4.1 Introduction

Discussions of current and future nuclear reactor designs utilize a convenient international notation based on the decades in which the designs originated. Thus Generation I reactors refer to early prototype reactors designed and built in the 1950s and early 1960s. Generation II reactors are those designed and built in the 1970s and 1980s and therefore include most of the commercial power generating reactors in operation today. Generation III reactors from the late 1990s, 2000s and 2010s are few in number and can be characterized as advanced LWRs, evolutionary designs offering improved economics. Generation IV reactors refer to those that might be possible, the focus of current research and development exploration. This chapter devoted to reactor designs will focus primarily on Generations II and IV.

As illustrated in figure 1, a nuclear power plant is similar to any other coal, gas or oil fired plant except that the source of the heat creating the steam that drives the steam turbines and therefore the electrical generators is the nuclear reactor core rather than the fossil fuel furnace. The focus in this text will be on that core, known as the *nuclear steam supply system* or *NSSS*. It will be assumed that the reader is familiar with the rest of the equipment (known as the *balance of plant*).

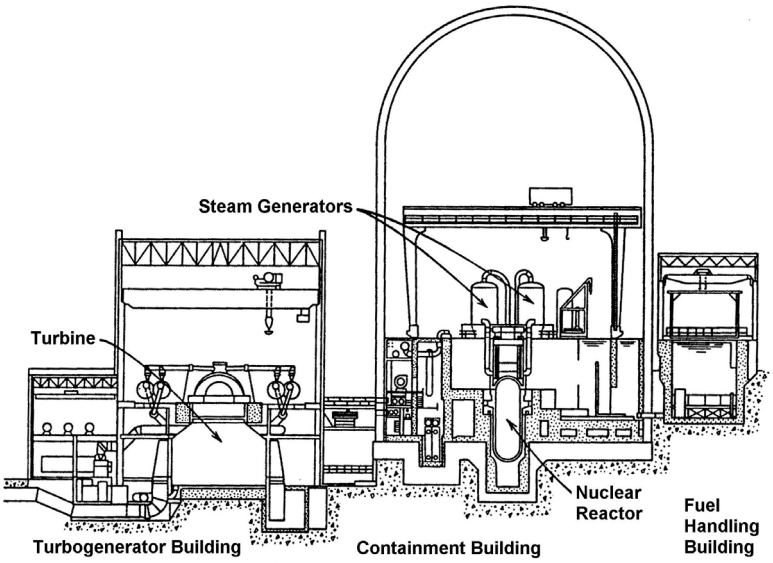

Figure 1: Schematic of a nuclear power plant. From Duderstadt and Hamilton (1976).

Before proceeding with further analysis it is useful to provide some engineering context by briefly describing the design and components of current Generation II reactors. Consequently, the focus of the first part of this chapter will be

on Generation II reactors and those designs used in commercial power generating reactors in operation today. The last sections will briefly describe some of the ideas being explored as Generation IV reactors.