Artificial Intelligence Preparedness – A Regulatory Perspective

NATIONAL ACADEMIES BEEBE SYMPOSIUM

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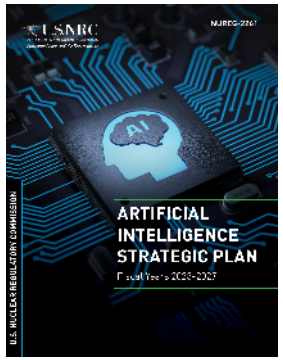
OUTLINE

- AI landscape and NRC activities
- Regulatory gap analysis
- Considerations for developing AI systems in nuclear applications
- Implications for agency use and moving forward

ARTIFICIAL INTELLIGENCE LANDSCAPE AND THE NRC

NUCLEAR INDUSTRY (EXTERNAL)

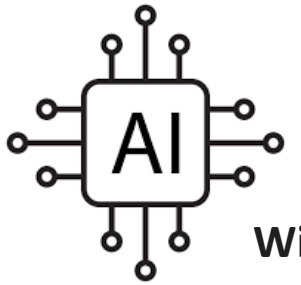
Industry wants to use AI



AI Strategic Plan to prepare staff to review AI

OTHER CONSIDERATIONS AND OPPORTUNITIES (INTERNAL)

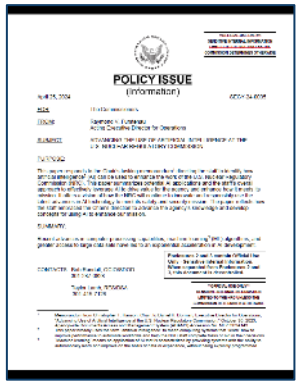
Federal actions for accelerating the use of AI in government operations



ACTIVITIES

Wide range of AI meetings, conferences, and research

INTERNAL TO THE NRC



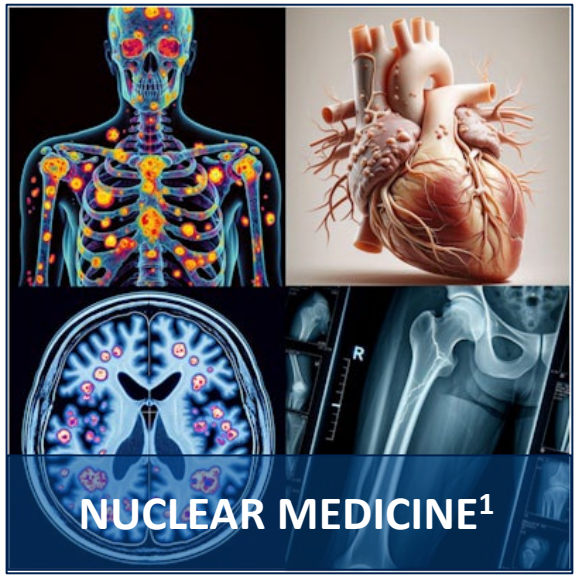
Advancing the Use of AI at the U.S. NRC*

NRC Evidence Building Priority Questions

Internal research into AI ranging from commercial applications to custom programming

*Available at https://www.nrc.gov/docs/ML2408/ML24086A001.html

THE RAPIDLY EVOLVING LANDSCAPE OF ARTIFICIAL INTELLIGENCE

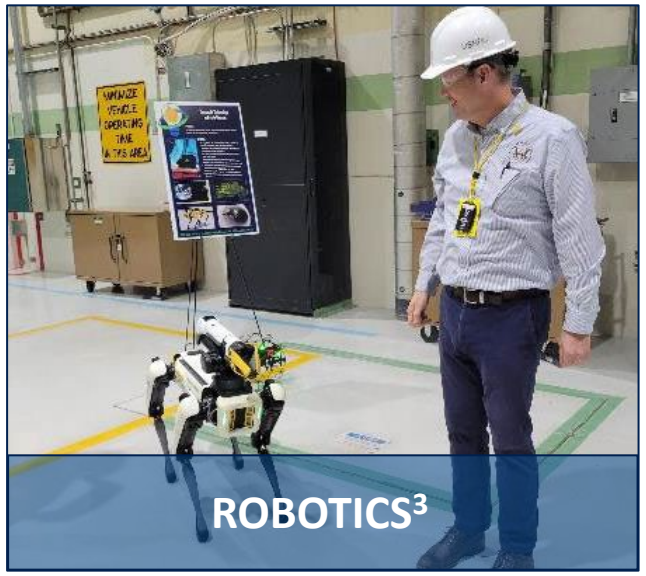


NUCLEAR MEDICINE[1]

1 https://arxiv.org/abs/2306.06148

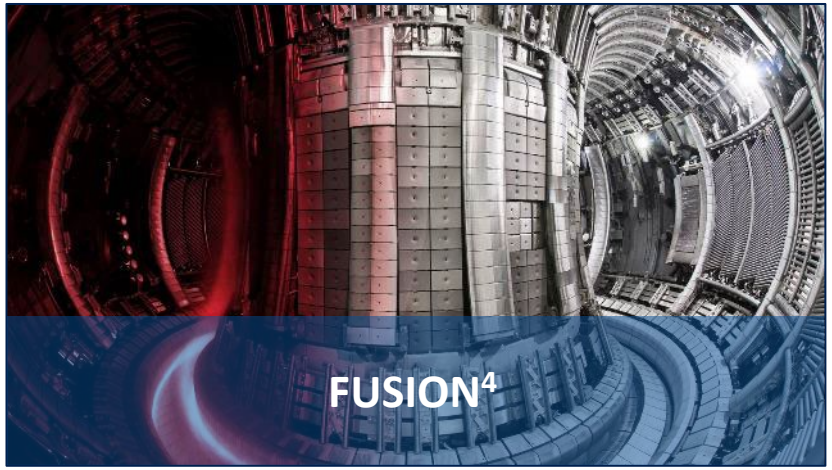
RADIATION PROTECTION[2]

2 https://www.iaea.org/newscenter/news/radiation-protection-of-patients-in-the-new-era-of-medical-imaging



ROBOTICS[3]

3 https://illumination.duke-energy.com/articles/spot-the-robot-dog-helps-humans-inspect-nuclear-power-plant



FUSION[4]

4 https://engineering.princeton.edu/news/2024/05/10/using-ai-wrangle-fusion-energy

EXCLUSIVE

Microsoft Targets Nuclear to Power AI Operations

The tech company aims to expedite the nuclear regulatory process using AI

GENERATIVE AI[5]

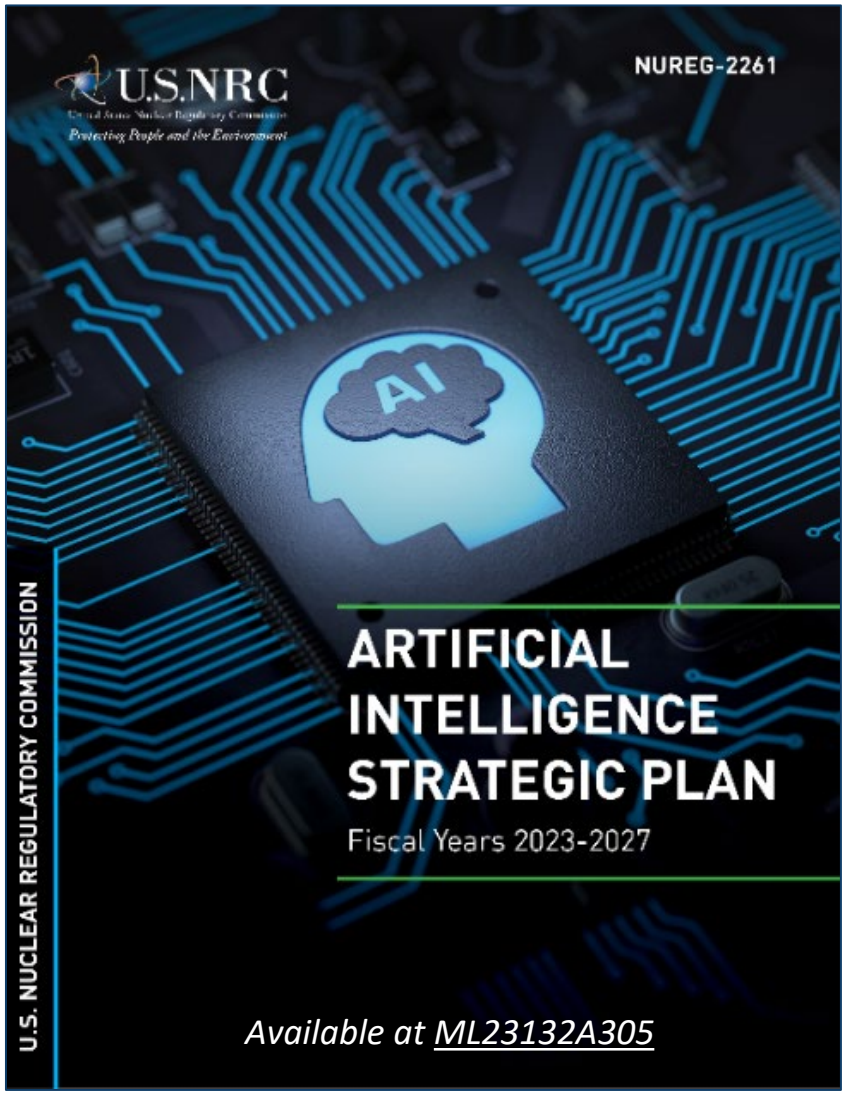
5 https://www.wsj.com/tech/ai/microsoft-targets-nuclear-to-power-ai-operations-e10ff798

THE NRC IS PREPARING FOR AI DEPLOYMENT

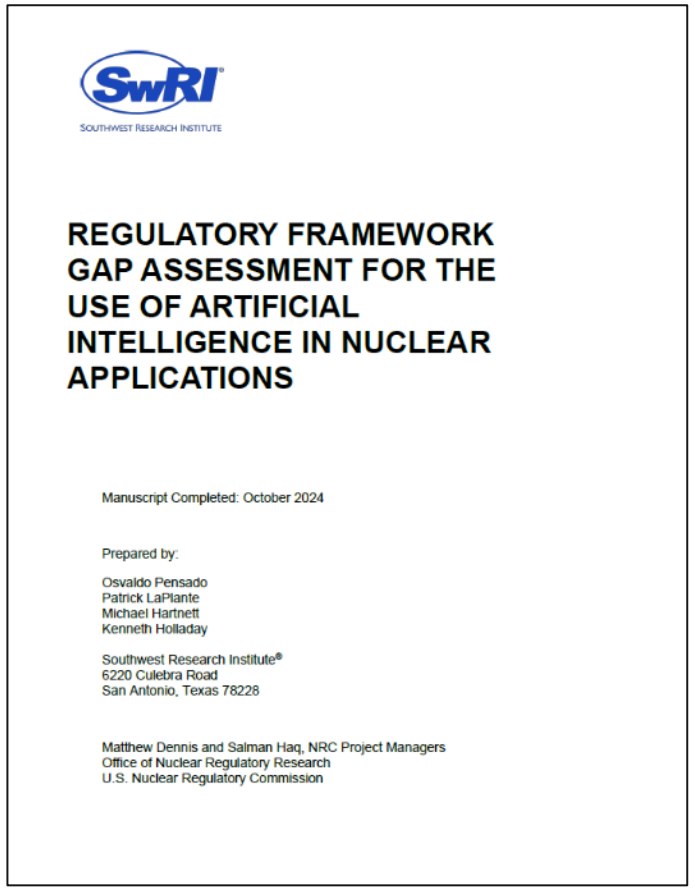
Enable the Safe and Secure Deployment of AI

Promote Engagement With External Stakeholders

Encourage Further AI Research and Development



AI REGULATORY GAP ANALYSIS



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SOUTHWEST RESEARCH INSTITUTE

REGULATORY FRAMEWORK GAP ASSESSMENT FOR THE USE OF ARTIFICIAL INTELLIGENCE IN NUCLEAR APPLICATIONS

Manuscript Completed: October 2024

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Available at ML23132A305

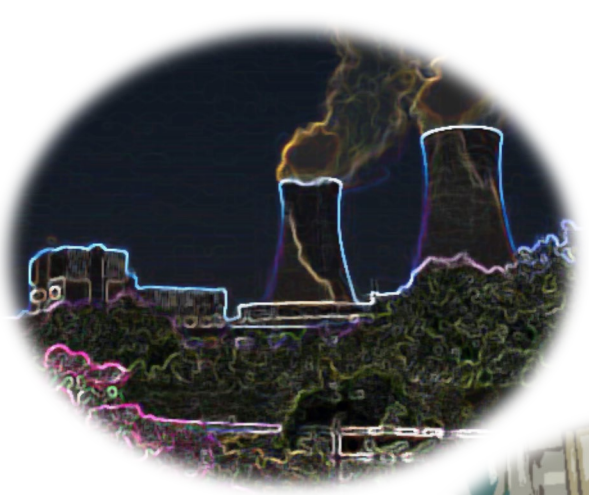
Project objectives

- Assess the applicability of the existing regulatory framework in considering the unique aspects of AI applications
- Determine where regulatory gaps may exist which could require updating existing or developing new regulations, guidance, or procedures to evaluate and review AI uses in NRC-regulated activities

AI REGULATORY GAP ANALYSIS CONCLUSIONS

- Eight potential AI gap categories
  - Implied manual actions
  - **Special computations**
  - Preoperational and initial testing programs that may omit AI
  - Habitability conditions under autonomous operations
  - Periodic testing, monitoring, surveillance and reporting
  - Software for critical applications
  - **Radiation safety support**
  - **Miscellaneous: training and human factors engineering**
- Recommendation to develop general guides addressing cross-cutting issues associated with potential gaps
- Existing AI standards by professional societies do not readily address the identified potential gaps

WORKING GROUP ON THE USE OF AI IN RADIATION PROTECTION



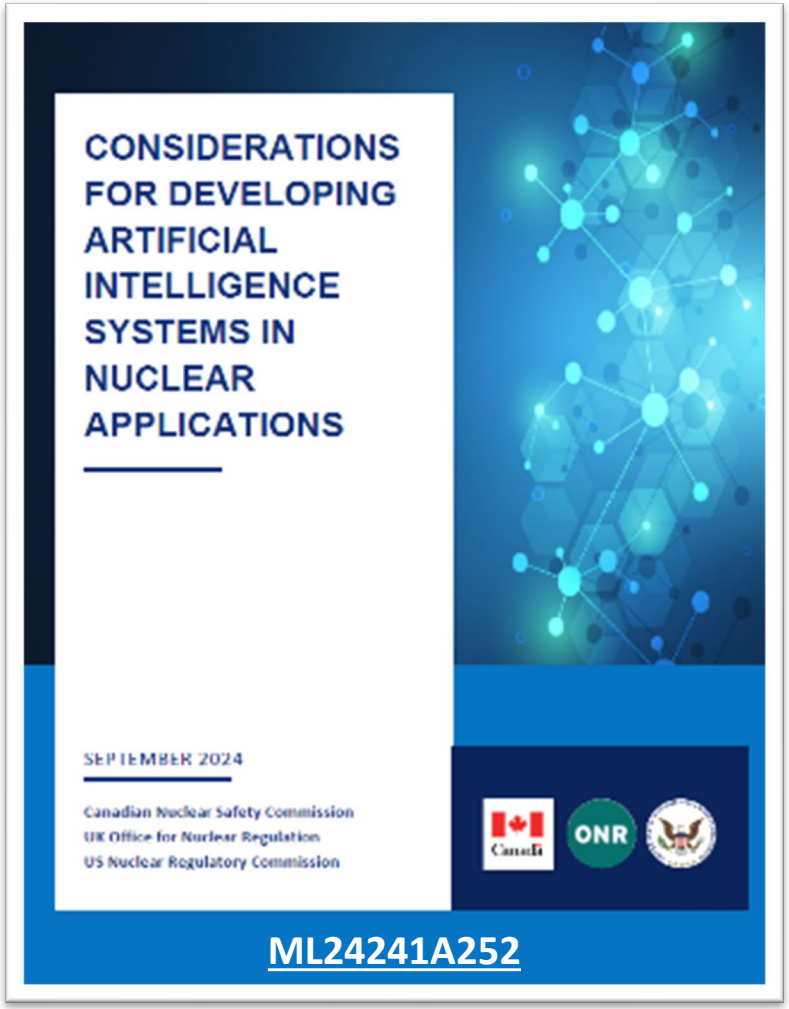
- Conference of Radiation Control Program Directors (CRCPD) formed a working group to consider the impact of AI on radiation protection
  - Identify potential applications and current state of AI in radiation protection
  - Assess the benefits and risks of using AI in radiation protection
- Example radiation protection application areas
  - Medical image recognition, radiotherapy treatment preparation, radiobiology, dosimetry

Next Steps: Develop recommendations for the responsible use of AI in radiation protection (projected Spring 2025)

STRENGTHENING AND EXPANDING AI PARTNERSHIPS

- Enhancing and leveraging existing Memoranda of Understanding (MOU)
- Participating in federal AI working groups and maintaining awareness of other AI regulatory activities
- Engaged with international counterparts interested in AI for nuclear
- Maintaining continual engagement on state-of-the-art research

CANUKUS AI PRINCIPLES PAPER



- Categorization of AI failure significance and AI autonomy
- Principles in abscence of consensus standards
  - Use of existing safety and security systems engineering principles
  - Human and organisational factors
  - AI architecture in nuclear applications
  - AI lifecycle management
  - Documenting AI safety and security
- Annex with relevant standards and guidance
- Similar principles approach from US FDA, Health Canada, and UK MHRA on AI/ML for medical devices[1,2]

ADVANCING THE USE OF ARTIFICIAL INTELLIGENCE AT THE NRC

- SECY-24-0035 summarizes potential AI applications and overall approach to effectively leverage AI at the NRC

- Staff identified 61 potential applications
  - 36 are recommended for AI use cases
  - 25 focus on data analytics or automating processes

POLICY ISSUE
(Information)

April 25, 2024 SECY-24-0035

FOR: The Commissioners

FROM: Raymond V. Furstenau
Acting Executive Director for Operations

SUBJECT: ADVANCING THE USE OF ARTIFICIAL INTELLIGENCE AT THE U.S. NUCLEAR REGULATORY COMMISSION

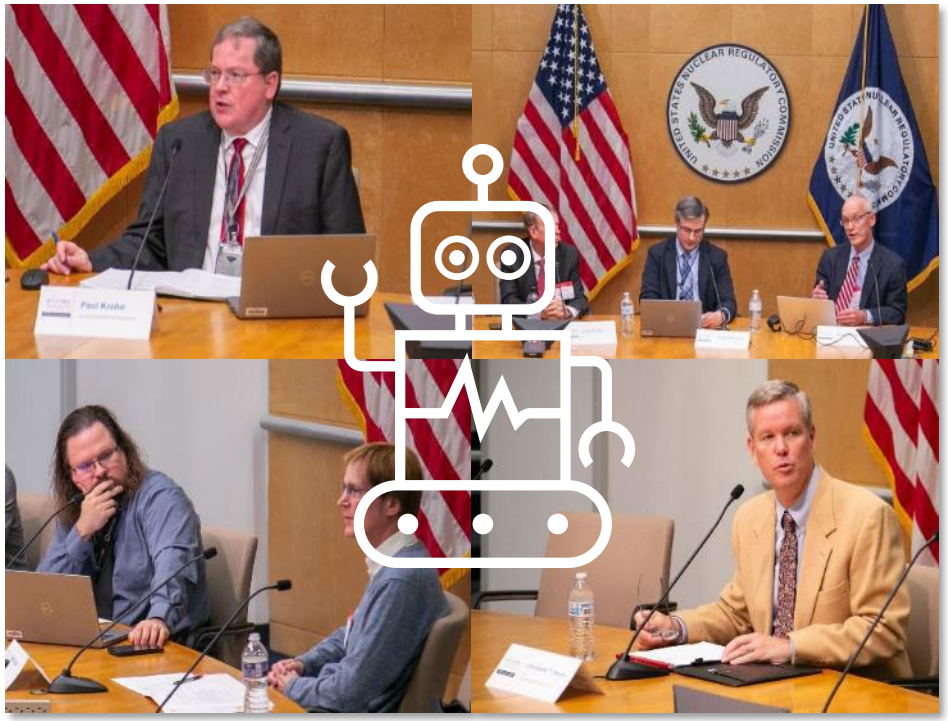
PURPOSE:

This paper responds to the Chair's tasking memorandum[1] directing the staff to identify how artificial intelligence[2] (AI) can be used to enhance the work of the U.S. Nuclear Regulatory Commission (NRC). This paper summarizes potential AI applications and the staff's overall approach to effectively leverage AI to drive value for the agency and enhance how it meets its mission. It offers a vision of how the NRC will continue to innovate and responsibly use the latest advances in AI technology to meet its safety and security mission. The paper reflects how the staff embraced the Chair's direction to advance the agency's knowledge and develop concepts for using AI to enhance our mission.

Next Steps: Develop an enterprisewide strategy and invest in foundational tools to support the implementation of several use cases

MOVING FORWARD AND STAKEHOLDER ENGAGEMENT

- **Vigilance on AI**: Monitoring AI's integration in nuclear materials and radiation protection
- **AI Governance**: Developing governance to ensure responsible use of AI at the NRC
- **Proactive Engagement**: Identifying challenges, gaps, and use cases in AI technologies
- **Skill Development**: Ensuring staff are equipped to leverage and regulate emerging technologies



SAVE THE DATE!

NRC AI Public Workshop*

September 2025

NRC Headquarters in Rockville, MD

*https://www.nrc.gov/public-involve/conference-symposia/data-science-ai-reg-workshops.html

CONTACT US

NRC AI WEBPAGE

https://www.nrc.gov/ai.html

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