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Workshop Summary Report on Using AI Tools to Improve the Efficiency and Outcomes of the NEPA Process

AI for Permitting Workshop at the 2025 National Association of Environmental Professionals (NAEP) Annual Conference

June 2025

U.S. DEPARTMENT of ENERGY

Prepared for the U.S. Department of Energy
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Workshop Report

June 2025

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Note to Reader

Any views and opinions expressed in this report are intended to capture ideas expressed during the workshop and do not necessarily reflect the views or opinions of the authors or any official policy or position of any other agency or organization.

Summary

On April 29, 2025, the U.S. Department of Energy (DOE) and Pacific Northwest National Laboratory (PNNL) hosted a workshop at the National Association of Environmental Professionals 2025 Conference and Training Symposium in Charleston, South Carolina. The workshop sought to provide environmental practitioners with an understanding of artificial intelligence (AI) capabilities relevant to National Environmental Policy Act (NEPA) reviews and federal permitting processes, demonstrate specific examples of how AI is being integrated into associated workflows, and solicit questions and feedback from practitioners.

The workshop was organized into a series of sessions. Keynote speaker Eric Beightel provided insights into how AI tools could modernize aging permitting systems and streamline environmental reviews. Sameera Horawalavithana of PNNL introduced DOE's PermitAI initiative, highlighting the development of NEPA-focused data pipelines and applications being tested by interagency partners. Next, a series of case studies showcased practical applications of AI in several aspects of permitting, including the agency action review process, agency evaluation of public comments, and the project sponsor application process. These case studies demonstrated the ability of AI to streamline specific aspects of permitting processes, such as expediting the preparation of categorical exclusions, more rapid extraction of insights from public comments, and achieving greater automation and standardization of environmental reports. Workshop attendees were encouraged to consider broader applications for the types of tools presented in the case studies.

Discussion with attendees following each presentation highlighted barriers and opportunities for implementation of AI in permitting processes. Key barriers discussed include inconsistent data standards and siloed databases that present challenges for integration and scalability of AI tools, which rely on consistent data standards for effectiveness. Decentralized and variable workflows and templates across agencies also limit the ability to quickly integrate automation mechanisms into agency workflows without additional software development. Additionally, challenges in handling NEPA documents' long contexts can hinder AI functionality. Ethical and quality assurance concerns emphasize the need for transparency in how the federal government is using AI, the importance of human validation of AI-generated content used as a basis for agency decisions, and accountability for errors introduced by AI. Additionally, challenges in handling NEPA documents' extensive contexts can hinder AI functionality. Finally, some expressed concern that loss of human capital from task automation and other factors could limit the ability to manage and evaluate AI tools.

Despite these barriers, AI affords various opportunities to improve and expedite NEPA and federal permitting processes. Data-ingestion pipelines can assist with standardization of historical documents and data to garner insights for application in future permitting. AI may also improve the efficiency of specific NEPA workflows, augmenting human expertise in analytical tasks like comment analysis and enabling faster review and drafting of analysis and decision documents. Critically evaluating the readiness of existing processes for AI integration also presents opportunities to make fundamental process improvements. Additionally, AI can be selectively deployed to perform reviews of documents for quality and accuracy before or after human validation, providing an additional level or review with negligible impacts on schedule. To increase transparency and accountability, AI can be used to automate tracking of permitting milestones for public awareness. Finally, AI tools show promise in scalability and broader application across diverse agencies to align with governmentwide strategic goals for energy and infrastructure development.

Acknowledgments

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Acronyms and Abbreviations

API	application programming interface
CEQ	Council on Environmental Quality
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
ERP	environmental review process
INL	Idaho National Laboratory
LLM	large language models
NAEP	National Association of Environmental Professionals
NEPA	National Environmental Policy Act
PNNL	Pacific Northwest National Laboratory
SME	subject matter expert

Contents

1.0 Introduction

On April 29, 2025, the U.S. Department of Energy (DOE) and Pacific Northwest National Laboratory (PNNL) hosted a workshop at the National Association of Environmental Professionals (NAEP) 2025 Conference and Training Symposium in Charleston, South Carolina, titled, “Effective and Responsible Use of Customized AI Tools to Improve the Efficiency and Outcomes of the NEPA Process.” The objectives of this workshop were to make environmental practitioners aware of the potential for using artificial intelligence (AI) in the National Environmental Policy Act (NEPA) process, demonstrate examples of how AI can be integrated effectively and responsibly to improve efficiency and outcomes, and solicit questions and feedback from practitioners. The workshop informs PNNL’s ongoing work on the DOE-sponsored PermitAI initiative—a data platform and testbed to enable faster federal permitting using AI. Additionally, the objectives of the workshop align with recent federal directives to update permitting technology and accelerate permit processing times while maintaining high quality standards.

The workshop included the following speakers and sessions, which are described in greater detail in Section 2.0:

- Jack Titus, policy fellow at the DOE’s Office of Policy and Office of Critical and Emerging Technologies, welcomed workshop participants and delivered opening remarks.
- Eric Beightel, former executive director at the Permitting Council and now federal strategy director at Environmental Science Associates, gave a keynote speech describing the evolving NEPA landscape and highlighting new technologies, data standards, and advancements to streamline environmental review processes.
- Sameera Horawalavithana, data scientist at PNNL, provided a primer of AI capabilities relevant to NEPA and gave an overview of the data pipelines and applications developed under the DOE’s PermitAI initiative.
- Case studies focused on different aspects of NEPA and federal permitting processes. Each of the following case studies consisted of a presentation followed by a question-and-answer session.
  - Case Study 1: Matthew Aumeier, environmental policy and systems innovation expert at Idaho National Laboratory (INL), explained how AI-driven search and summarization is being used to simplify and expedite the categorical exclusion process at INL.
  - Case Study 2: Michelle Rau, Senior NEPA principal and program manager, and Kevin Murphy, environmental data management practice lead, of Jacobs Engineering, demonstrated a human-AI workflow to enhance the evaluation of public comments on NEPA documents.
  - Case Study 3: James McWalter, co-founder and chief executive officer at Paces, demonstrated an application assistant tool to derisk and accelerate feasibility and permitting processes for energy project applicants.
- The workshop concluded with a plenary session to collate and share insights and findings with session attendees, fostering a broader understanding of AI's potential across the NEPA landscape. Staff members from PNNL, including Sai Munikoti, Dan Nally, Anurag Acharya, Mike Parker, Reilly Raab, Sarthak Chaturvedi, and Anastasia Bernat hosted this session.

2.0 Workshop Summary

2.1 Keynote

Eric Beightel, former Executive Director at the Permitting Council and now Federal Strategy Director at Environmental Science Associates, gave a keynote speech titled, “The Future of NEPA is Here: How Technology and Data Standards are Reshaping NEPA.” The keynote speech addressed the pervasive issue of outdated permitting systems, highlighting the transformative potential of AI to enhance environmental reviews and streamline communication with the public. The speech also presented AI as a pragmatic necessity during a time of reduced federal staffing and resources.

Eric related specific experiences from his prior role as a senior environmental policy advisor at the U.S. Department of Transportation (DOT), where he witnessed inefficiencies of processes in place at that time, such as the lack of systems to track the substantial volumes of categorical exclusions being prepared by state DOTs. Eric highlighted several critical issues that impeded effective NEPA compliance, such as the absence of federal headquarters’ guidance for state DOT determinations resulting in varied operational workflows across state DOTs and the lack of mechanisms to automate aspects of the environmental review processes. Eric explained that interagency coordination is often hampered by differing definitions and data sources, resulting in communication gaps and misunderstandings. He cited examples of steps taken to rectify these issues, such as and the introduction of official standardized forms, development of a tribal contact database, and funding from the U.S. Department of the Interior and DOE to train staff in NEPA analysis. Eric indicated that AI advancements could further enhance agency data management and planning, as well as enable staff to spend a greater proportion of their time on analytical, rather than administrative, work.

Eric noted that despite considerable challenges remaining, progress has been made toward the modernization of permitting processes. Significant funding (e.g., from the Permitting Council) has been earmarked to support agencies in developing AI tools and enriching their permitting data management. These enrichments can build upon existing tools, such as the Permitting Council’s Permitting Dashboard,[1] which has increased transparency, accountability, and interagency coordination for major infrastructure projects and remains active. Eric also noted that the Presidential memorandum dated April 15, 2025,[2] set ambitious objectives to further modernize federal permitting—a mission with considerable bipartisan support amid high polarization of broader issues around permitting.

Eric concluded by highlighting solution-oriented actions currently in process, including the Permitting Innovation Center's efforts to develop and implement a Permitting Technology Action Plan per instruction in the previously mentioned Presidential memorandum. Technological innovations and adaptive software will enable a more effective response to new requirements. Eric indicated that the NAEP workshop presents an opportunity to influence policy directions, culminating in a white paper to the Council on Environmental Quality (CEQ) with the potential to influence federal governmentwide guidance intended to meet technological and permitting objectives.

[1] “Permitting Dashboard, Federal Infrastructure Projects,” Permitting Council, accessed May 29, 2025, https://www.permits.performance.gov/.
[2] “Updating Permitting Technology for the 21st Century,” The White House, April 15, 2025, https://www.whitehouse.gov/presidential-actions/2025/04/updating-permitting-technology-for-the-21st-century/.

2.2 AI in NEPA

Sameera Horawalavithana, a data scientist at PNNL, gave a presentation titled, "Effective Use of AI in NEPA Workflows." The presentation centered on the understanding of, and strategies for, the integration of AI in NEPA reviews and federal permitting processes. The overarching goal is to enhance the efficiency and effectiveness of environmental reviews through human-machine collaboration. This effort is driven by increasing need for federal agencies to produce high-quality reviews more quickly and with reduced costs. The presentation outlined the AI-driven tools developed by the DOE and PNNL and their commitment to identifying priority applications in consultation with interagency partners and industry collaborators. This initiative, known as PermitAI, has yielded several applications currently being tested by interagency partners and has additional applications in development.

Sameera first provided a primer on AI concepts and terminology, including an overview of large language models (LLMs) and their role in the evolving AI landscape. LLMs, which excel in understanding and generating human language, are depicted as valuable collaborators in enhancing collective intelligence rather than as entities that replace human creativity and intuition. Attention, tokenization, and predictions were highlighted as key mechanisms underpinning LLM functionality. Having a fundamental understanding of LLMs forms the basis for their strategic integration into streamlined environmental review procedures.

Next, Sameera described the rapid advancement of AI capabilities relative to established benchmarks but also noted their limitations in matching the depth and consistency of human creativity. Despite having advanced conversational abilities, current LLMs are limited in their abilities to emulate human-like creativity and reasoning. Sameera offered a perspective, suggested by Narayanan and Kapoor,[3] which advocates for viewing AI as a tool subject to well-established patterns of innovation, implying that its effective use does not require drastic policy interventions. Central to the idea is the perception of AI not as a potential superintelligence or a passing fad but as a normal, general-purpose technology. Sameera emphasized the importance of maintaining control over AI and cautioned against falling into illusions regarding its capabilities. Instead, AI should be aligned with organizational goals and deployed in tasks where proficiency already exists, minimizing potential pitfalls associated with relying on AI for expertise that a team lacks.

Finally, Sameera provided an overview of progress on the PermitAI initiative to date. Shared updates included the development of a NEPA document taxonomy and metadata standards in collaboration with CEQ. The metadata standards will be applied to a text corpus called NEPATEC, which is a large, centralized repository of NEPA documents previously siloed within separate agency databases or not publicly available online. The growing NEPATEC corpus contains more than 80,000 documents yielding more than 5 billion tokens after ingestion through a processing pipeline. Version 1 of the NEPATEC corpus was released publicly in June 2024.[4] Agency partners are currently testing a beta version of integrated applications named SearchNEPA and ChatNEPA, which enable users to discover and view documents in the NEPATEC corpus through search and filter, as well as to receive AI-generated responses to questions posed in the chat interface. Sameera explained that PermitAI applications are already supporting specific agency inquiries and some are anticipated to be available for public use following further refinement based on tester feedback.

[3] Arvind Narayanan and Sayash Kapoor, “AI as Normal Technology,” 25-09 Knight First Amend. Inst., April 15, 2025, https://knightcolumbia.org/content/ai-as-normal-technology.
[4] “NEPATEC 1.0,” Hugging Face, June 13, 2024, https://huggingface.co/datasets/PolicyAI/NEPATEC1.0.

2.3 Case Study 1 (Matthew Aumeier)

Matthew Aumeier, Environmental Policy and Systems Innovation Expert at INL, delivered a presentation titled "AI Scope Assist for CX-level NEPA at INL," outlining a practical case study of integrating AI into the Environmental Review Process (ERP) at INL. ERP is a formal process for reviewing and assessing proposed activities and projects at INL, which occupies approximately 890 square miles in southeastern Idaho. Each year, INL is responsible for preparing a heavy volume of categorical exclusions and documents demonstrating the adequacy of existing NEPA reviews for activities conducted within the INL site. INL does not directly prepare or make determinations regarding categorical exclusions but instead prepares a precursor document called an Environmental Compliance Permit, which communicates recommended levels of review to the DOE.

The primary aim of the AI Scope Assist tool is to streamline the creation of project descriptions for categorical exclusion documents, which are a critical yet time-consuming aspect of the ERP. The tool facilitates user interaction by integrating seamlessly into the existing project entry system of ERP, allowing users to upload documents, confirm the absence of sensitive content, and receive project descriptions essentially instantaneously. Integration of AI Scope Assist into the ERP results in minimal disruption to the user workflow by eliminating the need for switching tools, ensuring efficiency and ease of use for staff conducting NEPA reviews at INL.

The development of AI Scope Assist reflects an emphasis on user-centered design and iterative improvement. The system uses INL high-performance computing AI accessed via a custom application programming interface (API) and incorporates a specific customizable prompt to guide the AI's purpose, tone, and content. Continuous refinement of prompts has yielded consistent results, highlighting the importance of adaptability in AI tools to maintain relevance and effectiveness. Notably, the project's development required minimal resource investment, with approximately 1.5 weeks of total development time managed by a single developer. The preparation of project descriptions using generative AI has demonstrated considerable time savings compared to manual drafting.

INL's ERP, which has experienced incremental growth through pragmatic and user-focused enhancements, provides an ideal platform for AI integration. Matthew also explained the broader applicability of this AI pilot due to its low barrier to entry. The AI Scope Assist or similar AI implementations could potentially be scaled to other elements within the NEPA process as well as to different agencies, organizations, or laboratories. Strategic application of focused AI pilots could support the expansive and diverse environmental review needs of the DOE’s strategic goals, which include energy, national security, science, and environmental objectives.

2.4 Case Study 2 (Michelle Rau, Kevin Murphy)

Michelle Rau, senior NEPA principal and program manager, and Kevin Murphy, environmental data management practice lead, of Jacobs, delivered a presentation titled, “Public Engagement & AI at Jacobs.” Jacobs is a professional services firm that often supports government agencies with NEPA reviews, other permitting processes, and supporting technological solutions. The presentation examined an AI-powered solution designed for efficient management of public engagement processes, especially within the context of public comments on NEPA reviews. The tool, called Jacobs AI – Engage, emphasizes the importance of streamlining data ingestion, processing, and analysis, utilizing AI technologies to optimize workflows that traditionally relied on manual methods. By automating tasks such as comment tagging, summarizing, and

response drafting, Jacobs AI – Engage aims to enhance data processing capacity and extract additional insights from public engagement.

A key theme of the presentation is the challenge faced in efficiently handling numerous public comments that come from various sources and formats. Prior to the implementation of Jacobs AI – Engage, comments were manually reviewed and tagged by topic within spreadsheets, a process that was not only time-consuming but also prone to inconsistencies and delays. Additionally, the level of public interest and number of comments received can be unpredictable and has the potential to overwhelm an agency's resources in the event a project "goes viral" and receives large volumes of correspondence.

Jacob's solution automates some aspects of collecting comment data, such as AI support for optical character recognition. Comment analysis tasks are supported by AI-assisted topic generation, tagging comments by topic, topic-driven summaries, response drafting, and identification of form letters. Jacobs AI – Engage also fosters improved communication and interpretation of comment analyses by decision-makers using structured dashboards, tables, and plots. The presentation showed screenshots illustrating specific aspects of the Jacobs AI – Engage workflow.

Key aspects detailed in the presentation are the capability of Jacobs AI – Engage to assess sentiment, categorize support or opposition to a proposed action, and generate draft responses based on identified topics of concern. This provides agencies with actionable insights into public perception and frees up additional time to engage in follow-up discussions with affected stakeholders. It also reveals an ethical approach in utilizing AI to streamline processes without replacing the role of human intelligence, which remains integral to validate the results of the comment analysis and confirm comment responses. The speakers stressed the importance of being transparent with clients on the use of AI and ensuring alignment with their organizational policies. Through transparency, alignment, and education, Jacobs emphasizes that AI can enhance decision-making processes and facilitate meaningful engagement with diverse stakeholders, including the general public, elected officials, and advocacy groups.

The presentation concluded by highlighting the potential of Jacobs AI – Engage to enable greater efficiency and responsiveness in the public engagement framework. It asserts that such innovations are critical for addressing pressing environmental and cultural issues.

2.5 Case Study 3 (James McWalter)

James McWalter, co-founder and chief executive officer of Paces, delivered a presentation outlining the use of AI in the permitting of large energy projects. Paces is a software company that offers a commercial platform and services designed to accelerate the development of large-scale energy projects by modeling early risks with site selection. Paces has developed a data platform that can support the entire project life cycle, with a particular focus on streamlining the process of preparing preconstruction environmental reports on behalf of energy project applicants that demonstrate compliance with local government and zoning ordinances. There are several challenges in local government permitting space, including (1) several thousands of jurisdictions (about 28,000) across the United States, each with unique restrictions and ordinances; (2) local data is often inconsistent, disorganized, inaccessible, difficult to interpret (e.g., distinguishing permitted vs. prohibited activities, dealing with mismatching definition units); and (3) traditional methods of manually drafting an environmental report can take months to complete.

To address some of the above-mentioned challenges, Paces has developed a sophisticated data pipeline and uses the curated data to draft environmental reports with AI (i.e., an LLM) and humans in the loop. For a given project type and location, the Paces data pipeline calls a curated in-house database and gathers information through web crawlers to pull current information. It also integrates geographic information system data and corresponding analytics. This data pipeline provides comprehensive power, land, and infrastructure-related multimodal data that can enable better decision-making for project planning, thereby improving effectiveness and lowering risk.

Another capability that Paces presented is the drafting tool to prepare an environmental report for a project applicant by leveraging its holistic data pipeline. Such environmental reports may be provided for internal evaluation by energy developers and/or to support applications for local permits. To create the drafting tool, Paces first analyzed thousands of historical documents to understand what constitutes an effective report and developed a schema that defines report structures, data sources, and other components. Specifically, the drafting content is divided into three modes: hard-coded text, direct data references, and LLM-generated content backed with data sources curated prior to the drafting stage. All LLM-generated content has citations to preselected data sources and Paces states that these sources are reviewed and validated by a subject matter expert (SME) prior to finalizing the report for a client.

The Paces data pipeline and drafting tool has improved the efficiency of the environmental reporting for local permitting and is backed with well-informed data to improve trust in the report artifacts. It's been reported that the initial report generation with AI takes less than 20 minutes, compared to 2 to 12 weeks with traditional manual methods. Although James has a stated goal to fully automate report creation if such methods can be demonstrated to meet quality standards, Paces currently assigns SMEs to review report contents to ensure quality, transparency, and trustworthiness.

2.6 Plenary

Following the conclusion of the case study presentations and the audience's questions, staff members from PNNL, including Dan Nally, Anurag Acharya, Mike Parker, Reilly Raab, Sarthak Chaturvedi, and Anastasia Bernat, hosted a plenary session. The plenary session summarized key points from the case study presentations and associated discussions. The case studies are summarized above in Sections 2.3 through 2.5. Audience questions, feedback, and concerns are summarized in Section 3.0. Workshop attendees could ask questions of the speakers verbally or by submitting comments to an online form.

3.0 Key Audience Questions, Feedback, and Concerns

The following sections list key questions (Q), responses (R), and comments (C) from the question-and-answer session following each workshop presentation. This summary is intended to capture the essence of the discussion and does not represent a verbatim transcription. The speaker for each session, as listed in the section heading, responded to questions from the audience unless otherwise noted.

3.1 Keynote (Eric Beightel)

Q: Is it a concern that technology layered over existing systems could simply make a flawed system go faster? Are we evaluating underlying problems before layering technology over current systems?

R: Technology forces us to rethink what is actually required or the best way to accomplish a given task, so this process does give us opportunities to reimagine the system and the technological architecture.

3.2 AI in NEPA (Sameera Horawalavithana)

Q: Are geographic information system analyses planned as a next step?

R: The initial focus is on collection and curation of text from NEPA documents. Subsequently, we aim to generate insights through georeferencing map images for a more comprehensive understanding of historical contexts.

Q: Considering the difficulty in retrieving data from NEPA documents, how is your evaluation of accuracy progressing?

R: We are actively engaged in creating benchmarks and conducting user evaluations alongside SME assessments of model quality and application. This iterative process prioritizes evaluations at scale to ensure reliability.

Q: How do you account for change in the significance of documents over time? For example, draft documents that are superseded by final documents and documents prepared under regulations that have since changed?

R: We would like our solution to understand documents within the context of historical changes to the regulatory framework and with a knowledge of litigation history, but this is a major challenge. Steps we hope to take in this direction are to connect NEPA documents with litigation information, thereby integrating various data elements for more comprehensive insights.

Q: Is PolicyAI now called PermitAI, and is it the same project?

R: Yes, PermitAI is the new name for the same project formerly known as PolicyAI.

Q: Is there a collaboration with Arizona State University's NEPAccess, specifically regarding a nationwide database?

R: Collaboration was initiated, but NEPAccess had some limitations in sharing the data publicly. Instead, we are working with the U.S. Environmental Protection Agency and other agencies, to ingest a broader set of NEPA documents (e.g., categorical exclusions, environmental assessments) to our platform. We already released a large NEPA document corpus publicly last year.

3.3 Case Study 1 (Matthew Aumeier)

Q: If there was an intermediate step, how would it be handled with this system?

R: Intermediate steps are managed outside the AI Scope Assist tool. The tool is focused specifically on streamlining the creation of initial project descriptions within the ERP.

Q: One of the concerns with AI is the energy demand. Do you have any idea about the energy demand for this work?

R: We currently do not have hard data for this but given the limited document volume and short processing times, the energy demand for this use case is considered negligible.

Q: Is the context window enough? How are you managing larger or more complex documents?

R (Matthew Aumeier): We have not encountered context-related issues for this application, as project scopes are generally concise. However, as we improved the prompt, we noticed higher quality results for documents that contained more context. We're continuing to evaluate longer-context capabilities for potential future needs.

R (Anurag Acharya): PNNL is actively researching methods to improve handling long contexts.

Q: Is there a way this application can pull all the project or other information into one place, not just do analytics?

R: The tool is in early development stages. Rapid progress is being made, and we plan to include additional capabilities for centralizing information.

Q: You said there are thousands of examples you're pulling from. Is the AI pulling NEPA documents from other agencies or external sources?

R: No. The tool uses a standard large language model that has not been custom trained on NEPA or agency-specific data. It operates by ingesting non-sensitive input and generating draft text through prompt-driven summarization.

Q: Are you planning to release more tools later this year? Could this approach be scaled more broadly?

R: We're actively refining our approach and considering additional applications of prompt-based AI to other parts of the review process. The methods used in AI Scope Assist are designed to be adaptable to a variety of use cases.

Q: Could this kind of AI help generate early drafts of technical report sections or NEPA chapters?

R: Yes. Generating structured first drafts based on technical input is a realistic and near-term application of this approach.

Q: Is the generated document 508 compliant?

R: Drafts produced by the tool are for internal use. Final publications are formatted and reviewed to ensure compliance with DOE accessibility and formatting requirements, including 508 standards.

Q: Can this tool eventually centralize all project-related information, beyond generating project descriptions?

R: *While the current focus is on generating scope content, we're exploring broader system integration to support centralized environmental review workflows.*

3.4 Case Study 2 (Michelle Rau, Kevin Murphy)

Q: What was the comparison in hours of labor required with and without AI?

R: For a sample case with 2,600 comments, manual processing required four people to work for 4 weeks. With AI, once the system is fine-tuned, data management takes approximately 4 hours, with an additional 1 to 2 hours needed for running the system. The primary advantage of AI is its ability to quickly stabilize categories, which traditionally requires a group of mid-level staff proposing categories derived from comments, a process usually taking a week.

Q: How are entry-level staff being incorporated now that AI performs their former introductory tasks?

R: Entry-level staff are now learning how to use AI tools interactively, as simply providing raw outputs is not well received. These tools require active engagement and understanding.

Q: Can the public give feedback on AI-generated feedback, and what is their recourse if AI misrepresents their comments?

R: Part of our responsibility is to review AI's outputs, which are subject to scrutiny and approval by SMEs. Although SME responses may differ, AI provides a valuable starting point. Public understanding hinges on transparency and effective communication of AI processes.

Q: If the public realizes a human is not reading their comments, how might they respond?

R: There must be human involvement in comment analysis to maintain trust and accountability in the process.

Q: Does the chatbot interface face clients or the public, and what are the risks of public access?

R: Currently, the chatbot is used internally. Granting public access could alter risk profiles.

C: AI could be used to simulate diverse personas, such as those from advocacy organizations, to generate synthetic comments and help agencies prepare accordingly.

Q: Can you share a comment delineation experience where the tool has been applied? I was part of a team that reviewed comments from the U.S. Marine Corps' Okinawa to Guam relocation. Delineation involved 35 people working over 3 to 4 months without AI assistance

R: While interdisciplinary comments remain challenging, automation is a welcome advancement, especially for projects with many unique comments.

Q: Are there ethical considerations in using AI, and how important is human quality assurance?

R: Continuous dialogue is essential to balance the benefits and ethical considerations of AI use, with an emphasis on human quality assurance and control.

Q: If AI conducted sentiment analysis on room comments, would the outcomes vary?

R: As public familiarity with AI grows, acceptance will likely increase. AI can produce varying results, echoing diverse public sentiment.

Q: How do you address discrepancies between SME expectations and AI-generated categories?

R: Common themes often recur, but AI can also reveal unexpected insights, requiring SME review. The tool aims to expedite reaching consensual themes.

Q: Are comments tagged once categories are defined, and how is sentiment handled?

R: Sentiment analysis is distinct from tagging due to language complexity. Category definitions can be modified and refined with few-shot examples.

Q: Have retrospective analyses been conducted to gain SME buy-in for AI? As an illustrative example, use of AI to process images of coral reefs and make interpretations about their health eventually became an accepted practice after demonstrating its ability to meet or exceed the accuracy of human classifications.

R: Yes, comprehensive analyses of past projects assessed accuracy and identified deviations, aiding SME acceptance.

C: Dr. Robert Wachter's work on digital health cautions that overstandardization and digitization can have unintended consequences; some of the lessons learned from the health care industry may be applicable to efforts to modernize the NEPA process.

3.5 Case Study 3 (James McWalter)

Q: How do you incorporate non-digitalized local government and zoning data from several jurisdictions across the United States?

R: The permitting-related database needs constant updates that require substantial effort, with the workload split roughly 50:50 between automatic pipeline and SME work. We leverage technology like web crawlers to constantly pull current data as well as multiple staff members to collect data.

Q: Is the Paces tool designed for specific sectors?

R: We currently work with energy and data center projects, but plan to expand our scope in the future.

Q: Is there a public engagement component to the reports Paces prepares?

R: Paces does not have plans to include public engagement in its reporting tools.

Q Do Paces' AI tools train on customers data?

R: Paces does not train AI models on customers data. Instead, SMEs are involved at every stage of the development and their inputs are used for training and evaluating the AI models.

Q: Does Paces' tool have any client project that successfully went through approval?

R: Yes, there are few projects that went through our platform/tool and got approved by regulatory bodies. However, they all are at the local permitting level but not for federal NEPA process.

Q: What is your plan or vision for Paces over the next 10 to 12 years?

R: My personal opinion is that permitting processes can eventually be heavily automated, substantially decreasing the need for robust SME input and the long lead times required to build energy projects.

Q: I am concerned about the commoditization of permits to just become checkboxes. The purpose of permitting is to consult with the public before making a decision.

R: I see the primary purpose as helping projects get built as quickly as possible. Projects should be approved after demonstrating that they meet the required regulations. Adding additional parties slows down this process.

4.0 Key Barriers to Implementation of AI in Permitting

- **Data Standardization Challenges:** Inconsistent or nonexistent data standards, siloed databases, and disparate requirements across permitting agencies hamper interagency coordination and contribute to communication gaps and misunderstandings with project sponsors. This poses significant barriers to implementing AI solutions that rely on consistent datasets for the best results.
- **Lack of Automation Mechanisms:** Agency processes for preparing NEPA documents typically utilize a wide variety of software applications and decentralized workflows rather than centralized, reconfigurable software systems, which makes it difficult for AI tools to integrate seamlessly and improve efficiency through automation without further software development. For processes that can be automated, there is the potential for automation to further institutionalize rather than address that process's fundamental flaws or challenges.
- **Analysis Integrity Concerns:** The prospect of increased standardization and automation raises concerns about reducing complex environmental reviews to simple checklists, whereby approvals and permits may become commoditized to meet specific technical requirements rather than subject to nuanced analysis of potential environmental effects. This commoditization risks diminishing the protective function of environmental processes and may undermine public trust if not carefully managed.
- **Ethical and Quality Assurance Issues:** Quality assurance for environmental analyses, NEPA documents, and handling of public comments remains vital amid AI integration, as public trust necessitates transparency and accountability in AI-driven processes. Ethical considerations around resource consumption and environmental impacts of AI, generation of synthetic comments and responses, automated decision-making, and the extent to which qualified human reviewers must validate LLM-produced text and recommendations require thorough discussion and resolution.
- **AI Limitations:** Challenges in handling long contexts typical of NEPA documents and supporting data or compiling data from multiple agencies can impede AI tool functionality. The absence of data standardization further complicates interagency collaboration and tool scalability. AI struggles with the interpretation of cultural nuance and polite dissent. AI could misinterpret sources or inadvertently cite irrelevant or nonexistent sources, potentially introducing inaccuracies or distractions. Lowering risk requires practitioners to be trained to filter and interpret AI-generated content critically.
- **Loss of Human Capital:** There is concern that automation of tasks traditionally assigned to entry-level NEPA practitioners (e.g., reviewing public comments) will reduce the demand for, and thus the availability of, entry-level jobs, resulting in gaps in staffing and skills training needed to prepare entry-level employees for mid-level and advanced roles, as well as challenges recruiting and retaining talented individuals. Additionally, reductions in the federal workforce and funding will diminish agency resources available to maintain and curate datasets used in NEPA reviews and reduce the availability of expert staff to manage and evaluate the performance of AI tools.

5.0 Key Opportunities for Implementation of AI in Permitting

- **Enhanced Data Management**: AI advancements can significantly enrich agency data-management practices, especially when the ingested data conforms to consistent standards. Enhanced data management can help agencies track and evaluate permitting actions, as well as position them to better extract lessons learned and best practices from completed processes. Data-ingestion pipelines can assist with standardization of data and metadata from historical NEPA documents and other relevant data, making information more accessible and available for AI-assisted evaluation of trends and insights.
- **Improved Efficiency**: The integration of AI into NEPA workflows offers potential for enhanced efficiency through collaborative approaches that augment rather than replace human expertise. AI tools can assist tedious tasks such as comment tagging, processing, and summarizing; synthesizing key points from supporting literature; and revising text to meet target length and reading level. These types of assistance would allow staff to focus more on analytical work rather than repetitive functions.
- **Improved Quality and Accuracy:** Advanced AI models like LLMs exhibit generally high accuracy for automated drafting for human review or review of human-prepared drafts. With careful consideration of AI limitations, staff can selectively use AI to perform reviews in scenarios where it exhibits high performance, such as checks for consistency, readability, and grammatical errors.
- **Improved Processes:** Properly evaluating the readiness of agency processes for AI integration requires a wholistic and nuanced understanding of that process. Systematic inventory and review of elements that support the NEPA process, including agency regulations, workflows, and software tools, can help to pinpoint bottlenecks and inefficiencies. This presents opportunities to make fundamental process improvements. regardless of whether they are ultimately addressed through use of AI.
- **Increased Transparency and Accountability**: Initiatives like the Permitting Dashboard have demonstrated the potential to increase transparency and interagency coordination for major infrastructure projects. AI could assist in making similar transparency and accountability tools and metrics available for a broader range of NEPA projects, using automation to minimize staff resources needed to manage the tools. For example, EIS milestones could be automatically posted to a centralized location through the use of LLMs to interpret Federal Register notices.
- **Scalability and Broader Applications**: AI tools developed for specific NEPA processes show promise for adaptation across different agencies and organizations. Furthermore, AI tools can potentially support the diverse environmental review needs aligned with broader strategic goals in energy, infrastructure, and environmental objectives. The PermitAI[5] project from DOE and PNNL demonstrates how AI-driven tools can evolve to address multiple aspects of environmental reviews and federal permitting processes.

[5] "PermitAI," Pacific Northwest National Laboratory, accessed May 29, 2025, https://www.pnnl.gov/projects/permitai.

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