

## 5.0 BASELINE FORECAST

Demand and production forecasts are given below for the years 1983 and 1990. These estimates were derived from a combination of publicly available forecasts. The projections presented here were done in this manner because historically there have been variations between individual forecasts. Taking an average of the various estimates gives a reasonable and representative forecast without having to determine the merit of each individual forecast and its implicit assumptions. In lieu of developing new forecasting models for demand and production a range and average will be given as a representative forecast, as derived from five published forecasts.

### 5.1 REACTOR FUEL DEMAND FORECAST

Demand forecasts from five different sources were used to develop a representative forecast. Reactor demand can be met in three ways: (1) U.S. production, (2) foreign production, and (3) inventory reduction. Consumption and reactor demand are assumed to be equivalent in this section. Table 5.1 shows the demand forecasts, their sources, and the representative forecast.

TABLE 5.1. Annual U.S. Uranium Demand in Tons  $U_3O_8 \times 10^3$

Source	Year	
	1983	1990
DOE Grand Junction (a)	16.5	23.8
Power Magazine (b)	14.2	18.8
Rocky Mountain Energy (c)	16.3	22.5
Nuclear Assurance Corporation (d)	16.7	20.7
Pickard, Lowe, and Garrick (e)	15.7	20.5
Representative Forecast		
Average	15.9	21.3
Range	14.2-16.7	18.8-23.8

Sources: (a) DeVergie, 1982. Table 5. (Based on the August 1981 low case prepared by the DOE Office of Uranium Enrichment and Assessment).  
(b) Catalano, 1983a. Figure 3.  
(c) Lang, 1982. Figure 13.  
(d) Leamon, 1982. Figure 5. (U.S. Reasonable Case Demand).  
(e) Nuclear Fuel 1983b, p. 8.

## 5.2 DEMAND/OTHER USES

John Hunter, Chief of Reactor Operations, Department of Energy, Washington, D.C., can provide information on uranium demand/use at non-commercial reactors. This information is not immediately available to the public. Since this segment makes up only a small percentage of total uranium demand, it will not be considered here in the ore production forecast.

## 5.3 ORE PRODUCTION FORECASTS

The same five sources that were used in Section 5.1 to develop the reactor fuel demand forecast will be utilized in this section to generate a representative ore production forecast. Explicit forecasts of uranium production were made by two of the sources DOE Grand Junction (DeVergie 1982) and Power (Catalano 1983a). For the other three sources, production forecasts must be derived from the demand forecasts.

Rocky Mountain Energy (Lang 1982) estimated inventory usage in each year of their 1982 to 1996 domestic market demand forecast. Combining their estimated inventory usage with an estimate of imports yields a production forecast as a percentage of demand. For 1983 an estimate of 30% imports was used. "Presently, about 28% of all uranium in the U.S. is imported, and this figure is expected to increase" (Catalano, 1983a). For 1990 imports were estimated as 37.5% of domestic demand which is the proposed import limit. The resulting Rocky Mountain Energy uranium production forecasts as a percentage of demand for 1983 and 1990 are approximately 61% and 55%, respectively.

Using the DOE Grand Junction (DeVergie 1982) and Power (Catalano 1983a) forecasts as well as the derived estimate of demand for Rocky Mountain Energy it was determined that U.S.  $U_3O_8$  production is an estimated 66.7% and 54.7% of reactor demand for the years 1983 and 1990 respectively. Using these values, forecasts of  $U_3O_8$  production were made from the Nuclear Assurance Corporation (Leamon 1982) and Pickard, Lowe & Garrick (Nuclear Fuel 1983b) forecasts of reactor demand. Table 5.2 shows the five  $U_3O_8$  production forecasts and the representative forecast. These forecasts consider only uranium demand for commercial reactors, i.e. demand for other uses is not included as mentioned in Section 5.2. In Table 5.3 the  $U_3O_8$  production is converted to ore production using estimated percent average ore grade as obtained from the U.S. DOE.

**TABLE 5.2. Annual U.S. Uranium Production in Tons  $U_3O_8 \times 10^3$**

Source	Year	
	1983	1990
DOE Group Junction (a)	10.9	9.5
Power Magazine	10.6	7.6
Rocky Mountain Energy (b,d)	9.9	12.4
Nuclear Assurance Corporation (c,d)	11.1	9.4
Pickard, Lowe & Garrick (c,d)	10.5	9.3
Representative Forecast		
Average	10.6	9.6
Range	9.9-11.1	7.6-12.4

Unless otherwise noted, references are the same as Table 5.1.

(a) Figure 8. (40 percent import limit).

(b) Assumes 30% imports for 1983 and 37.5% for 1990.

(c) Assumes 66.7% U.S. reactor demand is supplied by U.S. production for 1983 and 54.7% for 1990. (This is the average of the first three estimates).

(d) Estimate is derived from U.S. reactor demand forecast.

**TABLE 5.3. Annual Ore Production**

(Year)	(Tons $U_3O_8$ )	Average Ore Grade, % <sup>(a)</sup>	(Tons Ore)
1983	10,600	0.12	8,833,333
1990	9,600	0.13	7,384,615

(a) Conventionally mined and milled ore only. Information on percent average ore grade obtained from the DOE, Grand Junction Area office, Grand Junction, Colorado.

## 6.0 RADIONUCLIDE EMISSIONS TO AIR

This section will develop several important aspects of radionuclide emissions to air beginning with a discussion of the parameters and details involved in developing a model for emission measurement. This will be followed by a detailed description of three methods to measure/monitor radionuclide emissions followed by special topics on instrument calibration and vent flow measurement.

As an alternative method for reducing radionuclide emissions, increasing the effective height of release has been considered. A discussion of the increased cost to production resulting from the installation of a 20-meter-high vent stack will be given.

This section will then conclude with a discussion of the impact that current and projected mining activity (ore production) will have on the magnitude of radionuclide emissions to air.

### 6.1 TECHNIQUES FOR MONITORING $^{222}\text{Rn}$ EMISSIONS FROM UNDERGROUND URANIUM MINES

The determination of  $^{222}\text{Rn}$  emissions in uranium mine ventilation exhausts can be reliably made by direct field measurements of radon concentration in the air exhausted from the vent and the vent air-flow rate. It is impractical to rely on measurements of the concentrations of radon or its short-lived daughters taken underground to determine radon emission rates because the underground measurements are normally taken only in areas where active mine work is in progress. Those areas usually receive the main flow of ventilation air and therefore, with the exception of lunch and shop areas have some of the lowest radon and radon daughter concentrations in the mine. However, a large portion of the radon emanating surfaces of most mines consist of old mined-out areas. Those areas are often bulkheaded (closed off) from the active areas of the mine and receive only enough ventilation to keep them at a negative pressure relative to the active areas. Since a large part of the inactive area is often inaccessible, there will be no radon or radon daughter measurements available from them. The air pumped from those areas to the surface tends to have relatively high  $^{222}\text{Rn}$  concentrations but low flow rates and usually contains a large fraction of the total emission of radon.

