SALES | SPENT<br>FUEL DISP | TOTAL |
|------|-------------------|--------------|-----------|---------------|--------------------|-------|-------------|--------------------|------------|--------------|---------------|-----------------------------|----------|--------------------|-------|
| 1983 | 12.6              |              | 1.        | 12.           | 5.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 30.   |
| 1984 | 5.7               |              | 0.        | 0.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 6.    |
| 1985 | 10.4              |              | 0.        | 6.            | 1.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 18.   |
| 1986 | 7.8               |              | 0.        | 6.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 16.   |
| 1987 | 5.5               |              | 0.        | 4.            | 1.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 11.   |
| 1988 | 4.6               |              | 0.        | 4.            | 1.                 | 0.    | 0.00        | 0.00               | 1.         |              | 0.            | 0.                          | 0.       | 0.                 | 12.   |
| 1989 | 4.5               |              | 0.        | 3.            | 1.                 | 0.    | 0.00        | 0.00               | 1.         |              | 0.            | 0.                          | 0.       | 0.                 | 11.   |
| 1990 | 4.2               |              | 0.        | 3.            | 1.                 | 0.    | 0.00        | 0.00               | 1.         |              | 0.            | 0.                          | 0.       | 0.                 | 10.   |
| 1991 | 3.9               |              | 0.        | 3.            | 1.                 | 0.    | 0.00        | 0.00               | 1.         |              | 0.            | 0.                          | 0.       | 0.                 | 9.    |
| 1992 | 3.6               |              | 0.        | 2.            | 1.                 | 0.    | 0.00        | 0.00               | 1.         |              | 0.            | 0.                          | 0.       | 0.                 | 8.    |
| 1993 | 3.3               |              | 0.        | 2.            | 0.                 | 0.    | 0.00        | 0.00               | 1.         |              | 0.            | 0.                          | 0.       | 0.                 | 7.    |
| 1994 | 3.0               |              | 0.        | 2.            | 0.                 | 0.    | 0.00        | 0.00               | 1.         |              | 0.            | 0.                          | 0.       | 0.                 | 6.    |
| 1995 | 2.8               |              | 0.        | 2.            | 0.                 | 0.    | 0.00        | 0.00               | 1.         |              | 0.            | 0.                          | 0.       | 0.                 | 5.    |
| 1996 | 2.6               |              | 0.        | 2.            | 0.                 | 0.    | 0.00        | 0.00               | 1.         |              | 0.            | 0.                          | 0.       | 0.                 | 4.    |
| 1997 | 2.4               |              | 0.        | 1.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 3.    |
| 1998 | 2.3               |              | 0.        | 1.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 2.    |
| 1999 | 2.1               |              | 0.        | 1.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 1.    |
| 2000 | 1.9               |              | 0.        | 1.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 0.    |
| 2001 | 1.6               |              | 0.        | 1.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 0.    |
| 2002 | 1.5               |              | 0.        | 1.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 0.    |
| 2003 | 1.5               |              | 0.        | 1.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 0.    |
| 2004 | 1.3               |              | 0.        | 1.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 0.    |
| 2005 | 1.2               |              | 0.        | 1.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 0.    |
| 2006 | 1.0               |              | 0.        | 1.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 0.    |
| 2007 | 1.0               |              | 0.        | 0.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 0.    |
| 2008 | 1.0               |              | 0.        | 0.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 0.    |
| 2009 | 0.9               |              | 0.        | 0.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 0.    |
| 2010 | 0.8               |              | 0.        | 0.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 0.    |
| 2011 | 0.7               |              | 0.        | 0.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 0.    |
| 2012 | 0.7               |              | 0.        | 0.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 0.    |
| 2013 | 0.6               |              | 0.        | 0.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 0.    |
| 2014 | 0.2               |              | 0.        | 0.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 0.    |
| 2015 | -0.1              |              | -0.       | -1.           | 0.                 | 1.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | -0.   |
| TOTL | 96.8              | 4.           | 62.       | 14.           | 2.                 | 19.   | 0.03        | 0.00               | 10.        | 0.           | 0.            | 2.                          | 0.       | 0.                 | 209.  |

4.18

Levelized Fuel Cycle Cost, Mills/kW-hr

|       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 83-87 | 3.052 | 0.170 | 1.859 | 0.610 | 0.095 | 0.951 | 0.001 | 0.000 | 0.000 | 0.000 | 0.079 | 0.000 | 0.000 | 6.816 |
| 88-92 | 2.292 | 0.084 | 1.467 | 0.240 | 0.055 | 0.547 | 0.001 | 0.000 | 0.148 | 0.000 | 0.045 | 0.000 | 0.000 | 4.878 |
| 93-97 | 1.843 | 0.069 | 1.220 | 0.257 | 0.055 | 0.547 | 0.001 | 0.000 | 0.305 | 0.000 | 0.045 | 0.000 | 0.000 | 4.343 |
| 98-02 | 1.880 | 0.068 | 1.134 | 0.241 | 0.053 | 0.533 | 0.001 | 0.000 | 0.369 | 0.000 | 0.044 | 0.000 | 0.000 | 4.322 |
| 03-07 | 2.028 | 0.067 | 1.087 | 0.239 | 0.053 | 0.522 | 0.001 | 0.000 | 0.436 | 0.000 | 0.043 | 0.000 | 0.000 | 4.476 |
| 08-12 | 2.341 | 0.066 | 1.067 | 0.235 | 0.039 | 0.888 | 0.002 | 0.000 | 0.477 | 0.000 | 0.073 | 0.000 | 0.000 | 5.238 |
| 13-15 | 3.916 | 0.093 | 1.504 | 0.331 | 0.000 | 0.000 | 0.000 | 0.000 | 0.712 | 0.000 | 0.000 | 0.000 | 0.000 | 6.556 |



TABLE 4.16. Process Flows for 1,000 MWe BWR with Unlimited Reprocessing

| YEAR | MINING<br>MILLING<br>1000 ST | UF6<br>CONVR<br>1000 MTU | ENRICHMENT<br>1000<br>MT-SHU | U FUEL<br>FAB<br>MTU | SPENT<br>FUEL TRAN<br>MT-HM | REPROCESS<br>MT-HM | PU<br>TRANS<br>KG-TOT | INCR PU<br>STORAGE<br>KG-TOT | MOX<br>FAB<br>MT-HM | INCR<br>FUEL STOR<br>MT-HM | SPENT<br>FUEL STOR<br>MT-HM | WASTE<br>DISPOSAL<br>MT-HM<br>W PU | PU SALES<br>KG FISS | SPENT<br>FUEL DISP<br>MT-HM | TAILS<br>COMP<br>% |
|------|------------------------------|--------------------------|------------------------------|----------------------|-----------------------------|--------------------|-----------------------|------------------------------|---------------------|----------------------------|-----------------------------|------------------------------------|---------------------|-----------------------------|--------------------|
| 1983 | 0.28                         | 0.33                     | 0.22                         | 114.                 | 0                           | 0                  | 0                     | 0                            | 0                   | 0                          | 0                           | 0                                  | 0                   | 0                           | 0.250              |
| 1984 | 0.00                         | 0.00                     | 0.00                         | 0                    | 0                           | 0                  | 0                     | 0                            | 0                   | 0                          | 0                           | 0                                  | 0                   | 0                           | 0.250              |
| 1985 | 0.13                         | 0.05                     | 0.00                         | 0                    | 0                           | 0                  | 0                     | 0                            | 0                   | 0                          | 0                           | 0                                  | 0                   | 0                           | 0.250              |
| 1986 | 0.22                         | 0.18                     | 0.12                         | 36                   | 35                          | 0                  | 0                     | 0                            | 0                   | 0                          | 0                           | 0                                  | 0                   | 0                           | 0.250              |
| 1987 | 0.14                         | 0.12                     | 0.11                         | 35                   | 33                          | 35                 | 0                     | 0                            | 0                   | 0                          | 0                           | 0                                  | 0                   | 0                           | 0.250              |
| 1988 | 0.12                         | 0.08                     | 0.07                         | 21                   | 25                          | 33                 | 232                   | 0                            | 5                   | 0                          | 0                           | 0                                  | 0                   | 0                           | 0.250              |
| 1989 | 0.14                         | 0.10                     | 0.08                         | 24                   | 28                          | 25                 | 248                   | 0                            | 5                   | 0                          | 0                           | 0                                  | 0                   | 0                           | 0.250              |
| 1990 | 0.12                         | 0.09                     | 0.08                         | 23                   | 26                          | 28                 | 196                   | 0                            | 4                   | 0                          | 0                           | 0                                  | 0                   | 0                           | 0.250              |
| 1991 | 0.12                         | 0.09                     | 0.07                         | 23                   | 26                          | 26                 | 235                   | 0                            | 5                   | 0                          | 0                           | 0                                  | 0                   | 0                           | 0.250              |
| 1992 | 0.12                         | 0.09                     | 0.07                         | 23                   | 26                          | 26                 | 230                   | 0                            | 5                   | 0                          | 0                           | 35                                 | 0                   | 0                           | 0.250              |
| 1993 | 0.12                         | 0.09                     | 0.07                         | 23                   | 26                          | 26                 | 230                   | 0                            | 5                   | 0                          | 0                           | 33                                 | 0                   | 0                           | 0.250              |
| 1994 | 0.12                         | 0.09                     | 0.07                         | 21                   | 26                          | 26                 | 293                   | 0                            | 6                   | 0                          | 0                           | 25                                 | 0                   | 0                           | 0.250              |
| 1995 | 0.12                         | 0.08                     | 0.07                         | 21                   | 26                          | 26                 | 297                   | 0                            | 6                   | 0                          | 0                           | 28                                 | 0                   | 0                           | 0.250              |
| 1996 | 0.12                         | 0.09                     | 0.07                         | 21                   | 26                          | 26                 | 283                   | 0                            | 6                   | 0                          | 0                           | 26                                 | 0                   | 0                           | 0.250              |
| 1997 | 0.12                         | 0.09                     | 0.07                         | 21                   | 26                          | 26                 | 294                   | 0                            | 6                   | 0                          | 0                           | 26                                 | 0                   | 0                           | 0.250              |
| 1998 | 0.12                         | 0.09                     | 0.07                         | 21                   | 26                          | 26                 | 293                   | 0                            | 6                   | 0                          | 0                           | 26                                 | 0                   | 0                           | 0.250              |
| 1999 | 0.12                         | 0.09                     | 0.07                         | 21                   | 26                          | 26                 | 293                   | 0                            | 6                   | 0                          | 0                           | 26                                 | 0                   | 0                           | 0.250              |
| 2000 | 0.12                         | 0.08                     | 0.07                         | 21                   | 26                          | 26                 | 309                   | 0                            | 7                   | 0                          | 0                           | 26                                 | 0                   | 0                           | 0.250              |
| 2001 | 0.11                         | 0.08                     | 0.06                         | 20                   | 25                          | 26                 | 311                   | 0                            | 7                   | 0                          | 0                           | 26                                 | 0                   | 0                           | 0.250              |
| 2002 | 0.11                         | 0.08                     | 0.06                         | 19                   | 25                          | 25                 | 307                   | 0                            | 7                   | 0                          | 0                           | 26                                 | 0                   | 0                           | 0.250              |
| 2003 | 0.10                         | 0.07                     | 0.06                         | 19                   | 24                          | 25                 | 303                   | 0                            | 7                   | 0                          | 0                           | 26                                 | 0                   | 0                           | 0.250              |
| 2004 | 0.10                         | 0.07                     | 0.06                         | 18                   | 23                          | 24                 | 296                   | 0                            | 6                   | 0                          | 0                           | 26                                 | 0                   | 0                           | 0.250              |
| 2005 | 0.10                         | 0.07                     | 0.06                         | 17                   | 22                          | 23                 | 289                   | 0                            | 6                   | 0                          | 0                           | 26                                 | 0                   | 0                           | 0.250              |
| 2006 | 0.09                         | 0.07                     | 0.05                         | 17                   | 22                          | 22                 | 287                   | 0                            | 6                   | 0                          | 0                           | 26                                 | 0                   | 0                           | 0.250              |
| 2007 | 0.09                         | 0.06                     | 0.05                         | 16                   | 21                          | 22                 | 281                   | 0                            | 6                   | 0                          | 0                           | 25                                 | 0                   | 0                           | 0.250              |
| 2008 | 0.09                         | 0.06                     | 0.05                         | 15                   | 20                          | 21                 | 274                   | 0                            | 6                   | 0                          | 0                           | 25                                 | 0                   | 0                           | 0.250              |
| 2009 | 0.08                         | 0.06                     | 0.05                         | 15                   | 19                          | 20                 | 266                   | 0                            | 6                   | 0                          | 0                           | 24                                 | 0                   | 0                           | 0.250              |
| 2010 | 0.08                         | 0.06                     | 0.04                         | 14                   | 19                          | 19                 | 258                   | 0                            | 6                   | 0                          | 0                           | 23                                 | 0                   | 0                           | 0.250              |
| 2011 | 0.08                         | 0.05                     | 0.04                         | 14                   | 18                          | 19                 | 249                   | 0                            | 5                   | 0                          | 0                           | 22                                 | 0                   | 0                           | 0.250              |
| 2012 | 0.07                         | 0.05                     | 0.04                         | 13                   | 17                          | 18                 | 241                   | 0                            | 5                   | 0                          | 0                           | 22                                 | 0                   | 0                           | 0.250              |
| 2013 | 0.07                         | 0.05                     | 0.04                         | 12                   | 16                          | 17                 | 232                   | 0                            | 5                   | 0                          | 0                           | 21                                 | 0                   | 0                           | 0.250              |
| 2014 | 0.01                         | 0.03                     | 0.04                         | 12                   | 111                         | 16                 | 224                   | 0                            | 5                   | 0                          | 0                           | 20                                 | 0                   | 0                           | 0.250              |
| 2015 | -0.02                        | -0.02                    | -0.19                        | 0                    | 0                           | 111                | 2014                  | 0                            | 0                   | 0                          | 0                           | 19                                 | 0                   | 0                           | 0.250              |
| TOT  | 3.52                         | 2.67                     | 1.87                         | 691                  | 791                         | 791                | 9265                  | 0                            | 157                 | 1                          | 610                         | 0                                  | 0                   | 0                           |                    |



TABLE 4.17. Projected Unit Costs for 1,000 MWe BWR with  
Unlimited Reprocessing  
(in Millions of 1977 Dollars)

| YEAR       | U308<br>AS BURNED<br>\$/LB | U<br>CONVR<br>\$/KG-U | SEP WORK<br>\$/SMU | U FAB<br>\$/KG-U | SPENT<br>FUEL TRAN<br>\$/KG-HM | REPRO<br>\$/KG-HM | PU<br>TRAN<br>\$/G-TOT | INCR PU<br>STORAGE<br>\$/G-TOT | MOX<br>FAB<br>\$/KG-HM | INCR SPENT<br>FUEL STOR<br>\$/KG-HM-YR | WASTE PU<br>DISPOSAL<br>\$/KG-HM<br>W/O PU | VALUE<br>\$/G FISS | SPENT<br>FUEL DISP<br>\$/KG-HM |
|------------|----------------------------|-----------------------|--------------------|------------------|--------------------------------|-------------------|------------------------|--------------------------------|------------------------|--|--|--------------------|--------------------------------|
| ESCR       | 0.0%                       | 0.0%                  | 0.0%               | 0.0%             | 0.0%                           | 0.0%              | 0.0%                   | 0.0%                           | 0.0%                   | 0.0%                                   | 0.0%                                       |                    | 0.3%                           |
| 1983       | 42.0                       | 4.6                   | 90.0               | 91.8             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1984       | 42.0                       | 4.6                   | 93.0               | 91.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1985       | 42.0                       | 4.6                   | 95.0               | 90.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1986       | 42.0                       | 4.6                   | 98.0               | 89.9             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1987       | 42.0                       | 4.6                   | 100.0              | 89.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1988       | 42.0                       | 4.6                   | 100.0              | 88.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1989       | 44.7                       | 4.6                   | 100.0              | 88.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1990       | 44.7                       | 4.6                   | 100.0              | 87.4             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1991       | 44.7                       | 4.6                   | 100.0              | 87.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1992       | 44.7                       | 4.6                   | 100.0              | 86.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1993       | 44.7                       | 4.6                   | 95.0               | 85.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1994       | 44.7                       | 4.6                   | 94.0               | 85.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1995       | 44.7                       | 4.6                   | 93.0               | 84.4             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1996       | 44.7                       | 4.6                   | 92.0               | 83.9             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1997       | 44.7                       | 4.6                   | 91.0               | 83.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1998       | 45.2                       | 4.6                   | 91.0               | 82.8             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 1999       | 46.2                       | 4.6                   | 90.0               | 82.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2000       | 46.2                       | 4.6                   | 89.0               | 81.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2001       | 46.2                       | 4.6                   | 88.0               | 81.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2002       | 46.9                       | 4.6                   | 87.0               | 80.7             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2003       | 51.6                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2004       | 51.6                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2005       | 51.6                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2006       | 51.6                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2007       | 54.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2008       | 59.8                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2009       | 65.0                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2010       | 65.0                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2011       | 65.0                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2012       | 66.3                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2013       | 72.9                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2014       | 80.2                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| 2015       | 83.2                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 95.0                           |
| HT<br>AVE. | 48.0                       | 4.6                   | 92.6               | 85.1             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 7.4                                    | 20.0                                       | 0.00               | 0.0                            |

The annual costs are summarized in Table 4.14 and Table 4.18 for PWRs and BWRs respectively. Each of the annual cost summaries indicate a high cost associated with the first core followed by years of consistent annual costs and then a net credit when the final core is discharged. In Table 4.15 and 4.19, the discounted costs are shown plus the fuel cycle costs over five-year operating intervals.

Single reactor fuel cycle costs are developed in current dollars with a 6% escalation rate on all components starting in Table 4.20 for PWRs and Table 4.23 for BWRs. The physical fuel cycle flows are the same as we used in the previous constant dollar representations.

Single reactor fuel cycle costs are also developed for the case of no reprocessing and in a constant dollar format beginning with Table 4.26 for PWRs and Table 4.31 for BWRs. The unit costs for fuel cycle services and material were held at the same levels as the other single reactor cases so that results can be compared.

TABLE 4.18. Projected Costs for Materials and Services  
for 1,000 MWe BWR with Unlimited Reprocessing  
(in Millions of 1977 Dollars)

| YEAR | MINING<br>MILLING | UF6<br>CONVR | ENRICHMT | U FUEL<br>FAB | SPENT<br>FUEL TRAN | REPRO | PU<br>TRANS | INCR PU<br>STORAGE | MOX<br>FAB | INCR<br>FUEL | SPENT<br>STOR | WASTE<br>DISPOSAL<br>W/O PU | PU SALES | SPENT<br>FUEL DISP | TOTAL |
|------|-------------------|--------------|----------|---------------|--------------------|-------|-------------|--------------------|------------|--------------|---------------|-----------------------------|----------|--------------------|-------|
| 1983 | 23.7              | 1.           | 20.      | 10.           | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 56    |
| 1984 | 0.0               | 0.           | 0.       | 0.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 0     |
| 1985 | 10.6              | 0.           | 0.       | 0.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 11    |
| 1986 | 18.3              | 1.           | 12.      | 3.            | 1.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 35    |
| 1987 | 12.0              | 1.           | 11.      | 7.            | 0.                 | 5.    | 0.00        | 0.00               | 0.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 33    |
| 1988 | 10.3              | 0.           | 7.       | 2.            | 0.                 | 5.    | 0.00        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 27    |
| 1989 | 12.3              | 0.           | 8.       | 2.            | 0.                 | 4.    | 0.00        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 29    |
| 1990 | 11.1              | 0.           | 8.       | 2.            | 0.                 | 4.    | 0.00        | 0.00               | 1.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 28    |
| 1991 | 10.0              | 0.           | 7.       | 2.            | 0.                 | 4.    | 0.00        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 27    |
| 1992 | 11.2              | 0.           | 7.       | 2.            | 0.                 | 4.    | 0.00        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 27    |
| 1993 | 11.1              | 0.           | 7.       | 2.            | 0.                 | 4.    | 0.00        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 27    |
| 1994 | 10.6              | 0.           | 6.       | 2.            | 0.                 | 4.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 26    |
| 1995 | 10.7              | 0.           | 6.       | 2.            | 0.                 | 4.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 26    |
| 1996 | 10.7              | 0.           | 6.       | 2.            | 0.                 | 4.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 26    |
| 1997 | 10.7              | 0.           | 6.       | 2.            | 0.                 | 4.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 26    |
| 1998 | 11.1              | 0.           | 6.       | 2.            | 0.                 | 4.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 26    |
| 1999 | 11.1              | 0.           | 6.       | 2.            | 0.                 | 4.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 26    |
| 2000 | 10.7              | 0.           | 6.       | 2.            | 0.                 | 4.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 26    |
| 2001 | 10.3              | 0.           | 6.       | 2.            | 0.                 | 4.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 25    |
| 2002 | 10.1              | 0.           | 5.       | 2.            | 0.                 | 4.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 24    |
| 2003 | 10.7              | 0.           | 5.       | 1.            | 0.                 | 4.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 24    |
| 2004 | 10.4              | 0.           | 5.       | 1.            | 0.                 | 4.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 24    |
| 2005 | 10.0              | 0.           | 5.       | 1.            | 0.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 23    |
| 2006 | 9.6               | 0.           | 5.       | 1.            | 0.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 22    |
| 2007 | 9.0               | 0.           | 4.       | 1.            | 0.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 22    |
| 2008 | 10.3              | 0.           | 4.       | 1.            | 0.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 22    |
| 2009 | 10.0              | 0.           | 4.       | 1.            | 0.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 22    |
| 2010 | 10.3              | 0.           | 4.       | 1.            | 0.                 | 3.    | 0.01        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 21    |
| 2011 | 10.0              | 0.           | 4.       | 1.            | 0.                 | 3.    | 0.00        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 20    |
| 2012 | 9.7               | 0.           | 4.       | 1.            | 0.                 | 3.    | 0.00        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 20    |
| 2013 | 10.2              | 0.           | 3.       | 1.            | 0.                 | 3.    | 0.00        | 0.00               | 2.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 20    |
| 2014 | 2.2               | 0.           | 3.       | 1.            | 2.                 | 2.    | 0.00        | 0.00               | 0.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 12    |
| 2015 | -3.6              | -0.          | -16.     | 0.            | 0.                 | 17.   | 0.04        | 0.00               | 0.         | 0.           | 0.            | 1.                          | 0.       | 0.                 | -2    |
| TOTL | 337.6             | 12.          | 174.     | 59.           | 12.                | 119.  | 0.19        | 0.00               | 55.        | 0.           | 0.            | 10.                         | 0.       | 0.                 | 778   |

**TABLE 4.19.** Discounted and Levelized Process Costs for 1,000 MWe BWR  
with Unlimited Reprocessing  
(in Millions of 1977 Dollars)

Discount Rate, 8%

| YEAR | MILLING | UF6<br>CONVR | ENRICHMENT | U FUEL<br>FAB | SPENT<br>FUEL TRAN | REPRO | PU<br>TRANS | INCR PU<br>STORAGE | MOX<br>FAB | INCR<br>FUEL | SPENT<br>STOR | WASTE<br>DISPOSAL<br>W/O FU | PU SALES | SPENT<br>FUEL DISP | TOTAL |
|------|---------|--------------|------------|---------------|--------------------|-------|-------------|--------------------|------------|--------------|---------------|-----------------------------|----------|--------------------|-------|
| 1983 | 14.9    | 1            | 13         | 7             | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 35    |
| 1984 | 0.0     | 0            | 0          | 0             | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 0     |
| 1985 | 5.7     | 0            | 0          | 0             | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 6     |
| 1986 | 9.2     | 0            | 6          | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 17    |
| 1987 | 5.5     | 0            | 5          | 1             | 0                  | 2     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 15    |
| 1988 | 4.4     | 0            | 3          | 1             | 0                  | 2     | 0.00        | 0.00               | 1          | 0            | 0             | 0                           | 0        | 0                  | 12    |
| 1989 | 4.9     | 0            | 3          | 1             | 0                  | 1     | 0.00        | 0.00               | 1          | 0            | 0             | 0                           | 0        | 0                  | 12    |
| 1990 | 4.1     | 0            | 3          | 1             | 0                  | 2     | 0.00        | 0.00               | 1          | 0            | 0             | 0                           | 0        | 0                  | 10    |
| 1991 | 3.7     | 0            | 2          | 1             | 0                  | 1     | 0.00        | 0.00               | 1          | 0            | 0             | 0                           | 0        | 0                  | 9     |
| 1992 | 3.5     | 0            | 2          | 1             | 0                  | 1     | 0.00        | 0.00               | 1          | 0            | 0             | 0                           | 0        | 0                  | 8     |
| 1993 | 3.2     | 0            | 2          | 1             | 0                  | 1     | 0.00        | 0.00               | 1          | 0            | 0             | 0                           | 0        | 0                  | 8     |
| 1994 | 2.9     | 0            | 2          | 0             | 0                  | 1     | 0.00        | 0.00               | 1          | 0            | 0             | 0                           | 0        | 0                  | 7     |
| 1995 | 2.7     | 0            | 2          | 0             | 0                  | 1     | 0.00        | 0.00               | 1          | 0            | 0             | 0                           | 0        | 0                  | 7     |
| 1996 | 2.5     | 0            | 1          | 0             | 0                  | 1     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 6     |
| 1997 | 2.3     | 0            | 1          | 0             | 0                  | 1     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 6     |
| 1998 | 2.2     | 0            | 1          | 0             | 0                  | 1     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 5     |
| 1999 | 2.0     | 0            | 1          | 0             | 0                  | 1     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 5     |
| 2000 | 1.8     | 0            | 1          | 0             | 0                  | 1     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 5     |
| 2001 | 1.6     | 0            | 1          | 0             | 0                  | 1     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 4     |
| 2002 | 1.5     | 0            | 1          | 0             | 0                  | 1     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 4     |
| 2003 | 1.4     | 0            | 1          | 0             | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 4     |
| 2004 | 1.3     | 0            | 1          | 0             | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 4     |
| 2005 | 1.2     | 0            | 1          | 0             | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 4     |
| 2006 | 1.0     | 0            | 0          | 0             | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 3     |
| 2007 | 1.0     | 0            | 0          | 0             | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 3     |
| 2008 | 0.9     | 0            | 0          | 0             | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 3     |
| 2009 | 0.9     | 0            | 0          | 0             | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 3     |
| 2010 | 0.8     | 0            | 0          | 0             | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 2     |
| 2011 | 0.7     | 0            | 0          | 0             | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 2     |
| 2012 | 0.7     | 0            | 0          | 0             | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 1     |
| 2013 | 0.6     | 0            | 0          | 0             | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 1     |
| 2014 | 0.1     | 0            | 0          | 0             | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 1     |
| 2015 | -0.2    | -0           | -1         | 0             | 0                  | 1     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | -0    |
| TOTL | 89.2    | 4            | 54         | 18            | 2                  | 23    | 0.03        | 0.00               | 10         | 0            | 0             | 2                           | 0        | 0                  | 203   |

4.23

Levelized Fuel Cycle Cost, Mills/kW-hr

|       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 83-87 | 2.900 | 0.145 | 1.297 | 0.685 | 0.116 | 1.161 | 0.001 | 0.000 | 0.000 | 0.000 | 0.096 | 0.000 | 0.000 | 6.481 |
| 88-92 | 2.081 | 0.090 | 1.455 | 0.414 | 0.064 | 0.639 | 0.001 | 0.000 | 0.155 | 0.000 | 0.053 | 0.000 | 0.000 | 4.991 |
| 93-97 | 1.789 | 0.066 | 1.107 | 0.308 | 0.064 | 0.639 | 0.001 | 0.000 | 0.315 | 0.000 | 0.053 | 0.000 | 0.000 | 4.341 |
| 98-02 | 1.805 | 0.066 | 1.022 | 0.293 | 0.062 | 0.610 | 0.001 | 0.000 | 0.371 | 0.000 | 0.051 | 0.000 | 0.000 | 4.288 |
| 03-07 | 2.000 | 0.066 | 0.993 | 0.290 | 0.061 | 0.604 | 0.001 | 0.000 | 0.439 | 0.000 | 0.050 | 0.000 | 0.000 | 4.504 |
| 08-12 | 2.318 | 0.065 | 0.972 | 0.286 | 0.116 | 1.157 | 0.002 | 0.000 | 0.479 | 0.000 | 0.036 | 0.000 | 0.000 | 5.491 |
| 13-15 | 3.908 | 0.093 | 1.376 | 0.405 | 0.000 | 0.000 | 0.000 | 0.000 | 0.714 | 0.000 | 0.000 | 0.000 | 0.000 | 6.476 |

TABLE 4.20. Projected Unit Costs for 1,000 MWe PWR with Unlimited Reprocessing  
(in Million of Current Dollars with 6% Annual Escalation)

| YEAR | U308<br>AS BURNED<br>\$/LB | U<br>CONVR<br>\$/KG-U | SEP WORK<br>\$/SHU | U FAB<br>\$/KG-U | SPENT<br>FUEL TRAN<br>\$/KG-HM | REPRO<br>\$/KG-HM | PU<br>TRAN<br>\$/G-TOT | INCR PU<br>STORAGE<br>\$/G-TOT | MOX<br>FAB<br>\$/KG-HM | INCR<br>FUEL STOR<br>\$/KG-HM-YR | SPENT<br>FUEL STOR<br>\$/KG-HM-YR | WASTE PU<br>DISPOSAL<br>\$/KG-HM<br>W/O PU | VALUE<br>\$/G FISS | SPENT<br>FUEL DISP<br>\$/KG-HM |
|------|----------------------------|-----------------------|--------------------|------------------|--------------------------------|-------------------|------------------------|--------------------------------|------------------------|----------------------------------|-----------------------------------|--|--------------------|--------------------------------|
| ESCR | 6.0%                       | 6.0%                  | 6.0%               | 6.0%             | 6.0%                           | 6.0%              | 6.0%                   | 6.0%                           | 6.0%                   | 6.0%                             | 6.0%                              | 6.0%                                       |                    | 6.0%                           |
| 1983 | 59.6                       | 6.5                   | 127.7              | 130.2            | 21.3                           | 212.8             | 0.03                   | 0.00                           | 496.5                  | 10.5                             | 28.4                              | 0.00                                       |                    | 134.8                          |
| 1984 | 63.2                       | 6.9                   | 139.0              | 136.0            | 22.6                           | 225.5             | 0.03                   | 0.00                           | 526.3                  | 11.1                             | 30.1                              | 0.00                                       |                    | 142.8                          |
| 1985 | 66.9                       | 7.3                   | 151.4              | 144.2            | 23.9                           | 239.1             | 0.03                   | 0.00                           | 557.8                  | 11.8                             | 31.9                              | 0.00                                       |                    | 151.4                          |
| 1986 | 71.0                       | 7.8                   | 165.6              | 151.9            | 25.3                           | 253.4             | 0.03                   | 0.00                           | 591.3                  | 12.5                             | 33.8                              | 0.00                                       |                    | 160.5                          |
| 1987 | 75.2                       | 8.2                   | 179.1              | 159.4            | 26.9                           | 268.6             | 0.04                   | 0.00                           | 626.8                  | 13.2                             | 35.8                              | 0.00                                       |                    | 170.1                          |
| 1988 | 79.7                       | 8.7                   | 189.8              | 168.0            | 28.5                           | 284.7             | 0.04                   | 0.00                           | 664.4                  | 14.0                             | 38.0                              | 0.00                                       |                    | 180.3                          |
| 1989 | 89.9                       | 9.3                   | 201.2              | 177.1            | 30.2                           | 301.8             | 0.04                   | 0.00                           | 704.3                  | 14.9                             | 40.2                              | 0.00                                       |                    | 191.2                          |
| 1990 | 95.3                       | 9.8                   | 213.3              | 186.4            | 32.0                           | 319.9             | 0.04                   | 0.00                           | 746.5                  | 15.8                             | 42.7                              | 0.00                                       |                    | 202.6                          |
| 1991 | 101.1                      | 10.4                  | 226.1              | 196.7            | 33.9                           | 339.1             | 0.05                   | 0.00                           | 791.3                  | 16.7                             | 45.2                              | 0.00                                       |                    | 214.8                          |
| 1992 | 107.1                      | 11.0                  | 239.7              | 206.1            | 35.9                           | 359.5             | 0.05                   | 0.00                           | 838.8                  | 17.7                             | 47.9                              | 0.00                                       |                    | 227.7                          |
| 1993 | 113.6                      | 11.7                  | 241.3              | 217.2            | 38.1                           | 381.1             | 0.05                   | 0.00                           | 889.1                  | 18.8                             | 50.8                              | 0.00                                       |                    | 241.3                          |
| 1994 | 120.4                      | 12.4                  | 253.1              | 228.9            | 40.4                           | 403.9             | 0.05                   | 0.00                           | 942.5                  | 19.9                             | 53.9                              | 0.00                                       |                    | 255.8                          |
| 1995 | 127.6                      | 13.1                  | 265.5              | 240.9            | 42.8                           | 428.2             | 0.06                   | 0.00                           | 999.0                  | 21.1                             | 57.1                              | 0.00                                       |                    | 271.2                          |
| 1996 | 135.2                      | 13.9                  | 278.4              | 253.8            | 45.4                           | 453.8             | 0.06                   | 0.00                           | 1059.0                 | 22.4                             | 60.5                              | 0.00                                       |                    | 287.4                          |
| 1997 | 143.4                      | 14.8                  | 291.8              | 266.8            | 48.1                           | 481.1             | 0.06                   | 0.00                           | 1122.5                 | 23.7                             | 64.1                              | 0.00                                       |                    | 304.7                          |
| 1998 | 157.1                      | 15.6                  | 309.4              | 281.5            | 51.0                           | 509.9             | 0.07                   | 0.00                           | 1189.8                 | 25.2                             | 68.0                              | 0.00                                       |                    | 323.0                          |
| 1999 | 166.5                      | 16.6                  | 324.3              | 295.5            | 54.1                           | 540.5             | 0.07                   | 0.00                           | 1261.2                 | 26.7                             | 72.1                              | 0.00                                       |                    | 342.3                          |
| 2000 | 176.5                      | 17.6                  | 340.0              | 311.3            | 57.3                           | 573.0             | 0.08                   | 0.00                           | 1336.9                 | 28.2                             | 76.4                              | 0.00                                       |                    | 362.9                          |
| 2001 | 187.1                      | 18.6                  | 356.3              | 328.0            | 60.7                           | 607.3             | 0.08                   | 0.00                           | 1417.1                 | 30.0                             | 81.0                              | 0.00                                       |                    | 384.6                          |
| 2002 | 201.3                      | 19.7                  | 373.4              | 346.4            | 64.4                           | 643.8             | 0.09                   | 0.00                           | 1502.2                 | 31.8                             | 85.8                              | 0.00                                       |                    | 407.7                          |
| 2003 | 234.7                      | 20.9                  | 391.2              | 364.9            | 68.2                           | 682.4             | 0.09                   | 0.00                           | 1592.3                 | 33.7                             | 91.0                              | 0.00                                       |                    | 432.2                          |
| 2004 | 248.8                      | 22.2                  | 414.7              | 386.8            | 72.3                           | 723.4             | 0.10                   | 0.00                           | 1687.8                 | 35.7                             | 96.4                              | 0.00                                       |                    | 458.1                          |
| 2005 | 263.8                      | 23.5                  | 439.6              | 418.0            | 76.7                           | 766.8             | 0.10                   | 0.00                           | 1789.1                 | 37.8                             | 102.2                             | 0.00                                       |                    | 485.6                          |
| 2006 | 279.6                      | 24.9                  | 466.0              | 434.6            | 81.3                           | 812.8             | 0.11                   | 0.00                           | 1896.4                 | 40.1                             | 108.4                             | 0.00                                       |                    | 514.7                          |
| 2007 | 312.4                      | 26.4                  | 493.9              | 460.6            | 86.2                           | 861.5             | 0.11                   | 0.00                           | 2010.2                 | 42.5                             | 114.9                             | 0.00                                       |                    | 545.6                          |
| 2008 | 364.1                      | 28.0                  | 523.6              | 488.3            | 91.3                           | 913.2             | 0.12                   | 0.00                           | 2130.8                 | 45.1                             | 121.8                             | 0.00                                       |                    | 578.4                          |
| 2009 | 419.5                      | 29.7                  | 555.0              | 517.6            | 102.0                          | 968.0             | 0.13                   | 0.00                           | 2258.7                 | 47.8                             | 129.1                             | 0.00                                       |                    | 613.1                          |
| 2010 | 444.6                      | 31.5                  | 588.3              | 548.6            | 108.1                          | 1026.1            | 0.14                   | 0.00                           | 2394.2                 | 50.6                             | 136.8                             | 0.00                                       |                    | 649.9                          |
| 2011 | 477.1                      | 33.4                  | 623.6              | 581.5            | 108.8                          | 1087.7            | 0.15                   | 0.00                           | 2537.9                 | 53.7                             | 145.0                             | 0.00                                       |                    | 688.8                          |
| 2012 | 509.6                      | 35.4                  | 661.0              | 616.4            | 115.3                          | 1152.9            | 0.15                   | 0.00                           | 2690.1                 | 56.9                             | 153.7                             | 0.00                                       |                    | 730.2                          |
| 2013 | 593.9                      | 37.5                  | 700.7              | 653.4            | 122.2                          | 1222.1            | 0.16                   | 0.00                           | 2851.5                 | 60.2                             | 162.9                             | 0.00                                       |                    | 774.0                          |
| 2014 | 692.6                      | 39.7                  | 742.7              | 692.6            | 129.5                          | 1295.4            | 0.17                   | 0.00                           | 3022.6                 | 63.9                             | 172.7                             | 0.00                                       |                    | 820.4                          |
| 2015 | 807.4                      | 42.1                  | 787.3              | 734.2            | 137.3                          | 1373.1            | 0.18                   | 0.00                           | 3204.0                 | 67.7                             | 183.1                             | 0.00                                       |                    | 869.7                          |
| NT   |                            |                       |                    |                  |                                |                   |                        |                                |                        |                                  |                                   |  |                    |                                |
| AVE. | 176.2                      | 15.4                  | 285.9              | 287.1            | 66.5                           | 702.4             | 0.10                   | 0.00                           | ****                   | 0.0                              | 97.5                              | 0.00                                       |                    | 0.0                            |



TABLE 4.21. Projected Costs for Materials and Services  
for 1,000 MWe PWR with Unlimited Reprocessing  
(in Millions of Current Dollars)

| YEAR | MINING<br>MILLING | UF6<br>CONVR | ENRICHMT | U FUEL<br>FAB | SPENT<br>FUEL TRAN | REPRO | PU<br>TRANS | INCR PU<br>STORAGE | MOX<br>FAB | INCR<br>FUEL | SPENT<br>STOR | WASTE<br>DISPOSAL<br>W/O PU | PU SALES | SPENT<br>FUEL DISP | TOTAL |
|------|-------------------|--------------|----------|---------------|--------------------|-------|-------------|--------------------|------------|--------------|---------------|-----------------------------|----------|--------------------|-------|
| 1983 | 28.3              |              | 2.       | 27.           | 10.                | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 67.   |
| 1984 | 14.7              |              | 0.       | 0.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 15.   |
| 1985 | 30.6              |              | 1.       | 18.           | 4.                 | 1.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 54.   |
| 1986 | 26.4              |              | 1.       | 19.           | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 1.                          | 0.       | 0.                 | 54.   |
| 1987 | 21.1              |              | 1.       | 17.           | 4.                 | 1.    | 0.01        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 44.   |
| 1988 | 20.5              |              | 1.       | 16.           | 4.                 | 1.    | 0.01        | 0.00               | 3.         |              | 0.            | 1.                          | 0.       | 0.                 | 52.   |
| 1989 | 22.7              |              | 1.       | 16.           | 3.                 | 1.    | 0.01        | 0.00               | 4.         |              | 0.            | 1.                          | 0.       | 0.                 | 54.   |
| 1990 | 24.4              |              | 1.       | 17.           | 3.                 | 1.    | 0.01        | 0.00               | 4.         |              | 0.            | 1.                          | 0.       | 0.                 | 58.   |
| 1991 | 25.0              |              | 1.       | 18.           | 4.                 | 1.    | 0.01        | 0.00               | 4.         |              | 0.            | 1.                          | 0.       | 0.                 | 61.   |
| 1992 | 27.0              |              | 1.       | 19.           | 4.                 | 1.    | 0.01        | 0.00               | 4.         |              | 0.            | 1.                          | 0.       | 0.                 | 64.   |
| 1993 | 28.3              |              | 1.       | 18.           | 4.                 | 1.    | 0.01        | 0.00               | 4.         |              | 0.            | 1.                          | 0.       | 0.                 | 66.   |
| 1994 | 30.1              |              | 1.       | 19.           | 4.                 | 1.    | 0.02        | 0.00               | 6.         |              | 0.            | 1.                          | 0.       | 0.                 | 71.   |
| 1995 | 32.0              |              | 1.       | 20.           | 4.                 | 1.    | 0.02        | 0.00               | 6.         |              | 0.            | 1.                          | 0.       | 0.                 | 75.   |
| 1996 | 33.9              |              | 1.       | 21.           | 4.                 | 1.    | 0.02        | 0.00               | 7.         |              | 0.            | 1.                          | 0.       | 0.                 | 79.   |
| 1997 | 35.9              |              | 1.       | 22.           | 5.                 | 1.    | 0.02        | 0.00               | 7.         |              | 0.            | 1.                          | 0.       | 0.                 | 84.   |
| 1998 | 39.2              |              | 1.       | 23.           | 5.                 | 1.    | 0.02        | 0.00               | 7.         |              | 0.            | 1.                          | 0.       | 0.                 | 90.   |
| 1999 | 40.0              |              | 1.       | 24.           | 5.                 | 1.    | 0.02        | 0.00               | 8.         |              | 0.            | 1.                          | 0.       | 0.                 | 94.   |
| 2000 | 41.5              |              | 1.       | 25.           | 5.                 | 1.    | 0.02        | 0.00               | 9.         |              | 0.            | 1.                          | 0.       | 0.                 | 97.   |
| 2001 | 42.2              |              | 2.       | 25.           | 5.                 | 1.    | 0.03        | 0.00               | 9.         |              | 0.            | 1.                          | 0.       | 0.                 | 99.   |
| 2002 | 43.9              |              | 2.       | 25.           | 6.                 | 1.    | 0.03        | 0.00               | 10.        |              | 0.            | 1.                          | 0.       | 0.                 | 103.  |
| 2003 | 49.5              |              | 2.       | 25.           | 6.                 | 1.    | 0.03        | 0.00               | 10.        |              | 0.            | 1.                          | 0.       | 0.                 | 110.  |
| 2004 | 50.6              |              | 2.       | 26.           | 6.                 | 1.    | 0.03        | 0.00               | 11.        |              | 0.            | 1.                          | 0.       | 0.                 | 112.  |
| 2005 | 51.6              |              | 2.       | 26.           | 6.                 | 1.    | 0.03        | 0.00               | 11.        |              | 0.            | 1.                          | 0.       | 0.                 | 115.  |
| 2006 | 52.7              |              | 2.       | 27.           | 6.                 | 2.    | 0.03        | 0.00               | 12.        |              | 0.            | 1.                          | 0.       | 0.                 | 118.  |
| 2007 | 56.7              |              | 2.       | 27.           | 6.                 | 2.    | 0.03        | 0.00               | 12.        |              | 0.            | 1.                          | 0.       | 0.                 | 123.  |
| 2008 | 63.4              |              | 2.       | 28.           | 6.                 | 2.    | 0.03        | 0.00               | 13.        |              | 0.            | 1.                          | 0.       | 0.                 | 131.  |
| 2009 | 70.1              |              | 2.       | 28.           | 6.                 | 2.    | 0.03        | 0.00               | 13.        |              | 0.            | 1.                          | 0.       | 0.                 | 139.  |
| 2010 | 71.1              |              | 2.       | 29.           | 6.                 | 2.    | 0.03        | 0.00               | 13.        |              | 0.            | 1.                          | 0.       | 0.                 | 142.  |
| 2011 | 72.8              |              | 2.       | 29.           | 6.                 | 2.    | 0.04        | 0.00               | 14.        |              | 0.            | 1.                          | 0.       | 0.                 | 145.  |
| 2012 | 74.0              |              | 2.       | 30.           | 7.                 | 2.    | 0.04        | 0.00               | 14.        |              | 0.            | 1.                          | 0.       | 0.                 | 147.  |
| 2013 | 82.0              |              | 2.       | 30.           | 7.                 | 2.    | 0.04        | 0.00               | 14.        |              | 0.            | 2.                          | 0.       | 0.                 | 156.  |
| 2014 | 29.1              |              | 1.       | 30.           | 10.                | 18.   | 0.04        | 0.00               | 15.        |              | 0.            | 2.                          | 0.       | 0.                 | 111.  |
| 2015 | -20.3             |              | -1.      | -105.         | 0.                 | 105.  | 0.29        | 0.00               | 0.         |              | 0.            | 9.                          | 0.       | 0.                 | -12.  |
| TOTL | 1312.4            |              | 43.      | 620.          | 158.               | 44.   | 0.95        | 0.00               | 243.       |              | 0.            | 38.                         | 0.       | 0.                 | 2920. |



TABLE 4.22. Discounted and Levelized Process Costs for 1,000 MWe PWR with Unlimited Reprocessing (in Millions of Current Dollars)

Discount Rate, 8%

| YEAR  | MINING<br>MILLING | UF6<br>CONVR | ENRICHMT | U FUEL<br>FAB | SPENT<br>FUEL TRN | REPRO | FU<br>TRANS | INCR FU<br>STORAGE | MOX<br>FAB | INCR SPENT<br>FUEL STOR | WASTE<br>DISPOS HL<br>W/O FU | PU SALES | SPENT<br>FUEL DISP | TOTAL |
|-------|-------------------|--------------|----------|---------------|-------------------|-------|-------------|--------------------|------------|-------------------------|------------------------------|----------|--------------------|-------|
| 1983  | 12                | 9            | 1        | 12            | 5                 | 0     | 0.00        | 0.00               | 0          | 0                       | 0                            | 0        | 0                  | 31    |
| 1984  | 15                | 9            | 0        | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0                       | 0                            | 0        | 0                  | 15    |
| 1985  | 10                | 7            | 0        | 0             | 1                 | 0     | 0.00        | 0.00               | 0          | 0                       | 0                            | 0        | 0                  | 16    |
| 1986  | 18                | 7            | 0        | 0             | 1                 | 2     | 0.00        | 0.00               | 0          | 0                       | 0                            | 0        | 0                  | 12    |
| 1987  | 5                 | 7            | 0        | 4             | 1                 | 2     | 0.00        | 0.00               | 1          | 1                       | 0                            | 0        | 0                  | 12    |
| 1988  | 4                 | 9            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 1          | 0                       | 0                            | 0        | 0                  | 11    |
| 1989  | 4                 | 4            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 1          | 0                       | 0                            | 0        | 0                  | 11    |
| 1990  | 4                 | 4            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 1          | 0                       | 0                            | 0        | 0                  | 11    |
| 1991  | 4                 | 1            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 1          | 0                       | 0                            | 0        | 0                  | 10    |
| 1992  | 3                 | 5            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 1          | 0                       | 0                            | 0        | 0                  | 9     |
| 1993  | 3                 | 5            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 1          | 0                       | 0                            | 0        | 0                  | 8     |
| 1994  | 3                 | 2            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 1          | 0                       | 0                            | 0        | 0                  | 8     |
| 1995  | 3                 | 2            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 1          | 0                       | 0                            | 0        | 0                  | 8     |
| 1996  | 3                 | 2            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 1          | 0                       | 0                            | 0        | 0                  | 7     |
| 1997  | 3                 | 2            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 1          | 0                       | 0                            | 0        | 0                  | 7     |
| 1998  | 3                 | 2            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 1          | 0                       | 0                            | 0        | 0                  | 6     |
| 1999  | 3                 | 2            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 1          | 0                       | 0                            | 0        | 0                  | 6     |
| 2000  | 3                 | 2            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 1          | 0                       | 0                            | 0        | 0                  | 5     |
| 2001  | 1                 | 7            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 0          | 0                       | 0                            | 0        | 0                  | 4     |
| 2002  | 1                 | 6            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 0          | 0                       | 0                            | 0        | 0                  | 4     |
| 2003  | 1                 | 5            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 0          | 0                       | 0                            | 0        | 0                  | 4     |
| 2004  | 1                 | 3            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 0          | 0                       | 0                            | 0        | 0                  | 4     |
| 2005  | 1                 | 3            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 0          | 0                       | 0                            | 0        | 0                  | 4     |
| 2006  | 1                 | 3            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 0          | 0                       | 0                            | 0        | 0                  | 4     |
| 2007  | 1                 | 1            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 0          | 0                       | 0                            | 0        | 0                  | 4     |
| 2008  | 1                 | 1            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 0          | 0                       | 0                            | 0        | 0                  | 4     |
| 2009  | 1                 | 1            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 0          | 0                       | 0                            | 0        | 0                  | 4     |
| 2010  | 1                 | 1            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 0          | 0                       | 0                            | 0        | 0                  | 4     |
| 2011  | 1                 | 1            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 0          | 0                       | 0                            | 0        | 0                  | 4     |
| 2012  | 1                 | 1            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 0          | 0                       | 0                            | 0        | 0                  | 4     |
| 2013  | 1                 | 1            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 0          | 0                       | 0                            | 0        | 0                  | 4     |
| 2014  | 1                 | 1            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 0          | 0                       | 0                            | 0        | 0                  | 4     |
| 2015  | 1                 | 1            | 0        | 3             | 1                 | 1     | 0.00        | 0.00               | 0          | 0                       | 0                            | 0        | 0                  | 4     |
| TOTAL | 102               | 9            | 4        | 65            | 15                | 21    | 0.03        | 0.00               | 11         | 0                       | 2                            | 0        | 0                  | 223   |

Levelized Fuel Cycle Cost, Mills/kW-hr

|       |        |       |        |       |       |       |       |       |       |       |       |       |       |        |
|-------|--------|-------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| 83-87 | 3.860  | 0.244 | 2.792  | 0.915 | 0.180 | 1.905 | 0.002 | 0.000 | 0.000 | 0.000 | 0.150 | 0.000 | 0.000 | 10.056 |
| 88-92 | 4.050  | 0.158 | 2.750  | 0.451 | 0.130 | 1.374 | 0.002 | 0.000 | 0.278 | 0.000 | 0.114 | 0.000 | 0.000 | 19.307 |
| 93-97 | 4.365  | 0.173 | 3.062  | 0.646 | 0.173 | 1.838 | 0.003 | 0.000 | 0.767 | 0.000 | 0.152 | 0.000 | 0.000 | 11.180 |
| 98-2  | 5.947  | 0.229 | 3.603  | 0.807 | 0.225 | 2.389 | 0.005 | 0.000 | 1.237 | 0.000 | 0.198 | 0.000 | 0.000 | 14.840 |
| 3-7   | 8.571  | 0.300 | 4.867  | 1.072 | 0.298 | 3.129 | 0.006 | 0.000 | 1.951 | 0.000 | 0.259 | 0.000 | 0.000 | 20.400 |
| 8-12  | 12.230 | 0.397 | 6.388  | 1.405 | 0.679 | 7.142 | 0.017 | 0.000 | 2.856 | 0.000 | 0.391 | 0.000 | 0.000 | 32.703 |
| 13-15 | 27.570 | 0.693 | 11.222 | 2.474 | 0.000 | 0.000 | 0.000 | 0.000 | 5.318 | 0.000 | 0.000 | 0.000 | 0.000 | 47.277 |

TABLE 4.23. Projected Unit Cost for 1,000 MWe BWR with Unlimited Reprocessing  
(in Millions of Current Dollars, with 6% Annual Escalation)

| YEAR | U308<br>AS BURNED<br>\$/LB | U<br>CONVR<br>\$/KG-U | SEP WORK<br>\$/SMU | U FAB<br>\$/KG-U | SPENT<br>FUEL TRAN<br>\$/KG-HM | REPRO<br>\$/KG-HM | PU<br>TRAN<br>\$/G-TOT | INCR PU<br>STORAGE<br>\$/G-TOT | MOX<br>FAB<br>\$/KG-HM | INCR SPENT<br>FUEL STOR<br>\$/KG-HM-YR | WASTE PU<br>DISPOSAL<br>\$/KG-HM<br>N/O PU | PU VALUE<br>\$/G FISS | SPENT<br>FUEL DISP<br>\$/KG-HM |
|------|----------------------------|-----------------------|--------------------|------------------|--------------------------------|-------------------|------------------------|--------------------------------|------------------------|--|--|-----------------------|--------------------------------|
| ESCR | 6.0%                       | 6.0%                  | 6.0%               | 6.0%             | 6.0%                           | 6.0%              | 6.0%                   | 6.0%                           | 6.0%                   | 6.0%                                   | 6.0%                                       | 0.00                  | 6.0%                           |
| 1983 | 59.6                       | 6.5                   | 127.7              | 130.2            | 21.3                           | 212.8             | 0.03                   | 0.00                           | 496.5                  | 10.5                                   | 28.4                                       | 0.00                  | 134.8                          |
| 1984 | 63.2                       | 6.9                   | 139.8              | 136.8            | 22.6                           | 225.5             | 0.03                   | 0.00                           | 526.3                  | 11.1                                   | 30.1                                       | 0.00                  | 142.8                          |
| 1985 | 66.9                       | 7.3                   | 151.4              | 144.2            | 23.9                           | 239.1             | 0.03                   | 0.00                           | 557.8                  | 11.8                                   | 31.9                                       | 0.00                  | 151.4                          |
| 1986 | 71.0                       | 7.8                   | 165.6              | 151.9            | 25.3                           | 253.4             | 0.03                   | 0.00                           | 591.3                  | 12.5                                   | 33.8                                       | 0.00                  | 160.5                          |
| 1987 | 75.2                       | 8.2                   | 179.1              | 159.4            | 26.9                           | 268.6             | 0.04                   | 0.00                           | 626.8                  | 13.3                                   | 35.8                                       | 0.00                  | 170.1                          |
| 1988 | 79.7                       | 8.7                   | 189.8              | 168.0            | 28.5                           | 284.7             | 0.04                   | 0.00                           | 664.4                  | 14.0                                   | 38.0                                       | 0.00                  | 180.3                          |
| 1989 | 89.9                       | 9.3                   | 201.2              | 177.1            | 30.2                           | 301.8             | 0.04                   | 0.00                           | 704.3                  | 14.9                                   | 40.2                                       | 0.00                  | 191.2                          |
| 1990 | 95.3                       | 9.8                   | 213.3              | 186.4            | 32.0                           | 319.9             | 0.04                   | 0.00                           | 746.5                  | 15.8                                   | 42.7                                       | 0.00                  | 202.6                          |
| 1991 | 101.1                      | 10.4                  | 226.1              | 196.7            | 33.9                           | 339.1             | 0.05                   | 0.00                           | 791.3                  | 16.7                                   | 45.2                                       | 0.00                  | 214.8                          |
| 1992 | 107.1                      | 11.0                  | 239.7              | 206.1            | 35.9                           | 359.5             | 0.05                   | 0.00                           | 838.8                  | 17.7                                   | 47.9                                       | 0.00                  | 227.7                          |
| 1993 | 113.6                      | 11.7                  | 241.3              | 217.2            | 38.1                           | 381.1             | 0.05                   | 0.00                           | 889.1                  | 18.8                                   | 50.8                                       | 0.00                  | 241.3                          |
| 1994 | 120.4                      | 12.4                  | 253.1              | 228.9            | 40.4                           | 403.9             | 0.05                   | 0.00                           | 942.5                  | 19.9                                   | 53.9                                       | 0.00                  | 255.8                          |
| 1995 | 127.6                      | 13.1                  | 265.5              | 240.9            | 42.8                           | 428.2             | 0.06                   | 0.00                           | 999.0                  | 21.1                                   | 57.1                                       | 0.00                  | 271.2                          |
| 1996 | 135.2                      | 13.9                  | 278.4              | 253.8            | 45.4                           | 453.8             | 0.06                   | 0.00                           | 1059.0                 | 22.4                                   | 60.5                                       | 0.00                  | 287.4                          |
| 1997 | 143.4                      | 14.8                  | 291.8              | 266.8            | 48.1                           | 481.1             | 0.06                   | 0.00                           | 1122.5                 | 23.7                                   | 64.1                                       | 0.00                  | 304.7                          |
| 1998 | 157.1                      | 15.6                  | 309.4              | 281.5            | 51.0                           | 509.9             | 0.07                   | 0.00                           | 1189.8                 | 25.2                                   | 68.0                                       | 0.00                  | 323.0                          |
| 1999 | 166.5                      | 16.6                  | 324.3              | 295.5            | 54.1                           | 540.5             | 0.07                   | 0.00                           | 1261.2                 | 26.7                                   | 72.1                                       | 0.00                  | 342.3                          |
| 2000 | 176.5                      | 17.6                  | 340.0              | 311.3            | 57.3                           | 573.0             | 0.08                   | 0.00                           | 1336.9                 | 28.3                                   | 76.4                                       | 0.00                  | 362.9                          |
| 2001 | 187.1                      | 18.6                  | 356.3              | 328.0            | 60.7                           | 607.3             | 0.08                   | 0.00                           | 1417.1                 | 30.0                                   | 81.0                                       | 0.00                  | 384.6                          |
| 2002 | 201.3                      | 19.7                  | 373.4              | 346.4            | 64.4                           | 643.8             | 0.09                   | 0.00                           | 1502.2                 | 31.9                                   | 85.8                                       | 0.00                  | 407.7                          |
| 2003 | 234.7                      | 20.9                  | 391.2              | 364.9            | 68.2                           | 682.4             | 0.09                   | 0.00                           | 1592.3                 | 33.7                                   | 91.0                                       | 0.00                  | 432.2                          |
| 2004 | 248.0                      | 22.2                  | 414.7              | 386.8            | 72.3                           | 723.4             | 0.10                   | 0.00                           | 1687.8                 | 35.7                                   | 96.4                                       | 0.00                  | 458.1                          |
| 2005 | 263.8                      | 23.5                  | 439.6              | 410.0            | 76.7                           | 766.8             | 0.10                   | 0.00                           | 1789.1                 | 37.8                                   | 102.2                                      | 0.00                  | 485.6                          |
| 2006 | 279.6                      | 24.9                  | 466.0              | 434.6            | 81.3                           | 812.8             | 0.11                   | 0.00                           | 1896.4                 | 40.1                                   | 108.4                                      | 0.00                  | 514.7                          |
| 2007 | 312.4                      | 26.4                  | 493.9              | 460.6            | 86.2                           | 861.5             | 0.11                   | 0.00                           | 2010.2                 | 42.5                                   | 114.9                                      | 0.00                  | 545.6                          |
| 2008 | 364.1                      | 28.0                  | 523.6              | 488.3            | 91.3                           | 913.2             | 0.12                   | 0.00                           | 2130.8                 | 45.1                                   | 121.8                                      | 0.00                  | 578.4                          |
| 2009 | 419.5                      | 29.7                  | 555.0              | 517.6            | 102.0                          | 968.0             | 0.13                   | 0.00                           | 2258.7                 | 47.8                                   | 129.1                                      | 0.00                  | 613.1                          |
| 2010 | 444.6                      | 31.5                  | 588.3              | 548.6            | 108.1                          | 1026.1            | 0.14                   | 0.00                           | 2394.2                 | 50.6                                   | 136.8                                      | 0.00                  | 649.9                          |
| 2011 | 477.1                      | 33.4                  | 623.6              | 581.5            | 108.8                          | 1087.7            | 0.15                   | 0.00                           | 2537.9                 | 53.7                                   | 145.0                                      | 0.00                  | 688.8                          |
| 2012 | 509.6                      | 35.4                  | 661.0              | 616.4            | 115.3                          | 1152.9            | 0.15                   | 0.00                           | 2690.1                 | 56.9                                   | 153.7                                      | 0.00                  | 730.2                          |
| 2013 | 593.9                      | 37.5                  | 700.7              | 653.4            | 122.2                          | 1222.1            | 0.16                   | 0.00                           | 2851.5                 | 60.3                                   | 162.9                                      | 0.00                  | 774.0                          |
| 2014 | 692.6                      | 39.7                  | 742.7              | 692.6            | 129.5                          | 1295.4            | 0.17                   | 0.00                           | 3022.6                 | 63.9                                   | 172.7                                      | 0.00                  | 820.4                          |
| 2015 | 807.4                      | 42.1                  | 787.3              | 734.2            | 137.3                          | 1373.1            | 0.18                   | 0.00                           | 3204.0                 | 67.7                                   | 183.1                                      | 0.00                  | 869.7                          |
| MT   |                            |                       |                    |                  |                                |                   |                        |                                |                        |  |  |                       |                                |
| AVE  | 178.4                      | 15.5                  | 271.4              | 283.0            | 67.8                           | 716.4             | 0.11                   | 0.00                           | *****                  | 48.9                                   | 96.9                                       | 0.00                  | 0.0                            |

TABLE 4.24. Projected Costs for Materials and Services for 1,000 MWe BWR  
with Unlimited Reprocessing  
(in Millions of Current Dollars)

| YEAR | MINING<br>MILLING | UF6<br>CONVR | ENRICHINT | U FUEL<br>FAB | SPENT<br>FUEL TRAN | REPRO | PU<br>TRANS | INCR PU<br>STORAGE | MOX<br>FAB | INCR<br>FUEL | SPENT<br>STOR | WASTE<br>DISPOSAL<br>W/O PU | PU SALES | SPENT<br>FUEL DISP | TOTAL |
|------|-------------------|--------------|-----------|---------------|--------------------|-------|-------------|--------------------|------------|--------------|---------------|-----------------------------|----------|--------------------|-------|
| 1983 | 33.6              |              | 2         | 28.           | 15.                | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 79.   |
| 1984 | 0.0               |              | 0.        | 0.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 0.    |
| 1985 | 16.9              |              | 0.        | 0.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 17.   |
| 1986 | 31.0              |              | 1         | 20.           | 5.                 | 0.    | 0.00        | 0.00               | 0.         |              | 0.            | 0.                          | 0.       | 0.                 | 58.   |
| 1987 | 21.4              |              | 1         | 20.           | 6.                 | 9.    | 0.00        | 0.00               | 0.         |              | 0.            | 1.                          | 0.       | 0.                 | 59.   |
| 1988 | 17.6              |              | 1         | 13.           | 4.                 | 10.   | 0.01        | 0.00               | 3.         |              | 0.            | 1.                          | 0.       | 0.                 | 51.   |
| 1989 | 24.7              |              | 1         | 16.           | 4.                 | 8.    | 0.01        | 0.00               | 4.         |              | 0.            | 1.                          | 0.       | 0.                 | 59.   |
| 1990 | 23.8              |              | 1         | 16.           | 4.                 | 9.    | 0.01        | 0.00               | 3.         |              | 0.            | 1.                          | 0.       | 0.                 | 59.   |
| 1991 | 24.4              |              | 1         | 16.           | 4.                 | 9.    | 0.01        | 0.00               | 4.         |              | 0.            | 1.                          | 0.       | 0.                 | 60.   |
| 1992 | 26.7              |              | 1         | 17.           | 5.                 | 9.    | 0.01        | 0.00               | 4.         |              | 0.            | 1.                          | 0.       | 0.                 | 65.   |
| 1993 | 28.2              |              | 1         | 18.           | 5.                 | 10.   | 0.01        | 0.00               | 4.         |              | 0.            | 1.                          | 0.       | 0.                 | 68.   |
| 1994 | 28.6              |              | 1         | 17.           | 5.                 | 11.   | 0.02        | 0.00               | 6.         |              | 0.            | 1.                          | 0.       | 0.                 | 70.   |
| 1995 | 30.4              |              | 1         | 18.           | 5.                 | 11.   | 0.02        | 0.00               | 6.         |              | 0.            | 1.                          | 0.       | 0.                 | 74.   |
| 1996 | 32.5              |              | 1         | 19.           | 5.                 | 12.   | 0.02        | 0.00               | 7.         |              | 0.            | 1.                          | 0.       | 0.                 | 79.   |
| 1997 | 34.2              |              | 1         | 20.           | 6.                 | 13.   | 0.02        | 0.00               | 7.         |              | 0.            | 1.                          | 0.       | 0.                 | 80.   |
| 1998 | 37.8              |              | 1         | 21.           | 6.                 | 13.   | 0.02        | 0.00               | 8.         |              | 0.            | 1.                          | 0.       | 0.                 | 89.   |
| 1999 | 40.0              |              | 1         | 22.           | 6.                 | 14.   | 0.02        | 0.00               | 8.         |              | 0.            | 1.                          | 0.       | 0.                 | 95.   |
| 2000 | 40.9              |              | 1         | 23.           | 7.                 | 15.   | 0.02        | 0.00               | 9.         |              | 0.            | 1.                          | 0.       | 0.                 | 98.   |
| 2001 | 41.6              |              | 1         | 23.           | 7.                 | 16.   | 0.03        | 0.00               | 10.        |              | 0.            | 1.                          | 0.       | 0.                 | 101.  |
| 2002 | 43.2              |              | 2         | 23.           | 7.                 | 16.   | 0.03        | 0.00               | 10.        |              | 0.            | 1.                          | 0.       | 0.                 | 104.  |
| 2003 | 48.7              |              | 2         | 23.           | 7.                 | 17.   | 0.03        | 0.00               | 10.        |              | 0.            | 1.                          | 0.       | 0.                 | 111.  |
| 2004 | 50.1              |              | 2         | 24.           | 7.                 | 17.   | 0.03        | 0.00               | 11.        |              | 0.            | 1.                          | 0.       | 0.                 | 114.  |
| 2005 | 51.2              |              | 2         | 24.           | 7.                 | 18.   | 0.03        | 0.00               | 11.        |              | 0.            | 1.                          | 0.       | 0.                 | 116.  |
| 2006 | 52.1              |              | 2         | 25.           | 7.                 | 18.   | 0.03        | 0.00               | 12.        |              | 0.            | 2.                          | 0.       | 0.                 | 119.  |
| 2007 | 56.0              |              | 2         | 25.           | 7.                 | 19.   | 0.03        | 0.00               | 12.        |              | 0.            | 2.                          | 0.       | 0.                 | 124.  |
| 2008 | 62.8              |              | 2         | 26.           | 7.                 | 19.   | 0.03        | 0.00               | 13.        |              | 0.            | 2.                          | 0.       | 0.                 | 133.  |
| 2009 | 69.4              |              | 2         | 26.           | 8.                 | 20.   | 0.03        | 0.00               | 13.        |              | 0.            | 2.                          | 0.       | 0.                 | 141.  |
| 2010 | 70.6              |              | 2         | 26.           | 8.                 | 20.   | 0.04        | 0.00               | 13.        |              | 0.            | 2.                          | 0.       | 0.                 | 143.  |
| 2011 | 72.7              |              | 2         | 27.           | 8.                 | 20.   | 0.04        | 0.00               | 14.        |              | 0.            | 2.                          | 0.       | 0.                 | 147.  |
| 2012 | 74.3              |              | 2         | 27.           | 8.                 | 21.   | 0.04        | 0.00               | 14.        |              | 0.            | 2.                          | 0.       | 0.                 | 150.  |
| 2013 | 82.7              |              | 2         | 27.           | 8.                 | 21.   | 0.04        | 0.00               | 14.        |              | 0.            | 2.                          | 0.       | 0.                 | 153.  |
| 2014 | 19.0              |              | 1         | 28.           | 8.                 | 21.   | 0.04        | 0.00               | 15.        |              | 0.            | 2.                          | 0.       | 0.                 | 108.  |
| 2015 | -32.8             |              | -1        | -147.         | 0.                 | 152.  | 0.37        | 0.00               | 0.         |              | 6.            | 13.                         | 0.       | 0.                 | -16.  |
| TOTL | 1256.2            |              | 41        | 589.          | 196.               | 567.  | 1.02        | 0.00               | 245.       |              | 0.            | 47.                         | 0.       | 0.                 | 2916. |

TABLE 4.25. Discounted and Levelized Process Costs for 1,000 MWe BWR  
with Unlimited Reprocessing  
(in Millions of Current Dollars)

| Discount Rate, 14% |                   |                          |          |               |                   |       |            |                    |            |                         |                             |                       |       |
|--------------------|-------------------|--------------------------|----------|---------------|-------------------|-------|------------|--------------------|------------|-------------------------|-----------------------------|-----------------------|-------|
| YEAR               | MINING<br>MILLING | UF <sub>6</sub><br>CONVR | ENRICHMT | U FUEL<br>FAB | SPENT<br>FUEL TRN | REPRO | PU<br>TRNS | INCR PU<br>STORAGE | MOX<br>FAB | INCR SPENT<br>FUEL STOR | WASTE<br>DISPOSAL<br>M/O PU | PU SALES<br>FUEL DISP | TOTAL |
| 1983               | 15.3              | 1                        | 13       | 7             | 0                 | 0     | 0.00       | 0.00               | 0          | 0                       | 0                           | 0                     | 36    |
| 1984               | 10.0              | 0                        | 0        | 0             | 0                 | 0     | 0.00       | 0.00               | 0          | 0                       | 0                           | 0                     | 0     |
| 1985               | 5.9               | 0                        | 0        | 0             | 0                 | 0     | 0.00       | 0.00               | 0          | 0                       | 0                           | 0                     | 0     |
| 1986               | 5.5               | 0                        | 0        | 0             | 0                 | 0     | 0.00       | 0.00               | 0          | 0                       | 0                           | 0                     | 0     |
| 1987               | 5.8               | 0                        | 0        | 0             | 0                 | 2     | 0.00       | 0.00               | 0          | 0                       | 0                           | 0                     | 11    |
| 1988               | 4.6               | 0                        | 0        | 0             | 0                 | 2     | 0.00       | 0.00               | 1          | 0                       | 0                           | 0                     | 12    |
| 1989               | 4.1               | 0                        | 0        | 0             | 0                 | 2     | 0.00       | 0.00               | 1          | 0                       | 0                           | 0                     | 11    |
| 1990               | 3.9               | 0                        | 0        | 0             | 0                 | 2     | 0.00       | 0.00               | 1          | 0                       | 0                           | 0                     | 10    |
| 1991               | 3.7               | 0                        | 0        | 0             | 0                 | 1     | 0.00       | 0.00               | 1          | 0                       | 0                           | 0                     | 9     |
| 1992               | 3.5               | 0                        | 0        | 0             | 0                 | 1     | 0.00       | 0.00               | 1          | 0                       | 0                           | 0                     | 8     |
| 1993               | 3.1               | 0                        | 0        | 0             | 0                 | 1     | 0.00       | 0.00               | 1          | 0                       | 0                           | 0                     | 7     |
| 1994               | 2.9               | 0                        | 0        | 0             | 0                 | 1     | 0.00       | 0.00               | 1          | 0                       | 0                           | 0                     | 6     |
| 1995               | 2.2               | 0                        | 0        | 0             | 0                 | 1     | 0.00       | 0.00               | 1          | 0                       | 0                           | 0                     | 5     |
| 1996               | 2.2               | 0                        | 0        | 0             | 0                 | 1     | 0.00       | 0.00               | 1          | 0                       | 0                           | 0                     | 4     |
| 1997               | 2.2               | 0                        | 0        | 0             | 0                 | 1     | 0.00       | 0.00               | 1          | 0                       | 0                           | 0                     | 3     |
| 1998               | 2.2               | 0                        | 0        | 0             | 0                 | 1     | 0.00       | 0.00               | 1          | 0                       | 0                           | 0                     | 2     |
| 1999               | 2.2               | 0                        | 0        | 0             | 0                 | 1     | 0.00       | 0.00               | 1          | 0                       | 0                           | 0                     | 1     |
| 2000               | 2.0               | 0                        | 0        | 0             | 0                 | 1     | 0.00       | 0.00               | 0          | 0                       | 0                           | 0                     | 0     |
| 2001               | 1.6               | 0                        | 0        | 0             | 0                 | 1     | 0.00       | 0.00               | 0          | 0                       | 0                           | 0                     | 0     |
| 2002               | 1.6               | 0                        | 0        | 0             | 0                 | 1     | 0.00       | 0.00               | 0          | 0                       | 0                           | 0                     | 0     |
| 2003               | 1.5               | 0                        | 0        | 0             | 0                 | 1     | 0.00       | 0.00               | 0          | 0                       | 0                           | 0                     | 0     |
| 2004               | 1.3               | 0                        | 0        | 0             | 0                 | 1     | 0.00       | 0.00               | 0          | 0                       | 0                           | 0                     | 0     |
| 2005               | 1.2               | 0                        | 0        | 0             | 0                 | 0     | 0.00       | 0.00               | 0          | 0                       | 0                           | 0                     | 0     |
| 2006               | 1.1               | 0                        | 0        | 0             | 0                 | 0     | 0.00       | 0.00               | 0          | 0                       | 0                           | 0                     | 0     |
| 2007               | 1.1               | 0                        | 0        | 0             | 0                 | 0     | 0.00       | 0.00               | 0          | 0                       | 0                           | 0                     | 0     |
| 2008               | 1.1               | 0                        | 0        | 0             | 0                 | 0     | 0.00       | 0.00               | 0          | 0                       | 0                           | 0                     | 0     |
| 2009               | 1.0               | 0                        | 0        | 0             | 0                 | 0     | 0.00       | 0.00               | 0          | 0                       | 0                           | 0                     | 0     |
| 2010               | 0.9               | 0                        | 0        | 0             | 0                 | 0     | 0.00       | 0.00               | 0          | 0                       | 0                           | 0                     | 0     |
| 2011               | 0.8               | 0                        | 0        | 0             | 0                 | 0     | 0.00       | 0.00               | 0          | 0                       | 0                           | 0                     | 0     |
| 2012               | 0.8               | 0                        | 0        | 0             | 0                 | 0     | 0.00       | 0.00               | 0          | 0                       | 0                           | 0                     | 0     |
| 2013               | 0.7               | 0                        | 0        | 0             | 0                 | 0     | 0.00       | 0.00               | 0          | 0                       | 0                           | 0                     | 0     |
| 2014               | 0.1               | 0                        | 0        | 0             | 0                 | 0     | 0.00       | 0.00               | 0          | 0                       | 0                           | 0                     | 0     |
| 2015               | 0.2               | 0                        | 0        | 0             | 0                 | 1     | 0.00       | 0.00               | 0          | 0                       | 0                           | 0                     | 0     |
| TOTL               | 94.9              | 4                        | 57       | 19            | 3                 | 25    | 0.03       | 0.00               | 11         | 0                       | 2                           | 0                     | 216   |

## Levelized Fuel Cycle Cost, Mills/kW-hr

|       |        |       |        |       |       |       |       |       |       |       |       |       |        |
|-------|--------|-------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| 83-87 | 3.666  | 0.204 | 1.943  | 1.625 | 0.220 | 2.328 | 0.002 | 0.000 | 0.000 | 0.000 | 0.193 | 0.000 | 9.581  |
| 88-92 | 3.681  | 0.168 | 2.801  | 0.775 | 0.151 | 1.603 | 0.002 | 0.000 | 0.000 | 0.000 | 0.133 | 0.000 | 9.609  |
| 93-97 | 4.237  | 0.166 | 2.777  | 0.774 | 0.262 | 2.146 | 0.003 | 0.000 | 0.000 | 0.000 | 0.178 | 0.000 | 11.274 |
| 98-02 | 5.710  | 0.221 | 3.429  | 0.581 | 0.262 | 2.773 | 0.005 | 0.000 | 1.242 | 0.000 | 0.200 | 0.000 | 14.852 |
| 3-7   | 6.451  | 0.296 | 4.447  | 1.299 | 0.344 | 3.620 | 0.006 | 0.000 | 1.967 | 0.000 | 0.200 | 0.000 | 20.730 |
| 8-12  | 13.100 | 0.392 | 5.821  | 1.710 | 0.884 | 5.312 | 0.020 | 0.000 | 2.870 | 0.001 | 0.771 | 0.000 | 24.802 |
| 13-15 | 27.520 | 0.656 | 10.272 | 3.621 | 0.880 | 8.888 | 0.088 | 0.000 | 5.328 | 0.000 | 0.000 | 0.000 | 46.835 |



TABLE 4.26. Process Flows for 1,000 MWe PWR with No Reprocessing

| YEAR | MINING<br>MILLING<br>1000 SI | UFG<br>CONVR<br>1000 HTU | ENRICHMENT<br>1000<br>MT-SMU | U FUEL<br>FAB<br>MTU | SPENT<br>FUEL TRAN<br>MT-HM | REPROCESS<br>MT-HM | PU<br>TRANS<br>KG-TOT | INCR PU<br>STORAGE<br>KG-TOT | MOX<br>FAB<br>MT-HM | INCR<br>FUEL STOR<br>MT-HM | SPENT<br>STOR<br>MT-HM | WASTE<br>DISPOSAL<br>MT-HM<br>N/G PU | PU SALES<br>KG FISS | SPENT<br>FUEL DISP<br>MT-HM | TAILS<br>COMP<br>% |
|------|------------------------------|--------------------------|------------------------------|----------------------|-----------------------------|--------------------|-----------------------|------------------------------|---------------------|----------------------------|------------------------|--------------------------------------|---------------------|-----------------------------|--------------------|
| 1983 | 0.24                         | 0.27                     | 0.21                         | 79.                  | 0.                          | 0.                 | 0.                    | 0.                           | 0.                  | 0.                         | 0.                     | 0.                                   | 0.                  | 0.                          | 0.250              |
| 1984 | 0.12                         | 0.04                     | 0.00                         | 0.                   | 0.                          | 0.                 | 0.                    | 0.                           | 0.                  | 0.                         | 0.                     | 0.                                   | 0.                  | 0.                          | 0.250              |
| 1985 | 0.23                         | 0.18                     | 0.12                         | 27.                  | 0.                          | 0.                 | 0.                    | 0.                           | 0.                  | 0.                         | 0.                     | 0.                                   | 0.                  | 0.                          | 0.250              |
| 1986 | 0.22                         | 0.17                     | 0.11                         | 0.                   | 0.                          | 0.                 | 0.                    | 0.                           | 0.                  | 26.                        | 0.                     | 0.                                   | 0.                  | 0.                          | 0.250              |
| 1987 | 0.20                         | 0.16                     | 0.11                         | 27.                  | 0.                          | 0.                 | 0.                    | 0.                           | 0.                  | 26.                        | 0.                     | 0.                                   | 0.                  | 0.                          | 0.250              |
| 1988 | 0.20                         | 0.15                     | 0.10                         | 25.                  | 0.                          | 0.                 | 0.                    | 0.                           | 0.                  | 52.                        | 0.                     | 0.                                   | 0.                  | 0.                          | 0.250              |
| 1989 | 0.20                         | 0.15                     | 0.10                         | 24.                  | 0.                          | 0.                 | 0.                    | 0.                           | 0.                  | 75.                        | 0.                     | 0.                                   | 0.                  | 0.                          | 0.250              |
| 1990 | 0.20                         | 0.15                     | 0.10                         | 24.                  | 0.                          | 0.                 | 0.                    | 0.                           | 0.                  | 98.                        | 0.                     | 0.                                   | 0.                  | 0.                          | 0.250              |
| 1991 | 0.20                         | 0.15                     | 0.10                         | 24.                  | 26.                         | 0.                 | 0.                    | 0.                           | 0.                  | 94.                        | 0.                     | 0.                                   | 0.                  | 26.                         | 0.250              |
| 1992 | 0.20                         | 0.15                     | 0.10                         | 24.                  | 0.                          | 0.                 | 0.                    | 0.                           | 0.                  | 116.                       | 0.                     | 0.                                   | 0.                  | 0.                          | 0.250              |
| 1993 | 0.20                         | 0.15                     | 0.10                         | 24.                  | 26.                         | 0.                 | 0.                    | 0.                           | 0.                  | 113.                       | 0.                     | 0.                                   | 0.                  | 26.                         | 0.250              |
| 1994 | 0.20                         | 0.15                     | 0.10                         | 24.                  | 24.                         | 0.                 | 0.                    | 0.                           | 0.                  | 112.                       | 0.                     | 0.                                   | 0.                  | 24.                         | 0.250              |
| 1995 | 0.20                         | 0.15                     | 0.10                         | 24.                  | 22.                         | 0.                 | 0.                    | 0.                           | 0.                  | 112.                       | 0.                     | 0.                                   | 0.                  | 22.                         | 0.250              |
| 1996 | 0.20                         | 0.15                     | 0.10                         | 24.                  | 22.                         | 0.                 | 0.                    | 0.                           | 0.                  | 112.                       | 0.                     | 0.                                   | 0.                  | 22.                         | 0.250              |
| 1997 | 0.20                         | 0.15                     | 0.10                         | 24.                  | 22.                         | 0.                 | 0.                    | 0.                           | 0.                  | 112.                       | 0.                     | 0.                                   | 0.                  | 22.                         | 0.250              |
| 1998 | 0.20                         | 0.15                     | 0.10                         | 24.                  | 22.                         | 0.                 | 0.                    | 0.                           | 0.                  | 112.                       | 0.                     | 0.                                   | 0.                  | 22.                         | 0.250              |
| 1999 | 0.20                         | 0.15                     | 0.10                         | 24.                  | 22.                         | 0.                 | 0.                    | 0.                           | 0.                  | 112.                       | 0.                     | 0.                                   | 0.                  | 22.                         | 0.250              |
| 2000 | 0.19                         | 0.15                     | 0.10                         | 24.                  | 22.                         | 0.                 | 0.                    | 0.                           | 0.                  | 112.                       | 0.                     | 0.                                   | 0.                  | 22.                         | 0.250              |
| 2001 | 0.19                         | 0.14                     | 0.10                         | 23.                  | 22.                         | 0.                 | 0.                    | 0.                           | 0.                  | 112.                       | 0.                     | 0.                                   | 0.                  | 22.                         | 0.250              |
| 2002 | 0.18                         | 0.14                     | 0.09                         | 23.                  | 22.                         | 0.                 | 0.                    | 0.                           | 0.                  | 111.                       | 0.                     | 0.                                   | 0.                  | 22.                         | 0.250              |
| 2003 | 0.17                         | 0.13                     | 0.09                         | 22.                  | 22.                         | 0.                 | 0.                    | 0.                           | 0.                  | 110.                       | 0.                     | 0.                                   | 0.                  | 22.                         | 0.250              |
| 2004 | 0.17                         | 0.13                     | 0.09                         | 21.                  | 22.                         | 0.                 | 0.                    | 0.                           | 0.                  | 109.                       | 0.                     | 0.                                   | 0.                  | 22.                         | 0.250              |
| 2005 | 0.16                         | 0.13                     | 0.08                         | 21.                  | 22.                         | 0.                 | 0.                    | 0.                           | 0.                  | 106.                       | 0.                     | 0.                                   | 0.                  | 22.                         | 0.250              |
| 2006 | 0.16                         | 0.12                     | 0.08                         | 20.                  | 22.                         | 0.                 | 0.                    | 0.                           | 0.                  | 103.                       | 0.                     | 0.                                   | 0.                  | 22.                         | 0.250              |
| 2007 | 0.15                         | 0.12                     | 0.08                         | 19.                  | 22.                         | 0.                 | 0.                    | 0.                           | 0.                  | 100.                       | 0.                     | 0.                                   | 0.                  | 22.                         | 0.250              |
| 2008 | 0.15                         | 0.11                     | 0.08                         | 19.                  | 21.                         | 0.                 | 0.                    | 0.                           | 0.                  | 97.                        | 0.                     | 0.                                   | 0.                  | 21.                         | 0.250              |
| 2009 | 0.14                         | 0.11                     | 0.07                         | 18.                  | 21.                         | 0.                 | 0.                    | 0.                           | 0.                  | 94.                        | 0.                     | 0.                                   | 0.                  | 21.                         | 0.250              |
| 2010 | 0.13                         | 0.10                     | 0.07                         | 17.                  | 20.                         | 0.                 | 0.                    | 0.                           | 0.                  | 90.                        | 0.                     | 0.                                   | 0.                  | 20.                         | 0.250              |
| 2011 | 0.13                         | 0.10                     | 0.07                         | 16.                  | 19.                         | 0.                 | 0.                    | 0.                           | 0.                  | 87.                        | 0.                     | 0.                                   | 0.                  | 19.                         | 0.250              |
| 2012 | 0.12                         | 0.10                     | 0.06                         | 16.                  | 19.                         | 0.                 | 0.                    | 0.                           | 0.                  | 84.                        | 0.                     | 0.                                   | 0.                  | 19.                         | 0.250              |
| 2013 | 0.12                         | 0.09                     | 0.06                         | 15.                  | 18.                         | 0.                 | 0.                    | 0.                           | 0.                  | 81.                        | 0.                     | 0.                                   | 0.                  | 18.                         | 0.250              |
| 2014 | 0.06                         | 0.07                     | 0.06                         | 14.                  | 17.                         | 0.                 | 0.                    | 0.                           | 0.                  | 78.                        | 0.                     | 0.                                   | 0.                  | 17.                         | 0.250              |
| 2015 | 0.00                         | 0.00                     | 0.00                         | 0.                   | 17.                         | 0.                 | 0.                    | 0.                           | 0.                  | 137.                       | 0.                     | 0.                                   | 0.                  | 17.                         | 0.250              |
| TOTL | 5.59                         | 4.39                     | 2.92                         | 707.                 | 518.                        | 0.                 | 0.                    | 0.                           | 0.                  | 2881.                      | 0.                     | 0.                                   | 0.                  | 518.                        |                    |

TABLE 4.27. Projected Unit Cost for 1,000 MWe PWR with  
No Reprocessing  
(in Millions of 1977 Dollars)

| YEAR | U308<br>AS BURNED<br>\$/LB | U<br>CONVR<br>\$/KG-U | SEP WORK<br>\$/SHU | U FAB<br>\$/KG-U | SPENT<br>FUEL TRAN<br>\$/KG-HH | REPRO<br>\$/KG-HH | PU<br>TRAN<br>\$/G-TOT | INCR PU<br>STORAGE<br>\$/G-TOT | MOX<br>FAB<br>\$/KG-HH | INCR<br>FUEL STOR<br>\$/KG-HH-YR | SPENT<br>FUEL STOR<br>\$/KG-HH-YR | WASTE PU<br>DISPOSAL<br>\$/KG-HH<br>W/O PU | VALUE<br>\$/G FISS | SPENT<br>FUEL DISP<br>\$/KG-HH |
|------|----------------------------|-----------------------|--------------------|------------------|--------------------------------|-------------------|------------------------|--------------------------------|------------------------|----------------------------------|-----------------------------------|--|--------------------|--------------------------------|
| ESCR | 0.0%                       | 0.0%                  | 0.0%               | 0.0%             | 0.0%                           | 0.0%              | 0.0%                   | 0.0%                           | 0.0%                   | 0.0%                             | 0.0%                              | 0.0%                                       |                    | 0.0%                           |
| 1983 | 42.0                       | 4.6                   | 90.0               | 91.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 1984 | 42.0                       | 4.6                   | 93.0               | 91.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 1985 | 42.0                       | 4.6                   | 95.0               | 90.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 1986 | 42.0                       | 4.6                   | 98.0               | 89.9             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 1987 | 42.0                       | 4.6                   | 100.0              | 89.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 1988 | 42.0                       | 4.6                   | 100.0              | 88.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 1989 | 44.7                       | 4.6                   | 100.0              | 88.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 1990 | 44.7                       | 4.6                   | 100.0              | 87.4             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 1991 | 44.7                       | 4.6                   | 100.0              | 87.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 1992 | 44.7                       | 4.6                   | 100.0              | 86.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 1993 | 46.2                       | 4.6                   | 95.0               | 85.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 1994 | 46.2                       | 4.6                   | 94.0               | 85.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 1995 | 46.2                       | 4.6                   | 93.0               | 84.4             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 1996 | 46.2                       | 4.6                   | 92.0               | 83.9             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 1997 | 46.9                       | 4.6                   | 91.0               | 83.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 1998 | 51.6                       | 4.6                   | 91.0               | 82.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 1999 | 53.6                       | 4.6                   | 90.0               | 82.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 2000 | 59.0                       | 4.6                   | 89.0               | 81.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 2001 | 59.0                       | 4.6                   | 88.0               | 81.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 2002 | 60.2                       | 4.6                   | 87.0               | 80.7             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 2003 | 66.3                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 2004 | 72.9                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 2005 | 80.2                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 2006 | 88.2                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 2007 | 88.2                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 2008 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 2009 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 2010 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 2011 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 2012 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 2013 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 2014 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| 2015 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                    | 95.0                           |
| HT   |                            |                       |                    |                  |                                |                   |                        |                                |                        |                                  |                                   |  |                    |                                |
| AVE. | 58.4                       | 4.6                   | 91.7               | 84.4             | 15.0                           | 0.0               | 0.00                   | 0.00                           | 0.0                    | 5.0                              | 0.0                               | 0.00                                       |                    | 95.0                           |



TABLE 4.28. Projected Costs for Materials and Services  
for 1,000 MWe PWR with No Reprocessing  
(in Millions of 1977 Dollars)

| YEAR | MINING<br>MILLING | UF6<br>CONVR | ENRICHMENT | U FUEL<br>FAB | SPENT<br>FUEL TRAN | REPRO | FU<br>TRANS | INCR FU<br>STORAGE | MOX<br>FAB | INCR<br>FUEL | SPENT<br>STOR | WASTE<br>DISPOSAL<br>N/O FU | FU SALES | SPENT<br>FUEL DISP | TOTAL |
|------|-------------------|--------------|------------|---------------|--------------------|-------|-------------|--------------------|------------|--------------|---------------|-----------------------------|----------|--------------------|-------|
| 1983 | 19.9              | 1.           | 19.        | 7.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 47.   |
| 1984 | 9.7               | 0.           | 0.         | 0.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 10.   |
| 1985 | 19.2              | 1.           | 11.        | 2.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 44.   |
| 1986 | 18.2              | 1.           | 11.        | 0.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 0.            | 0.                          | 0.       | 2.                 | 30.   |
| 1987 | 17.1              | 1.           | 11.        | 2.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 0.            | 0.                          | 0.       | 0.                 | 31.   |
| 1988 | 16.6              | 1.           | 10.        | N             | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 0.            | 0.                          | 0.       | 2.                 | 31.   |
| 1989 | 17.7              | 1.           | 10.        | N             | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 0.            | 0.                          | 0.       | 1.                 | N     |
| 1990 | 17.7              | 1.           | 10.        | N             | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 1991 | 17.7              | 1.           | 10.        | N             | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 1992 | 17.7              | 1.           | 10.        | N             | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 1993 | 18.3              | 1.           | 10.        | N             | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 1994 | 18.3              | 1.           | 9.         | N             | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 1995 | 18.3              | 1.           | 9.         | N             | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 1996 | 18.3              | 1.           | 9.         | N             | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 1997 | 18.6              | 1.           | 9.         | N             | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 1998 | 20.4              | 1.           | 9.         | N             | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 1999 | 21.0              | 1.           | 9.         | N             | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 2000 | 22.5              | 1.           | 9.         | N             | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 2001 | 21.8              | 1.           | 8.         | N             | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 2002 | 21.6              | 1.           | 8.         | N             | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 2003 | 23.0              | 1.           | 8.         | N             | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 2004 | 24.5              | 1.           | 7.         | N             | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 2005 | 26.1              | 1.           | 7.         | N             | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 2006 | 27.7              | 1.           | 7.         | N             | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 2007 | 26.7              | 1.           | 7.         | N             | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 2008 | 26.6              | 1.           | 6.         | 1.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 2009 | 29.6              | 0.           | 6.         | 1.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 2010 | 24.5              | 0.           | 6.         | 1.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 2011 | 23.5              | 0.           | 6.         | 1.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 1.                 | N     |
| 2012 | 22.5              | 0.           | 5.         | 1.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 0.            | 0.                          | 0.       | 1.                 | N     |
| 2013 | 21.4              | 0.           | 5.         | 1.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 0.            | 0.                          | 0.       | 1.                 | N     |
| 2014 | 10.5              | 0.           | 5.         | 1.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 0.            | 0.                          | 0.       | 1.                 | N     |
| 2015 | 0.0               | 0.           | 0.         | 0.            | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 1.            | 0.                          | 0.       | 5.                 | 9.    |
| TOTL | 653.0             | 20.          | 268.       | 60.           | 0.                 | 0.    | 0.00        | 0.00               | 0.         | 0.           | 17.           | 0.                          | 0.       | 39.                | 1064. |

4.33

| Discount Rate, 8% |                   |              |                |               |                   |       |             |                    |            |              |               |                             |          |                    |       |
|-------------------|-------------------|--------------|----------------|---------------|-------------------|-------|-------------|--------------------|------------|--------------|---------------|-----------------------------|----------|--------------------|-------|
| YEAR              | MINING<br>MILLING | UF6<br>CONVR | CONC<br>SHIPMT | U FUEL<br>FAB | SPENT<br>FUEL TRN | REPRO | PU<br>TRANS | INCR PU<br>STORAGE | MOX<br>FAB | INCR<br>FUEL | SPENT<br>STOR | WASTE<br>DISPOSAL<br>W/O PU | PU SALES | SPENT<br>FUEL DISP | TOTAL |
| 1983              | 12.6              | 1            | 12             | 5             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 30    |
| 1984              | 5.7               | 0            | 0              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 18    |
| 1985              | 10.4              | 0            | 6              | 1             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 16    |
| 1986              | 9.1               | 0            | 6              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 1                  | 14    |
| 1987              | 7.9               | 0            | 5              | 1             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 13    |
| 1988              | 7.1               | 0            | 4              | 1             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 1                  | 13    |
| 1989              | 7.0               | 0            | 4              | 1             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 1                  | 12    |
| 1990              | 6.5               | 0            | 4              | 1             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 11    |
| 1991              | 6.0               | 0            | 3              | 1             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 10    |
| 1992              | 5.6               | 0            | 3              | 1             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 10    |
| 1993              | 5.3               | 0            | 3              | 1             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 9     |
| 1994              | 4.9               | 0            | 3              | 1             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 8     |
| 1995              | 4.6               | 0            | 2              | 1             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 8     |
| 1996              | 4.2               | 0            | 2              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 7     |
| 1997              | 4.0               | 0            | 2              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 6     |
| 1998              | 4.1               | 0            | 2              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 6     |
| 1999              | 3.9               | 0            | 2              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 6     |
| 2000              | 3.8               | 0            | 1              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 6     |
| 2001              | 3.4               | 0            | 1              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 5     |
| 2002              | 3.2               | 0            | 1              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 5     |
| 2003              | 3.1               | 0            | 1              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 5     |
| 2004              | 3.1               | 0            | 1              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 4     |
| 2005              | 3.0               | 0            | 1              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 4     |
| 2006              | 3.0               | 0            | 1              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 4     |
| 2007              | 2.7               | 0            | 1              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 4     |
| 2008              | 2.4               | 0            | 1              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 4     |
| 2009              | 2.2               | 0            | 1              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 4     |
| 2010              | 1.5               | 0            | 0              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 3     |
| 2011              | 1.7               | 0            | 0              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 3     |
| 2012              | 1.5               | 0            | 0              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 3     |
| 2013              | 1.3               | 0            | 0              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 3     |
| 2014              | 0.6               | 0            | 0              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 1     |
| 2015              | 0.0               | 0            | 0              | 0             | 0                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 0     |
| TOTL              | 145.9             | 5            | 73             | 17            | 1                 | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 25    |

## Levelized Fuel Cycle Cost, Mills/kW-hr

[illegible]

TABLE 4.30. Process flows for 1,000 MWe BWR with No Reprocessing

| YEAR | MINING<br>MILLING<br>1000 ST | UF6<br>CONVR<br>1000 MTU | ENRICHMENT<br>1000<br>MT-SMU | U FUEL<br>FAB<br>MTU | SPENT<br>FUEL TRAN<br>MT-HM | REPROCESS<br>MT-HM | PU<br>TRANS<br>KG-TOT | INCR PU<br>STORAGE<br>KG-TOT | MOX<br>FAB<br>MT-HM | INCR<br>FUEL<br>MT-HM | SPENT<br>STOR<br>MT-HM | WASTE<br>DISPOSAL<br>MT-HM<br>W/O PU | PU SALES<br>KG FISS | SPENT<br>FUEL DISP<br>MT-HM | TAILS<br>COMP<br>% |
|------|------------------------------|--------------------------|------------------------------|----------------------|-----------------------------|--------------------|-----------------------|------------------------------|---------------------|-----------------------|------------------------|--------------------------------------|---------------------|-----------------------------|--------------------|
| 1983 | 0.28                         | 0.33                     | 0.22                         | 114                  | 0                           | 0                  | 0                     | 0                            | 0                   | 0                     | 0                      | 0                                    | 0                   | 0                           | 0.250              |
| 1984 | 0.00                         | 0.00                     | 0.00                         | 0                    | 0                           | 0                  | 0                     | 0                            | 0                   | 0                     | 0                      | 0                                    | 0                   | 0                           | 0.250              |
| 1985 | 0.13                         | 0.05                     | 0.00                         | 0                    | 0                           | 0                  | 0                     | 0                            | 0                   | 0                     | 0                      | 0                                    | 0                   | 0                           | 0.250              |
| 1986 | 0.20                         | 0.17                     | 0.12                         | 36                   | 0                           | 0                  | 0                     | 0                            | 0                   | 0                     | 0                      | 0                                    | 0                   | 0                           | 0.250              |
| 1987 | 0.16                         | 0.12                     | 0.03                         | 35                   | 0                           | 0                  | 0                     | 0                            | 0                   | 35                    | 0                      | 0                                    | 0                   | 0                           | 0.250              |
| 1988 | 0.19                         | 0.15                     | 0.09                         | 26                   | 0                           | 0                  | 0                     | 0                            | 0                   | 68                    | 0                      | 0                                    | 0                   | 0                           | 0.250              |
| 1989 | 0.20                         | 0.16                     | 0.10                         | 30                   | 0                           | 0                  | 0                     | 0                            | 0                   | 93                    | 0                      | 0                                    | 0                   | 0                           | 0.250              |
| 1990 | 0.19                         | 0.15                     | 0.09                         | 28                   | 0                           | 0                  | 0                     | 0                            | 0                   | 122                   | 0                      | 0                                    | 0                   | 0                           | 0.250              |
| 1991 | 0.19                         | 0.15                     | 0.09                         | 28                   | 0                           | 0                  | 0                     | 0                            | 0                   | 148                   | 0                      | 0                                    | 0                   | 0                           | 0.250              |
| 1992 | 0.19                         | 0.15                     | 0.09                         | 28                   | 35                          | 0                  | 0                     | 0                            | 0                   | 139                   | 0                      | 0                                    | 0                   | 35                          | 0.250              |
| 1993 | 0.19                         | 0.15                     | 0.09                         | 28                   | 33                          | 0                  | 0                     | 0                            | 0                   | 132                   | 0                      | 0                                    | 0                   | 33                          | 0.250              |
| 1994 | 0.19                         | 0.15                     | 0.09                         | 28                   | 25                          | 0                  | 0                     | 0                            | 0                   | 133                   | 0                      | 0                                    | 0                   | 25                          | 0.250              |
| 1995 | 0.19                         | 0.15                     | 0.09                         | 28                   | 28                          | 0                  | 0                     | 0                            | 0                   | 131                   | 0                      | 0                                    | 0                   | 28                          | 0.250              |
| 1996 | 0.19                         | 0.15                     | 0.09                         | 28                   | 26                          | 0                  | 0                     | 0                            | 0                   | 131                   | 0                      | 0                                    | 0                   | 26                          | 0.250              |
| 1997 | 0.19                         | 0.15                     | 0.09                         | 28                   | 26                          | 0                  | 0                     | 0                            | 0                   | 131                   | 0                      | 0                                    | 0                   | 26                          | 0.250              |
| 1998 | 0.19                         | 0.15                     | 0.09                         | 28                   | 26                          | 0                  | 0                     | 0                            | 0                   | 131                   | 0                      | 0                                    | 0                   | 26                          | 0.250              |
| 1999 | 0.19                         | 0.15                     | 0.09                         | 28                   | 26                          | 0                  | 0                     | 0                            | 0                   | 131                   | 0                      | 0                                    | 0                   | 26                          | 0.250              |
| 2000 | 0.19                         | 0.15                     | 0.09                         | 28                   | 26                          | 0                  | 0                     | 0                            | 0                   | 131                   | 0                      | 0                                    | 0                   | 26                          | 0.250              |
| 2001 | 0.18                         | 0.14                     | 0.09                         | 27                   | 26                          | 0                  | 0                     | 0                            | 0                   | 131                   | 0                      | 0                                    | 0                   | 26                          | 0.250              |
| 2002 | 0.18                         | 0.14                     | 0.09                         | 26                   | 26                          | 0                  | 0                     | 0                            | 0                   | 130                   | 0                      | 0                                    | 0                   | 26                          | 0.250              |
| 2003 | 0.17                         | 0.13                     | 0.08                         | 25                   | 26                          | 0                  | 0                     | 0                            | 0                   | 128                   | 0                      | 0                                    | 0                   | 26                          | 0.250              |
| 2004 | 0.17                         | 0.13                     | 0.08                         | 24                   | 26                          | 0                  | 0                     | 0                            | 0                   | 126                   | 0                      | 0                                    | 0                   | 26                          | 0.250              |
| 2005 | 0.16                         | 0.13                     | 0.08                         | 24                   | 26                          | 0                  | 0                     | 0                            | 0                   | 123                   | 0                      | 0                                    | 0                   | 26                          | 0.250              |
| 2006 | 0.16                         | 0.12                     | 0.07                         | 23                   | 26                          | 0                  | 0                     | 0                            | 0                   | 119                   | 0                      | 0                                    | 0                   | 26                          | 0.250              |
| 2007 | 0.15                         | 0.12                     | 0.07                         | 22                   | 25                          | 0                  | 0                     | 0                            | 0                   | 116                   | 0                      | 0                                    | 0                   | 25                          | 0.250              |
| 2008 | 0.15                         | 0.11                     | 0.07                         | 21                   | 25                          | 0                  | 0                     | 0                            | 0                   | 112                   | 0                      | 0                                    | 0                   | 25                          | 0.250              |
| 2009 | 0.14                         | 0.11                     | 0.07                         | 20                   | 24                          | 0                  | 0                     | 0                            | 0                   | 108                   | 0                      | 0                                    | 0                   | 24                          | 0.250              |
| 2010 | 0.13                         | 0.10                     | 0.06                         | 20                   | 23                          | 0                  | 0                     | 0                            | 0                   | 104                   | 0                      | 0                                    | 0                   | 23                          | 0.250              |
| 2011 | 0.13                         | 0.10                     | 0.06                         | 19                   | 22                          | 0                  | 0                     | 0                            | 0                   | 101                   | 0                      | 0                                    | 0                   | 22                          | 0.250              |
| 2012 | 0.12                         | 0.10                     | 0.06                         | 18                   | 22                          | 0                  | 0                     | 0                            | 0                   | 97                    | 0                      | 0                                    | 0                   | 22                          | 0.250              |
| 2013 | 0.12                         | 0.09                     | 0.06                         | 17                   | 21                          | 0                  | 0                     | 0                            | 0                   | 93                    | 0                      | 0                                    | 0                   | 21                          | 0.250              |
| 2014 | 0.06                         | 0.07                     | 0.05                         | 17                   | 20                          | 0                  | 0                     | 0                            | 0                   | 90                    | 0                      | 0                                    | 0                   | 20                          | 0.250              |
| 2015 | 0.00                         | 0.00                     | 0.00                         | 0                    | 19                          | 0                  | 0                     | 0                            | 0                   | 181                   | 0                      | 0                                    | 0                   | 19                          | 0.250              |
| TOTL | 5.29                         | 4.18                     | 2.54                         | 848                  | 610                         | 0                  | 0                     | 0                            | 0                   | 3411                  | 0                      | 0                                    | 0                   | 610                         |                    |

TABLE 4.31. Projected Unit Cost for 1,000 MWe BWR with No Reprocessing  
(in Millions of 1977 Dollars)

| YEAR | U308<br>AS BURNED<br>\$/LB | U<br>CONVR<br>\$/KG-U | SEP WORK<br>\$/SNU | U FAB<br>\$/KG-U | SPENT<br>FUEL TRAN<br>\$/KG-HM | REPRO<br>\$/KG-HM | PU<br>TRAN<br>\$/G-TOT | INCR PU<br>STORAGE<br>\$/G-TOT | HOX<br>FAB<br>\$/KG-HM | INCR<br>FUEL STOR<br>\$/KG-HM-YR | SPENT<br>FUEL STOR<br>\$/KG-HM-YR | WASTE PU<br>DISPOSAL<br>\$/KG-HM<br>W/O PU | PU VALUE<br>\$/G FISS | SPENT<br>FUEL DISP<br>\$/KG-HM |
|------|----------------------------|-----------------------|--------------------|------------------|--------------------------------|-------------------|------------------------|--------------------------------|------------------------|----------------------------------|-----------------------------------|--|-----------------------|--------------------------------|
| ESCR | 0.0%                       | 0.0%                  | 0.0%               | 0.0%             | 0.0%                           | 0.0%              | 0.0%                   | 0.0%                           | 0.0%                   | 0.0%                             | 0.0%                              | 0.0%                                       |                       | 0.0%                           |
| 1983 | 42.0                       | 4.6                   | 90.0               | 91.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 1984 | 42.0                       | 4.6                   | 93.0               | 91.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 1985 | 42.0                       | 4.6                   | 95.0               | 90.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 1986 | 42.0                       | 4.6                   | 98.0               | 89.9             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 1987 | 42.0                       | 4.6                   | 100.0              | 89.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 1988 | 42.0                       | 4.6                   | 100.0              | 88.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 1989 | 44.7                       | 4.6                   | 100.0              | 88.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 1990 | 44.7                       | 4.6                   | 100.0              | 87.4             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 1991 | 44.7                       | 4.6                   | 100.0              | 87.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 1992 | 44.7                       | 4.6                   | 100.0              | 86.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 1993 | 46.2                       | 4.6                   | 95.0               | 85.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 1994 | 46.2                       | 4.6                   | 94.0               | 85.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 1995 | 46.2                       | 4.6                   | 93.0               | 84.4             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 1996 | 46.2                       | 4.6                   | 92.0               | 83.9             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 1997 | 46.9                       | 4.6                   | 91.0               | 83.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 1998 | 51.6                       | 4.6                   | 91.0               | 82.8             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 1999 | 51.6                       | 4.6                   | 90.0               | 82.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 2000 | 59.0                       | 4.6                   | 89.0               | 81.5             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 2001 | 59.0                       | 4.6                   | 88.0               | 81.0             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 2002 | 60.2                       | 4.6                   | 87.0               | 80.7             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 2003 | 66.3                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 2004 | 72.9                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 2005 | 80.2                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 2006 | 80.2                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 2007 | 80.2                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 2008 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 2009 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 2010 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 2011 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 2012 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 2013 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 2014 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| 2015 | 91.4                       | 4.6                   | 86.0               | 80.2             | 15.0                           | 150.0             | 0.02                   | 0.00                           | 350.0                  | 5.0                              | 20.0                              | 0.00                                       |                       | 95.0                           |
| MT   |                            |                       |                    |                  |                                |                   |                        |                                |                        |                                  |                                   |  |                       |                                |
| AVE  | 59.3                       | 4.6                   | 91.3               | 84.6             | 15.0                           | 0.0               | 0.00                   | 0.00                           | 0.0                    | 5.0                              | 0.0                               | 0.00                                       |                       | 95.0                           |

TABLE 4.32. Projected Costs for Materials and Services  
for 1,000 MWe BWR with No Reprocessing  
(in Millions of 1977 Dollars)

| YEAR  | MINING<br>MILLING | UF6<br>CONVR | ENRICHMT | U FUEL<br>FAB | SPENT<br>FUEL TRAN | REPRO | PU<br>TRANS | INCR PU<br>STORAGE | HGX<br>FAB | INCR<br>FUEL | SPENT<br>STOR | WASTE<br>DISPOSAL<br>W/O PU | PU SALES | SPENT<br>FUEL DISP | TOTAL |
|-------|-------------------|--------------|----------|---------------|--------------------|-------|-------------|--------------------|------------|--------------|---------------|-----------------------------|----------|--------------------|-------|
| 1983  | 23.7              | 1            | 20       | 10            | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 56    |
| 1984  | 0.0               | 0            | 0        | 0             | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 0     |
| 1985  | 10.6              | 0            | 0        | 0             | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 11    |
| 1986  | 16.5              | 1            | 12       | 3             | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 0                  | 29    |
| 1987  | 13.6              | 1            | 3        | 0             | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 2                  | 28    |
| 1988  | 16.4              | 1            | 9        | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 0            | 0             | 0                           | 0        | 2                  | 30    |
| 1989  | 17.8              | 1            | 10       | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 1                  | 31    |
| 1990  | 17.2              | 1            | 9        | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 2                  | 31    |
| 1991  | 17.2              | 1            | 9        | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 2                  | 31    |
| 1992  | 17.2              | 1            | 9        | 2             | 1                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 2                  | 33    |
| 1993  | 17.8              | 1            | 9        | 2             | 1                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 3                  | 34    |
| 1994  | 17.8              | 1            | 9        | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 2                  | 34    |
| 1995  | 17.8              | 1            | 8        | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 2                  | 34    |
| 1996  | 17.8              | 1            | 8        | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 2                  | 34    |
| 1997  | 18.0              | 1            | 8        | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 2                  | 35    |
| 1998  | 19.8              | 1            | 8        | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 2                  | 37    |
| 1999  | 20.6              | 1            | 8        | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 2                  | 39    |
| 2000  | 22.4              | 1            | 8        | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 2                  | 41    |
| 2001  | 21.7              | 1            | 8        | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 2                  | 40    |
| 2002  | 21.5              | 1            | 7        | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 1                  | 39    |
| 2003  | 22.9              | 1            | 7        | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 1                  | 41    |
| 2004  | 24.4              | 1            | 7        | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 1                  | 43    |
| 2005  | 26.0              | 1            | 7        | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 1                  | 45    |
| 2006  | 27.6              | 1            | 6        | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 1                  | 47    |
| 2007  | 26.6              | 1            | 6        | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 1                  | 45    |
| 2008  | 26.6              | 1            | 6        | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 1                  | 45    |
| 2009  | 25.6              | 1            | 6        | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 1                  | 44    |
| 2010  | 24.6              | 0            | 6        | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 1                  | 43    |
| 2011  | 23.6              | 0            | 5        | 2             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 1                  | 41    |
| 2012  | 22.6              | 0            | 5        | 1             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 1                  | 39    |
| 2013  | 21.6              | 0            | 5        | 1             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 1                  | 37    |
| 2014  | 18.5              | 0            | 5        | 1             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 1                  | 33    |
| 2015  | 0.0               | 0            | 0        | 0             | 0                  | 0     | 0.00        | 0.00               | 0          | 1            | 0             | 0                           | 0        | 2                  | 2     |
| TOTAL | 628.0             | 19           | 232      | 72            | 9                  | 0     | 0.00        | 0.00               | 0          | 20           | 0             | 0                           | 0        | 47                 | 1027  |



4.37

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APPENDIX A

EXAMPLE UNICST RUN WITH PLANT BUILDING SCHEDULES

| YEAR    | DEMAND | LEARNING<br>CURVE | CAPACITY THRUPT. |        | CAPACITY THRUPT |        | CAPACITY THRUPT |        | CAPACITY THRUPT |        |
|---------|--------|-------------------|------------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|
| ----    | -----  | -----             | -----            | -----  | -----           | -----  | -----           | -----  | -----           | -----  |
| 1 1969  | 0.0    | 0.0000            | 0.0              | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    |
| 2 1970  | 0.0    | 0.0000            | 0.0              | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    |
| 3 1971  | 0.0    | 0.0000            | 0.0              | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    |
| 4 1972  | 0.0    | 0.0000            | 0.0              | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    |
| 5 1973  | 0.0    | 1.0000            | 0.0              | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    |
| 6 1974  | 403.6  | 1.0000            | 300.0            | 403.6  | 0.0             | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    |
| 7 1975  | 367.6  | 1.0000            | 600.0            | 367.6  | 0.0             | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    |
| 8 1976  | 534.8  | 1.0150            | 1015.0           | 534.8  | 0.0             | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    |
| 9 1977  | 686.0  | 1.0302            | 1030.2           | 686.0  | 0.0             | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    |
| 10 1978 | 769.1  | 1.0457            | 1045.7           | 769.1  | 0.0             | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    |
| 11 1979 | 910.6  | 1.0614            | 1061.4           | 910.6  | 0.0             | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    |
| 12 1980 | 1208.8 | 1.0773            | 1077.3           | 908.9  | 355.5           | 290.9  | 0.0             | 0.0    | 0.0             | 0.0    |
| 13 1981 | 1073.9 | 1.0934            | 1093.4           | 646.9  | 721.7           | 427.0  | 0.0             | 0.0    | 0.0             | 0.0    |
| 14 1982 | 1637.6 | 1.1098            | 1109.8           | 779.9  | 1220.8          | 857.9  | 0.0             | 0.0    | 0.0             | 0.0    |
| 15 1983 | 1676.8 | 1.1265            | 1126.5           | 798.5  | 1239.1          | 878.3  | 0.0             | 0.0    | 0.0             | 0.0    |
| 16 1984 | 2075.0 | 1.1434            | 1143.4           | 988.1  | 1257.7          | 1086.9 | 0.0             | 0.0    | 0.0             | 0.0    |
| 17 1985 | 2153.4 | 1.1605            | 1160.5           | 1025.4 | 1276.6          | 1128.0 | 0.0             | 0.0    | 0.0             | 0.0    |
| 18 1986 | 2141.6 | 1.1779            | 1177.9           | 1019.8 | 1295.7          | 1121.8 | 0.0             | 0.0    | 0.0             | 0.0    |
| 19 1987 | 2435.0 | 1.1956            | 1195.6           | 1159.5 | 1315.2          | 1275.5 | 0.0             | 0.0    | 0.0             | 0.0    |
| 20 1988 | 2701.1 | 1.2136            | 1213.6           | 1080.4 | 1820.3          | 1620.6 | 0.0             | 0.0    | 0.0             | 0.0    |
| 21 1989 | 2757.0 | 1.2318            | 1231.8           | 1102.8 | 1847.6          | 1654.2 | 0.0             | 0.0    | 0.0             | 0.0    |
| 22 1990 | 2942.5 | 1.2502            | 1250.2           | 1177.0 | 1875.3          | 1765.5 | 0.0             | 0.0    | 0.0             | 0.0    |
| 23 1991 | 3305.4 | 1.2690            | 1269.0           | 1037.3 | 1903.5          | 1631.0 | 685.3           | 547.1  | 0.0             | 0.0    |
| 24 1992 | 3387.8 | 1.2880            | 1288.0           | 946.3  | 1932.0          | 1419.5 | 1391.1          | 1022.0 | 0.0             | 0.0    |
| 25 1993 | 3635.3 | 1.3073            | 1307.3           | 845.4  | 1961.0          | 1266.1 | 2353.2          | 1521.7 | 0.0             | 0.0    |
| 26 1994 | 3622.3 | 1.3270            | 0.0              | 0.0    | 1990.4          | 1737.4 | 2388.5          | 2064.9 | 0.0             | 0.0    |
| 27 1995 | 3839.2 | 1.3469            | 0.0              | 0.0    | 2020.3          | 1745.1 | 2424.3          | 2094.1 | 0.0             | 0.0    |
| 28 1996 | 3990.0 | 1.3671            | 0.0              | 0.0    | 2050.6          | 1813.7 | 2460.7          | 2176.4 | 0.0             | 0.0    |
| 29 1997 | 4142.2 | 1.3876            | 0.0              | 0.0    | 2081.3          | 1862.8 | 2497.6          | 2259.4 | 0.0             | 0.0    |
| 30 1998 | 4128.3 | 1.4084            | 0.0              | 0.0    | 2112.0          | 1876.5 | 2535.1          | 2251.8 | 0.0             | 0.0    |
| 31 1999 | 4229.1 | 1.4295            | 0.0              | 0.0    | 2142.3          | 1922.3 | 2573.1          | 2306.8 | 0.0             | 0.0    |
| 32 2000 | 4162.5 | 1.4509            | 0.0              | 0.0    | 0.0             | 0.0    | 2611.7          | 2611.7 | 783.5           | 783.5  |
| 33 2001 | 4240.8 | 1.4727            | 0.0              | 0.0    | 0.0             | 0.0    | 2650.9          | 2650.5 | 1590.5          | 1590.3 |
| 34 2002 | 4153.2 | 1.4948            | 0.0              | 0.0    | 0.0             | 0.0    | 2690.6          | 2076.6 | 2690.6          | 2076.6 |
| 35 2003 | 4362.5 | 1.5172            | 0.0              | 0.0    | 0.0             | 0.0    | 2731.0          | 2181.3 | 2731.0          | 2181.3 |
| 36 2004 | 0.0    | 0.0000            | 0.0              | 0.0    | 0.0             | 0.0    | 2731.0          | 2181.3 | 2731.0          | 2181.3 |
| 37 2005 | 0.0    | 0.0000            | 0.0              | 0.0    | 0.0             | 0.0    | 2731.0          | 2181.3 | 2731.0          | 2181.3 |
| 38 2006 | 0.0    | 0.0000            | 0.0              | 0.0    | 0.0             | 0.0    | 2731.0          | 2181.3 | 2731.0          | 2181.3 |
| 39 2007 | 0.0    | 0.0000            | 0.0              | 0.0    | 0.0             | 0.0    | 2731.0          | 2181.3 | 2731.0          | 2181.3 |
| 40 2008 | 0.0    | 0.0000            | 0.0              | 0.0    | 0.0             | 0.0    | 2731.0          | 2181.3 | 2731.0          | 2181.3 |
| 41 2009 | 0.0    | 0.0000            | 0.0              | 0.0    | 0.0             | 0.0    | 2731.0          | 2181.3 | 2731.0          | 2181.3 |
| 42 2010 | 0.0    | 0.0000            | 0.0              | 0.0    | 0.0             | 0.0    | 2731.0          | 2181.3 | 2731.0          | 2181.3 |
| 43 2011 | 0.0    | 0.0000            | 0.0              | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    | 2731.0          | 2181.3 |
| 44 2012 | 0.0    | 0.0000            | 0.0              | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    | 2731.0          | 2181.3 |
| 45 2013 | 0.0    | 0.0000            | 0.0              | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    | 2731.0          | 2181.3 |
| 46 2014 | 0.0    | 0.0000            | 0.0              | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    | 2731.0          | 2181.3 |
| 47 2015 | 0.0    | 0.0000            | 0.0              | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    | 2731.0          | 2181.3 |
| 48 2016 | 0.0    | 0.0000            | 0.0              | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    | 2731.0          | 2181.3 |
| 49 2017 | 0.0    | 0.0000            | 0.0              | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    | 2731.0          | 2181.3 |
| 50 2018 | 0.0    | 0.0000            | 0.0              | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    | 2731.0          | 2181.3 |
| 51 2019 | 0.0    | 0.0000            | 0.0              | 0.0    | 0.0             | 0.0    | 0.0             | 0.0    | 2731.0          | 2181.3 |

| PLANT NUMBER | 1      | 2                              | 3                           | 4                |
|--------------|--------|--------------------------------|-----------------------------|------------------|
| YEAR         | DEMAND | VARIABLE<br>OPERATING<br>COSTS | FIXED<br>OPERATING<br>COSTS | CAPITAL<br>COSTS |
| 1 1969       | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 2 1970       | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 3 1971       | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 4 1972       | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 5 1973       | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 6 1974       | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 7 1975       | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 8 1976       | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 9 1977       | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 10 1978      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 11 1979      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 12 1980      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 13 1981      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 14 1982      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 15 1983      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 16 1984      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 17 1985      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 18 1986      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 19 1987      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 20 1988      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 21 1989      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 22 1990      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 23 1991      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 24 1992      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 25 1993      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 26 1994      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 27 1995      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 28 1996      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 29 1997      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 30 1998      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 31 1999      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 32 2000      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 33 2001      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 34 2002      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 35 2003      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 36 2004      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 37 2005      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 38 2006      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 39 2007      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 40 2008      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 41 2009      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 42 2010      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 43 2011      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 44 2012      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 45 2013      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 46 2014      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 47 2015      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 48 2016      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 49 2017      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 50 2018      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 51 2019      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 52 2020      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 53 2021      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 54 2022      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 55 2023      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 56 2024      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 57 2025      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 58 2026      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 59 2027      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 60 2028      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 61 2029      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 62 2030      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 63 2031      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 64 2032      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 65 2033      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 66 2034      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 67 2035      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 68 2036      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 69 2037      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 70 2038      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 71 2039      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 72 2040      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 73 2041      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 74 2042      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 75 2043      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 76 2044      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 77 2045      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 78 2046      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 79 2047      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 80 2048      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 81 2049      | 0.0    | 0.0                            | 0.0                         | 0.0              |
| 82 2050      | 0.0    | 0.0                            | 0.0                         | 0.0              |

URANIUM FUEL FABRICATION

PLANT NUMBER 1

SUMMARY REPORT

BASED ON A RETURN TO EQUITY OF 12.0 PCT

LEVELIZED CAPITAL CHARGES = 3.32 \$/KG

LEVELIZED EXPENSES = 90.84 \$/KG

TOTAL LEVELIZED PRICE = 94.17 \$/KG

CALCULATED INTERNAL RETURN ON EQUITY = .1 PCT



# URANIUM FUEL FABRICATION

PLANT NUMBER 1 PLANT CAPACITY 1000.

CASH FLOW ANALYSIS IN MILLIONS OF DOLLARS

- STUDY CONDITIONS -

FEDERAL INCOME TAX RATE IS 45.0 PCT  
STATE INCOME TAX RATE IS 7.0 PCT  
STATE REVENUE TAX RATE IS 4.0 PCT  
FEDERAL SURTAX RATE IS 0.0 PCT  
INVESTMENT CREDIT RATE IS 7.0 PCT

CASH FLOW DISCOUNTED TO 1969  
INCOME TAX LOSSES WRITTEN OFF  
SUM OF YEARS DIGITS DEPRECIATION USED  
PRODUCTION UNITS = TONNES OF HEAVY METAL

| PLANT<br>YEAR | UNITS<br>PRODUCED | REVENUE<br>(SALES) | CAPITAL<br>COSTS | WORKING<br>CAPITAL | OPER.<br>COST | FIN.<br>COST | BOND<br>INT. | INSUR<br>& PROP<br>TAXES | STATE<br>REV.<br>TAXES | TOTAL<br>EXPENSES | INCOME<br>BEFORE<br>TAXES | STATE &<br>FEDERAL<br>TAXES | INVEST-<br>MENT<br>CREDIT | INCOME<br>AFTER<br>TAXES | NET<br>CASH<br>FLOW |
|---------------|-------------------|--------------------|------------------|--------------------|---------------|--------------|--------------|--------------------------|------------------------|-------------------|---------------------------|-----------------------------|---------------------------|--------------------------|---------------------|
| 1969          | 0.0               | 0.0                | 0.0              | 0.0                | 0.0           | 0.0          | 0.0          | 0.0                      | 0.0                    | 0.0               | 0.0                       | 0.0                         | 0.0                       | 0.0                      | 0.0                 |
| 1970          | 0.0               | 0.0                | 0.0              | 0.0                | 0.0           | 0.0          | 0.0          | 0.0                      | 0.0                    | 0.0               | 0.0                       | 0.0                         | 0.0                       | 0.0                      | 0.0                 |
| 1971          | 0.0               | 0.0                | 0.0              | 0.0                | 0.0           | 0.0          | 0.0          | 0.0                      | 0.0                    | 0.0               | 0.0                       | 0.0                         | 0.0                       | 0.0                      | 0.0                 |
| 1972          | 0.0               | 0.0                | 0.0              | 0.0                | 0.0           | 0.0          | 0.0          | 0.0                      | 0.0                    | 0.0               | 0.0                       | 0.0                         | 0.0                       | 0.0                      | 0.0                 |
| 1973          | 0.0               | 0.0                | 0.0              | 0.0                | 0.0           | 0.0          | 0.0          | 0.0                      | 0.0                    | 0.0               | 0.0                       | 0.0                         | 0.0                       | 0.0                      | 0.0                 |
| 1974          | 403.6             | 38.0               | 13.2             | 10.0               | 47.8          | 3.8          | .5           | .8                       | 1.5                    | 54.4              | -16.4                     | -9.4                        | 1.3                       | 1.0                      | -17.8               |
| 1975          | 367.6             | 34.6               | 0.0              | 0.0                | 45.7          | 3.6          | 1.0          | .7                       | 1.4                    | 52.4              | -17.8                     | -9.2                        | 0.0                       | -7.0                     | -26.4               |
| 1976          | 534.8             | 50.4               | 0.0              | 0.0                | 55.6          | 3.4          | 1.1          | .7                       | 2.0                    | 62.8              | -12.5                     | -6.4                        | 0.0                       | -6.0                     | -2.6                |
| 1977          | 686.0             | 64.6               | 0.0              | 0.0                | 64.5          | 3.2          | 1.2          | .6                       | 2.6                    | 72.1              | -7.5                      | -3.9                        | 0.0                       | -3.6                     | .4                  |
| 1978          | 769.1             | 72.4               | 0.0              | 0.0                | 69.4          | 3.0          | 1.2          | .6                       | 2.9                    | 77.1              | -4.7                      | -2.4                        | 0.0                       | -2.3                     | .8                  |
| 1979          | 918.5             | 86.1               | 0.0              | 0.0                | 78.0          | 2.9          | 1.2          | .6                       | 3.4                    | 86.0              | .1                        | .1                          | 0.0                       | .1                       | 2.9                 |
| 1980          | 904.9             | 85.6               | 0.0              | 0.0                | 77.6          | 2.7          | 1.1          | .5                       | 3.4                    | 85.4              | .2                        | .1                          | 0.0                       | .1                       | 2.6                 |
| 1981          | 846.9             | 80.0               | 0.0              | 0.0                | 62.2          | 2.5          | 1.1          | .5                       | 2.4                    | 68.6              | -7.7                      | -4.0                        | 0.0                       | -3.7                     | -1.3                |
| 1982          | 770.0             | 73.8               | 0.0              | 0.0                | 70.9          | 2.3          | 1.1          | .4                       | 2.9                    | 70.8              | -5.3                      | -1.7                        | 0.0                       | -1.6                     | .7                  |
| 1983          | 798.5             | 75.2               | 0.0              | 0.0                | 71.1          | 2.1          | 1.1          | .4                       | 3.0                    | 77.7              | -2.5                      | -1.3                        | 0.0                       | -1.2                     | .9                  |
| 1984          | 925.1             | 93.0               | 0.0              | 0.0                | 82.3          | 1.9          | 1.1          | .4                       | 3.7                    | 89.4              | 3.7                       | 1.9                         | 0.0                       | 1.6                      | 3.7                 |
| 1985          | 1025.8            | 96.6               | 0.0              | 0.0                | 84.5          | 1.7          | 1.0          | .3                       | 3.9                    | 91.4              | 5.2                       | 2.7                         | 0.0                       | 2.5                      | 4.2                 |
| 1986          | 1016.6            | 96.0               | 0.0              | 0.0                | 84.2          | 1.5          | .9           | .3                       | 3.8                    | 90.7              | 5.3                       | 2.7                         | 0.0                       | 2.6                      | 4.1                 |
| 1987          | 1159.5            | 107.2              | 0.0              | 0.0                | 92.4          | 1.3          | .6           | .2                       | 4.4                    | 99.2              | 10.0                      | 5.2                         | 0.0                       | 4.8                      | 6.2                 |
| 1988          | 1040.4            | 101.7              | 0.0              | 0.0                | 87.7          | 1.1          | .7           | .2                       | 4.1                    | 93.9              | 7.9                       | 4.1                         | 0.0                       | 3.8                      | 5.0                 |
| 1989          | 1102.8            | 103.8              | 0.0              | 0.0                | 89.1          | 1.0          | .6           | .2                       | 4.2                    | 94.4              | 8.9                       | 4.6                         | 0.0                       | 4.3                      | 5.3                 |
| 1990          | 1177.0            | 110.8              | 0.0              | 0.0                | 93.4          | .8           | .5           | .1                       | 4.4                    | 99.3              | 11.6                      | 6.0                         | 0.0                       | 5.6                      | 6.4                 |
| 1991          | 1087.3            | 102.4              | 0.0              | 0.0                | 88.2          | .6           | .4           | .1                       | 4.1                    | 93.3              | 9.1                       | 4.7                         | 0.0                       | 4.4                      | 5.0                 |
| 1992          | 946.3             | 89.1               | 0.0              | 0.0                | 73.8          | .4           | .3           | .0                       | 3.6                    | 84.1              | 5.0                       | 2.6                         | 0.0                       | 2.4                      | 2.7                 |
| 1993          | 845.4             | 79.6               | 0.0              | -10.0              | 73.9          | .2           | .2           | -.0                      | 3.2                    | 77.5              | 2.1                       | 1.1                         | 0.0                       | 1.0                      | 11.2                |
| TOTAL         | 17241.9           | 1623.6             | 40.0             | 0.0                | 1497.3        | 40.2         | 17.3         | 8.3                      | 64.9                   | 1627.8            | -4.2                      | -5.0                        | 2.8                       | .8                       | .8                  |

URANIUM FUEL FABRICATION

PLANT NUMBER 2

SUMMARY REPORT

BASED ON A RETURN TO EQUITY OF 12.0 PCT

LEVELIZED CAPITAL CHARGES = 2.98 \$/KG

LEVELIZED EXPENSES = 86.18 \$/KG

TOTAL LEVELIZED PRICE = 89.16 \$/KG

CALCULATED INTERNAL RETURN ON EQUITY = .1 PCT

URANIUM FUEL FABRICATION  
PLANT NUMBER 2 PLANT CAPACITY 1100.  
CASH FLOW ANALYSIS IN MILLIONS OF DOLLARS

- STUDY CONDITIONS -

FEDERAL INCOME TAX RATE IS 48.0 PCT  
STATE INCOME TAX RATE IS 7.0 PCT  
STATE REVENUE TAX RATE IS 4.0 PCT  
FEDERAL SURTAX RATE IS 0.0 PCT  
INVESTMENT CREDIT RATE IS 7.0 PCT

CASH FLOW DISCOUNTED TO 1975  
INCOME TAX LOSSES WRITTEN OFF  
SUM OF YEARS DIGITS DEPRECIATION USED  
PRODUCTION UNITS = TONNES OF HEAVY METAL

| PLANT<br>YEAR | UNITS<br>PRODUCED | REVENUE<br>(SALES) | CAPITAL<br>COSTS | WORKING<br>CAPITAL | OPER.<br>COSTS | DEPIN | BOND<br>INT. | INSUR<br>& PROP<br>TAXES | STATE<br>REV.<br>TAXES | TOTAL<br>EXPENSES | INCOME<br>BEFORE<br>TAXES | STATE &<br>FEDERAL<br>TAXES | INVEST-<br>MENT<br>CREDIT | INCOME<br>AFTER<br>TAXES | NET<br>CASH<br>FLOW |
|---------------|-------------------|--------------------|------------------|--------------------|----------------|-------|--------------|--------------------------|------------------------|-------------------|---------------------------|-----------------------------|---------------------------|--------------------------|---------------------|
| 1975          | 0.0               | 0.0                | 0.0              | 0.0                | 0.0            | 0.0   | 0.0          | 0.0                      | 0.0                    | 0.0               | 0.0                       | 0.0                         | 0.0                       | 0.0                      | 0.0                 |
| 1976          | 0.0               | 0.0                | 0.0              | 0.0                | 0.0            | 0.0   | 0.0          | 0.0                      | 0.0                    | 0.0               | 0.0                       | 0.0                         | 0.0                       | 0.0                      | 0.0                 |
| 1977          | 0.0               | 0.0                | 0.0              | 0.0                | 0.0            | 0.0   | 0.0          | 0.0                      | 0.0                    | 0.0               | 0.0                       | 0.0                         | 0.0                       | 0.0                      | 0.0                 |
| 1978          | 0.0               | 0.0                | 0.0              | 0.0                | 0.0            | 0.0   | 0.0          | 0.0                      | 0.0                    | 0.0               | 0.0                       | 0.0                         | 0.0                       | 0.0                      | 0.0                 |
| 1979          | 0.0               | 0.0                | 0.0              | 0.0                | 0.0            | 0.0   | 0.0          | 0.0                      | 0.0                    | 0.0               | 0.0                       | 0.0                         | 0.0                       | 0.0                      | 0.0                 |
| 1980          | 299.9             | 26.7               | 20.7             | 11.0               | 44.1           | 4.2   | 0.0          | 0.0                      | 0.0                    | 0.0               | 0.0                       | 0.0                         | 0.0                       | 0.0                      | 0.0                 |
| 1981          | 427.0             | 38.1               | 14.5             | 0.0                | 51.6           | 4.0   | 0.0          | 0.0                      | 0.0                    | 50.7              | -24.0                     | -1.8                        | 1.4                       | 1.1                      | -19.6               |
| 1982          | 457.9             | 75.5               | 0.0              | 0.0                | 77.0           | 3.8   | 1.2          | 0.0                      | 1.1                    | 59.1              | -21.0                     | -13.4                       | 1.0                       | -10.2                    | -31.9               |
| 1983          | 878.3             | 72.3               | 0.0              | 0.0                | 78.2           | 3.6   | 1.3          | 0.0                      | 3.1                    | 85.9              | -9.9                      | -10.9                       | 0.0                       | -10.2                    | -31.2               |
| 1984          | 1085.9            | 96.0               | 0.0              | 0.0                | 90.5           | 3.4   | 1.3          | 0.0                      | 3.1                    | 87.0              | -8.6                      | -4.9                        | 0.0                       | -4.2                     | -8.2                |
| 1985          | 1124.0            | 100.0              | 0.0              | 0.0                | 93.0           | 3.1   | 1.3          | 0.0                      | 3.9                    | 99.8              | -2.9                      | -1.5                        | 0.0                       | -1.4                     | -0.0                |
| 1986          | 1121.4            | 100.0              | 0.0              | 0.0                | 92.6           | 2.4   | 1.3          | 0.0                      | 4.0                    | 102.0             | -1.5                      | -7.7                        | 0.0                       | -7.7                     | -2.0                |
| 1987          | 1275.5            | 113.7              | 0.0              | 0.0                | 101.7          | 2.7   | 1.3          | 0.0                      | 4.5                    | 101.4             | -1.3                      | -1.0                        | 0.0                       | -1.5                     | -2.4                |
| 1988          | 1620.6            | 148.5              | 16.0             | 4.0                | 131.0          | 5.0   | 1.2          | 0.0                      | 5.8                    | 110.7             | 3.0                       | 1.6                         | 0.0                       | 1.5                      | 2.3                 |
| 1989          | 1650.2            | 147.5              | 0.0              | 0.0                | 133.6          | 4.6   | 1.4          | 0.0                      | 5.9                    | 144.3             | 2.2                       | -1.0                        | 1.1                       | 1.2                      | 2.3                 |
| 1990          | 1765.5            | 157.4              | 0.0              | 0.0                | 140.2          | 4.1   | 1.3          | 0.0                      | 6.3                    | 146.2             | 1.9                       | 2.5                         | 0.0                       | 2.6                      | 2.5                 |
| 1991          | 1819.5            | 165.3              | 0.0              | 0.0                | 136.2          | 3.7   | 1.2          | 0.0                      | 6.3                    | 143.5             | 1.9                       | 1.0                         | 0.0                       | 2.9                      | 2.5                 |
| 1992          | 1266.1            | 113.1              | 0.0              | 0.0                | 119.7          | 3.5   | 1.1          | 0.0                      | 5.1                    | 129.7             | -3.2                      | -1.6                        | 0.0                       | -1.5                     | 1.8                 |
| 1993          | 1732.0            | 155.0              | 0.0              | 0.0                | 136.5          | 2.9   | 1.1          | 0.0                      | 4.5                    | 119.7             | -6.7                      | -3.4                        | 0.0                       | -3.2                     | 1.3                 |
| 1994          | 1732.0            | 155.0              | 0.0              | 0.0                | 136.5          | 2.5   | 1.1          | 0.0                      | 4.5                    | 119.7             | -6.7                      | -3.4                        | 0.0                       | -3.2                     | 1.3                 |
| 1995          | 1732.0            | 155.0              | 0.0              | 0.0                | 136.5          | 2.1   | 1.0          | 0.0                      | 4.2                    | 146.0             | 6.3                       | 3.3                         | 0.0                       | 3.4                      | 5.5                 |
| 1996          | 1811.7            | 161.7              | 0.0              | 0.0                | 143.0          | 1.7   | 0.8          | 0.0                      | 6.5                    | 146.5             | 7.1                       | 3.7                         | 0.0                       | 3.4                      | 5.5                 |
| 1997          | 1852.8            | 167.9              | 0.0              | 0.0                | 147.1          | 1.2   | 0.7          | 0.0                      | 6.5                    | 152.2             | 9.5                       | 4.9                         | 0.0                       | 4.6                      | 6.3                 |
| 1998          | 1876.5            | 167.3              | 0.0              | 0.0                | 146.7          | 0.6   | 0.6          | 0.0                      | 6.7                    | 154.9             | 12.4                      | 6.2                         | 0.0                       | 5.6                      | 7.0                 |
| 1999          | 1922.3            | 171.0              | 0.0              | -15.0              | 149.4          | 0.4   | 0.4          | 0.0                      | 6.9                    | 157.1             | 14.3                      | 7.3                         | 0.0                       | 6.0                      | 6.6                 |
| TOTAL         | 27411.9           | 2444.0             | 60.0             | 0.0                | 2260.5         | 60.0  | 21.6         | 10.9                     | 97.8                   | 2450.7            | -6.7                      | -7.0                        | 4.2                       | 1.0                      | 1.0                 |

URANIUM FUEL FABRICATION

PLANT NUMBER 3

SUMMARY REPORT

BASED ON A RETURN TO EQUITY OF 12.0 PCT

LEVELIZED CAPITAL CHARGES = 2.50 \$/KG

LEVELIZED EXPENSES = 76.33 \$/KG

TOTAL LEVELIZED PRICE = 78.83 \$/KG

CALCULATED INTERNAL RETURN ON EQUITY = .1 PCT

## URANIUM FUEL FABRICATION

PLANT NUMBER 3 PLANT CAPACITY 1800.

## CASH FLOW ANALYSIS IN MILLIONS OF DOLLARS

## - STUDY CONDITIONS -

FEDERAL INCOME TAX RATE IS 48.0 PCT  
 STATE INCOME TAX RATE IS 7.0 PCT  
 STATE REVENUE TAX RATE IS 4.0 PCT  
 FEDERAL SURTAX RATE IS 0.0 PCT  
 INVESTMENT CREDIT RATE IS 7.0 PCT

CASH FLOW DISCOUNTED TO 1986  
 INCOME TAX LOSSES - WRITEUP OFF  
 SUM OF YEARS DIGITS DEPRECIATION USED  
 PRODUCTION UNITS = TONNES OF HEAVY METAL

| PLANT<br>YEAR | UNITS<br>PRODUCED | REVENUE<br>(SALES) | CAPITAL<br>COSTS | WORKING<br>CAPITAL | OPER.<br>COSTS | DEPRN | BOND<br>INT. | INSUR<br>& PROP<br>TAXES | STATE<br>REV.<br>TAXES | TOTAL<br>EXPENSES | INCOME<br>BEFORE<br>TAXES | STATE &<br>FEDERAL<br>TAXES | INVEST-<br>MENT<br>CREDIT | INCOME<br>AFTER<br>TAXES | NET<br>CASH<br>FLOW |
|---------------|-------------------|--------------------|------------------|--------------------|----------------|-------|--------------|--------------------------|------------------------|-------------------|---------------------------|-----------------------------|---------------------------|--------------------------|---------------------|
| 1986          | 0.0               | 0.0                | 0.0              | 0.0                | 0.0            | 0.0   | 0.0          | 0.0                      | 0.0                    | 0.0               | 0.0                       | 0.0                         | 0.0                       | 0.0                      | 0.0                 |
| 1987          | 0.0               | 0.0                | 0.0              | 0.0                | 0.0            | 0.0   | 0.0          | 0.0                      | 0.0                    | 0.0               | 0.0                       | 0.0                         | 0.0                       | 0.0                      | 0.0                 |
| 1988          | 0.0               | 0.0                | 0.0              | 0.0                | 0.0            | 0.0   | 0.0          | 0.0                      | 0.0                    | 0.0               | 0.0                       | 0.0                         | 0.0                       | 0.0                      | 0.0                 |
| 1989          | 0.0               | 0.0                | 14.8             | 0.0                | 0.0            | 0.0   | 0.0          | 3.3                      | 0.0                    | 3.3               | -3.3                      | -1.2                        | 2.4                       | 1.8                      | -13.5               |
| 1990          | 0.0               | 0.0                | 33.8             | 0.0                | 0.0            | 0.0   | 0.0          | 1.0                      | 0.0                    | 1.2               | -1.2                      | -3.0                        | 1.7                       | 1.8                      | -32.1               |
| 1991          | 587.1             | 46.8               | 23.2             | 18.0               | 77.8           | 6.9   | 9.9          | 1.4                      | 0.0                    | 46.6              | -42.5                     | -23.6                       | 0.0                       | -17.4                    | -23.8               |
| 1992          | 1022.0            | 80.6               | 0.0              | 0.0                | 103.5          | 6.5   | 2.0          | 1.3                      | 3.2                    | 116.5             | -36.0                     | -16.0                       | 0.0                       | -17.4                    | -10.9               |
| 1993          | 1521.7            | 120.0              | 0.0              | 0.0                | 133.0          | 6.2   | 2.2          | 1.2                      | 4.6                    | 147.4             | -27.4                     | -14.2                       | 0.0                       | -15.3                    | -7.1                |
| 1994          | 2084.9            | 164.3              | 0.0              | 0.0                | 166.2          | 5.8   | 2.4          | 1.2                      | 6.6                    | 182.1             | -17.4                     | -8.9                        | 0.0                       | -6.6                     | -2.8                |
| 1995          | 2098.1            | 165.1              | 0.0              | 0.0                | 166.8          | 5.5   | 2.4          | 1.1                      | 6.6                    | 182.3             | -17.3                     | -8.0                        | 0.0                       | -7.5                     | -2.9                |
| 1996          | 2176.4            | 171.6              | 0.0              | 0.0                | 171.0          | 5.1   | 2.5          | 1.0                      | 6.9                    | 187.1             | -15.5                     | -7.1                        | 0.0                       | -6.7                     | -2.4                |
| 1997          | 2259.0            | 177.5              | 0.0              | 0.0                | 176.5          | 4.6   | 2.5          | 0.9                      | 7.1                    | 191.9             | -13.8                     | -7.0                        | 0.0                       | -5.9                     | -1.9                |
| 1998          | 2351.8            | 181.6              | 0.0              | 0.0                | 179.1          | 4.5   | 2.6          | 0.8                      | 7.3                    | 194.0             | -12.5                     | -6.3                        | 0.0                       | -5.0                     | -1.8                |
| 1999          | 2466.8            | 191.6              | 0.0              | 0.0                | 179.3          | 3.8   | 2.6          | 0.7                      | 8.2                    | 198.1             | -9.8                      | -3.5                        | 0.0                       | -3.3                     | 0.5                 |
| 2000          | 2611.7            | 205.9              | 0.0              | 0.0                | 199.5          | 3.4   | 2.6          | 0.6                      | 9.4                    | 212.7             | -5.7                      | -3.0                        | 0.0                       | -2.8                     | 0.7                 |
| 2001          | 2650.5            | 208.9              | 0.0              | 0.0                | 195.7          | 3.1   | 2.6          | 0.5                      | 9.4                    | 218.6             | -10.9                     | -7.7                        | 0.0                       | -7.2                     | 0.1                 |
| 2002          | 2076.5            | 163.7              | 0.0              | 0.0                | 165.7          | 2.7   | 2.6          | 0.5                      | 6.9                    | 178.0             | -12.8                     | -6.6                        | 0.0                       | -6.2                     | 0.4                 |
| 2003          | 2181.5            | 171.0              | 0.0              | 0.0                | 128.7          | 2.4   | 2.6          | 0.4                      | 6.9                    | 141.2             | 30.8                      | 15.9                        | 0.0                       | 14.9                     | 17.3                |
| 2004          | 2181.3            | 171.0              | 0.0              | 0.0                | 128.7          | 2.1   | 2.4          | 0.4                      | 6.9                    | 140.4             | 31.5                      | 16.3                        | 0.0                       | 15.2                     | 17.3                |
| 2005          | 2181.3            | 171.0              | 0.0              | 0.0                | 126.7          | 1.7   | 2.1          | 0.3                      | 6.9                    | 139.7             | 32.3                      | 16.7                        | 0.0                       | 15.6                     | 17.3                |
| 2006          | 2181.3            | 171.0              | 0.0              | 0.0                | 128.7          | 1.4   | 1.7          | 0.2                      | 6.9                    | 136.9             | 33.0                      | 17.1                        | 0.0                       | 16.0                     | 17.3                |
| 2007          | 2181.3            | 171.0              | 0.0              | 0.0                | 128.7          | 1.0   | 1.4          | 0.1                      | 6.9                    | 138.1             | 33.8                      | 17.5                        | 0.0                       | 16.3                     | 17.4                |
| 2008          | 2181.3            | 171.0              | 0.0              | 0.0                | 128.7          | 0.7   | 1.1          | 0.1                      | 6.9                    | 137.4             | 34.0                      | 17.8                        | 0.0                       | 16.7                     | 17.4                |
| 2009          | 2181.3            | 171.0              | 0.0              | 0.0                | 128.7          | 0.3   | 0.7          | 0.0                      | 6.9                    | 136.6             | 35.3                      | 15.2                        | 0.0                       | 17.1                     | 17.4                |
| 2010          | 2181.3            | 171.0              | 0.0              | -18.0              | 128.7          | 0.3   | 0.7          | -0.0                     | 6.9                    | 136.6             | 35.3                      | 15.2                        | 0.0                       | 17.1                     | 17.4                |
| TOTAL         | 41093.2           | 3239.3             | 72.0             | 0.0                | 2985.1         | 72.0  | 43.1         | 14.9                     | 129.6                  | 3265.7            | -6.4                      | -6.4                        | 5.0                       | 1.9                      | 1.9                 |



URANIUM FUEL FABRICATION

PLANT NUMBER 4

SUMMARY REPORT

BASED ON A RETURN TO EQUITY OF 12.0 PCT

LEVELIZED CAPITAL CHARGES = 2.46 \$/KG

LEVELIZED EXPENSES = 66.19 \$/KG

TOTAL LEVELIZED PRICE = 68.65 \$/KG

CALCULATED INTERNAL RETURN ON EQUITY = .1 PCT

# URANIUM FUEL FABRICATION

PLANT NUMBER 4 PLANT CAPACITY 1800.

CASH FLOW ANALYSIS IN MILLIONS OF DOLLARS

- STUDY CONDITIONS -

FEDERAL INCOME TAX RATE IS 48.0 PCT  
STATE INCOME TAX RATE IS 7.0 PCT  
STATE REVENUE TAX RATE IS 4.0 PCT  
FEDERAL SURTAX RATE IS 0.0 PCT  
INVESTMENT CREDIT RATE IS 7.0 PCT

CASH FLOW DISCOUNTED TO 1995  
INCOME TAX LOSSES WRITTEN OFF  
SUM OF YEARS DIGITS DEPRECIATION USED  
PRODUCTION UNITS = TONNES OF HEAVY METAL

| PLANT<br>YEAR | UNITS<br>PRODUCED | REVENUE<br>(SALES) | CAPITAL<br>COSTS | WORKING<br>CAPITAL | OPER.<br>COSTS | DEPRN | BOND<br>INT. | INSUR<br>& PROP<br>TAXES | STATE<br>REV.<br>TAXES | TOTAL<br>EXPENSES | INCOME<br>BEFORE<br>TAXES | STATE &<br>FEDERAL<br>TAXES | INVEST-<br>MENT<br>CREDIT | INCOME<br>AFTER<br>TAXES | NET<br>CASH<br>FLOW |
|---------------|-------------------|--------------------|------------------|--------------------|----------------|-------|--------------|--------------------------|------------------------|-------------------|---------------------------|-----------------------------|---------------------------|--------------------------|---------------------|
| 1995          | 0.0               | 0.0                | 0.0              | 0.0                | 0.0            | 0.0   | 0.0          | 0.0                      | 0.0                    | 0.0               | 0.0                       | 0.0                         | 0.0                       | 0.0                      | 0.0                 |
| 1996          | 0.0               | 0.0                | 0.0              | 0.0                | 0.0            | 0.0   | 0.0          | 0.0                      | 0.0                    | 0.0               | 0.0                       | 0.0                         | 0.0                       | 0.0                      | 0.0                 |
| 1997          | 0.0               | 0.0                | 0.0              | 0.0                | 0.0            | 0.0   | 0.0          | 0.0                      | 0.0                    | 0.0               | 0.0                       | 0.0                         | 0.0                       | 0.0                      | 0.0                 |
| 1998          | 0.0               | 0.0                | 14.2             | 0.0                | 0.0            | 0.0   | 0.0          | .3                       | 0.0                    | .3                | -1.2                      | -1.2                        | 1.0                       | .9                       | -13.5               |
| 1999          | 0.0               | 0.0                | 33.8             | 0.0                | 0.0            | 0.0   | .3           | 1.0                      | 0.0                    | 1.2               | -1.2                      | -3.0                        | 2.4                       | 1.8                      | -32.1               |
| 2000          | 783.5             | 53.8               | 23.8             | 18.0               | 89.4           | 6.9   | .9           | 1.4                      | 2.2                    | 100.7             | -46.9                     | -23.9                       | 1.7                       | -21.0                    | -55.9               |
| 2001          | 1590.3            | 109.2              | 0.0              | 0.0                | 157.0          | 6.5   | 2.0          | 1.3                      | 4.4                    | 151.2             | -42.1                     | -21.7                       | 0.0                       | -20.3                    | -13.8               |
| 2002          | 2076.6            | 142.6              | 0.0              | 0.0                | 165.7          | 6.2   | 2.3          | 1.2                      | 5.7                    | 181.1             | -38.6                     | -19.9                       | 0.0                       | -18.7                    | -12.5               |
| 2003          | 2181.3            | 149.7              | 0.0              | 0.0                | 171.9          | 5.8   | 2.6          | 1.2                      | 6.0                    | 187.4             | -37.7                     | -19.5                       | 0.0                       | -18.2                    | -12.4               |
| 2004          | 2181.3            | 149.7              | 0.0              | 0.0                | 128.7          | 5.5   | 2.8          | 1.1                      | 6.0                    | 144.1             | 5.7                       | 2.9                         | 0.0                       | 2.7                      | 6.2                 |
| 2005          | 2181.3            | 149.7              | 0.0              | 0.0                | 128.7          | 5.1   | 2.6          | 1.0                      | 6.0                    | 143.5             | 6.3                       | 3.2                         | 0.0                       | 3.0                      | 6.2                 |
| 2006          | 2181.3            | 149.7              | 0.0              | 0.0                | 128.7          | 4.8   | 2.5          | .9                       | 6.0                    | 142.9             | 6.8                       | 3.5                         | 0.0                       | 3.3                      | 8.1                 |
| 2007          | 2181.3            | 149.7              | 0.0              | 0.0                | 128.7          | 4.5   | 2.3          | .9                       | 6.0                    | 142.3             | 7.4                       | 3.8                         | 0.0                       | 3.6                      | 8.0                 |
| 2008          | 2181.3            | 149.7              | 0.0              | 0.0                | 128.7          | 4.1   | 2.2          | .8                       | 6.0                    | 141.8             | 8.0                       | 4.1                         | 0.0                       | 3.9                      | 8.0                 |
| 2009          | 2181.3            | 149.7              | 0.0              | 0.0                | 128.7          | 3.8   | 2.0          | .7                       | 6.0                    | 141.2             | 8.6                       | 4.4                         | 0.0                       | 4.1                      | 7.9                 |
| 2010          | 2181.3            | 149.7              | 0.0              | 0.0                | 128.7          | 3.4   | 1.9          | .6                       | 6.0                    | 140.6             | 9.1                       | 4.7                         | 0.0                       | 4.4                      | 7.8                 |
| 2011          | 2181.3            | 149.7              | 0.0              | 0.0                | 128.7          | 3.1   | 1.7          | .6                       | 6.0                    | 140.0             | 9.7                       | 5.0                         | 0.0                       | 4.7                      | 7.8                 |
| 2012          | 2181.3            | 149.7              | 0.0              | 0.0                | 128.7          | 2.7   | 1.5          | .5                       | 6.0                    | 139.5             | 10.3                      | 5.3                         | 0.0                       | 5.0                      | 7.7                 |
| 2013          | 2181.3            | 149.7              | 0.0              | 0.0                | 128.7          | 2.4   | 1.4          | .4                       | 6.0                    | 138.9             | 10.8                      | 5.6                         | 0.0                       | 5.2                      | 7.6                 |
| 2014          | 2181.3            | 149.7              | 0.0              | 0.0                | 128.7          | 2.1   | 1.2          | .4                       | 6.0                    | 138.3             | 11.4                      | 5.9                         | 0.0                       | 5.5                      | 7.6                 |
| 2015          | 2181.3            | 149.7              | 0.0              | 0.0                | 128.7          | 1.7   | 1.1          | .3                       | 6.0                    | 137.8             | 12.0                      | 6.2                         | 0.0                       | 5.8                      | 7.5                 |
| 2016          | 2181.3            | 149.7              | 0.0              | 0.0                | 128.7          | 1.4   | .9           | .2                       | 6.0                    | 137.2             | 12.5                      | 6.5                         | 0.0                       | 6.1                      | 7.4                 |
| 2017          | 2181.3            | 149.7              | 0.0              | 0.0                | 128.7          | 1.0   | .8           | .1                       | 6.0                    | 136.7             | 13.1                      | 6.8                         | 0.0                       | 6.3                      | 7.4                 |
| 2018          | 2181.3            | 149.7              | 0.0              | 0.0                | 128.7          | .7    | .6           | .1                       | 6.0                    | 136.1             | 13.7                      | 7.1                         | 0.0                       | 6.6                      | 7.3                 |
| 2019          | 2181.3            | 149.7              | 0.0              | -18.0              | 128.7          | .3    | .5           | -.0                      | 6.0                    | 135.5             | 14.2                      | 7.3                         | 0.0                       | 6.9                      | 25.2                |
| TOTAL         | 41532.0           | 2851.2             | 72.0             | 0.0                | 2623.2         | 72.   | 34.3         | 14.9                     | 114.0                  | 2658.4            | -7.2                      | -6.6                        | 5.0                       | 1.5                      | 1.5                 |

| BEGINNING<br>YEAR | AVERAGE LEVELIZED COST |
|-------------------|------------------------|
| 1977              | 94.168                 |
| 1978              | 94.168                 |
| 1979              | 94.168                 |
| 1980              | 92.925                 |
| 1981              | 92.176                 |
| 1982              | 91.544                 |
| 1983              | 91.544                 |
| 1984              | 91.544                 |
| 1985              | 91.544                 |
| 1986              | 91.544                 |
| 1987              | 91.544                 |
| 1988              | 91.163                 |
| 1989              | 91.163                 |
| 1990              | 91.163                 |
| 1991              | 88.972                 |
| 1992              | 87.442                 |
| 1993              | 85.909                 |
| 1994              | 83.524                 |
| 1995              | 83.524                 |
| 1996              | 83.524                 |
| 1997              | 83.524                 |
| 1998              | 83.524                 |
| 1999              | 83.524                 |
| 2000              | 76.480                 |
| 2001              | 75.012                 |
| 2002              | 73.740                 |
| 2003              | 73.740                 |
| 2004              | 73.740                 |
| 2005              | 73.740                 |
| 2006              | 73.740                 |
| 2007              | 73.740                 |
| 2008              | 73.740                 |
| 2009              | 73.740                 |
| 2010              | 73.740                 |
| 2011              | 68.651                 |
| 2012              | 68.651                 |
| 2013              | 68.651                 |
| 2014              | 68.651                 |
| 2015              | 68.651                 |
| 2016              | 68.651                 |
| 2017              | 68.651                 |
| 2018              | 68.651                 |
| 2019              | 68.651                 |