



Technical Meeting on Instrumentation and Control Aspects of Human Factors Engineering: Design and Analysis

**Hosted by the
Government of Spain**

**through
Tecnatom**

Madrid, Spain

4–7 September 2018

Ref. No.: EVT1702866

Information Sheet

A. Background

The personnel at a nuclear power plant (NPP) play a vital role in the safe and efficient generation of power. Operators monitor and control the plant to ensure it is functioning properly. Test and maintenance personnel help to ensure that the equipment is working as it should and restore components when malfunctions occur. Personnel performance and the resulting plant performance are influenced by many aspects of plant design, including the level of automation, personnel training, and the human–system interfaces (HSIs) provided for personnel to interact with the plant. These interfaces include alarms, displays and controls that are located in the main control room, as well as numerous local control positions situated throughout the plant.

Human–system interfaces can have different characteristics depending on the technology installed in the plant, the operational and maintenance requirements, the operational and maintenance environment

and ergonomics. Safety and availability requirements may also determine the capabilities and configuration of an HSI. Human–system interfaces are becoming more computer based, incorporating features such as ‘soft controls’ and computerized procedures, touch screen interfaces, sit-down workstations, and large screen overview displays. The plant instrumentation and control (I&C) and HSI designs can impact the role of personnel, the tasks to be performed and the way they are performed, and the knowledge, skills and training required of personnel.

While modern plant HSI designs can greatly improve personnel and plant performance, it is important to recognize that, if poorly planned, designed or implemented, there is the potential to negatively impact performance and maintainability for both the equipment and the worker and reduce human reliability, resulting in a detrimental effect on safety and cost effective power production. Human factors engineering is needed to ensure that the benefits of the technology are realized and problems with its implementation are minimized. A structured approach and guidance on human factors engineering in the design and modification of HSIs needs to be followed in order to minimize the risk of human errors and optimize human performance.

The IAEA’s Division of Nuclear Installation Safety has prepared a new Safety Guide entitled *Human Factors Engineering in the Design of Nuclear Power Plants*, which is under publication at present. The guide provides a structured approach and guidance on human factors engineering in the design and modification of HSIs in order to minimize the risk of human errors and optimize human performance to ensure the safe operation of NPPs. It focuses on recommended designs but not on implementation issues.

Recognizing the relevance of the above-mentioned issues and the rapid development of techniques, the members of the Technical Working Group on Nuclear Power Plant Instrumentation and Control (TWG-NPPIC) at their 2017 meeting recommended to the IAEA that it should initiate relevant activities to address these problems in the nuclear power engineering field. In response, the IAEA is developing a new IAEA Nuclear Energy Series report provisionally entitled *Instrumentation and Control Aspects of Human Factors Engineering: Design and Analysis* to provide guidance to Member States in this area.

The objective of this proposed new publication is to provide an overview of the current knowledge, up-to-date best practices, experiences, benefits and challenges related to the design of HSIs taking into account the most up-to-date human factors engineering principles. The planned IAEA Nuclear Energy Series report will complement the proposed new Safety Guide provisionally entitled *Human Factors Engineering in the Design of Nuclear Power Plants* (DS492). It will elaborate on some specific areas of design and analysis in a more in-depth manner and with a focus on practical aspects. The document is intended to be used by Member States to support the design, development, licensing, implementation and operation of HSIs at NPPs.

B. Objectives

The purpose of the meeting is to serve as an international forum for sharing best practices and strategies used in the application of human factors engineering principles in the design of HSIs, as well as for discussing the challenges and issues that need to be resolved in this area. An additional goal of the meeting is to disseminate information on the lessons learned through the work carried out so far on the above-mentioned proposed new IAEA Nuclear Energy Series report, and to review the latest draft of this document.

The meeting has the following primary objectives:

- To provide an international forum for presentations and discussions on the subject of the meeting;
- To strengthen Member States' capabilities for improved understanding of the I&C aspects of human factors engineering;
- To disseminate the experience that has been gained while developing the new IAEA Nuclear Energy Series report provisionally entitled *Instrumentation and Control Aspects of Human Factors Engineering: Design and Analysis*;
- To review the draft version of that report; and
- To support the IAEA in defining future activities in the field of I&C system design for NPPs.

C. Topics

Presentations are invited on all approaches that are related to the I&C aspects of human factors engineering in the design of NPPs. The following list provides examples of presentation topics that would be appropriate for the meeting:

- Human factors engineering requirements
- Operating experience review, functional analysis and allocation, task analysis, HSI analysis and review
- Control centre design guidance and 'end point vision', hybridization of control rooms
- Design and review methods in human factors engineering
- HSI technologies, effectiveness, performance/reliability impact
- Implementation strategies
- I&C aspects of computerized operator support systems and procedures
- I&C support for better situational awareness of NPP operators and workers
- Cognitive workload and distraction analysis in control room design, HSI-induced cognitive error analysis
- Issues with the level of control automation, including human–automation interaction
- Software and hardware methods and tools for prevention of errors of NPP operators and workers
- Application of augmented/virtual reality technologies in the design of HSIs
- HSI functions dedicated to the maintenance of hardware and software
- I&C aspects of supporting control room staff and field workers for operations, maintenance and productivity improvements — use of mobile and smart devices
- Lessons learned from experience (case studies, operating experience, proven practices, etc.).

D. Working Material

The draft manuscript of the new IAEA Nuclear Energy Series report provisionally entitled *Instrumentation and Control Aspects of Human Factors Engineering: Design and Analysis* will be provided to the participants prior to the meeting. This draft will serve as the basis for dialogues at the meeting. Participants will be requested to review selected parts of the document and to provide their remarks and comments.

E. Participation

In view of the subject of the meeting, participation is limited to IAEA Member States that currently operate NPPs or are constructing their first NPP units. Participation is solicited from representatives of NPPs and regulatory bodies, utilities, technical support organizations, designers, developers, vendors, and research organizations engaged in the field of HSI design for NPPs. To ensure maximum effectiveness in the exchange of information, participants should be persons actively involved in the subject matter of the meeting.

F. Application Procedure

Designations should be submitted using the attached Participation Form (Form A). Completed forms should be endorsed by the competent national authority (e.g. Ministry of Foreign Affairs, Permanent Mission to the IAEA, or National Atomic Energy Authority) and returned through the established official channels. They must be received by the IAEA not later than **18 June 2018**. Designations received after that date or applications sent directly by individuals or by private institutions cannot be considered. Designating Governments will be informed in due course of the names of the selected candidates and at that time full details will be given on the procedures to be followed with regard to administrative and logistic matters.

The meeting is, in principle, open to all officially designated persons. The IAEA, however, reserves the right to limit participation due to limitations imposed by the available facilities. The maximum number of participants for this meeting (excluding those from Spain) is 50. It is, therefore, recommended that interested persons take the necessary steps for securing their official designation as early as possible.

G. Visas

Designated participants who require a visa to enter Spain should submit the necessary application to the nearest diplomatic or consular representative of Spain as soon as possible.

H. Expenditure

The costs of the meeting are to be borne by the host organization; no registration fee is charged to participants. Travel and subsistence expenses of participants will have to be borne in general by their designating Governments/organizations. The IAEA has, however, limited funds at its disposal to help meet the cost of attendance of certain participants. Such assistance may be offered upon specific request to one participant per country provided that, in the IAEA's view, the participant on whose behalf assistance is requested will make an important contribution to the meeting. The application for financial support should be made at the time of designating the participant.

The organizers of the meeting do not accept liability for the payment of any cost or compensation that may arise from damage to or loss of personal property, or from illness, injury, disability or death of a participant while he/she is travelling to and from or attending the meeting, and it is clearly understood that each Government, in designating participants, undertakes responsibility for such coverage. Governments would be well advised to take out insurance against these risks.

I. Presentations

Presentations should be prepared as Microsoft PowerPoint (.ppt) or Portable Document Format (.pdf) files. Computer-based projection facilities will be provided. Authors are requested to provide the Scientific Secretary (see Section M) with electronic copies of their presentation files in advance of their scheduled presentation slot so that the files can be duly uploaded. Electronic versions of the presentations are also necessary to ensure timely issuance of the proceedings to be prepared and distributed in electronic form.

It is not mandatory for all participants to submit a presentation. However, the IAEA welcomes and encourages contributions in this format. Time for the presentations will be limited to 25 minutes followed by a five-minute discussion period. The number of presentations may have to be limited so as to leave sufficient time for discussions and review of the draft IAEA Nuclear Energy Series report provisionally entitled *Instrumentation and Control Aspects of Human Factors Engineering: Design and Analysis*.

J. Working Language

The working language of the meeting will be English; no interpretation will be provided.

K. Local Arrangements

The meeting will be held at TBD, Madrid, Spain and will start on Tuesday, 4 September 2018, at 9.30 a.m. and end on Friday, 7 September 2018, at 2.00 p.m.

The meeting agenda, together with information on local arrangements, will be sent to the designated participants in due course.

The local representative of the host organization (Tecnatom) will be Mr Pedro Trueba Alonso.

Contact details:

Mr Pedro Trueba Alonso
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Host organization administrative assistance:

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L. Accommodation

The host organization (Tecnatom) will be providing an Internet link to the appropriate hotel webpage to help participants in making hotel room reservations at the TBD Hotel. Participants are requested to book their rooms themselves. Information on the hotel can be found at: TBD

Additionally, participants may elect to make their own bookings at other hotels in the area of the meeting location.

M. IAEA Secretariat

The IAEA Scientific Secretary for the meeting is Mr Janos Eiler of the Department of Nuclear Energy. His contact details are:

Mr Janos Eiler

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Subsequent correspondence on scientific matters should be sent to the Scientific Secretary and correspondence on other matters related to the meeting to the Administrative Secretary.