IAEA
International Atomic Energy Agency
Atoms for Peace and Development

Technical Meeting on Digitalization and the Use of Artificial Intelligence in Advanced Nuclear Fuel Manufacturing and Quality Control

IAEA Headquarters, Vienna, Austria
and virtual participation via Cisco Webex

27-31 July 2026

Ref. No.: EVT2504147

Information Sheet

Introduction

The global trend toward digital transformation is reshaping the nuclear industry, including the design, fabrication, and quality control (QC) of nuclear fuels. The adoption of digital technologies, Artificial Intelligence (AI), and Machine Learning (ML) presents significant opportunities to enhance process efficiency, product quality, and safety assurance throughout the nuclear fuel cycle.

The complexity of modern nuclear fuel engineering — encompassing advanced materials, high-precision fabrication, stringent safety and regulatory requirements, and extensive quality verification — demands increasingly sophisticated analytical and decision-support tools. Traditional approaches to data analysis, process optimization, and quality control are reaching their practical limits as the volume, diversity, and velocity of data generated in fuel manufacturing continue to grow. AI and ML methods provide the capability to process large, heterogeneous datasets to detect subtle correlations, identify anomalies, and predict performance trends that would be difficult or impossible to discern through conventional techniques.

In nuclear fuel manufacturing, digitalization and digital twins are emerging as transformative tools for enhancing production efficiency and quality assurance. Their applications include defect detection, simulation of chemical and mechanical processes for equipment optimization, training and knowledge retention, and predictive quality management. AI systems can support the optimization of process

parameters, enable the early detection of defects, and facilitate the simulation of fuel behaviour under irradiation, thereby improving product reliability, reducing manufacturing variability, and shortening development cycles. Digital twins and predictive analytics can enable real-time monitoring and adaptive process control, contributing to more stable and reproducible production.

In the area of research and design, AI-driven materials informatics can accelerate the discovery and qualification of advanced fuel compositions and improve understanding of their thermo-mechanical properties. The integration of AI into fuel manufacturing and quality assurance systems also enhances knowledge preservation and transfer, capturing expert insights and institutional experience in digital form – an increasingly important objective as experienced personnel retire and new generations enter the nuclear workforce.

However, the implementation of AI and digital technologies introduces new challenges. These include managing large and complex data sets; ensuring data integrity, cybersecurity, and interoperability; and addressing the risks associated with uncorrelated or incomplete datasets that may complicate quality assessments. Special attention must also be given to the standardization of procedures and equipment, including robotics, sensors, and data interfaces, to ensure consistency and reliability across systems and facilities. Furthermore, model validation, regulatory acceptance, and maintaining the appropriate balance between automated and human decision-making are essential. Ensuring transparency, traceability, and explainability of AI-based decisions is crucial for building confidence among regulators, operators, and the public.

AI is also being increasingly explored for fuel behaviour simulation and multi-physics applications. For instance, combining neural networks (NNs) for individual physical phenomena can create integrated, physics-informed computational frameworks. While data-driven algorithms excel at interpolation within known domains, their performance can deteriorate significantly when extrapolating beyond trained data. Therefore, physics-informed neural networks (PINNs) and AI-assisted scientific computing approaches are needed, where physical laws are embedded directly into the learning process – for example, by adding physics terms to the loss function or by adapting the architecture of neural networks to reflect physical relationships. These hybrid approaches can improve both accuracy and reliability for extrapolative predictions, supporting next-generation simulation and predictive modelling capabilities in nuclear fuel engineering.

Members of the IAEA Technical Working Group on Fuel Cycle Facilities (TWG-FCF) and of the IAEA Nuclear Fuel Engineering (NFE) Network's Task Forces on Fuel Manufacturing and Quality Management, as well as on AI/ML in Nuclear Fuel Engineering, have recognized the growing importance of these developments and recommended that the IAEA organize a Technical Meeting to bring together key stakeholders – including fuel manufacturers, utilities, reactor designers, regulators, and representatives from industries with mature AI integration – to discuss management systems, cybersecurity, human–AI collaboration, and shared lessons from both successful and unsuccessful implementations.

In response, the IAEA will organize a Technical Meeting on Digitalization and the Use of Artificial Intelligence in Advanced Nuclear Fuel Manufacturing and Quality Control, from 27-31 July 2026 at the IAEA Headquarters in Vienna, Austria, to facilitate the exchange of knowledge, experience, and best practices in the digitalization of fuel manufacturing and the application of AI for Nuclear Fuel Engineering.

Objectives

The purpose of the event is to bring together key stakeholders, including fuel manufacturers, utilities, reactor designers, regulators and representatives from industries with mature artificial intelligence (AI) integration, to explore the potential for digitalization and the use of AI in nuclear fuel manufacturing and quality control, including challenges and implementation pathways.

Target Audience

Participation in the workshop is subject to designation by Governments or national organizations. The workshop is open to participants from fuel manufacturers, utilities, reactor and fuel designers, regulators and technical support organizations, research institutions and laboratories, national authorities from all IAEA Member States with existing or planned activity on the Use of Artificial Intelligence in Nuclear Fuel Engineering and industry partners.

Working Language(s)

English.

Topics

The meeting will cover a broad range of topics related to digital transformation and AI integration in fuel manufacturing and QC, including:

- AI-based optimisation of fuel and core designs;
- Application of AI/ML in nuclear fuel fabrication and quality control;
- Application of AI/ML in fuel performance simulation including use of surrogates, as well as Large Language Models (LLMs) coding assistants;
- Application of AI in the material discovering;
- Data management and knowledge retention (e.g. use of LLMs to inform literature reviews);
- Cybersecurity, safety, and regulatory aspects of AI deployment;
- Cross-sectoral insights and best practices from other then nuclear industries experienced in digital and AI technologies.

Participation and Registration

All persons wishing to participate in the event have to be designated by an IAEA Member State or should be members of organizations that have been invited to attend.

In order to be designated by an IAEA Member State or invited organization, participants are requested to submit their application via the InTouch+ platform (https://intouchplus.iaea.org) to the competent national authority (Ministry of Foreign Affairs, Permanent Mission to the IAEA or National Atomic Energy Authority) or organization for onward transmission to the IAEA by **15 May 2026**, following the registration procedure in InTouch+:

1. Access the InTouch+ platform (https://intouchplus.iaea.org):
   - Persons with an existing NUCLEUS account can sign in to the platform with their username and password;
   - Persons without an existing NUCLEUS account can register here.

2. Once signed in, prospective participants can use the InTouch+ platform to:
   - Complete or update their personal details under 'Complete Profile' and upload the relevant supporting documents;
   - Search for the relevant event under the 'My Eligible Events' tab;
   - Select the Member State or invited organization they want to represent from the drop-down menu entitled 'Designating Authority' (if an invited organization is not listed, please contact InTouchPlus.Contact-Point@iaea.org);
   - If applicable, indicate whether a paper is being submitted and complete the relevant information;
   - If applicable, indicate whether financial support is requested and complete the relevant information (this is not applicable to participants from invited organizations);
   - Based on the data input, the InTouch+ platform will automatically generate the Participation Form (Form A) and/or the Grant Application Form (Form C);
   - Submit their application.

Once submitted through the InTouch+ platform, the application, together with the auto-generated form(s), will be transmitted automatically to the required authority for approval. If approved, the application, together with the applicable form(s), will automatically be sent to the IAEA through the online platform.

NOTE: The requests for financial support should be made, together with the submission of the applications, by **15 May 2026.**

For additional information on how to apply for an event, please refer to the InTouch+ Help page. Any other issues or queries related to InTouch+ can be sent to InTouchPlus.Contact-Point@iaea.org.

Selected participants will be informed in due course on the procedures to be followed with regard to administrative and financial matters.

Participants are hereby informed that the personal data they submit will be processed in line with the Agency's Personal Data and Privacy Policy and is collected solely for the purpose(s) of reviewing and assessing the application and to complete logistical arrangements where required. The IAEA may also use the contact details of Applicants to inform them of the IAEA's scientific and technical publications, or the latest employment opportunities and current open vacancies at the IAEA. These secondary purposes are consistent with the IAEA's mandate. Further information can be found in the Data Processing Notice concerning IAEA InTouch+ platform.

Papers and Presentations

The IAEA encourages participants to deliver presentations on the work of their respective institutions that falls under the topics listed above. Approximately 25 minutes will be allotted for each presentation, including floor discussion.

Participants who wish to deliver presentations are requested to submit an abstract of their work. The abstracts will be reviewed as part of the selection process for presentations. The abstracts should be in A4 page format, should be **more than 2 pages but less than 4 pages** (including figures and references) and should be in the IAEA template available in INDICO platform.

Additionally, for the selection process, abstracts must be submitted through the INDICO platform not later than **15 May 2026.** Authors will be notified of the acceptance of their proposed work by **31 May 2026.**

Submission of a presentation should be confirmed, together with the submission of the main application via the InTouch+ platform, by **15 May 2026.**

Expenditures and Grants

No registration fee is charged to participants.

The IAEA is generally not in a position to bear the travel and other costs of participants in the event. The IAEA has, however, limited funds at its disposal to help meet the cost of attendance of certain participants. Upon specific request, such assistance may be offered to normally one participant per country, provided that, in the IAEA's view, the participant will make an important contribution to the event.

The requests for financial support should be made, together with the submission of the applications, by **15 May 2026.**

Venue

The event will be held at the Vienna International Centre (VIC), where the IAEA's Headquarters are located. Participants must make their own travel and accommodation arrangements.

General information on the VIC and other practical details, such as a list of hotels offering a reduced rate for IAEA participants, are listed on the following IAEA web page:

www.iaea.org/events.

Participants are advised to arrive at Checkpoint 1/Gate 1 of the VIC one hour before the start of the event on the first day in order to allow for timely registration. Participants will need to present an official photo identification document in order to be admitted to the VIC premises.

In addition, the event will allow for virtual participation via Cisco WebEx.

Visas

Participants who require a visa to enter Austria should submit the necessary application to the nearest diplomatic or consular representative of Austria at least four weeks before they travel to Austria. Since Austria is a Schengen State, persons requiring a visa will have to apply for a Schengen visa. In States where Austria has no diplomatic mission, visas can be obtained from the consular authority of a Schengen Partner State representing Austria in the country in question.

IAEA Contacts

Scientific Secretaries:

Ms Anzhelika Khaperskaia
Division of Nuclear Fuel Cycle and Waste Technology
Department of Nuclear Energy
International Atomic Energy Agency
Vienna International Centre
PO Box 100
1400 VIENNA
AUSTRIA

Tel.: +43 1 2600 22760
Fax: +43 1 26001
Email: A.Khaperskaia@iaea.org

Mr. Lakshman Valiveti
Division of Nuclear Installation Safety
Department of Nuclear Safety and Security
International Atomic Energy Agency
Vienna International Centre
PO Box 100
1400 VIENNA
AUSTRIA

Tel.: +43 1 2600 22473
Fax: +43 1 26007
Email: L.Valiveti@iaea.org

Administrative Secretary:

Mr Ufuk Can Kalender
Division of Nuclear Fuel Cycle and Waste Technology
Department of Nuclear Energy
International Atomic Energy Agency
Vienna International Centre
PO Box 100
1400 VIENNA
AUSTRIA

Tel.: +43 1 2600 24656
Fax: +43 1 26007
Email: u.kalender@iaea.org

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

Event Web Page

Please visit the following IAEA web page regularly for new information regarding this event:

www.iaea.org/events/EVT2504147

INDICO Webpage for Paper submission: https://conferences.iaea.org/event/455/