Microsoft AI for Nuclear Licensing

Reducing cost and time for licensing SMR projects

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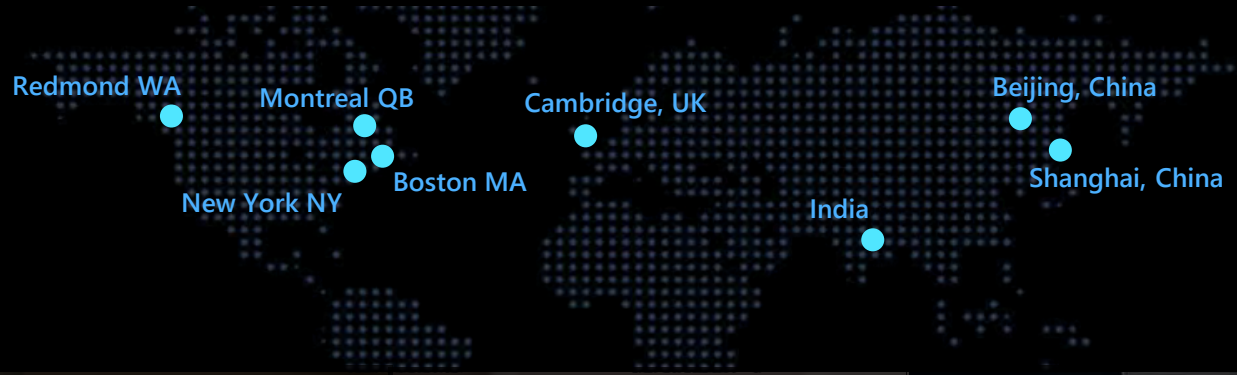
AI innovation fueled by research



8
Global research centers

1k+
Researchers employed worldwide

22k
AI-related patents

3k+
AI research papers published

1st
To human parity on vision, speech, and language

Microsoft

January 9, 2024 | News Release

PNNL Kicks Off Multi-Year Energy Storage, Scientific Discovery Collaboration with Microsoft

The imperative to move faster from research to application of energy solutions gets a boost with AI trained to dramatically accelerate scientific discovery

Microsoft Azure Quantum Blog

Unlocking a new era for scientific discovery with AI: How Microsoft's AI screened over 32 million candidates to find a better battery

January 9, 2024 • 8 min read

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Microsoft and SMRs

Accelerating Advanced Nuclear

Advanced Nuclear is a key energy source to complement renewable energy in decarbonizing energy supply

Microsoft will accelerate the SMR industry with

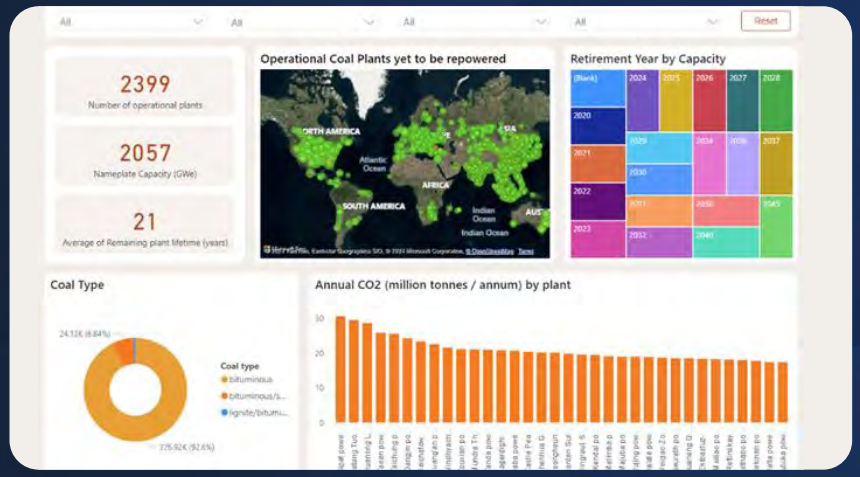
1. Power Purchasing
2. Policy Advocacy
3. Technology Partnerships

The Licencing Bottleneck

Licencing an SMR or Advanced Nuclear project currently takes years and significant expense.

Objective: Accelerate the industry by applying Generative AI to greatly reduce the cost and time to license projects.

Opportunity for Generative AI to accelerate Advanced Nuclear



- We will need a broad rollout of SMRs to decarbonize electricity and industry.
- Licensing is the single biggest bottleneck for getting new projects online – 10 years and $100M.
- Generative AI can greatly reduce the cost and time to compile a new application.
- We are creating a GenAI for Nuclear Licensing solution accelerator, trained on historic NRC licensing data, to increase the productivity of creating permits.

Flood and Earthquake History

GenAI requires more than just historic licencing data, it also needs real-time and project specific data

Making Relevant Datasets Available to GenAI

1 Geographical Data, Seismic Data

Add N additional internet datasets .. 2

Real-Time Internet and Internal Datasets

OpenAPI Plugin **Licensing Training Data**

OpenAPI Plugin **Geographical & Seismic Data; Add other data sources**

OpenAPI Plugin **Internal Datasets**

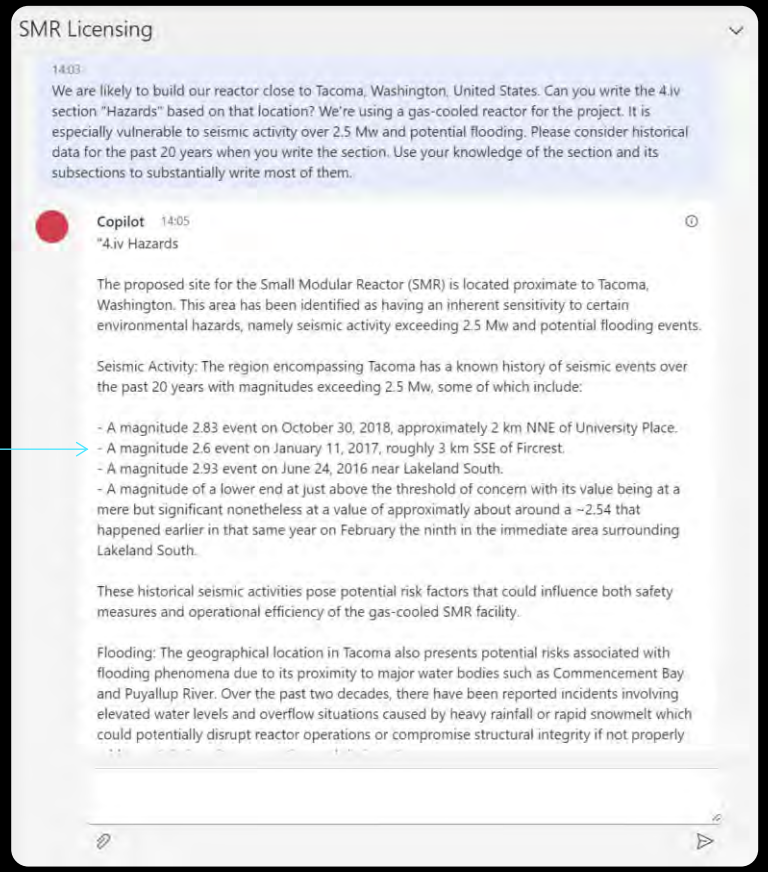
Data Orchestration Engine, Query Merging and Direction

3 **Azure Generative AI**
Semantic Kernel orchestration

Azure OpenAI Service | **GPT-4** | Fine Tuned, Small Language Models

4 **Permitting Content for Human Review**

Model leverages plugins to automatically pull in flood and earthquake history data for the area specified, and turns this into an English writeup



Drafting Entire Documents

Drafting documents with multiple calls to the GenAI model(s), using previous licensing data, project specific data, and company datasets—plugged into existing licensing workflow ready for human review and refinement.

Automated Document Creation

1. "Please draft a full Environmental Review for new project with these details"

Automated Document Drafting

2. Azure Scales background workers in parallel to automate parallel calls to Azure OpenAI Service, compiles document as responses gradually come back

Azure Generative AI
Semantic Kernel orchestration

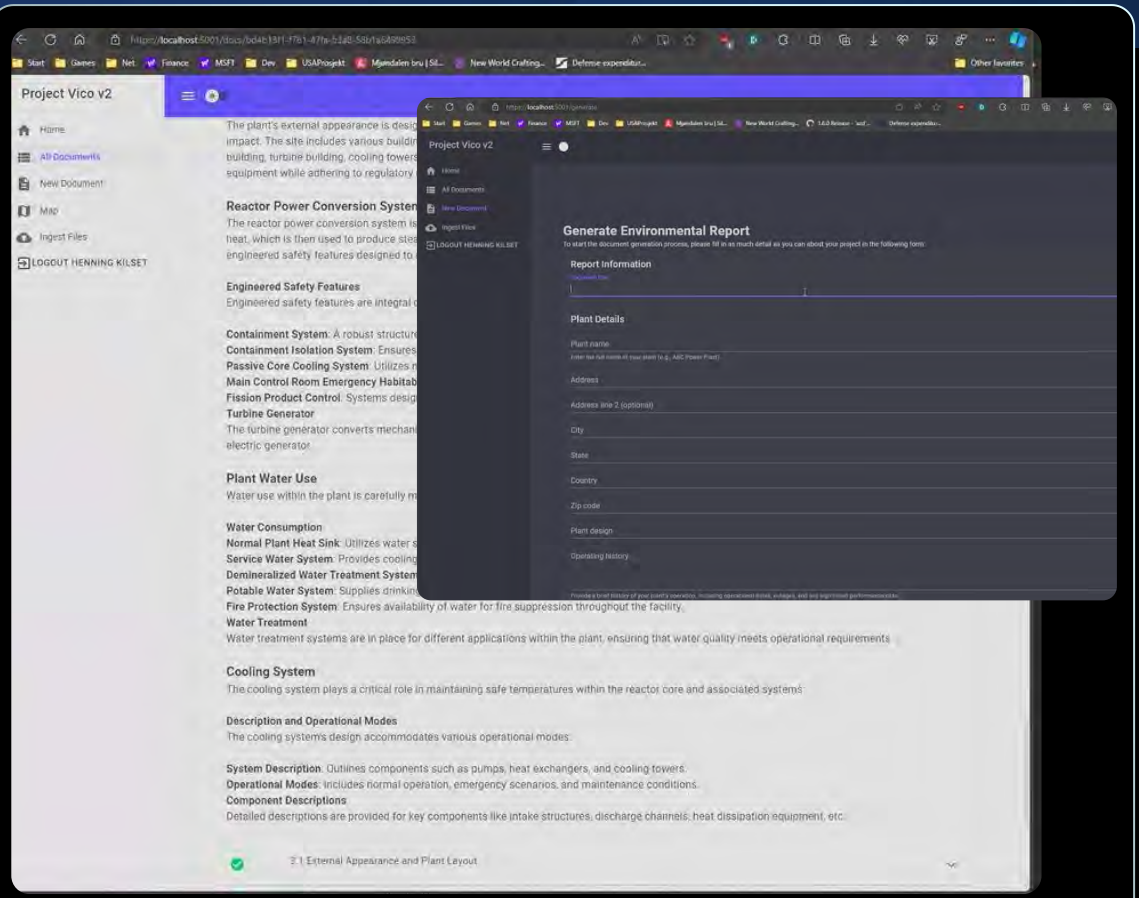
- Azure OpenAI Service
- GPT-4
- Fine Tuned, Small Language Models

Licencing Data + Real Time Project Specific Data + Company Datasets

3

Existing Nuclear Permitting Workflow

Workflows and Human Refinement



Supplementing with Project and Company Data

Making additional relevant datasets available improves relevance and quality of outputted content

Making Company and Project Datasets Available to GenAI

1 Technology & Project Specific Datasets

Add N additional internet datasets .. 2

Azure Gov Cloud (US DOE 10 CFR Part 810 Compliant)

OpenAPI Plugin **Licensing Training Data**

OpenAPI Plugin **Company Specific Datasets**

OpenAPI Plugin **Internal Datasets**

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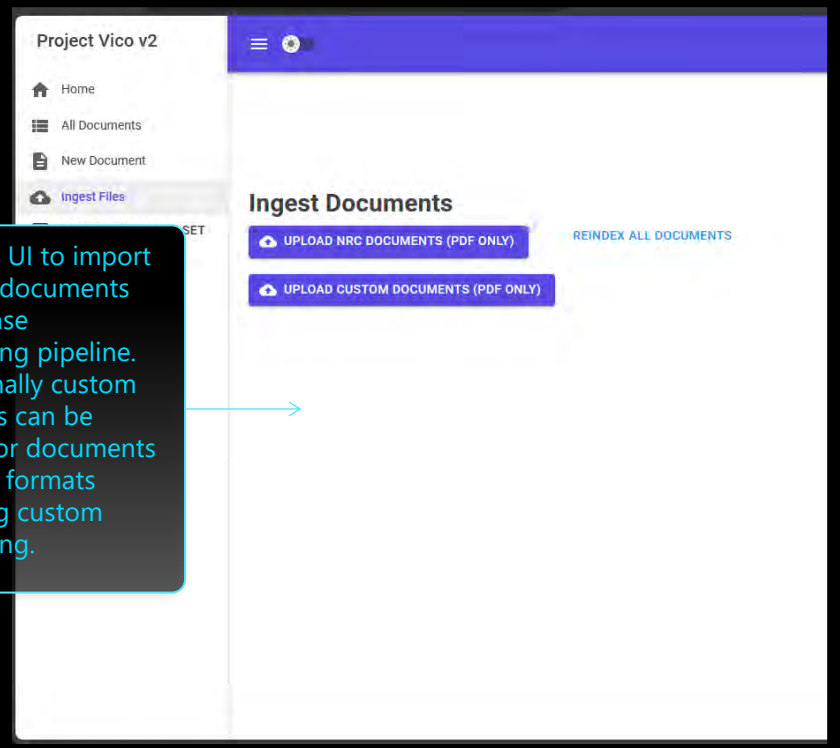
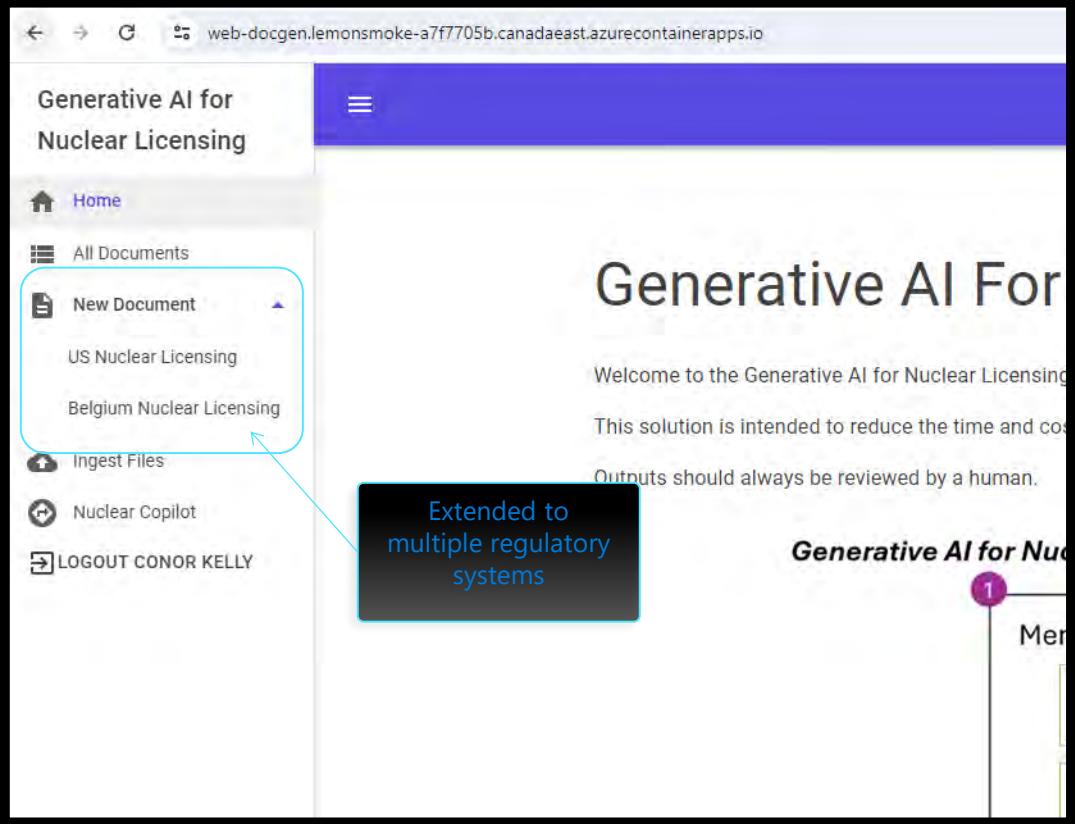
4 Permitting Content for Human Review

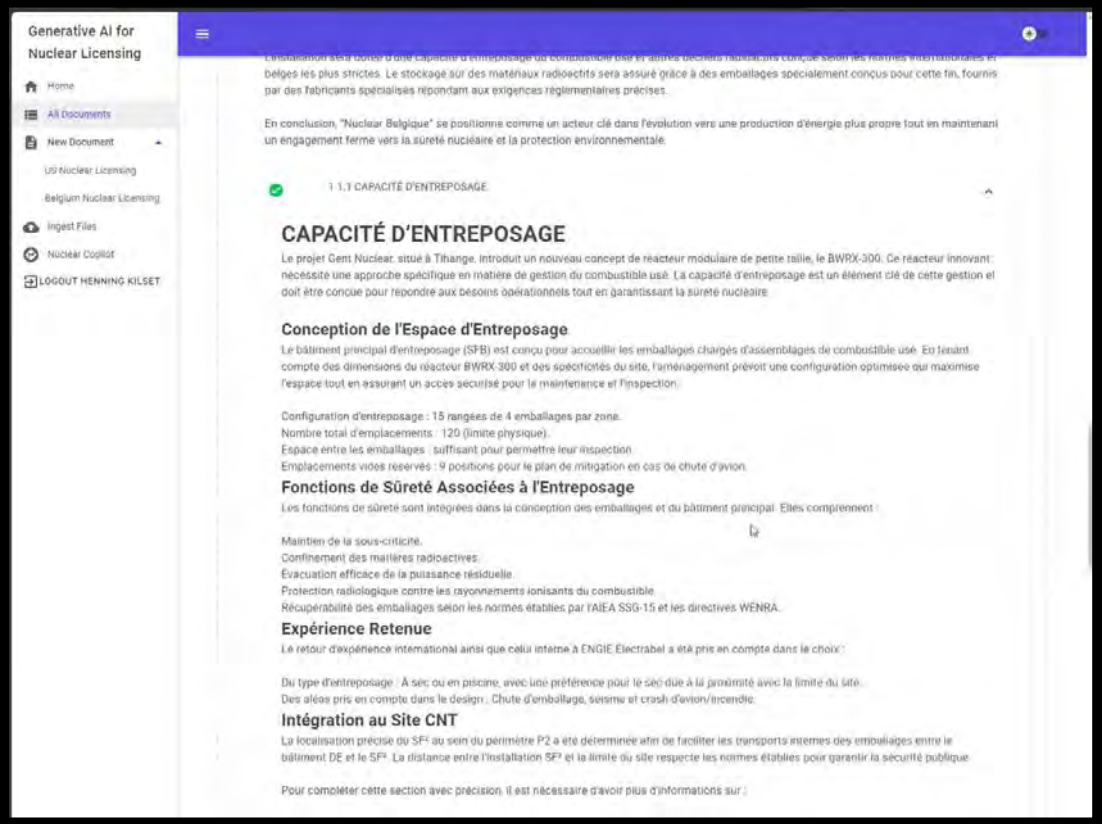
Solution UI to import internal documents using base processing pipeline. Additionally custom pipelines can be added for documents types or formats requiring custom processing.



Extending to Multiple Regulatory Systems and Languages

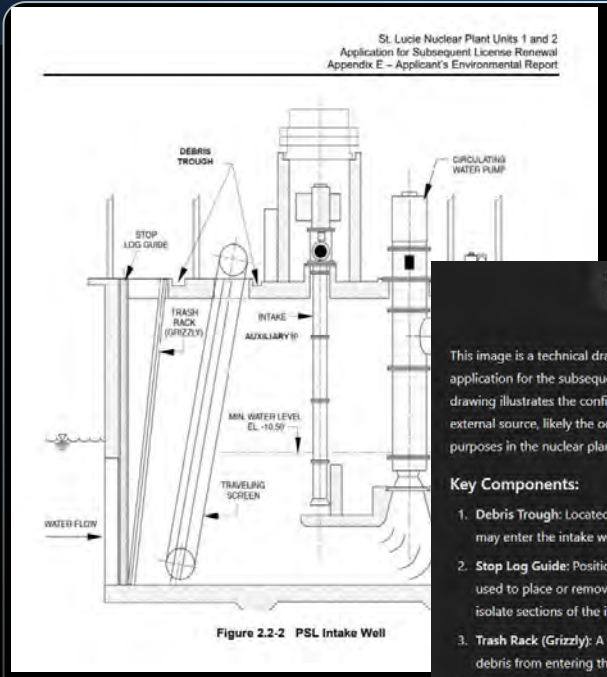
The system can be extended to multiple regulatory regimes, so long as training data exists for it, and can generate content in those formats, and in the language required for those application documents





Continuously Adopting Ongoing Advances in Generative AI

Generative AI continues to advance rapidly. The GenAI solution will continue to adopt the latest models and capabilities under the hood, so output quality will continue to improve.

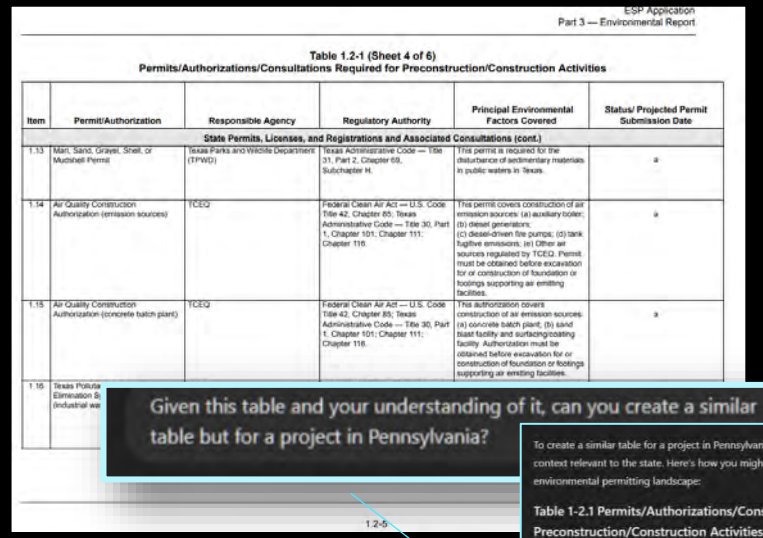


Can you please describe this image? It's in a renewal application for a nuclear plant.

This image is a technical drawing titled "Figure 2.2-2 PSL Intake Well," which appears in an application for the subsequent license renewal of the St. Lucie Nuclear Plant Units 1 and 2. The drawing illustrates the configuration and components of the intake well used to draw water from an external source, likely the ocean or a similar body of water, for cooling and other operational purposes in the nuclear plant.

Key Components:

1. **Debris Trough**: Located at the top left of the image, it appears to guide or collect debris that may enter the intake well, preventing it from reaching further into the system.
2. **Stop Log Guide**: Positioned above the intake path, this guide seems to be a part of the system used to place or remove stop logs, which are barriers that can be used to control water flow or isolate sections of the intake structure.
3. **Trash Rack (Grizzly)**: A slanted grid-like structure that serves as a coarse filter to prevent large debris from entering the intake well, protecting downstream equipment from damage.
4. **Traveling Screen**: Located below the trash rack, this component likely acts as a secondary filtering mechanism that moves to continuously remove debris from the water before it flows deeper into the system.
5. **Intake Pipes (Auxiliary 1P)**: These pipes are shown extending down into the well, drawing water from the intake well to supply various parts of the plant's systems, including the circulating water pump.



Given this table and your understanding of it, can you create a similar table but for a project in Pennsylvania?

To create a similar table for a project in Pennsylvania, I'll base it on the structure and the regulatory context relevant to the state. Here's how you might translate the table's contents to fit Pennsylvania's environmental permitting landscape:

Table 1-2.1 Permits/Authorizations/Consultations Required for Preconstruction/Construction Activities in Pennsylvania

Item	Permit/Authorization	Responsible Agency	Regulatory Authority	Principal Environmental Factors Covered	Status/Projected Permit Submission Date
1.13	Earth Disturbance Permit	Pennsylvania Department of Environmental Protection (PADEP)	Pennsylvania Clean Streams Law (35 P.S. §§ 691.1 – 691.1001); Chapter 102 Erosion and Sediment Control	This permit is required for disturbance of earth that might impact water quality.	a
1.14	Air Quality Plan Approval (emission sources)	PADEP	Pennsylvania Air Pollution Control Act (35 P.S. §§ 4001 – 4015); 25 Pa. Code Chapters 127, 129	This permit covers construction of air emission sources including boilers, generators, and other regulated emission sources. Permit must be	a

Message ChatGPT

Continuously Adopting Ongoing Advances in Generative AI

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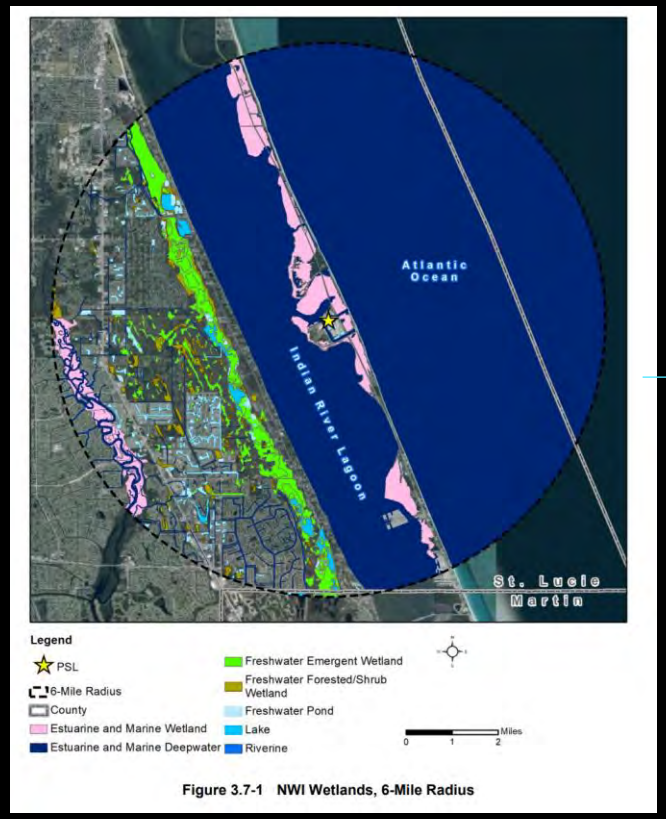


Figure 3.7-1 NWI Wetlands, 6-Mile Radius

The image you provided appears to be related to the environmental analysis for the license renewal of the St. Lucie Nuclear Power Plant, which is located on Hutchinson Island on the east coast of Florida. The location is suggested by the reference to "St. Lucie" and "Martin" counties, which are near the actual plant's location.

Description of the Image:

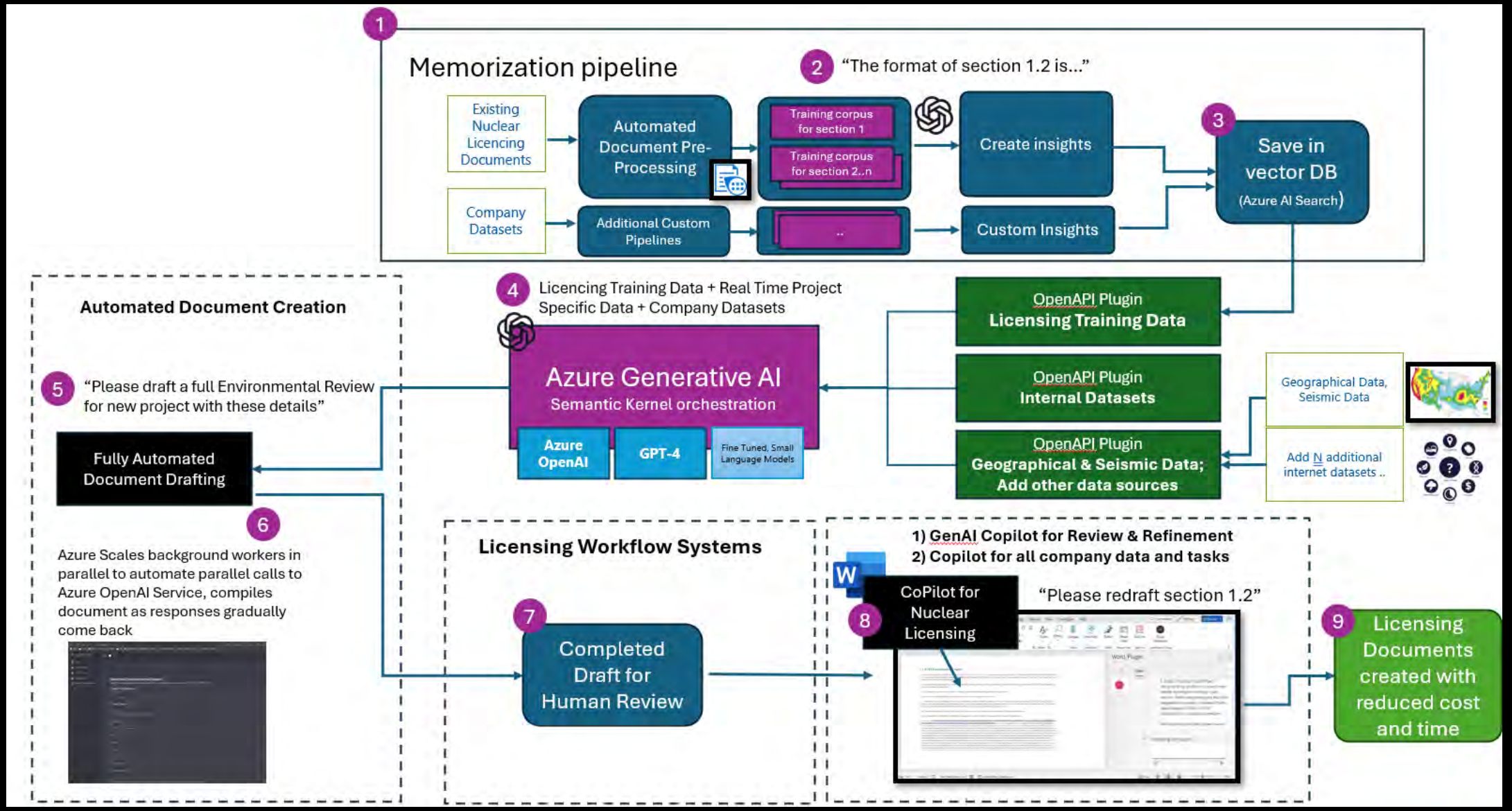
- **Map Scope**: The image is a map showing the surrounding area within a 6-mile radius of a point of interest, marked by a yellow star with the label "PSL" (likely referring to "Port St. Lucie" or "St. Lucie" plant).
- **Legend Information**:
  - **Freshwater Emergent Wetland** (Green)
  - **Freshwater Forested/Shrub Wetland** (Brown)
  - **Freshwater Pond** (Light Blue)
  - **Lake** (Darker Blue)
  - **Riverine** (Dark Blue lines)
  - **Estuarine and Marine Wetland** (Pink)
  - **Estuarine and Marine Deepwater** (Dark Blue)
- **Main Features**:
  - **Atlantic Ocean**: On the right side of the image, it shows a large expanse labeled as "Atlantic Ocean".
  - **Indian River Lagoon**: A significant body of water between the mainland and the barrier island, indicated on the map.
  - **Barrier Island**: The landmass to the right of the Indian River Lagoon, which is part of the barrier island chain where the St. Lucie Nuclear Power Plant is located.
  - **Wetlands**: Various wetlands, including freshwater and marine wetlands, are highlighted in different colors, showing the diverse ecosystems within the 6-mile radius.
  - **Urban Areas**: The map also shows the urban development west of the barrier island, where Port St. Lucie and other settlements are located.

Context:

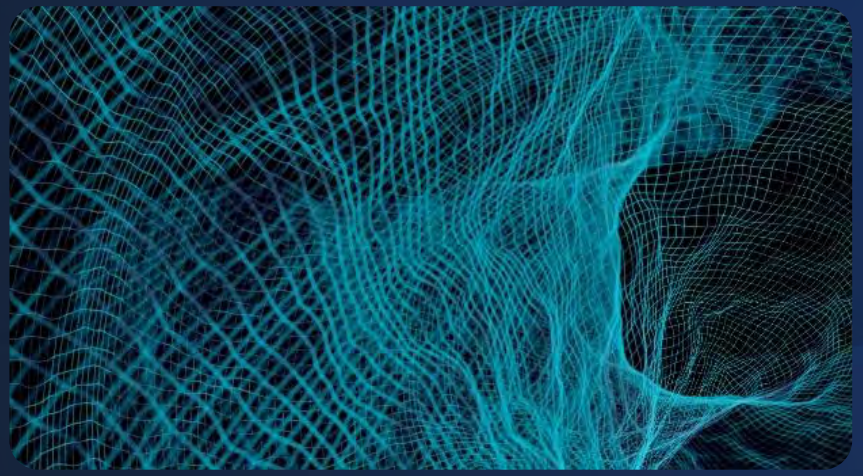
Such maps are typically used in environmental assessments to evaluate the impact of facilities like nuclear power plants on surrounding ecosystems. The presence of wetlands, rivers, and other water bodies are of particular concern due to their ecological importance.

Given the location, the likely candidate for the nuclear power plant in question is the **St. Lucie Nuclear Power Plant**, operated by Florida Power & Light (FPL). The map is likely part of the documentation required for renewing the plant's operating license, ensuring that the plant's operations do not negatively impact these sensitive areas.

Generative AI for Nuclear Licensing Solution Accelerator



Ongoing work to accelerate the rollout of Advanced Nuclear



- Industry Engagement
- Regulation Compliance, for example US DOE 10 CFR Part 810
- When validated with Advanced Nuclear permitting, broadening to further scenarios. Timeframe: Autumn of 2024.

Microsoft

Thank you

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