Risk Assessment for Nuclear Power Plant Projects

John R. Longenecker
Ted Quinn
Jeffrey Bannon

ABSTRACT

This paper examines the risks that must be considered in any nuclear power project. Topics discussed are:

- Regional political instability/Changes in government policy with respect to nuclear power;
- The effect of a nuclear incident anywhere in the world;
- Terrorist threats;
- Changes in the relative cost of competing fuels;
- Shortages of skilled labor and/or manufacturing capability for nuclear components;
- Spent fuel storage issues;
- Unique risks inherent in a country's building its first nuclear power plant.

The paper goes into the challenges that all of these topics present to the development and building of a nuclear power plant anywhere in the world, with specific emphasis on challenges in the Middle East. In summary, there are a number of significant issues that must be addressed in any new nuclear power plant project. Early planning and continuous evaluation of these issues throughout the life of the project is essential to success.

EXECUTIVE SUMMARY

There are risks that must be considered in any nuclear power plant project. These risks include:

Regional political instability/Changes in government policy with respect to nuclear power.
A nuclear incident anywhere in the world
Terrorist threats.
Changes in the relative cost of competing fuels.
Shortages of skilled labor and/or manufacturing capability for nuclear components.
Spent fuel storage issues.

1. *Changes in government policy with respect to nuclear power/ Regulatory policy changes*

Nuclear power plants take roughly a decade from the initial planning stages of the project to full plant operation. Any changes in government policy during this period of time can have significant impacts on the project, mainly due to delays in obtaining government approvals to construct and operate the plant. This occurred in 1977 in the US when the Carter Administration adopted anti-nuclear power policies. These policies slowed regulatory approvals, caused multi-year delays to a number of plants under construction, and led to either multi billion dollar cost increases or cancellation of many of the plants in the pipeline.

2. *A nuclear incident anywhere in the world*

Any nuclear power plant event, whether it is a leak of radioactive material or a potential security issue, draws worldwide media attention. A recent example is the July 2007 seismic event in Japan. In this event, all nuclear power plant safety systems worked successfully, and no one was injured or exposed to radiation. However, a small leak (a few liters) of spent fuel pool cooling water made world headlines for weeks.

If an event were to occur that resulted in a more serious release of radioactivity, local support for new nuclear power plants could quickly erode and strong opposition could result. One key aspect of mitigating such risks is to assure that there is a continuing communication plan for the public and all key constituencies from the outset of the project.

3. *Terrorist threats – Need for state of the art security*

Terrorist threats are a concern for any nuclear power project from project inception through operation. Terrorist attacks, even on construction sites (this occurred in France and Germany in the 1980's) raise public concerns regarding the vulnerability of the plant and its fissile material once the plant begins operation.

Nuclear plant buildings and systems are very robust and among the most impervious to terrorist attack. Over the past decade,

plant security has been increased worldwide through the hardening of nuclear power plant vulnerable areas (vehicle barriers, etc.) and the use of advanced technologies both to detect and defeat intruders before they can enter any areas of the plant.

Advances in this area will continue, and can be incorporated into any new project at an affordable cost.

4. Changes in the relative cost of competing fuels.

The price of natural gas may fall during the course of a new nuclear project, as it did recently, causing concerns about the relative economics of a new nuclear plant. Over the past two years, the price of natural uranium has increased from about $10/lb to more than $100/lb raising concerns about the long term stability of nuclear fuel prices. Although nuclear fuel costs are a very small part of the total cost of nuclear generated electricity, this concern must be addressed.

Uranium costs were driven up over the past two years by several factors, including, problems at several large uranium mines in Canada and Australia (flooding causing temporary mine shut down); delays in bringing several new uranium mines (that had been under development for more than a decade) on line; speculators and commodity dealers entering the uranium market for the first time; lack of adequate mining capacity to meet total world demand due to decades of dependence on uranium supplies from US, Russian and other government inventories.

Over the past few years, several hundred new mining ventures have been announced worldwide. Although only a fraction of these are likely to be commercially viable, a significant amount of new supply capacity will come on line over the next decade, alleviating supply issues and lowering world prices. In the interim, the US government is continuing to sell a portion of its inventories of natural and enriched uranium both to alleviate pricing concerns and to generate funds for the treasury while prices are high.

This issue can be effectively addressed by entering into long term nuclear fuel supply contracts that contain pricing protections. Some suppliers offer such contracts with the purchase of a nuclear plant.

5. Shortages of skilled labor and/or manufacturing capability for nuclear components.

Labor and manufacturing shortages for nuclear equipment may become a major issue if a large number of new nuclear plants are ordered concurrent with world wide attempts to update or expand oil refineries, chemical plants, and other industrial infrastructure. There is a limited manufacturing capacity in the world for nuclear grade materials and workers (such as welders) especially in the U.S. For example, in the US, nuclear pressure vessels now require a minimum four year lead time. Advanced planning with vendors and effective oversight of the design and procurement processes to assure adequate product quality is essential to success.

6. Spent Fuel Storage

The used nuclear fuel that is discharged from the reactor can be stored safely on site for decades in secure air cooled spent fuel storage vaults. These vaults are low cost and relatively impervious to terrorist attack. The volume of spent fuel generated depends on the type of reactor.

However, some suppliers of nuclear fuel and nuclear power plants may offer a spent fuel return option under which the power plant returns all fuel to the country of origin for storage or reprocessing. If the returned fuel is recycled, this may involve the return of the resulting waste to the nuclear power plant site or host country as a condition (as is the policy of France). In this instance, the waste would be returned in a stable form (usually borosilicate glass) that is easily stored, is a difficult terrorist target due to its high radiation dose and weight, and that can be stored in air cooled vaults for decades, as is done now in France.

This issue must be addressed early in the project to assure that physical storage and public concern issues are addressed.

7. Unique risks inherent in an country's building its first nuclear power plant

In addition there are the unique risks inherent in an country's building its first nuclear power plant including establishing a regulatory infrastructure, etc.

In summary, there are a number of significant issues that must be addressed in any new nuclear power plant project. Early planning and continuous evaluation of these issues throughout the life of the project is essential to success.