MIT Workshop-Automation of NPPs

Advanced I&C for NPPs

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Key Desires for Potential Upgrades in I&C Functions and Capabilities

- Number of licensed operator reduced by at least one half, accounting for multiple interconnected plants on site
- Number of plant security personnel reduced by half or more, and enhanced security system capabilities provided
- Eliminate need for emergency safety-grade AC power and assure safety-grade DC power has substantial operating period, e.g., month or more following accidents so prompt response is not required

Major Gains Needed for Advanced I&C Systems

- License I&C systems and meet regulatory requirements with substantial cost and timing reduction compared to current systems
- Resolve fundamental technology issues such as cybersecurity and combination of many different suppliers, systems and components including system/component lives versus that of plant, and spare part changes
- Reduce overall plant costs and schedules by providing specific up-graded I&C functions and capabilities

Potential “Big Data” or “Advanced Informatics”

- I&C Industry is implementing in areas in non-NPPs and by exploring areas in some NPPs
- Some use of Advanced Intelligence (AI) learning algorithms to correlate inputs and trace trends without detailed plant model
- Other approaches being considered to use operational data and more detailed physical models of plant systems.
- Intent is early, effective detection of occurrence and progression of plant failures to achieve optimal plant performance and avoid plant outages.
- Potential approach could be to utilize plant data already in existence to assess ability to detect and deal with issues that have occurred, and decide how many monitoring instruments and analyses are needed to obtain major financial and safety benefits

Examples of Potential R&D Items

- Dealing with emergent problems - achieve reliable proven tools, procedures, and support equipment once required performance conditions are understood (including cost and timing)
- Advanced Instrumentation/Monitoring of new plant materials and more demanding operating conditions such as higher temperature and radiation
- Robotics for Operation and Maintenance with wider application during normal operation such as faster access to plant equipment at power, fewer personnel needed for testing, maintenance and repair
- Advanced instrumentation for severe accident conditions, providing enhanced operator understanding and guidance to assure safety and minimize radiation release
- Robotics for dealing with specific major effects from major site accidents as well as from environmental event impacts on-site or via off-site systems/interfaces, e.g., seismic, flooding, grid failures, transportation failures, etc