Turning the Tables on Digital Upgrade Issues

New design guideline will help instrumentation and control engineers incorporate digital technology considerations into plant modification processes.

Poorly executed digital upgrades have caused plant trips and other undesirable results that could have been avoided. To increase the likelihood of successful upgrades and the likelihood that key technical issues will be addressed early on, EPRI developed the Digital Instrumentation and Control Design Guide (3002002989), which systematically and comprehensively addresses digital technology issues within the framework of existing plant modification processes. The guidance reflects the extensive experience and lessons learned of several experienced plant engineers.

The engineering change processes used at existing nuclear plants are typically based on regulations, standards, and guidance that do not specifically address digital technology issues. Moreover, the aspects specific to digital design, especially software elements, are often not well integrated into the overall plant design change process and are sometimes overlooked entirely. This can lead to inadequate treatment of key issues, resulting in significant unanticipated project costs and delays, and undesired events and system behaviors after installation, up to and including inadvertent plant trips.

The Digital Instrumentation and Control Design Guide can help improve the degree to which the digital design activities are integrated with the plant modification process to ensure that the key digital issues are properly addressed throughout the life cycle of a digital system. The guide parses the important digital-specific activities by engineering topic (analysis, requirements, procurement, human factors, testing, data communications, etc.) and organization (engineering, operations, program management, etc.), and offers suggested responsibilities, activity sequencing, and interactions that might be expected among stakeholders during the various phases of the modification process.

A large wall poster that accompanies the guideline illustrates relationships among the activities and stakeholders using a “swimlane format” (see figure). The swimlane diagrams help communicate the bigger picture to stakeholders and drive successful coordination among participating organizations.

A user does not have to read and digest the complete guideline to apply it. After reading the introductory sections, they can use the table of contents to find specific topics of interest and go to the corresponding sections to find detailed swimlane figures and related materials that explain the relevant activities and interactions, with specific references to more detailed information. For example, a human factors expert assigned to a large project could quickly go to that section of the guideline and identify all the activities they would be directly or indirectly
involved in during each phase of the project and then consult the reference materials for additional guidance as needed.

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The Digital Design Guide addresses stakeholder activities in the context of the plant modification process.