NUCLEAR PHYSICISTS AND ENGINEERS … THE LEADERS NEEDED FOR TODAY'S COMMERCIAL POWER INDUSTRY

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ABSTRACT

Recent operating costs of nuclear power plants worldwide have demonstrated their ability to compete economically with all other sources of electrical power. In 1999, the best year in history for U.S. nuclear plants, nuclear generation was over 22% of the country's total electrical output. Average capacity factors at operating nuclear plants exceeded 90%. Nuclear plant operating, maintenance and fuel costs continued to improve. And, in light of expectations that uranium and enrichment costs will continue to be near their currently low levels, fuel cycle costs are likely to remain at levels at or below one-half cent per kilowatt-hour.

All these signs point to the abilities of existing nuclear plants to compete economically, at or near the one cent per kilowatt-hour goal that Westinghouse foresaw several years ago. These successes are excellent indicators for the industry, but continue to pressure fuel suppliers for ways to achieve ever more reliable and economical fuel designs and core management strategies. Nuclear core engineers are at the center of the need to meet these demands – as they have been since the earliest days of the industry.

Throughout much of the fifty-year history of commercial nuclear power, nuclear engineers and physicists have been able to carry out their research and design efforts somewhat independently of other nuclear plant disciplines. These nuclear engineers and physicists were many of the Founders and Pioneers of today's industry.

Now, however, nuclear fuel is often pushed extremely hard to achieve maximum power output in each reactor cycle. As a consequence, a "Total Systems Approach" to core design and operation is required. Nuclear physics considerations need to be integrated more closely than ever with materials design, thermal-hydraulic design, fuel rod design and reactor coolant chemistry considerations. Recently-observed phenomena such as incomplete control rod insertions, axial

offset anomalies and fuel rod corrosion have taught the industry this lesson quite clearly. A similar approach must be extended from core design considerations across the boundaries of other fuel-cycle related activities, such as uranium asset management and fuel enrichment, to achieve optimum economic design.

Looking ahead, we need to extend today's success into the next generation of nuclear power plants. When we consider the research and development needed to advance our nuclear engineering discipline in the years ahead, we need to see ourselves first as part of a Total System. We need to understand how reactor physics, nuclear materials and plant chemistry all interrelate to determine research directions and priorities. We need to understand the implications of our reload core designs on other plant systems. We need to perform the Loading Pattern Risk Assessments that are necessary to integrate these many disciplines. And we need to integrate all these activities into the context of the entire fuel cycle.

More than ever, our countries need nuclear power to energize their economies. Reactor engineers and physicists, once the Pioneers and Builders of our industry, now need to be its Leaders – to contribute to its continued success.