Establishing an Early CO_2 Storage Complex in Kemper County, Mississippi

Prepared for:
2023 FECM/NETL Carbon Management Research Project Review Meeting

Prepared By:
Ben Roth, Senior Consultant - Geology
Advanced Resources International, Inc.

August 29, 2023
Pittsburgh, PA

Advanced Resources International, Inc.

Disclaimer

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express of implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Partnerships

ECO_2S Phase III Project Update

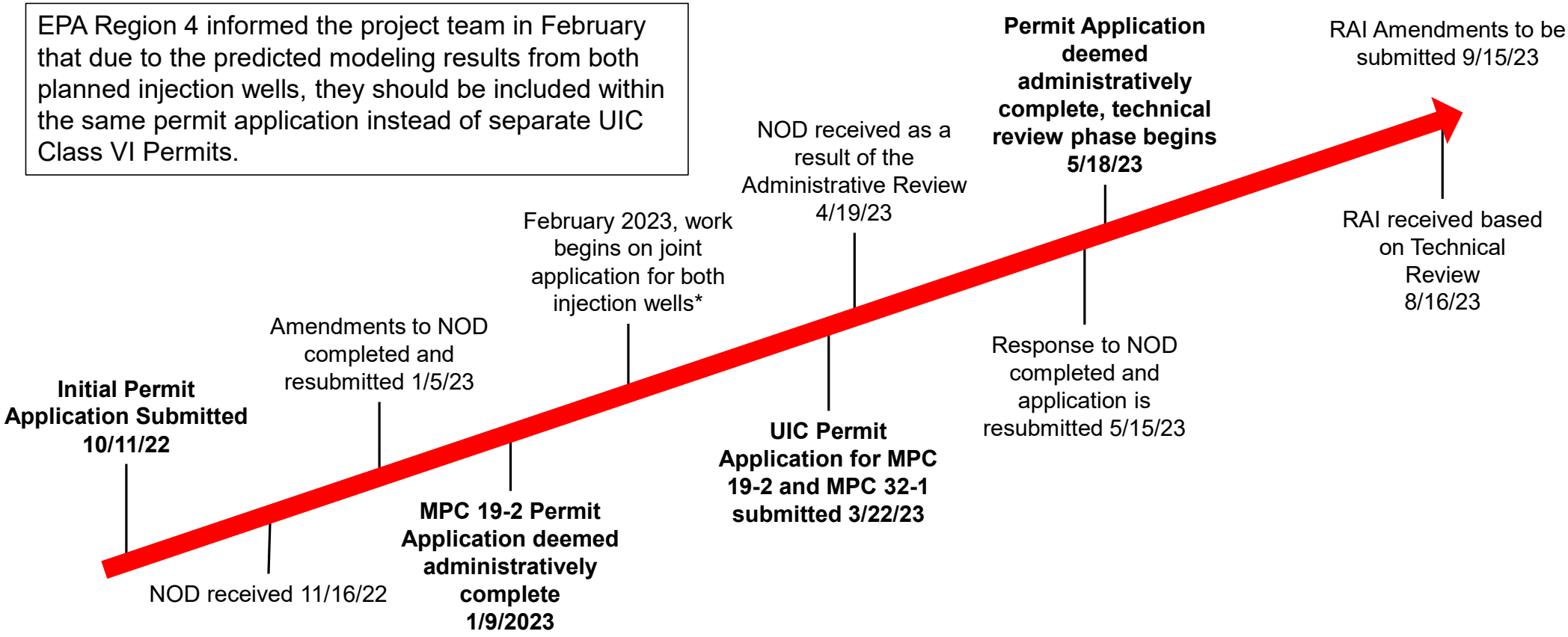
	Outline
1	UIC Permitting Process
2	NEPA
3	Operations Update
4	CSEM Survey
5	Update from Southern Company

Project ECO$_2$S General Update

- 2022 Recap: Majority of the year spent on UIC Permit Application write-up
  - First application submission occurred in October 2022 for the MPC 19-2 injection well
  - Correspondence with EPA Region 4 occurred as necessary – providing in several instances a Notice of Deficiency (NOD) or Request for Additional Information (RAI)
  - February 2023, after second submission of MPC 19-2 permit, communications with EPA determined that both planned injection wells can be incorporated into a single UIC Permit Application
  - Permit Application for both wells (MPC 19-2 and MPC 32-1)
  - Application was deemed administratively complete in May of 2023, Technical Review phase begins
- Working through the development of the Site Development Plan
- Pipeline FEED Study
- National Environmental Policy Act – Environmental Information Volume

Permitting Timeline Status

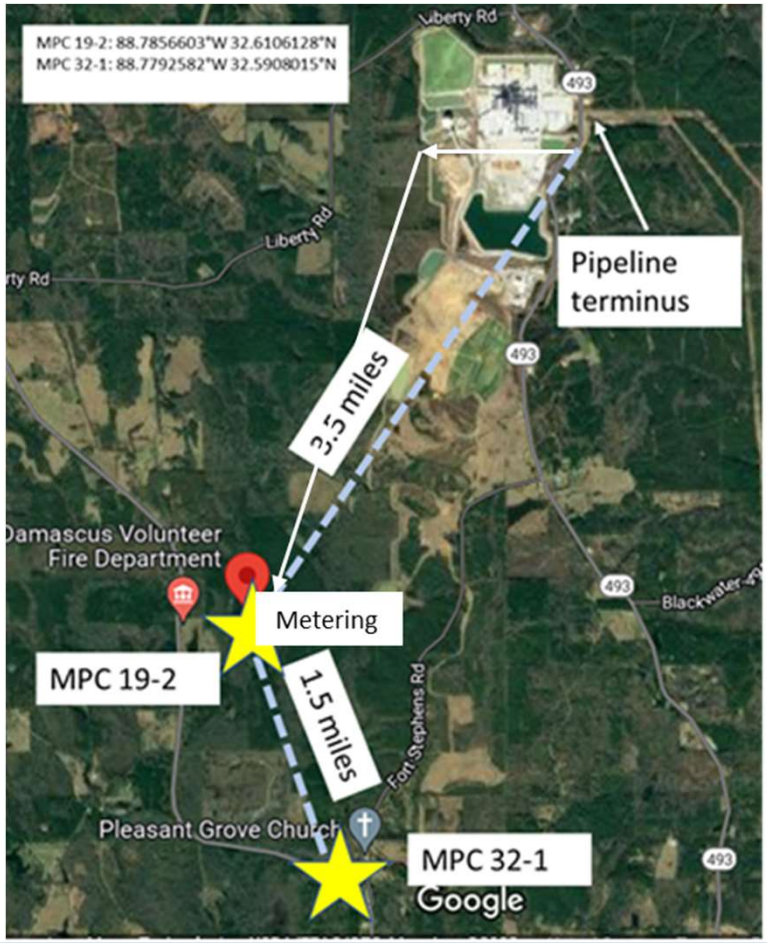
EPA Region 4 informed the project team in February that due to the predicted modeling results from both planned injection wells, they should be included within the same permit application instead of separate UIC Class VI Permits.



Advanced Resources International, Inc.

NEPA Status

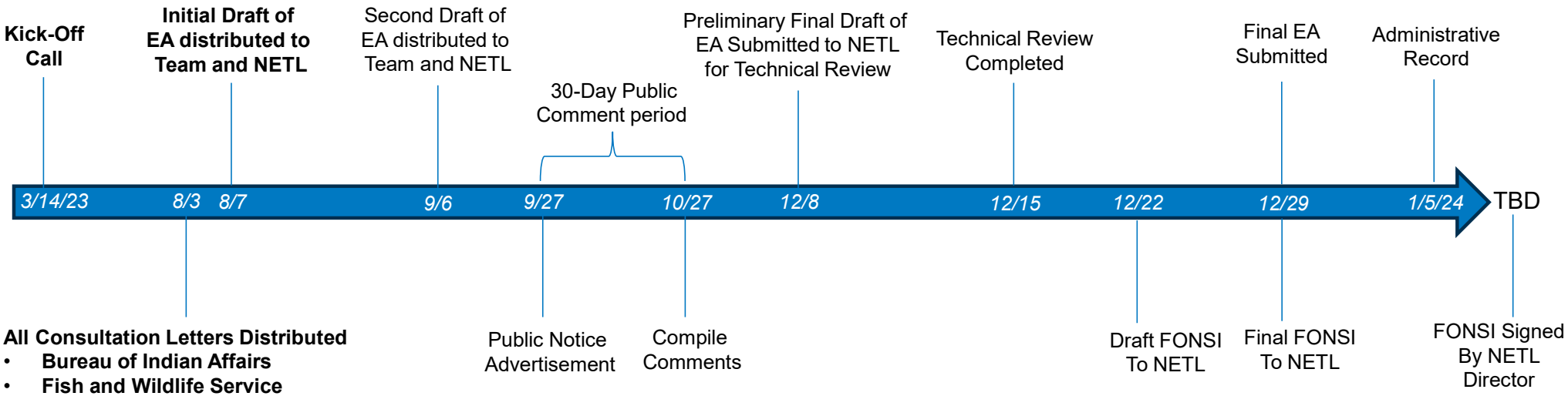
- Environmental Information Volume submitted Feb. 2022 by Environmental Consulting and Technology (ECT)
  - DOE, SSEB, and ECT completed execution of three-party Memorandum of Understanding for Preparation of the Environmental Assessment (March 2023)
  - EA Kickoff Meeting held March 14, 2023
- Project Scope
  - February EIV addressed CO_2 injection well field with potential of seven wells
  - Decision to limit Project point sources to Plant Radcliffe and eliminate Plants Miller and Daniel from the NEPA Assessment was made by managing partners (June, 2022)
    - Confirmed that Plant Radcliffe sufficient to supply necessary volume of CO_2 over 30-year period



Advanced Resources International, Inc.

NEPA Status

- The project team kicked off the Environmental Assessment (EA) on March 14, 2023
  - Pipeline FEED study initiated on April 21, 2023 to identify pipeline routing for the ECO_2S Project
- Project team holds bi-weekly calls to discuss the EA and any concerns or changes

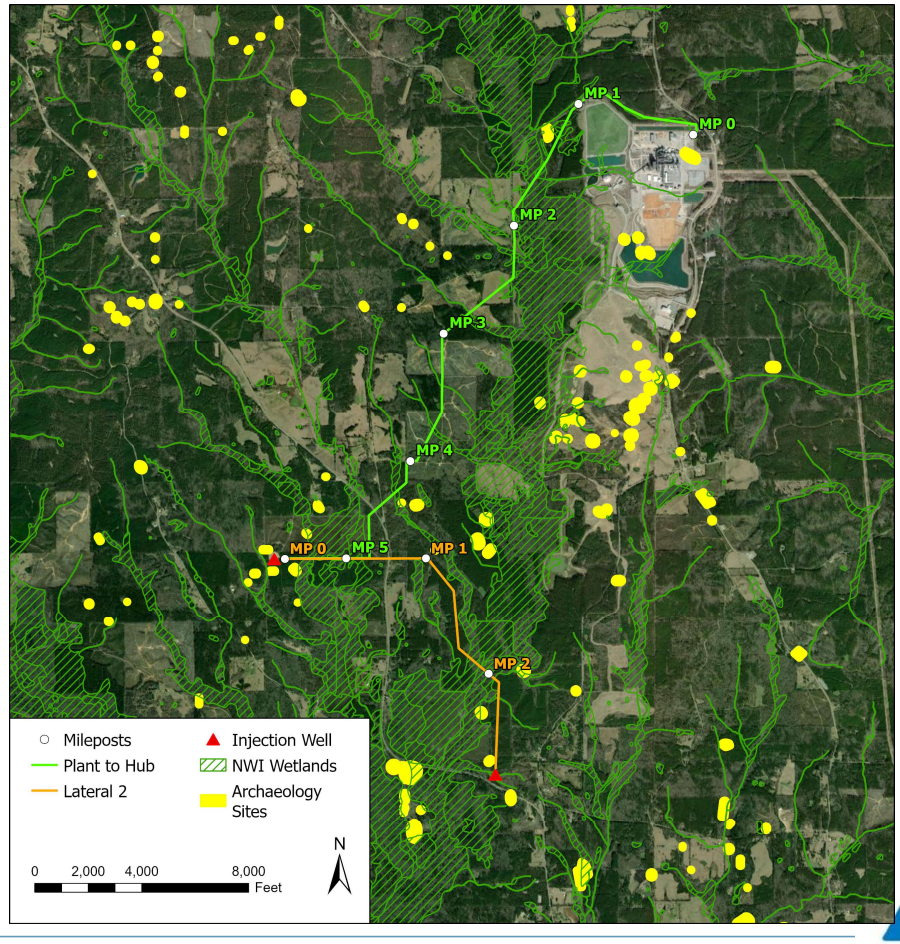


- **Bureau of Indian Affairs**
- **Fish and Wildlife Service**
- **Environmental Protection Agency, Region 4**
- **Mississippi Department of Wildlife Fisheries and Parks**
- **Mississippi Department of Archives and History**
- **11 Tribal Governments**

Advanced Resources International, Inc.

NEPA Status

- Information developed during the preparation of EIV and EA, including work completed during the Pipeline FEED study have informed current pipeline routing for the project
- The current pipeline routing developed to deliver CO_2 from Plant Ratcliffe to the two injection wells is shown here



Advanced Resources International, Inc.

Field Operations

- Injection fall-off test was performed on the MPC 10-4 well (Fall, 2022)
  - Obtain fracture pressure, permeability, and other reservoir characteristics
- Step-rate and constant-rate tests were conducted on consecutive days
  - Each test displayed similar pressure characteristics and reservoir behavior
- Test results demonstrate (confirm) the Paluxy formation is highly prospective target for CO_2 injection storage
  - Reservoir fracture pressure observed at 2,300 psi
  - Water injection rates confirm allowable CO_2 injection rates of 3,751 metric tons per day (1.37 million metric tons per year)
  - Permeability determined to be 3.327 D

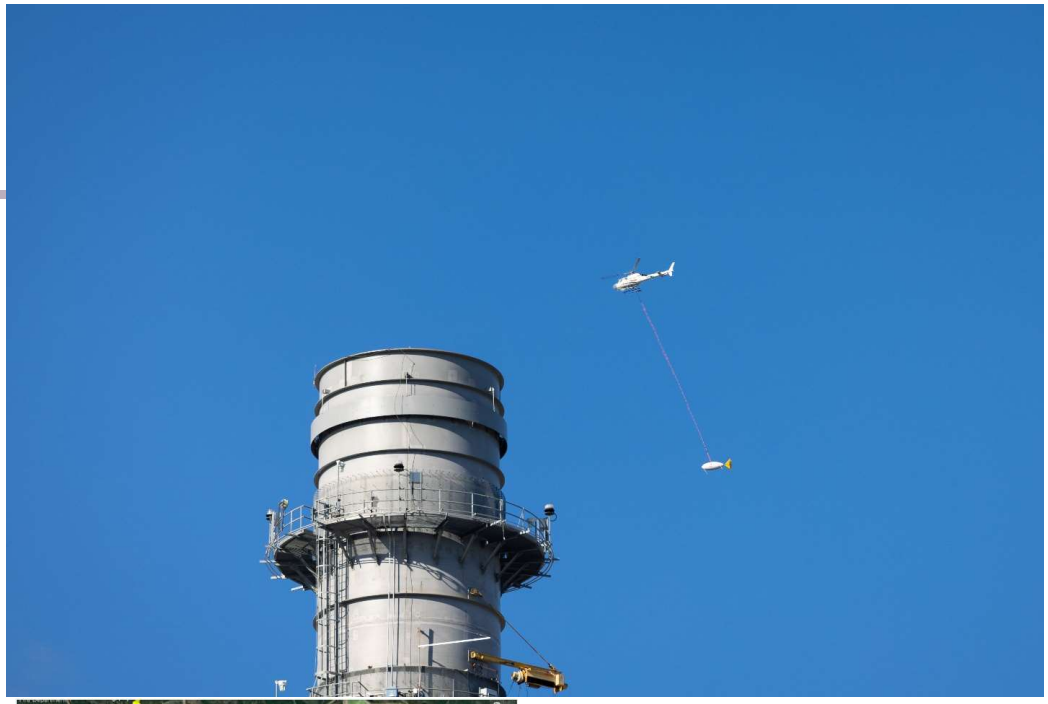
Field Operations

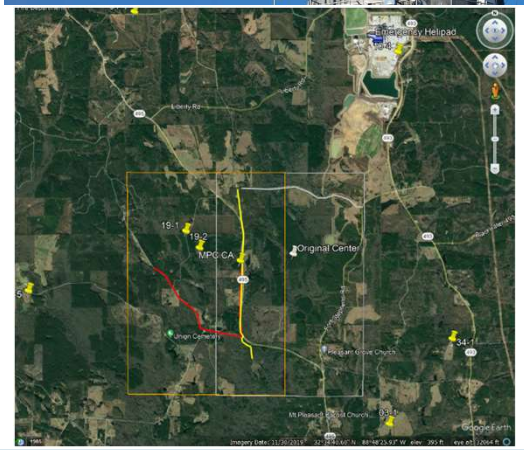
- Purpose to establish baseline conditions of target intervals prior to injection of CO_2
- Water sampling from USDWs, local water supply, and 34-1 well
- Pulsed Neutron Capture (PNC) logging acquired on 34-1, 26-5, and 19-1 wells
- Data obtained will aid in determining location of CO_2 plume migration during injection phase
- Comparison to baseline values necessary to ensure containment during active and monitoring phases of the project

Advanced Resources International, Inc.

CSEM Survey

- Controlled Source Electromagnetic Survey
- Objective to establish a baseline survey to determine sources of background EM activity
- February 2023, 15 km^2 flight area focused over MPC 19-1
- Crossed dipole transmitters laid out on public roads
- Team from Colorado School of Mines carried out baseline gravity survey
  - Rick Hammack, Thursday 11:50am





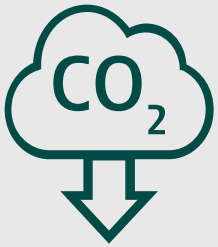
Advanced Resources International, Inc.

Office Locations
Washington, DC
4501 Fairfax Drive, Suite 910
Arlington, VA 22203
Phone: (703) 528-8420

Knoxville, TN
1210 Kenesaw Ave.
Suite 1210A
Knoxville, TN 37919-7736

Columbus, OH
1840 Mackenzie Dr.
Suite 100
Columbus, OH 43220

Beliefs about the future of CCS



- **Department of Energy** – DOE's leadership and support has been critical to prepare industry for commercial deployment.
- **Utility sector** – CCS is an enabling technology for a net-zero power sector, even where energy reliability, resiliency, and cost is fundamental to operations.
- **Policy** – Current incentives help offset costs and driving investment, but must have durability

CarbonSAFE Program Benefits

- A CCS retrofit project can take up to 8 years to develop and execute commissioning; having T&S ready tightens up that schedule
- CarbonSAFE provides industry with early insights into a successfully strategy for stakeholder acceptance
- CarbonSAFE projects do not necessary develop new technologies, but more importantly provides a platform to "de-risk" deployment
- Class VI UIC permitting is our single greatest risk management tool available for safe and secure storage operations
- CarbonSAFE allows CCS projects to deliver on the storage front so ongoing owner/investor/stakeholder acceptance will be successful

Owner/Operator - what have we learned from Project ECO$_2$S

- Portfolio of stacked storage reservoirs and seals in East Central Mississippi
- Low-cost and low-risk drilling
- High injectivity sandstone reservoir rocks with high Darcy (3.6 Darcy) permeability and high-porosity (28%); seals are nano-Darcy mud-rocks
- Storage reservoirs at depths between 3,500 – 5,500 feet – equates to low storage costs (< $8/tonne)
- Geologic structure is low-dip with no faults in or above the storage formations
- FEED study completed on 9-mile pipeline from Plant Radcliffe to injection wells
- Site has available space for capture on existing NGCC units
- Pre-FEED on Radcliffe units completed; SCS has completed full FEED on other NGCC
- Two UIC permit applications submitted to Region 4 EPA; under technical review
- Mississippi Power owns fee simple property required for a 30-year injection operations


Southern
Company

Permitting Process Notes/Learnings

- Time commitment is substantial
- Open communication with EPA is vital
- GSDT
- EPA – NOD's and RAI's
  - Largely looking to ensure consistency throughout documents (formation nomenclature, units, etc)
  - Ensuring that all necessary materials are included
  - Content needs to be explicit, and absorbable by multiple audiences
  - Main take-home point though is that the EPA is paying attention to substance of permit applications (which is a good thing!)