

AI Regulatory Gap Analysis Working Group

Status Update and Recommendations on AI Guidance Development

Matt Dennis

*Senior Data Scientist
Division of Systems Analysis
Office of Nuclear Regulatory Research*



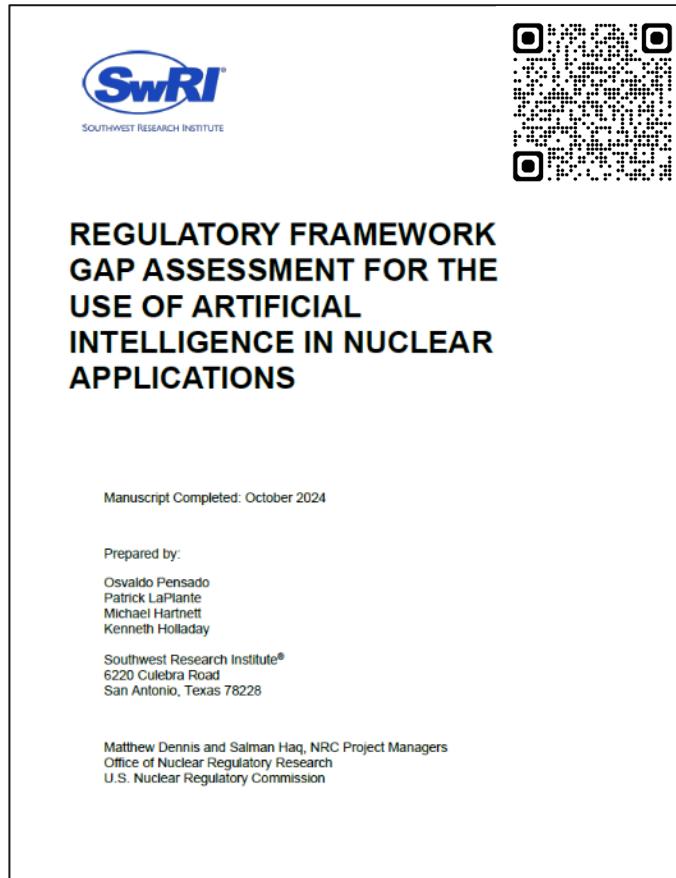
September 24, 2025



OUTLINE

- Working Group Charter and Background
- Deliberation on AI Guidance
- Recommended Path Forward and Observations

AI REGULATORY GAP ANALYSIS (AIRGA) BACKGROUND



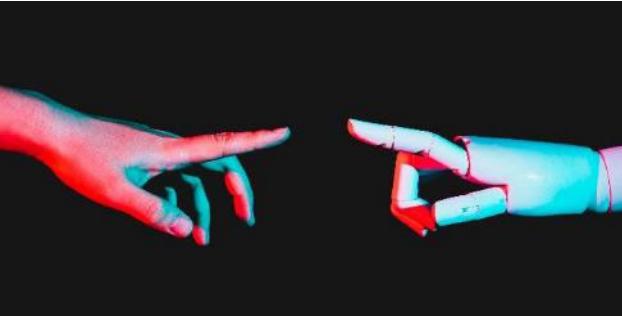
Project objectives

- 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

Available at [ML24290A059](https://www.osti.gov/ML24290A059)



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

AIRGA WORKING GROUP CHARTER

- SwRI recommended that NRC develop general guides addressing cross-cutting issues associated with potential gaps, such as software development with AI systems, and use of AI technologies in special computations
- The report made six recommendations for the working group to consider in relation to 71 regulatory guides identified with potential gaps where AI may be used:
 - Four recommendations to develop guidance for 1) data quality for AI/ML purposes, 2) systematic testing and documentation to cover rare events, 3) fail-safe design integration and detection in safety systems, 4) testing and documentation for computations and predictions
 - Examine work by other federal agencies
 - Deploy a pilot program to evaluate AI technology likely to be used by the nuclear industry
- The working group will consider the six SwRI recommendations and provide feedback, recommendations, and potential options to either proceed with addressing the recommendations or how they should be considered in future revisions of the NRC AI Project Plan, Rev. 1 (ML24194A116)



HIGH LEVEL OBSERVATIONS ON AI GUIDANCE

- Nine options for AI guidance development were discussed among the working group
 - Options 1-5 represent a variety of AI guidance options that may be appropriate for a given technical and regulatory function
 - Based on known AI use cases and level of technology maturity in the nuclear sector, it was assessed that options 6-9 were least preferred

Preferred Guidance Options	Less Desirable Guidance Options
1. NUREG	6. Revise existing regulatory guides one-by-one
2. RIL	7. Rely on consensus AI standards
3. ISG	8. Maintain the status quo (no change to regulation or guidance)
4. Staff Desk Guide	9. Initiate new rulemaking
5. Universal AI Regulatory Guide	

- Several options (desk guide, Research Information Letter (RIL), Interim Staff Guidance (ISG), NUREG, Regulatory Guide), each with increasing complexity, could require some level of external support. A desk guide could be substantially supported through staff resources.



RECOMMENDED PATH FORWARD

- Each subject matter area pursues the guidance vehicle that is most appropriate for their use case
 - For example, a desk guide might be appropriate for the inspectors but would not be helpful for development of the cyber security plan
- Recommend a phased approach
 - Identify specific topic areas where AI/ML will impact NRC-regulated activities (e.g., online monitoring or AI for cybersecurity) and focus on the appropriate guidance vehicle
 - Near-term use case guidance development will benefit other program areas who have yet to determine the appropriate guidance vehicle
 - Research Information Letter (RIL) on AI Tabletop with SNL/ANL will provide evaluation options for a variety of use cases



OBSERVATIONS FROM CURRENT AI ENGAGEMENTS

- The working group would appreciate any feedback from industry, given the known use cases, on
 - Preference for NRC developed AI guidance, or
 - Preference for industry-led approaches
- In the absence of guidance, difficult for both applicant and evaluator to assess completeness
 - Early engagement through pre-application meetings and sharing of information (e.g., draft topical reports) has been shown to be beneficial
 - Previous evaluations ([ML003734509](#), [NUREG/CR-6895](#)) of machine learning inform the process and requirements for modern AI use cases



ISOP network fosters Innovation in the nuclear industry to ensure the sustainable operation of existing NPPs or plants expected to enter service in the next ~5y

www.linkedin.com/groups/9562434/

ISOP

Innovation to Support Operating Plants



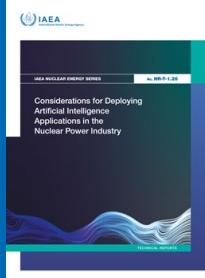
Ed BRADLEY
ISOP Scientific Secretary
IAEA NENP/NPES



Berenger BRIQUEZ
ISOP Chair
Westinghouse



ISOP Deliverables



<https://doi.org/10.61092/iaea.s6uy-wjt8>



Awards



WG Network



LinkedIn Community



Webinars



Publications

ISOP refinement from Steering Committee and Collaborative Framework

ISOP outputs from WGs

COMMUNICATION / COLLECTION / CONVERGENCE / COLLABORATION

Highlights / Outputs



WG on Artificial Intelligence

Highlights / Outputs



WG on Drones & Robotics

Highlights / Outputs



WG on Advanced Manufacturing

Highlights / Outputs



WG Next Generation I&C

Highlights / Outputs



Others IAEA Network & WGs

ISOP inputs from stakeholders

UTILITIES / REGULATORS / VENDORS / UNIVERSITIES / INSTITUTES / AGENCIES / NATIONAL LABS / ...