

Fact Sheet on
Nuclear Power Plant Instrumentation and Control Technologies

Background

Nuclear power plants (NPPs) are facing challenges in several instrumentation and control (I&C) areas with ageing and obsolete components and equipment. With license renewals and power uprates, the long-term operation and maintenance of obsolete I&C systems may not be a cost-effective and reliable option. The effort needed to maintain or increase the reliability and useful life of existing I&C systems may be greater in the long run than modernizing I&C systems or replacing them completely with new digital systems. The increased functionality of the new I&C systems can also open up new possibilities to better support the operation and maintenance activities in the plant. The IAEA recognizes the importance of the profound role the I&C systems play in the reliable, safe, efficient, and cost-effective operations of NPPs by supporting the activities of the Department of Nuclear Energy's Technical Working Group on Nuclear Power Plant Control and Instrumentation (TWG-NPPCI). The group was established in March 1970. Its membership currently includes thirty Member States and three international organizations. The most recent meeting of the TWG-NPPCI was held in May 2005 in Vienna. The meeting report is available at http://www.iaea.org/OurWork/ST/NE/NENP/twg_nppc.html. The next meeting of the TWG-NPPCI will be the 21st meeting of the advisory body, and it will be held in May 2007.

Recently completed work

On the recommendation of the TWG-NPPCI, the following IAEA I&C Technical Meetings were held recently:

- “On-line Condition Monitoring of Equipment and Processes in Nuclear Power Plants Using Advanced Diagnostic Systems”, 27-30 June 2005, Knoxville, Tennessee, USA
- “The Impact of Modern Technology on Instrumentation and Control in Nuclear Power Plants”, 13-16 September 2005, Chatou, France
- “Implementing and Licensing Digital Instrumentation and Control Systems and Equipment in Nuclear Power Plants”, 22-25 November 2005, Espoo, Finland.

The topics discussed at these technical meetings included the following larger issues:

- Ageing of I&C Systems, Equipment, and Cables; I&C Modernization Projects
- On-Line Condition Monitoring Techniques and Applications
- Data Acquisition Systems Required for On-Line Monitoring
- Implementation of On-Line Monitoring for Instrument Channels and Reactor Systems
- Loose Parts and Vibration Monitoring Systems; Anomaly Detection and Diagnostics
- Control Room & Human System Interface Modernization in NPPs; Hybrid Control Rooms
- Computerized Operator Support Systems
- Equipment Qualification Procedures
- Role of I&C in Power Upgrading and License Renewal Projects
- Challenges for Utilities and Regulators in Implementing & Licensing Digital I&C Systems
- Reliability of Software in Digital I&C Systems; Design Process for Safety Critical I&C Systems
- New Sensor Technology and Signal Processing Techniques

For more information visit

<http://www.iaea.org/OurWork/ST/NE/NENP/NPES/Activity/infrastr.html>

Looking ahead

Additional Technical Meetings will be held this year covering a wide variety of I&C issues relevant to I&C safety system modernization, plant performance improvements, power uprating and I&C cyber security:

- Joint IAEA-EPRI Workshop on NPP I&C Systems Modernization to be held in Vienna on 3-6 October 2006
- Cyber Security of Nuclear Power Plant Instrumentation, Control, and Information Systems to be held in Idaho Falls, ID, the USA on 17-20 October 2006
- Increasing Power Output and Improving Performance of NPPs by Improved I&C Systems to be held in Prague, Czech Republic on 28 November – 1 December 2006

For more information please visit <http://www.iaea.org/OurWork/ST/NE/NENP/NPES/index.html>

In addition, the work on six new I&C-related technical documents has been already started or will be started this year. These I&C documents support improvements in both the cost-effectiveness and the safety of operation and maintenance activities. The consultancy meetings cover the following areas:

- “Integration of Analog and Digital I&C Systems in Hybrid Main Control Rooms” was held in March 2006. A Technical Meeting on the subject is planned for 2007.
- “Avoiding Common Cause Failures in Digital I&C Systems” was held in March 2006. A Technical Meeting on the subject is planned for 2007.
- “On-line Monitoring for NPPs; Part 2: Process and Component Condition Monitoring and Diagnostics” was held in April 2006.
- “The Role of I&C Systems in Power Up-Rating Projects in Nuclear Power Plants” will be held in August 2006.
- “Implementing and Licensing Digital I&C Systems and Equipment in Nuclear Power Plant” will be held in September 2006. A Technical Meeting on the subject is planned for 2007.
- “Testing the Dynamic Response and Effectiveness of Reactor Protection Systems and Their Instrumentation” will be held in December 2006. An additional Consultancy Meeting on the subject is planned for 2007.

How to benefit from these activities?

Member States can benefit by directly taking part in the work of Technical Meetings and Consultancy Meetings, or by using the materials produced at these meetings (proceedings, technical and guidance documents). Initiations of national TC projects, focusing on country or utility specific areas, can be requested by Member States on any of the above I&C-related subjects. Currently, NPES supports national TC projects in Argentina, China, Hungary, Iran, Mexico, and Ukraine. Support is also provided on selected NPP I&C areas under Regional TC Projects in the European Region (RER/4/027) and the Asian Region (RAS/4/021).

For more information please contact your IAEA TC Country Officer, or

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