<table>
<thead>
<tr>
<th>Question 1.</th>
<th>(Note: List the point of contact that will be made available for inter-agency and public inquires)</th>
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</thead>
<tbody>
<tr>
<td>2B.</td>
<td>Additional point of contact name and email address</td>
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### Explore the use of big data, artificial intelligence (AI), and machine learning technology

This project will develop the capability to intelligently control and optimize advanced energy resources. The research will include the identification and management of anomalies, failures, and trends. The research will include the identification and management of anomalies, failures, and trends.

- **U.S. Department of Energy Office of Electricity Frank, Gregory**
- **U.S. Department of Energy Idaho National Laboratory Kerman, Mitchell C.**
- **U.S. Department of Energy Brookhaven National Laboratory Byung-Jun, Yoon**
- **Advanced Machine Learning-based Neural Networks**
  - **Interdependent Infrastructure Systems**
  - **Automated Malware Analysis Via (5G) Attacks including Zero-Day Attacks**
  - **Red Teaming Artificial Intelligence**
  - **Advanced Machine Learning-based Intelligent Devices**
  - **Network for in-depth Power Grid Analysis (GMLC 0064)**
  - **Composite Load Models of Emerging Platform (GRIP)**
  - **Sharing with Autonomous Beam Twins**

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### Summary

- **AI Techniques**
  - **Data Approach**
  - **Technical Solution**
  - **Information System**
  - **Code.gov**

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### Question 4.

- **Is the agency able to monitor and manage critical cyber-physical systems?**
  - **No**

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### Question 3.

- **Are there any notable limitations or challenges associated with the implementation of this technology?**
  - **Yes**

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### Question 2.

- **What is the status of this technology within the agency?**
  - **Early**

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### Question 1.

- **What stage of production is the AI system in?**
  - **Prototype**

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### Table

<table>
<thead>
<tr>
<th>Performance Area</th>
<th>Project Category</th>
<th>Data Type</th>
<th>Model Type</th>
<th>Technical Solution</th>
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### Additional Information

- The project uses post-irradiation examination of uranium-10wt.% zirconium (UZr) metal microstructural image and local thermal conductivity data collected from UZr. This serves as a case study to show how artificial intelligence (AI)-based technology should leverage sparse sensing for identifying optimal locations and the minimal set of measurements to achieve the lowest uncertainty quantification studies for the design and optimization of advanced reactor physics.
This research will develop a methodology that relies on mechanism-informed machine learning (ML) techniques in a new and novel manner to identify and correlate the critical microstructural features in a material to its failure under harsh operating conditions. Artificial intelligence will be used to understand the large amounts of data and predict reactor performance. Additional microstructural features, different alloys, and/or target mechanical environments to identify key microstructural features and correlate those features with novel failure approaches. The results of the experiment will be incorporated into the model so that the material response can be predicted for future predictions.

Evaluating thermal properties of advanced materials.

Physics-based multi-scale modeling was coupled with deep, recursive, and transfer learning approaches to accelerate nuclear materials research and qualification of high-nuclear critical infrastructure.

This project addressed limitations in current probabilistic risk assessment (PRA) by evaluating thermal properties of advanced materials.

The standard thermal diffusivity measurement technique laser flash is enhanced by computer vision, a broad set of techniques for training statistical models and neural networks for automatic system representation, modeling, and end-to-end learning.

Passive strain measurements for cyber response of integrated energy systems.

Decision analytics for integrated energy systems.

Deep reinforcement learning and discovery in complex systems.

Support vector analysis for in situ the effects of different components on the reactor performance.

Experiments in radiation environments.
