



Effective Use of AI in NEPA Decision Making Workflows

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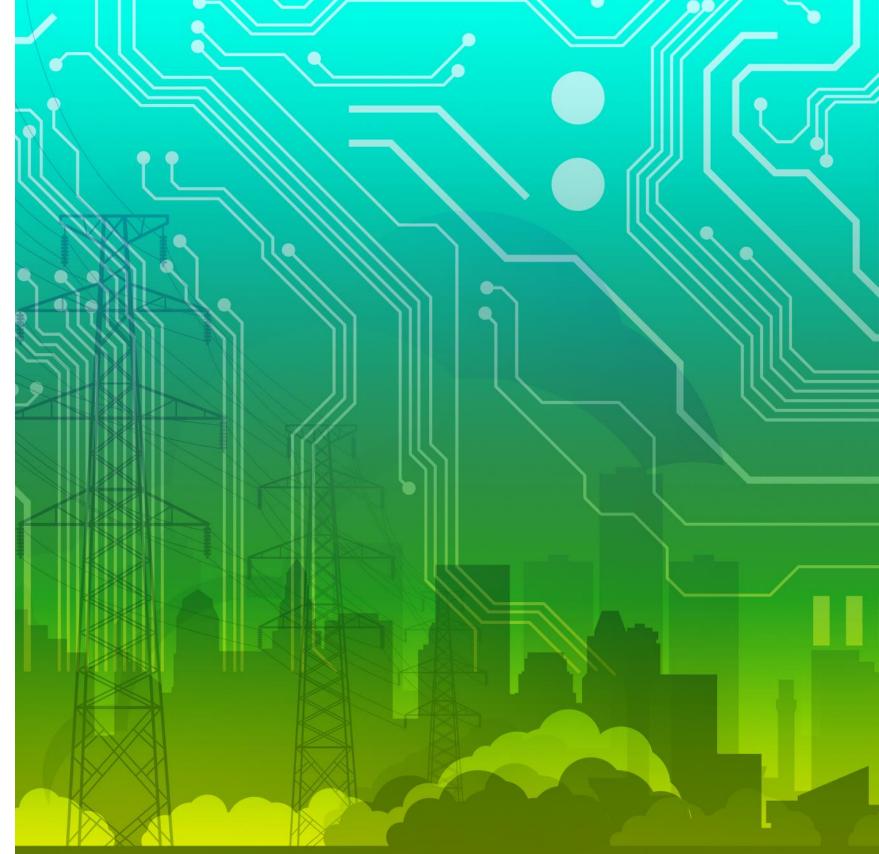
PermitAl, Faster Federal Permitting using Al





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PNNL-SA-210962





Al and LLM Primer



Al and LLM

Perspective: Human-Like Reasoning

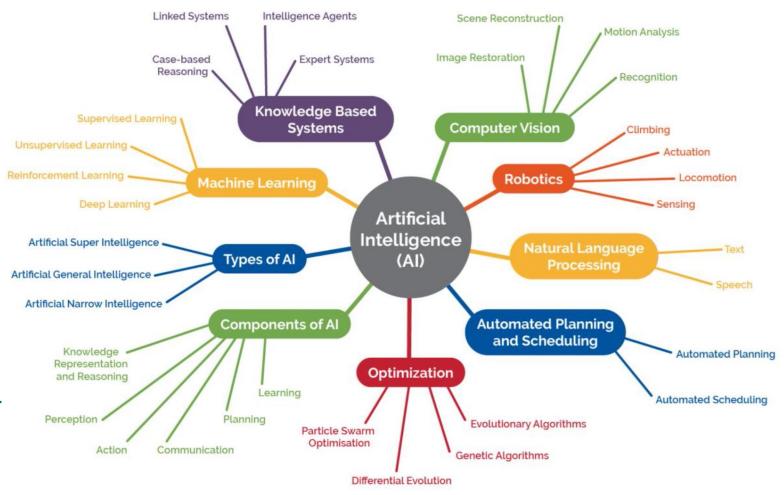
"The theory and development of computer systems able to perform tasks normally requiring human intelligence such as, visual perception, speech recognition, learning, decision-making, and natural language processing."

Perspective: An Algorithm that Pursues a Goal

"Any computational method that is made to act independently towards a goal based on inferences from theory or patterns in data."

Perspective: Intelligence Augmentation

"Augmented intelligence is a design pattern for a humancentered partnership model of people and artificial intelligence (AI) working together to enhance cognitive performance, including learning, decision making, and new experiences."

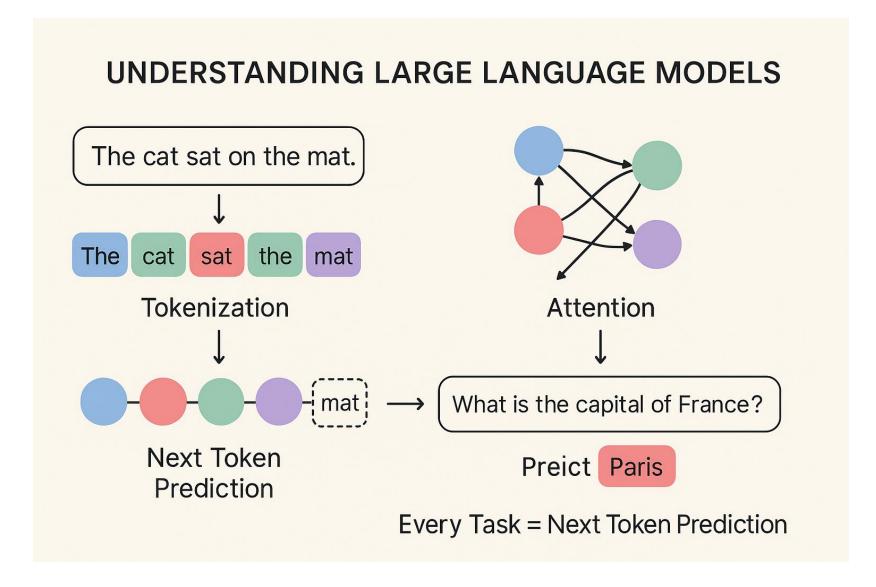




Understanding Large Language Models (LLMs)

Imagine a super-smart computer program that's read tons and tons of books, articles, and websites. It learns how words usually go together and can then create new sentences, answer questions, and even write stories!

That's kind of what a Large Language Model (LLM) is. LLMs are great at understanding and generating human language.



GPT-4 generated this image with the prompt "Create a a GIF that help 8-grader to understand Large Language Model, Help to understand how Tokenization works, how attention works, how next token prediction works, how every task is an instance of next token prediction"



Tokenization Breaking Down the Code



Tokenization - Computers are great with numbers, but not so much with words directly. So, the first step is to break down sentences into smaller pieces they *can* understand. These pieces are called "tokens". Tokens can be whole words, parts of words (like "ing" or "un"), or even punctuation.

It's like taking a big Lego structure apart into individual bricks!

	g Technology into the 21st Century!		
Let s bring	Permitting Technology into the 21st Century !		
Cool Fact: LLMs use different ways to tokenize. Some break words into smaller "subwords" so they can handle new or misspelled words better!			

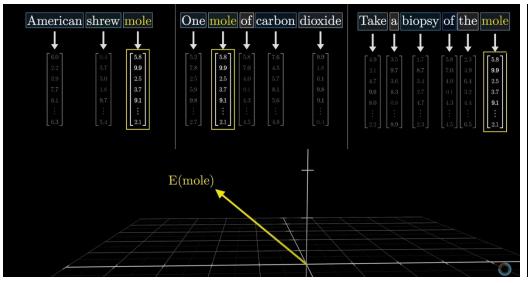


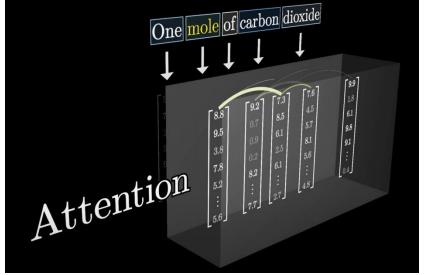
Attention - Who's Talking to Who?

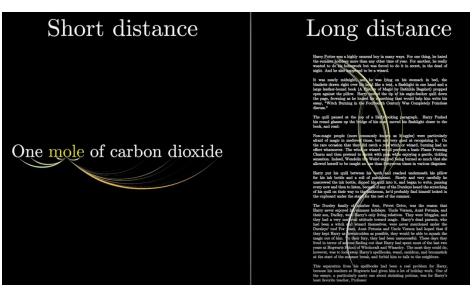


When you read a sentence, you naturally know which words are important and how they relate to each other.

LLMs need to do this too! "Attention" is a clever mechanism that helps the model figure out which words in the sentence are most important when it's thinking about a specific word.









Next Token Prediction - The Guessing Game



At its core, a lot of what an LLM does is try to predict the *very next* token that should come in a sequence. Based on everything it's seen before (the input text and the tokens it has already generated), it calculates the chances (probabilities) for *every possible* next token.

Temperature: Controlling Creativity When predicting the next token, the LLM doesn't *always* pick the single most likely one. "Temperature" is a setting that controls how adventurous the model is.

emp	erature: 0.7 edict Next Token!
Th	e model thinks the most likely next token is: Century
He	ere are the possibilities the model considered (probabilities adjusted by temperature):
	Century: 63.7%
	century: 17.2%
	: 11.4%
5	st: 4.6%
	C.: 2.4%
)	vear: 0.6%
	w it Chooses: With temperature, the model still uses probabilities, but temperature "smooths" or "sharpens" these babilities before making a choice.



Everything is a Prediction Task!



Almost anything you ask an LLM to do can be framed as predicting the next token. The LLM just keeps predicting token after token until it thinks it's finished the task.

Task: Translation

Input: Translate English to French: 'Hello'

Model Predicts: 'Bonjour' (It predicts the French tokens that should follow the instruction)

Task: Summarization **№** □ **>**

Input: Summarize this article: [A really long article about space]

Model Predicts: [A short summary about space] (It predicts the tokens that condense the article)

Task: Question Answering 9 2

Input: Answer this question: 'What is the capital of France?'

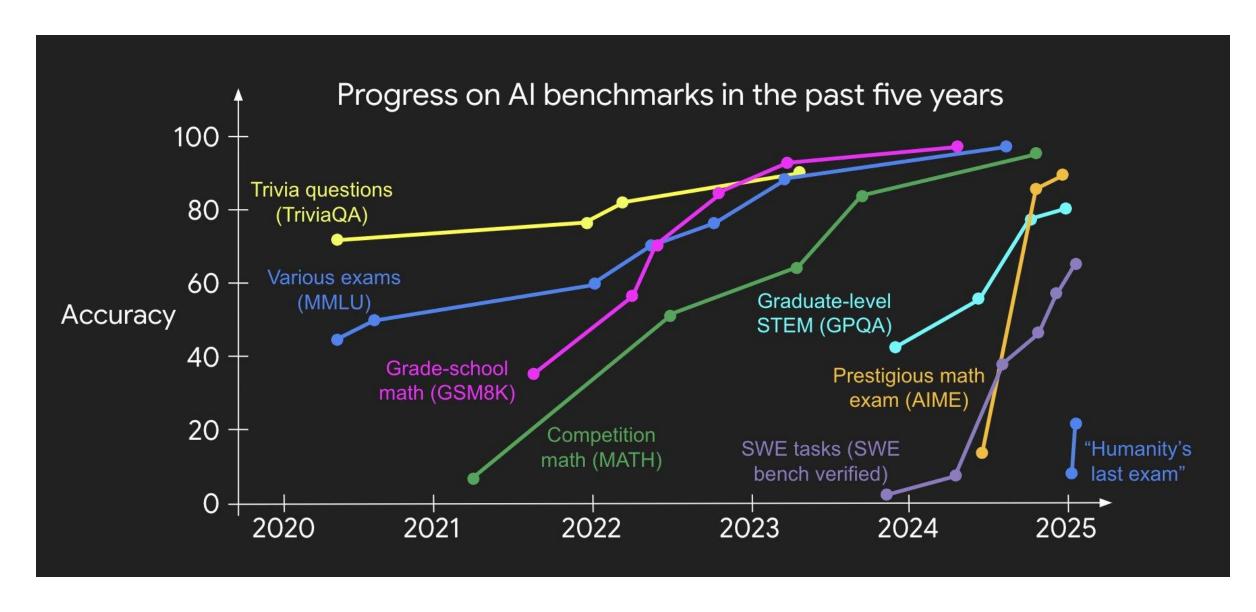
Model Predicts: 'Paris' (It predicts the tokens that directly answer the question)



Al Current (April 2025) Status



Al Benchmarks



Jason Wei @X



Do LLMs Pass the Turing test?

- The Turing's "imitation game." If the interrogator couldn't correctly determine which respondent was the computer and which was the human, it would suggest, on a very general level, that the machine could imitate a human.
- 3-party Turing test: Participants communicate with both a human and AI, then decide which is which
- Current Status: LLMs excel as master conversationalists

NEWS FEATURE | 25 July 2023

ChatGPT broke the Turing test – the race is on for new ways to assess AI

Large language models mimic human chatter, but scientists disagree on their ability to reason.



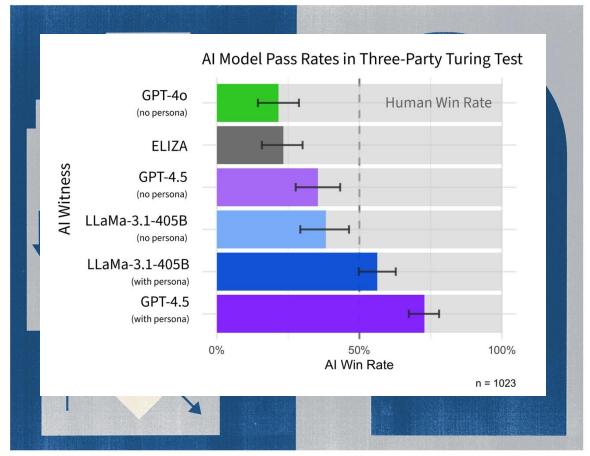


Illustration by The Project Twins



Are LLMs Creative and Intuitive?

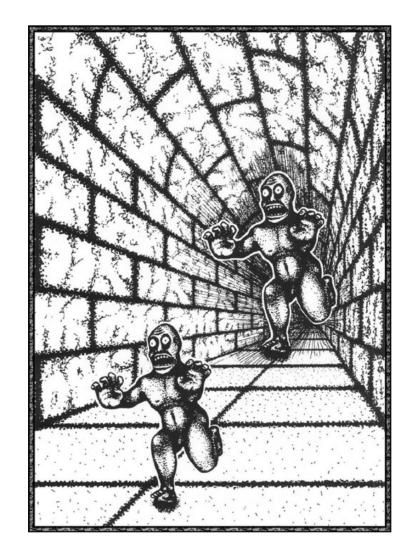
Google DeepMind CEO Demis Hassabis acknowledges the lack of true curiosity and imagination in present AI systems.

While AI can generate creative content, studies suggest it may not yet match the depth and consistency of human creativity.

Al can be a powerful tool to assist and augment human creative processes, but it doesn't yet replicate the full scope of human creativity, including intention and deeper understanding.

Artificial intelligence could end disease, lead to "radical abundance," Google DeepMind CEO Demis Hassabis says

Haase, Jennifer, Paul HP Hanel, and Sebastian Pokutta. "Has the Creativity of Large-Language Models peaked? An analysis of inter-and intra-LLM variability." arXiv preprint arXiv:2504.12320 (2025).



Source: Roger Shepard, "Terror Subterra," in Mind Sights: Original Visual Illusions, Ambiguities, and other Anomalies (New York: W. H. Freeman & Co, 1990). Downloaded from http://direct.mit.edu/daed/article-pdf/151/2/139/2060633/daed_a_01906.pdf by guest on 24 April 2025



Community Perspective

LLMs as Good Collaborators

The New York Times

OPINION

GUEST ESSAY

The Robot Doctor Will See You Now

Feb. 2, 2025



nature human behaviour

Perspective

https://doi.

How large language models can reshape collective intelligence

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Check for updates

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Collective intelligence underpins the success of groups, organizations, markets and societies. Through distributed cognition and coordination, collectives can achieve outcomes that exceed the capabilities of individuals—even experts—resulting in improved accuracy and novel capabilities. Often, collective intelligence is supported by information technology, such as online prediction markets that elicit the 'wisdom of crowds', online forums that structure collective deliberation or digital platforms that crowdsource knowledge from the public. Large language models, however, are transforming how information is aggregated, accessed and transmitted online. Here we focus on the unique opportunities and challenges this transformation poses for collective intelligence. We bring together interdisciplinary perspectives from industry and academia to identify potential benefits, risks, policy-relevant considerations and open research questions, culminating in a call for a closer examination of how large language models affect humans' ability to collectively tackle complex problems.

Burton, Jason W., et al. "How large language models can reshape collective intelligence." Nature human behaviour 8.9 (2024): 1643-1655.



Community Perspective

Adopt Al as a Normal Technology

Analysis of Al often contrasts "Al as impending superintelligence" with "Al as a fad that will soon end". Naraynan et al. suggest the third alternative: Al as a general-purpose technology that will follow well-worn patterns of innovation and diffusion.

"We view AI as a tool that we can and should remain in control of, and we argue that this goal does not require drastic policy interventions or technical breakthroughs."

"We do not think that viewing AI as a humanlike intelligence is currently accurate or useful for understanding its societal impacts, nor is it likely to be in our vision of the future"

Al as Normal Technology: An alternative to the vision of Al as a potential superintelligence By Arvind Narayanan & Sayash Kapoor

	$Capability \rightarrow Power$	$\mathbf{Power} \rightarrow \mathbf{Loss} \ \mathbf{of} \ \mathbf{control}$
Super- intelligence view	Seen as almost inevitable due to superhuman AI abilities, including speed and persuasion (which we consider either irrelevant or unlikely to be possible). Use of the term "intelligence" to refer to both capability and power, essentially erasing the distinction.	Seen as the primary locus of safety interventions, primarily to be achieved using model alignment.
Normalist view	Seen as the primary locus of safety interventions. Achievable due to: • market incentives for safety, and safety regulation; • techniques discussed in "many flavors of control"; • the use of AI for defense; downstream defenses; • policies that inhibit concentration of power (whether by human or AI systems) Made more tractable due to slow diffusion.	Seen as largely irrelevant; for highly agentic systems, power and loss of control are essentially tautological.

Figure 5. Two views of the causal chain from increases in AI capability to loss of control.

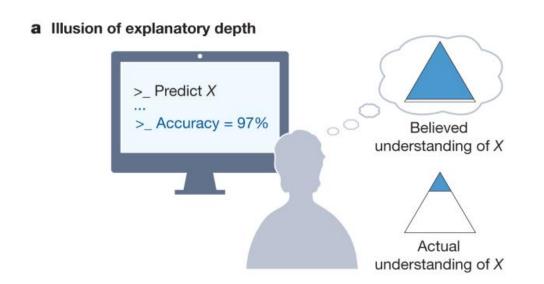
Once we stop using the terms 'intelligence' and 'superintelligence,' things become much clearer (Figure 5). The worry is that if AI capabilities continue to increase indefinitely (whether or not they are humanlike or superhuman is irrelevant), they may lead to AI systems with more and more power, in turn leading to a loss of control. If we accept that capabilities are likely to increase indefinitely (we do), our options for preventing a loss of control are to intervene in one of the two causal steps.

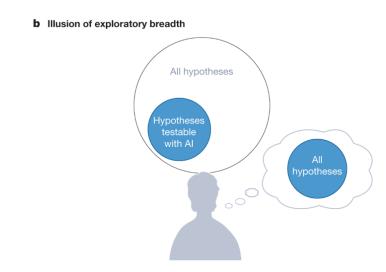
The superintelligence view is pessimistic about the first arrow in Figure 5—preventing arbitrarily capable AI systems from acquiring power that is significant enough to pose catastrophic risks—and instead focuses on alignment techniques that try to prevent arbitrarily powerful AI systems from acting against human interests. Our view is precisely the opposite, as we elaborate in the rest of this paper.

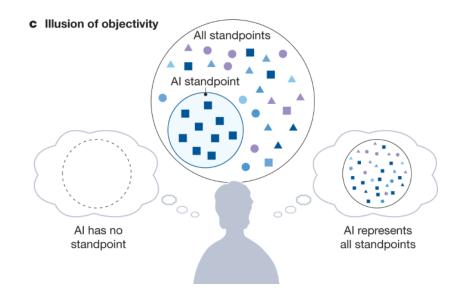


Community Perspective

Do Not Trap to Al Illusions







People relying on another person — or, in this case, an algorithm — for knowledge have a tendency to mistake that knowledge for their own and think their understanding is deeper than it actually is.

Research becomes skewed towards studying the kinds of thing that AI systems can test

Researchers see AI systems as representing all possible viewpoints or not having a viewpoint.

For NEPA SMEs, you can reduce potential issues with AI through several strategies.

- Align your proposed use of Al with your goals and consider which common pitfalls you might encounter.
- Deploying AI tools to streamline tasks you are already proficient in is less risky than relying on them to provide expertise your team lacks.

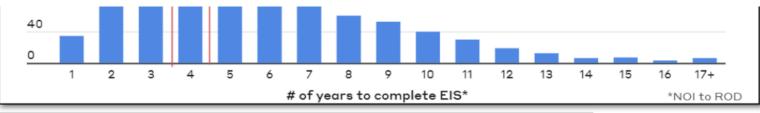


AI in NEPA Reviews



Fast Federal Permitting using Al





Source: Council on Environmental Quality

Federal agencies are under increasing pressure to complete high-quality environmental reviews faster, cheaper, and with lower page counts.

Timeline

Current status: Research and development, pilot and v1 applications, interagency agreements and feedback

1–2 years

Al-enabled pilots improving permitting workflows

5 years

Operationalized AI models streamlining permitting

An Al-driven platform and tools to streamline and improve review/permitting efficiency and outcomes through human-machine collaboration

DOE and PNNL are working with industry collaborators to augment frontier Al technologies for specific use in permitting workflows.

DOE and PNNL will identify additional potential priority applications in consultation with interagency partners



NEPA and Permitting Technology Ecosystem

Primary Responsibilities:

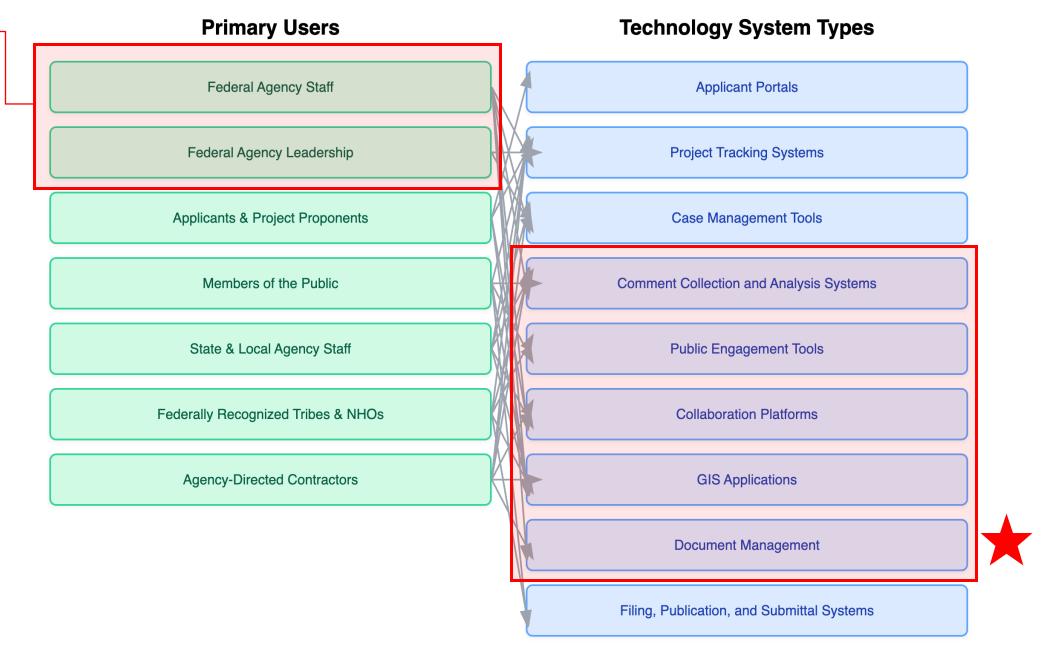
- Conduct NEPA reviews
- Review and make decisions on permit applications
- Consult with federally recognized Tribes
- Solicit and respond to public comments

Additional Duties:

- Manage the NEPA process
- Collaborate with other agencies on NEPA documents and consultations
- Engage with Tribal, state, and local governments, project applicants, stakeholders, and the public

Roles in NEPA Process:

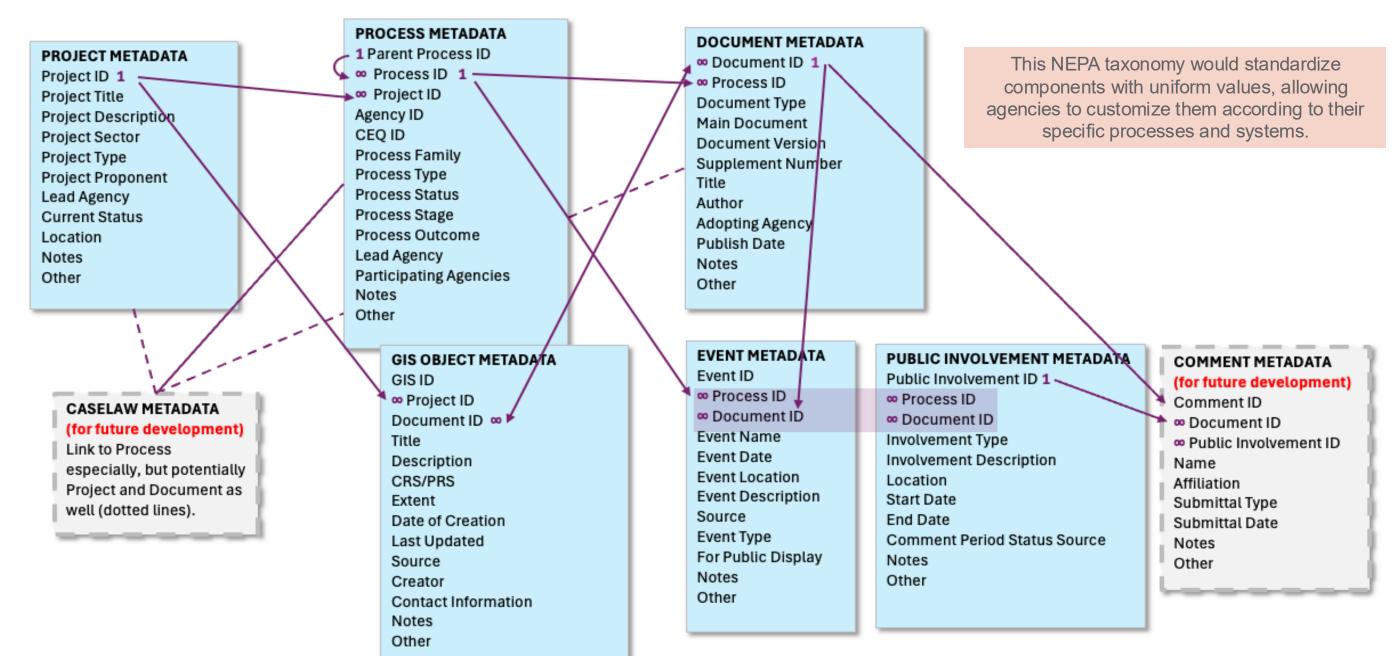
- Serve as lead, joint lead, cooperating, or participating agencies
- Varying degrees of involvement in proposed actions



Council on Environmental Quality Report to Congress on the Potential for Online and Digital Technologies to Address Delays in Reviews and Improve Public Accessibility and Transparency under 42 U.S.C. 4332(2)(C) https://ceq.doe.gov/docs/ceq-reports/CEQ-E-NEPA-Report-to-Congress_Final-(508).pdf



NEPA Taxonomy and Metadata Standards





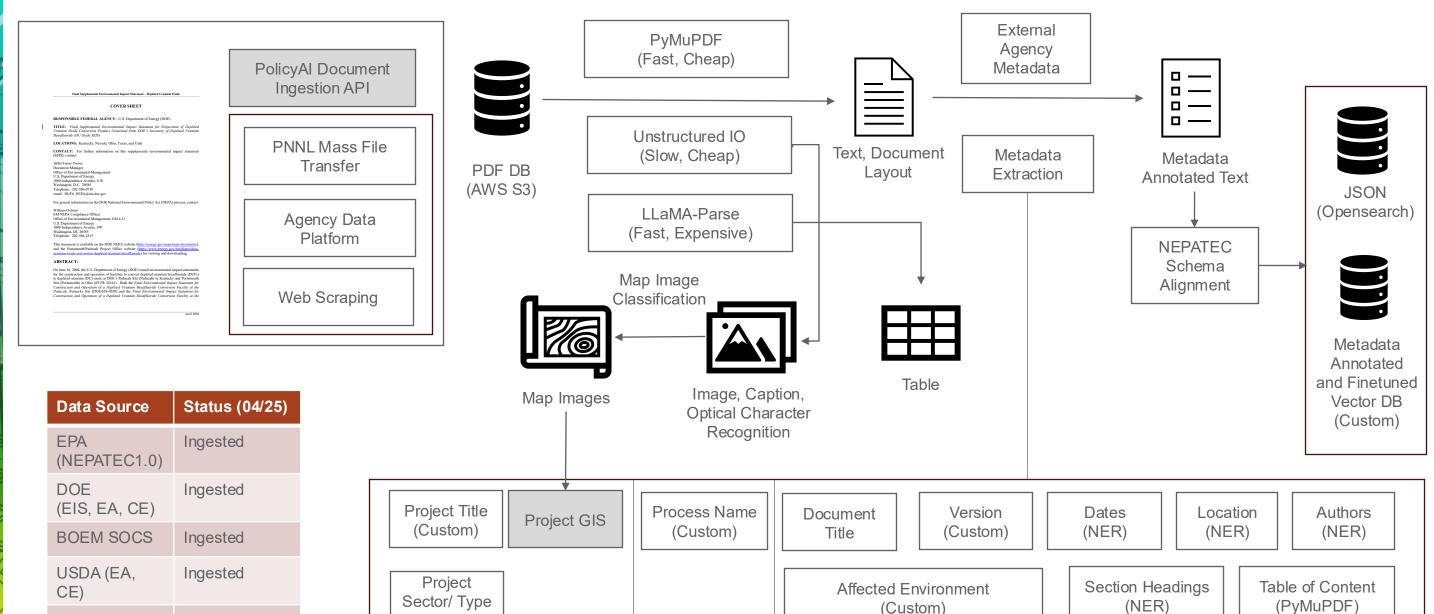
Ingested

BLM

(EIS, EA, CE)

(Custom)

NEPA Document Processing Pipeline



Project Metadata Process Metadata Document Metadata

20



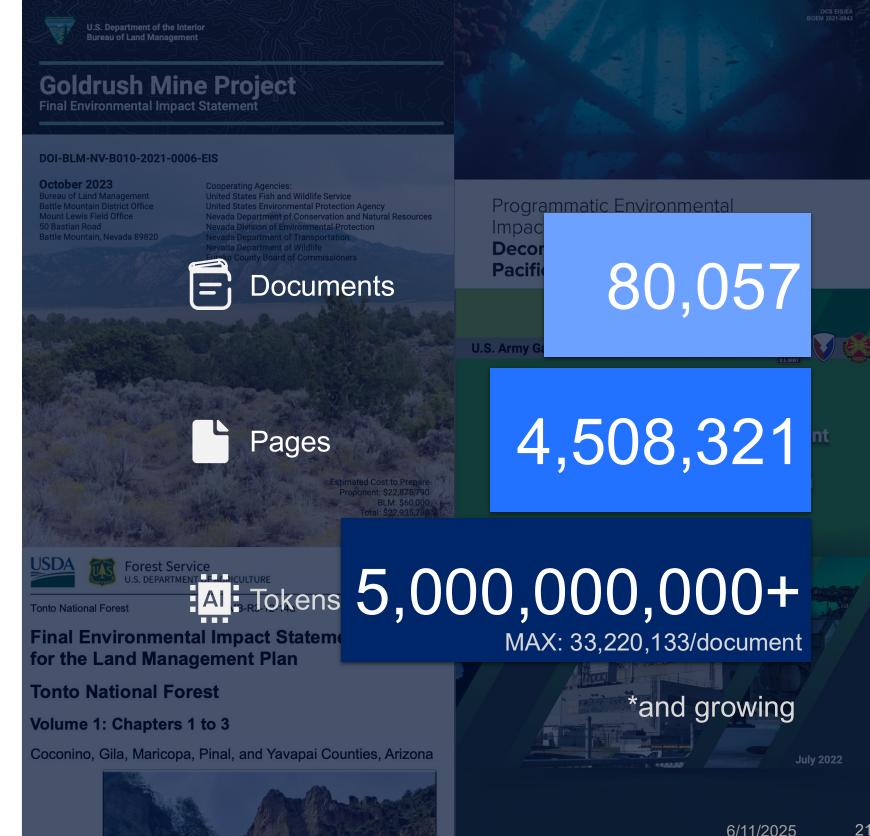
NEPA Text Corpus (NEPATEC)

Documents are collected across 5+ Siloed Data Sources

- **EPA**
- DOE
- **BOEM**
- **USDA**
- **BLM**

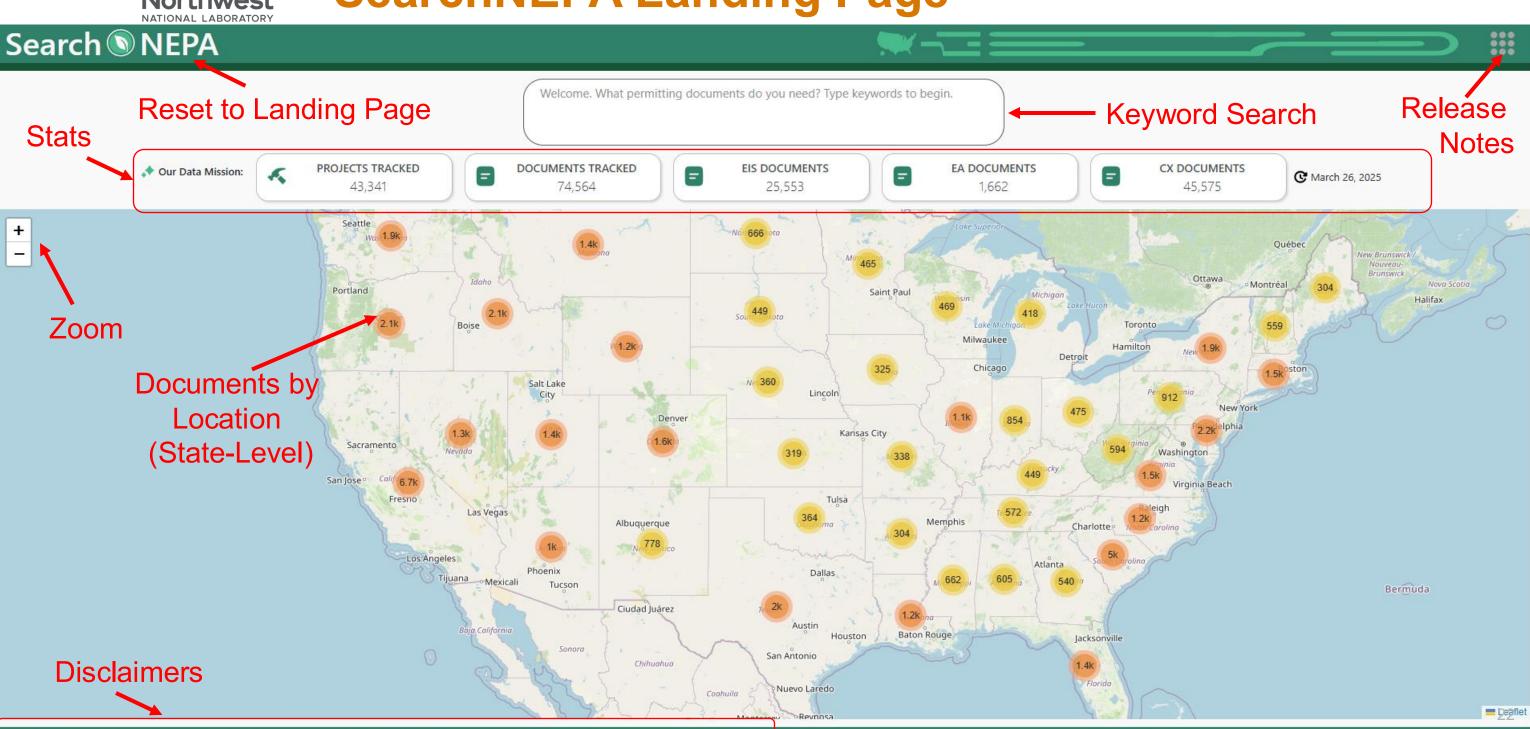
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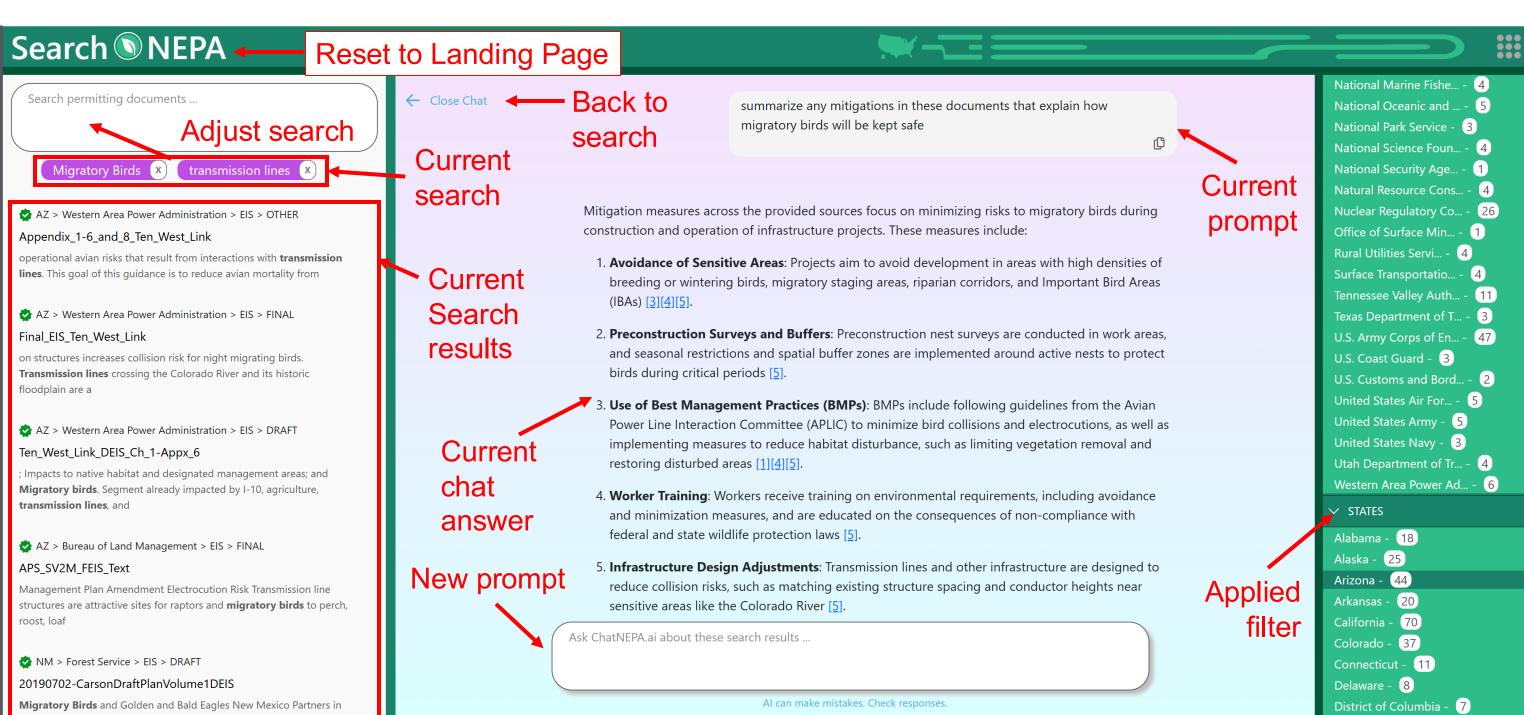


SearchNEPA Document Search Results Number of results

Search NEPA *** Reset to Landing Page 594 Documents Initiate ChatNEPA Search permitting documents .. Filters 11 Sort by Clear Filters Vol 4 CCSM FEIS Attchments B-E > □38 pages ← Click for document ✓ ACTNCIES Searched Term(s) Migratory Birds x Seagle Take Permits for the Chokecherry and Sierra Madre Phase I Wind Energy Project Click for project Animal and Plant Heal... fiii Fish and Wildlife Service FINAL (+) Not Supplemental Map It Bonneville Power Admi... -Bureau of Indian Affa... - 17 Chokecherry and Sierra Madre Wind Energy Project Environmental Constraints and Measures Phase I Wind Turbine Development TABLE 4. APPLICANT COMMITTED BEST MANAGEMENT PRACTICES (ROD TABLE D-3) 38 August 2015 Item Bureau of Land Manage... - 106 Resource Concern Measure Applicability to Migratory Birds and Bats A-3-69 Soils - Erosion Control If, during operation, it is Bureau of Ocean Energ... - 6 determined that snow accumulation causes significant accelerated erosion, appropriate mitigation measures (e.g., snow fence Bureau of Prisons - 2 construction) would be developed and implemented. Measure will reduce impacts to soils, increase reclamation success, and Bureau of Reclamation - 6 maintain habitats that are used by migratory birds and bats. A-3-70 Soils - Excavation and Blasting Activities Foundations and California Department... - 5 trenches would be backfilled with originally excavated material as much as possible. Excess excavation materials would be disposed of only in approved areas or, if suitable, stockpiled for use in reclamation activities. No applicability to migratory Department of Commerc... - 12 birds and bats. A-3-71 Soils - Excavation and Blasting Activities Borrow material would be obtained only from authorized and Department of Energy - 41 permitted sites. Existing sites would be used in preference to new sites when possible. No applicability to migratory birds and Department of Housing... - (2) bats. A-3-72 Soils - Topsoil Handling Topsoil from all excavations and construction activities would be salvaged and reapplied during reclamation. Topsoil salvage will increase reclamation success and benefit migratory birds and bats per item A-3-41. A-Department of State - 4 3-73 Soils - Topsoil Handling Topsoil material suitable for site reclamation would be removed in conjunction with clearing and Department of Transpo... - 1 grading and reserved in local stockpiles. Topsoil storage areas would generally be located within staging areas and alongside Department of Treasur... - 1 roadways during construction. Topsoil salvage will increase reclamation success and benefit migratory birds and bats per item Department of the Int... - 1 A-3-41. A-3-74 Soils – Wet Soils During Construction Construction activities would be suspended when soils are wet. Environmental Protect... - 2 Construction would resume when soils become dry enough to support construction equipment. The Environmental Inspector (El) would determine when conditions are too wet to continue. Measure will reduce impacts to soils, increase reclamation Federal Aviation Admi... - 3 success, and maintain habitats that are used by migratory birds and bats. ... Federal Emergency Man... - 1 Federal Energy Regula... - 94 Federal Highway Admin... - 23 CP-KCS FEIS EPA Vol XI 01272023 > 28 pages **Search Results** Federal Railroad Admi... - 2 Canadian Pacific Acquisition of Kansas City Southern Federal Transit Admin... - 5 Fish and Wildlife Ser... - 27 Michigan, Oklahoma, Arkansas, Illinois, Texas, Missouri, Louisiana, Kansas, Iowa, Minnesota ि ग्रां। Surface Transportation Board Forest Service - (135) + Not Supplemental FINAL Map It Minerals Management S... - 2 please contact our office for further coordination. For communication and wind energy projects, please refer to additional National Aeronautics ... - 3



ChatNEPA for NEPA Fact Finding





ChatNEPA for Project-level Fact Finding

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Early Site Permit at PSEG Site

AGENCY



LOCATION



New Jersey

DOCUMENTS

- ♦ NJ > Nuclear Regulatory Commission > > FINAL NUREG-2168_Vol_1
- NJ > Nuclear Regulatory Commission > > FINAL NUREG-2168_Vol_2
- NJ > Nuclear Regulatory Commission > > FINAL NUREG-2168_Vol_3
- ❖ NJ > Nuclear Regulatory Commission > > COMMENT
 CEQ20150329

Project title

Current prompt what is the purpose and need for this action?

The purpose and need for the proposed action are twofold. For the NRC, the purpose of issuing the Early Site Permit (ESP) is to provide early resolution of site safety and environmental issues, which contributes to stability in the licensing process. Although no reactor will be built under the ESP, the environmental review assumes the construction and operation of one or two reactors to meet the need for up to 2,200 MW(e) of baseload power in New Jersey by 2021 [1]. For the USACE, the purpose is to issue a Department of the Army permit to allow PSEG to perform dredge and fill activities necessary for building a power plant to generate additional baseload electricity [1].

Al can make mistakes. Check responses.

Page 26 of NUREG 2168 Vol 1

Part of the Early Site Permit at PSEG Site, overseen by the Nuclear Regulatory Commission

Page 167 of NUREG 2168 Vol 2

Part of the Early Site Permit at PSEG Site, overseen by

the Nuclear Regulatory Commission

Page 426 of NUREG 2168 Vol 3

the Nuclear Regulatory Commission

Part of the Early Site Permit at PSEG Site, overseen by

Page 59 of NUREG 2168 Vol 1

Part of the **Early Site Permit at PSEG Site**, overseen by the **Nuclear Regulatory Commission**

Page 169 of NUREG 2168 Vol 2

Part of the Early Site Permit at PSEG Site, overseen by the Nuclear Regulatory Commission

New prompt

ChatNEPA.ai about this project

25

Current

chat

answer

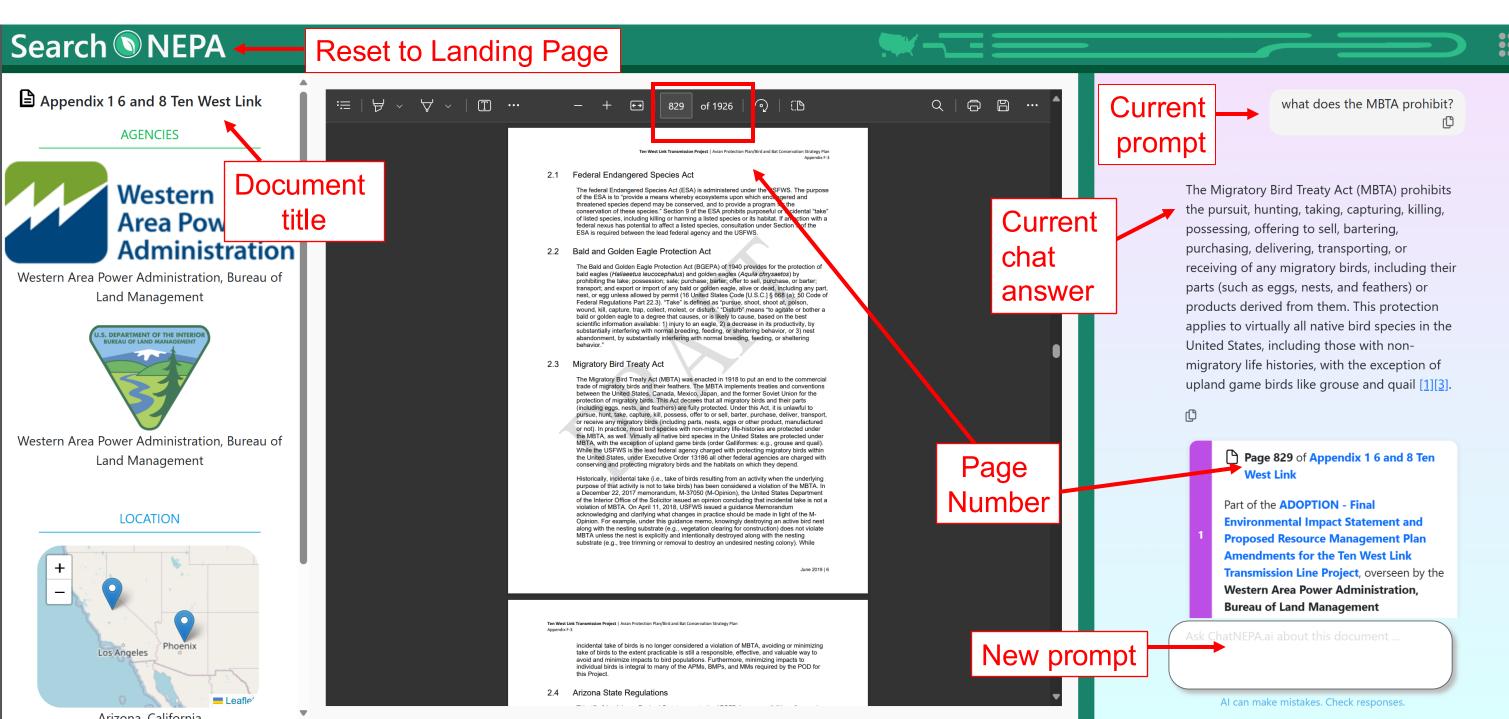
Sources

used in

answer



ChatNEPA for Document-level Fact Finding





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Gihan Panapitiya (Past)



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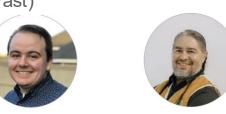


Sai Koneru



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Taylor Edwards



Kathy Nwe



Reilly Raab



Amanda Reed



Heng (Alfred) Wan



Alex Buchko



Karen Dsouza (Past)



Srinath Kannan



Cleve Davis



Kaustav Bhattacharjee



Mahantesh Halappanavar



Karl Pazdernik



Ann Miracle

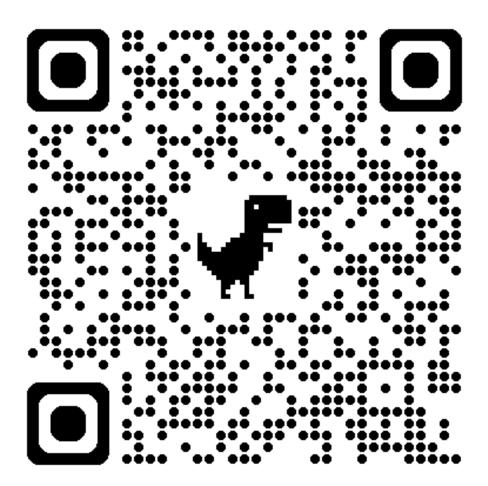


Bethel Tarekegne (Project manager) 6/11/2025



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