The demand for energy increases dramatically. By the year 2050, the world population is predicted to increase from 6 billion to 10 billion people (U.S. DOE and GIF, 2002) and the global electricity consumption is projected to increase by 160% (Deutch and Moniz, 2006). To satisfy the demand, all options of energy production are needed. Intensive consumption of fossil fuel, however, evidently increases the concentration of CO2, SOx and NOx in the atmosphere, leading to a global climate change. The technology of clean fossil fuel is not proven yet. On the other hand, contribution of renewable energy increases too slowly while the oil and gas resources are depleting. On this account, the role of nuclear energy will be vital in the future. In order to successfully deploy nuclear power plants in the future, the developers of nuclear power plants are faced with challenges in the following issues: (i) safety, (ii) economics, (iii) proliferation and (iv) waste. Some proposals have been put forward to address those challenges by implementing either evolutionary designs or innovative designs. The evolutionary design comprises gradual development and improvements of the power plant to be deployed in near-term future based upon the results of the operational records and the implementation of the defense-in-depth and the probabilistic safety analysis. The innovative design emphasizes on radical advances in design and safety features of the plant for the long-term future deployment (IAEA, 1997b). Here passive safety features and intensive means to prevent core damage are stressed.IOS Press is an international science, technical and medical publisher of high-quality books for academics, scientists, and professionals in all fields. Some of the areas we publish in: -Biomedicine -Oncology -Artificial intelligence -Databases and information systems -Maritime engineering -Nanotechnology -Geoengineering -All aspects of physics -E-governance -E-commerce -The knowledge economy -Urban studies -Arms control -Understanding and responding to terrorism -Medical informatics -Computer Sciences

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