

## UK Nuclear Sector AI Strategy

### **Vision**

Ensure that the nuclear sector has access to the AI skills and capabilities to meet the challenge to modernise approaches to whole-life safety and regulation. It is important we move industry forward at the same pace to avoid friction which could slow down the pace of progress for the sector. The Fingleton led nuclear regulatory review, published in 2025, further recommends that we “Establish a nuclear digital strategy to accelerate the take up of digital technologies, including AI, to modernise approaches to whole-life safety and regulation”

To deliver this, it is proposed that the AI4Nuclear group leads an activity to outline a strategy for AI within the nuclear sector. The outline scope for this strategy, developed by the AI4Nuclear steering group, is set out in this document:

*About AI4Nuclear: AI4Nuclear is a special interest group run through the Nuclear Institute. Its members provide a broad cross-sector and domain specific expertise covering policy & regulation, technology and nuclear science and engineering. Our groups terms of reference are focused on the development for a guidance framework for the adoption of AI. It currently reaches over 130 organizations working in the nuclear sector and over 350 individual members have attended its online and in-person meetings since 2022.*

### **Scope of the UK Nuclear Sector AI Strategy**

There are 6 proposed pillars of a nuclear industry AI strategy, subject and content of which is outlined below:

#### **(1) People, skills and culture:**

- Skills development focusing on enhancing existing competencies in nuclear engineering and sciences. Define a sector-wide AI competency framework (e.g., AI model developers, AI assurance engineers, human–AI teaming specialists).
- New skilling of individuals working in the sector through for example the creation of a nuclear sector focused AI Skills Boost programme. Making sure that we have the right skills to right problem building on the current technocratic nature of the sector. Establish professional accreditation routes via to formalise AI capability in nuclear.
- Introduce leadership training on AI governance and strategic adoption to drive culture change and accountable ownership across the sector.

## **(2) Governance, ethics and psychological safety:**

- Ensuring organisations have the correct policies, procedures and guidance to implement AI within UK and international regulatory and legal frameworks.
  - Define procedures for application of AI in specific business contexts covering topics including managing model drift, dataset degradation, bias detection/mitigation, and retirement criteria.
- Ensuring that individuals have the confidence to report issues accurately in an industry where AI enhanced decision making (and automated) decision making becomes increasingly common. This is vital to ensuring that AI (particularly agentic AI) has trustworthy data from which to base models on.
  - Codify human-in-the-loop / human-on-the-loop principles for safety-relevant and regulator-facing AI applications.
  - Define psychological safety metrics and reporting channels, especially where AI outputs conflict with human judgement.

## **(3) Data and knowledge management:**

- Ensure that UK sovereign data can be exploited by UK companies to maximise the GVA generated from our 80+ years of nuclear knowledge.
- Nuclear-sector data is uniquely positioned to advance AI in areas such as ultra-reliable anomaly detection, robust uncertainty quantification, physics-informed neural networks, safety verification, and explainable systems for high-risk environments. Because these applications demand provable reliability under uncertainty, nuclear operations provide an exceptionally rigorous testbed for developing next-generation AI validation, safety, and assurance frameworks for mission-critical systems.

## **(4) Science, technology and infrastructure:**

- Define what bodies need to be established to sit at the intersection between industry (need) and the technology development (research) ensuring that the UK promotes industry relevant world-class research in AI.
- Develop a set of common standards to access sovereign-UK and cloud-based resources to enable the practical implementation of AI tools within the nuclear industry.
- Define the role for AI growth zones in developing AI technologies to support the nuclear sector.

**(5) Regulation and trustworthiness:**

- Develop an assurance framework to bring technical competency, application context competency and innovation process competency together to build trustworthiness to the implementation of AI within the sector.
  - Stand up AI validation testbeds (including regulatory sandboxes): synthetic data generation, digital twins, and safety-critical scenario replay.
- Develop a roadmap for accessing UK compute assets for nuclear-specific workloads, including confidential compute.
- Issue guidance on responsible use of generative AI for specific purposes including the production of technical documentation, modelling assistance, and safety case support.
- Create a joint industry–regulator working group to iterate guidance, share lessons, and reduce time-to-clarity.

**(6) Business goals and use cases:**

- Helping organisations navigate the complex landscape of AI technology, adapting to the high decision density associated with AI adoption across all 6 pillars of the nuclear AI strategy.
- Develop models for business change, quantifying the risk and return. This will be centred on the development of a new operating model for the nuclear sector relying on proportionally fewer human resources dedicated to safety case development and safety management supplemented by AI based technologies.
- Sharing learning across projects and programmes to encourage rapid adoption of AI technologies and act as a bridge to develop partnerships across all organisations working in the sector.