A DECADE OF EFFORTS TO PROTECT ALABAMA'S UNDERGROUND SOURCES OF DRINKING WATER FROM CONTAMINATION BY THE METHANE GAS INDUSTRY

By: David A. Ludder, Esq.[1]

The Promise of the Safe Drinking Water Act

The Safe Drinking Water Act requires that states or the U.S. Environmental Protection Agency (EPA) regulate "underground injection" activities to ensure the protection of "underground sources of drinking water."[2] "Underground injection" means "the subsurface emplacement of fluids by well injection."[3] "Underground sources of drinking water" include aquifers or portions of aquifers which contain a sufficient quantity of ground water to supply a public water system and less than 10,000 mg/L total dissolved solids."[4] "Underground sources of drinking water" must be protected from contamination regardless of whether they are presently used as a water supply.[5] To fulfill the requirements of the Safe Drinking Water Act, the EPA has established a program which strictly regulates the injection of fluids into the subsurface through wells.[6]

The Alabama Coalbed Methane Gas Industry

Approximately 5,000 coalbed methane gas wells have been permitted and drilled in Tuscaloosa, Walker, Jefferson, Shelby, Bibb, Hale, Greene, and Pickens Counties of Alabama. Of these, approximately 2,900 coalbed methane gas wells are currently operating.[7]

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[2] 42 U.S.C. §§ 300h and 300h-1.

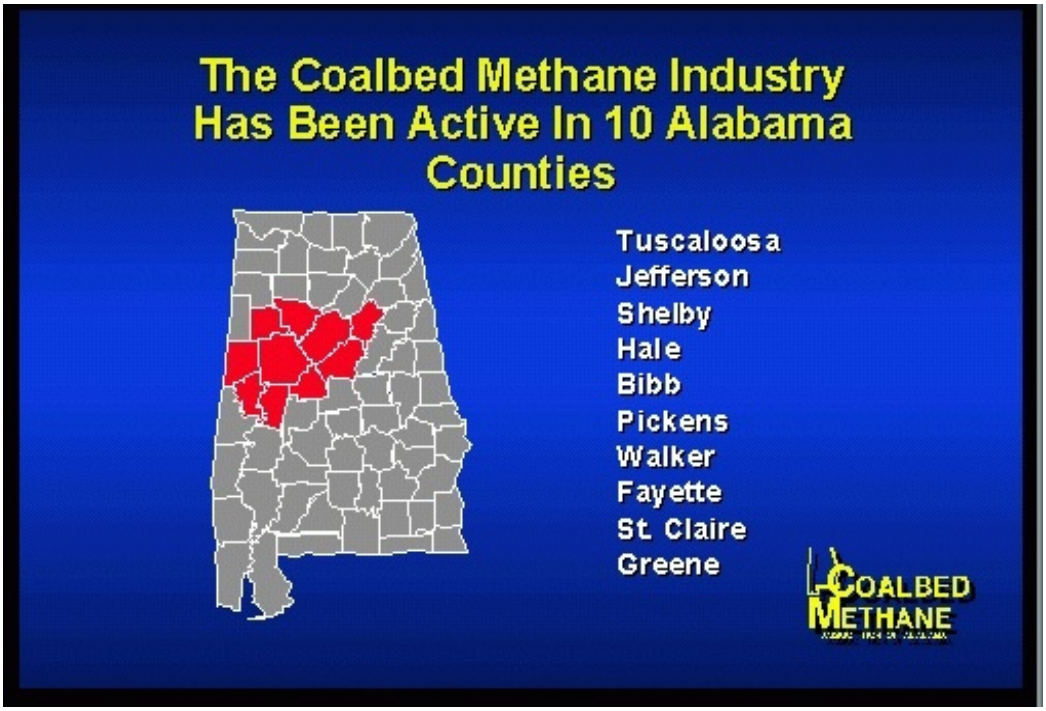
[3] 42 U.S.C. § 300h(d)(1). *See also* 40 C.F.R. § 144.3.

[4] 40 C.F.R. § 144.3.

[5] H.R. Rep. No. 93-1185, 93rd Cong., 2nd Sess. 32 (1974), *reprinted in* 1974 U.S. Code Cong. & Admin. News 6454, 6484 ("The Committee seeks to protect not only currently-used sources of drinking water, but also potential drinking water sources for the future. This may include water sources which presently exceed minimum intake water quality requirements or maximum contaminant levels or which are not presently accessible for use as a community drinking water supply source.").

[6] 40 C.F.R. Parts 144, 145, and 146.

[7] State Oil and Gas Board of Alabama, Coalbed Methane Development in Alabama and Hydraulic Fracturing Fact Sheet (1999).



"It has been demonstrated that the gas flow from a coal bed can be increased as much as twenty-fold by hydraulic fracturing."[8]

> "Hydraulic fracturing" involves the injection of fluids and a propping agent (usually sand) into a coal bed. The application of pressure injects fluids into the coal bed thereby widening natural fractures and inducing new ones that are held open by the propping agent after the pressure is released." As a result, these fractures provide paths for gas to migrate to the wellbore, thus stimulating gas flow.[9]

"The fluids used in hydraulic fracturing may contain guar gel, nitrogen or carbon dioxide gases, gelled oil, diesel oil, sodium hydroxide, hydrochloric acid, sulfuric acid, fumeric acid, as well as other additives."[10]

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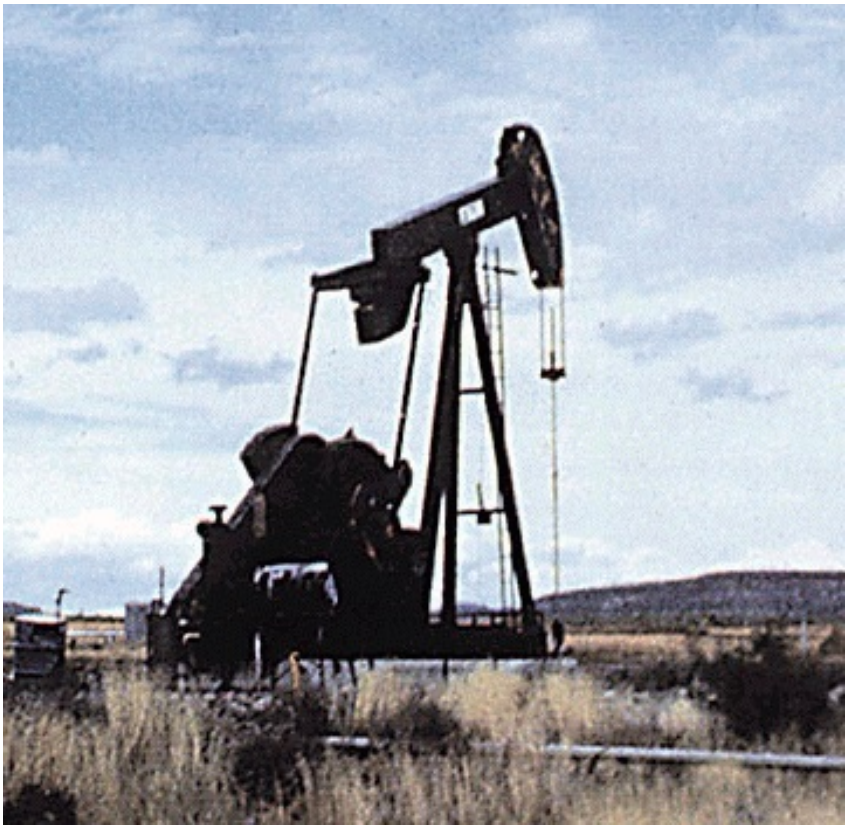
[8] Thomas E. Sexton & Frank Hinkle, *Alabama's Coalbed Gas Industry* 12-15 (State Oil and Gas Board, Oil and Gas Report 8B, 1985).

[9] Id.

[10] *LEAF v. U.S. EPA*, 118 F.3d 1467, 1471 (11th Cir. 1997).



The familiar appearance of a coalbed methane gas well

> Stimulation fluids that have been used in the Alabama coalbed methane fields include acid, water, foam, and gel. * * * Water was used as the stimulation fluid in more than half the wells completed prior to 1988, but since that time, water has been used in less than one-fourth of the wells. * * * Today, foam is being used more commonly as a stimulating fluid. The foam used to stimulate coalbed methane wells is a mixture of about 70 percent nitrogen and 30 percent water, as well as a surfactant, or foaming agent. * * * Since 1988, approximately three-quarters of the coalbed methane wells completed in Alabama have been stimulated with cross-linked gel. Gel is a mixture of water, thickener, and breaker, whereas cross-linked gel is a mixture of thickener and another substance, generally sodium borate or boric acid . . .. Polymers are mixed with water . . .. Breaker fluids, such as enzymatic compounds and sodium persulfate, are used . . ..[11]

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[11] Jack C. Pashin & Frank Hinkle, *Coalbed Methane in Alabama* 47-48 (Geol. Survey of Alabama Circ. 192, 1997).

"[T]he characteristics of fluids used for well stimulation vary considerably from formation-to formation. To achieve the required compatibility, chemical additives may need to be combined with the stimulation fluid. Additives include, but are not limited to, alkalines, surfactants, demulsifiers, defoamers, corrosion and scale inhibitors, and paraffin and asphaltine inhibitors."[12]

SELECTED HYDRAULIC FRACTURING FLUID CONSTITUENTS, DRINKING WATER STANDARDS, AND AVAILABLE HEALTH EFFECTS DATA[13]

Hydraulic Fracturing Fluid Chemical Name	CAS Number	MCL Drinking Water Standard	Oral Reference Dose Assessment (IRIS)	Carcinogenicity Assessment (IRIS)
Hydrochloric acid (hydrogen chloride)	7647-01-0	2.8×10^{5} mg/L	No data	No data
propargyl alcohol	107-19-7	No listed	2×10^{-3} mg/kg/day [renal and hepato-toxicity]	No data
isopropanol (isopropyl alcohol; 2-propanol)	67-63-0	Not listed	Not assessed	Not assessed
dimethyl formamide (N,N-Dimethylformamide)	68-12-2	Not listed	No data	No data
cuprous iodide	6781-65-4	Not listed	Not assessed	Not assessed
Ethoxylated nonyphenol (Polyethylene glycol nonylphenyl ether)	9016-45-9	Not listed	Not assessed	Not assessed
Formaldehyde	50-00-0	Not listed	2×10^{-1} mg/kg/day [reduced weight gain, histopathology in rats]	Probable human carcinogen (inhalation)
Ethylene glycol	107-21-1	Not listed	2 mg/kg/day [kidney toxicity]	No data
Cellulose derivative (Hydroxethylcellulose)	9004-62-0	Not listed	Not assessed	Not assessed
Fumaric acid	110-17-8	Not listed	Not assessed	Not assessed
Sodium carbonate	497-19-8	Not listed	Not assessed	Not assessed
Methanol	67-56-1	2807 mg/L	5×10^{-1} mg/kg/day [Increased SAP and SGPT, and decreased brain weight]	No data

[12] U.S. EPA, Information on Well Stimulation Processes 2 (draft 1998).

[13] Compiled by LEAF from Halliburton Services, Comparison of Three Halliburton Coalbed Methane Stimulation Treatments to U.S. EPA National Primary and Secondary Drinking Water Regulations (1999) and U.S. EPA's Integrated Risk Information System database.

Ethylene glycol monobutyl ether (Ethylene glycol nono-n-butyl ether)	111-76-2	Not listed	Assessment pending	Assessment pending
2-ethyl hexanol (2-ethyl-1-hexanol)	104-76-7	Not listed	Not assessed	Not assessed
2-bromo-2-nitro-1,3-propanediol	52-51-7	Not listed	Not assessed	Not assessed
Guar gum	9000-30-0	Not listed	Not assessed	Not assessed
Hydroxylpropyl guar	39421-75-5	Not listed	Not assessed	Not assessed
Acetic acid	64-19-7	Not listed	Not assessed	Not assessed
Thiourea	62-56-6	Not listed	Not assessed	Not assessed
Acetone	67-64-1	Not listed	1×10^{-1} mg/kg/day [Increased liver and kidney weights and nephrotoxicity]	Insufficient data
Hexahydro-1,3,5-tris(2-hydroxylethyl)-s-triazine	4719-04-4	Not listed	Not assessed	Not assessed
Ethyl octynol (4-Ethyl-1-octyn-3-ol)	5877-42-9	Not listed	Not assessed	Not assessed
Formamide	75-12-7	Not listed	Not assessed	Not assessed
Naptha	8030-30-6	Not listed	Not assessed	Not assessed
IR-192	12154-84-6	Not listed	Not assessed	Not assessed
Ammonium persulfate	7727-54-0	Not listed	Not assessed	Not assessed
Sodium carbonate	497-19-8	Not listed	Not assessed	Not assessed
Sodium borate	12007-42-0	Not listed	Not assessed	Not assessed
Boric acid	11113-50-1	Not listed	Not assessed	Not assessed
5-Chloro-2-methyl-4-isothiazolin-3-one	26172-55-4	Not listed	Not assessed	Not assessed
2-Methyl-4-isothiazolin-3-one	2682-20-4	Not listed	Not assessed	Not assessed
Sulfuric acid	7664-93-9	Not listed	Not assessed	Not assessed
Phosphonate	15477-76-6	Not listed	Not assessed	Not assessed
Sodium hydroxide	1310-73-2	Not listed	Not assessed	Not assessed
Phosphorus	7723-14-0	Not listed	2×10^{-5} mg/kg/day [Parturition mortality; forelimb hair loss]	Insufficient data
Boron	7440-42-8	Not listed	9×10^{-2} mg/kg/day [Testicular atrophy; spermatogenic arrest]	Not assessed
Magnesium	7439-95-4	Not listed	Not assessed	Not assessed
Iron	7439-89-6	Not listed	Not assessed	Not assessed

Aluminum	7429-90-5	Not listed	Not Assessed	Not assessed
Silicon	7440-21-3	Not listed	Not assessed	Not assessed
Calcium	7440-70-2	Not listed	Not assessed	Not assessed
Potassium	7440-09-7	Not listed	Not assessed	Not assessed
Sodium	7440-23-5	Not listed	Not assessed	Not assessed
Titanium	7440-62-2	Not listed	Not assessed	Not assessed
Barium	7440-39-3	2 mg/L	7×10^{-2} mg/kg/day [Increased kidney weight]	Unlikely human carcinogen
Vanadium	7440-62-2	Not listed	Not assessed	Not assessed
Manganese	7439-96-5	Not listed	1.4×10^{-1} mg/kg/day [central nervous system effects]	Insufficient data
Zinc	7440-66-6	Not listed	3×10^{-1} mg/kg/day [Decrease in erythrocyte superoxide dismutase (ESOD) concentration]	Insufficient data
Copper	7440-50-8	Treatment Technique required if ≥ 1.3 mg/L	Not assessed	Insufficient data
Boron Oxide	12045-60-2	Not listed	Not assessed	Not assessed

Hydraulic fracturing results in fractures that may extend horizontally or vertically several hundred feet.[14] These induced fractures may intersect existing natural fractures which are commonly conduits for subsurface water flow. As a result, these fractures provide paths for gas to migrate to the wellbore, thus stimulating gas flow.

"After the coal beds are hydraulically fractured, the injected fluids and groundwater are pumped out of the production well before the flow of methane gas starts. A portion of the injected fluids [one study indicates 20% - 30%[15]], however, remains in the ground."[16] Often, fluids are reinjected into the well to further fracture the coal bed or simply to maintain previously-induced fractures free of obstructions.[17] It is estimated that more than 10,000 "hydraulic fracturing" injections have occurred in coal beds of Alabama.[18]

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[14] U.S. EPA, *supra* note 12, at 3.

[15] I.D. Palmer et al., *Comparison between Gel-Fracture and Water-Fracture Stimulations in the Black Warrior Basin*, Proceedings of the 1991 Coalbed Methane Symposium 233, 237.

[16] *LEAF v. U.S. EPA*, 118 F.3d at 1471.

[17] Id.

[18] State Oil and Gas Board of Alabama, *supra*, note 7.

Damage to Underground Sources of Drinking Water

In 1988, Ruben DeVaughn McMillian, a LEAF member, complained that immediately after the injection of hydraulic fracturing fluids at a nearby coalbed methane well, his private water well, which had always produced abundant and clean water, became contaminated. Long "strings" of a black oily substance flowed from his tap. A strong sulfur smell emanated from the hot shower head. His wellhouse rumbled and hissed.[19] Eventually, Mr. McMillian had to purchase and install a $3,000 water filter system to ensure that his water was safe to drink.

At least a dozen other Alabama residents have complained that coalbed methane production activities have caused a degradation in the quality of the water produced from their drinking water wells.[20] To silence others, landowners often evicted or threatened to evict those that complained. Complaints have also been made in Virginia and Colorado where coalbed methane production is practiced.[21]

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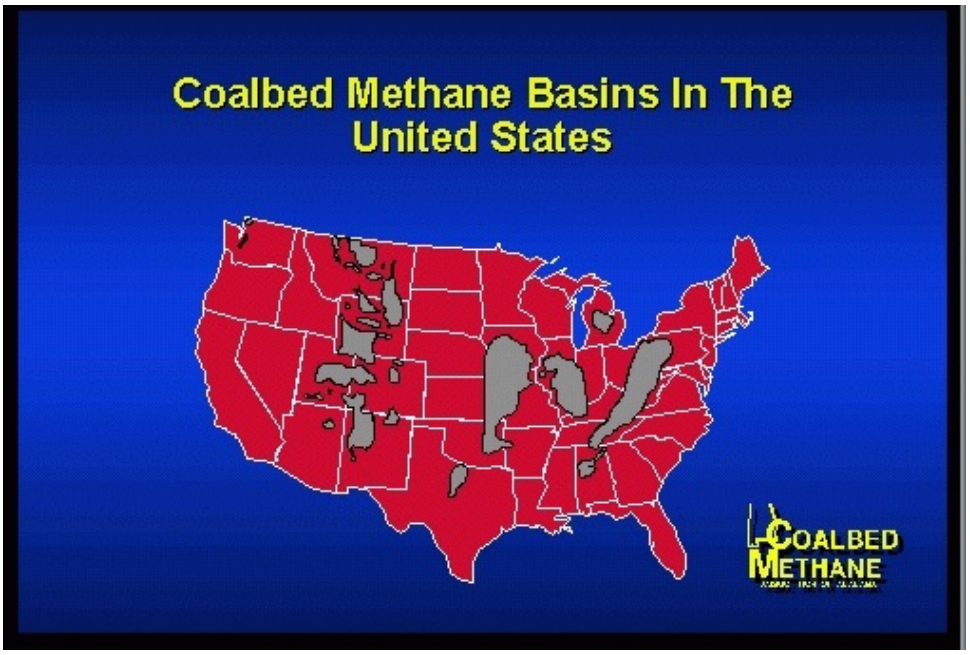
[19] Letter from David A. Ludder to Ernest A. Mancini (Re: Petition for Declaratory Ruling) at 10-13 (August 9, 1993); Letter from David A. Ludder to Leigh Pegues (Re: Petition for Declaratory Ruling) at 14-17 (August 9, 1993). *See also LEAF v. U.S. EPA*, 118 F.3d at1471.

[20] *E.g.*, Statement of the Alabama Department of Environmental Management at the UIC Class II Program Public Hearing in Tuscaloosa (July 28, 1999); Letter from George Adair to U.S. EPA (Sept. 15, 1999); Letter from Stan Herring to Larry Cole (Nov. 29, 1999).

[21] *E.g.*, Letter from Travis E. Stills to Larry Cole (Sept. 14, 1999); Letter from George Adair to U.S. EPA (Sept. 15, 1999).



Establishing the State's Failure to Regulate Hydraulic Fracturing as "Underground Injection"

On April 26, 1989 and again on May 19, 1989, the State Oil and Gas Board of Alabama provided LEAF with informal opinions that hydraulic fracturing does not constitute a Class II well (a well used for the enhanced recovery of oil or gas).[22] Later, the State Oil and Gas Board of Alabama declined to act on a petition filed by LEAF on August 9, 1993 seeking a formal ruling on whether hydraulic fracturing constituted underground injection and an activity regulated by the State Oil and Gas Board's underground injection control program.[23]

On May 10, 1989, the Alabama Department of Environmental Management provided LEAF with an informal opinion expressing the position that hydraulic fracturing is not subject to that agency's regulatory requirements because the Department's regulatory authority does not extend to fluids within the regulatory criteria of the State Oil and Gas Board.[24] Subsequently, on June 29, 1989, the Alabama Department of Environmental Management provided LEAF with another informal opinion expressing the position that hydraulic fracturing is not underground injection because it does

[22] Letter from Ernest A. Mancini to David A. Ludder (April 26, 1989); Letter from Ernest A. Mancini to David A. Ludder (May 19, 1989).

[23] Letter from S. Marvin Rogers to David A. Ludder (August 12, 1993).

[24] Letter from Leigh Pegues to David A. Ludder (May 10, 1989).

not result in the subsurface "emplacement" of fluids through a well.[25] Later, the Alabama Department of Environmental Management declined to act on a petition filed by LEAF on August 9, 1993 seeking a formal ruling on whether hydraulic fracturing constituted underground injection and an activity regulated by the Department's underground injection control program.[26]

No state agency was admitting responsibility for protecting underground sources of drinking water from contamination by the underground injection of hydraulic fracturing fluids.

Petition for Withdrawal of State Primacy over Underground Injection

On March 4, 1994, LEAF petitioned EPA to initiate proceedings to withdraw approval of the Alabama underground injection control program.[27] LEAF alleged that the Alabama program was deficient because it does not regulate the underground injection of hydraulic fracturing fluids associated with methane gas production as required by the Safe Drinking Water Act.

On May 5, 1995, EPA denied the petition because it determined that hydraulic fracturing does not fall within the *regulatory* definition of "underground injection" and because the "primary purpose" of coalbed methane wells is not underground injection.[28]

Judicial Review of EPA's Erroneous Decision

LEAF filed a petition for review of the EPA's order in the United States Court of Appeals for the Eleventh Circuit on June 19, 1995. In *LEAF v. U.S. EPA*, 118 F.3d 1467 (11th Cir. 1997), the Court held

> (1) hydraulic fracturing of coal beds to produce methane gas constitutes "underground injection" under Part C of the Safe Drinking Water Act, *id*. at 1478;
>
> (2) all underground injection is required to be regulated (by permit or rule), *id*. at 1474; and
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> (3) hydraulic fracturing associated with coalbed methane gas production is not currently regulated under Alabama's underground injection control program. *Id.* at 1471.

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[25] Letter from Thomas L. Johnston to David A. Ludder (June 29, 1989).

[26] Letter from James Wright to David A. Ludder (Sept. 23, 1993).

[27] Petition for Promulgation of Rule Withdrawing Approval of Alabama's Underground Injection Control Program *included with* Letter from David A. Ludder to Carol M. Browner (May 3, 1994).

[28] Letter from Carol M. Browner to David A. Ludder (May 5, 1995).

The Court instructed EPA to reconsider LEAF's petition to withdraw approval of Alabama's underground injection control program.

Frustrated by EPA's subsequent lack of progress in regulating hydraulic fracturing as underground injection, on November 23, 1998, LEAF filed a petition for writ of mandamus to compel EPA to implement the decision of the court in *LEAF v. U.S. EPA*.[29] In response to LEAF's petition and EPA's opposition to the petition, the Court said:

> [T]his Court is not satisfied with EPA's alleged efforts to comply with the Court's mandate and is determined to ensure that full and complete compliance is obtained without further delay. Thirteen months is too long, and limited resources is no excuse. Further delay will not be tolerated.[30]

Subsequently, the Court issued a writ of mandamus requiring that EPA adhere to a specified process and schedule to bring hydraulic fracturing in Alabama under regulation.[31] The writ of mandamus required that EPA determine whether the State of Alabama's EPA-approved underground injection control program regulates hydraulic fracturing of coal beds associated with coal bed methane gas production as underground injection in compliance with the requirements of the Safe Drinking Water Act and 40 C.F.R. Part 145.

Alabama's Revised Underground Injection Control Program

On March 5, 1999, the State Oil and Gas Board of Alabama adopted some emergency rules to regulate the hydraulic fracturing of coal beds. These rules did little more than codify the industry's existing practices. The State Oil and Gas Board of Alabama did not submit these rules to EPA for approval as a revision to its underground injection control program.

Consistent with the Court's writ of mandamus, on March 19, 1999, EPA notified the State of Alabama that it "is required to regulate . . . hydraulic fracturing of coal beds to produce methane as underground injection" and afforded the State 30 days in which to demonstrate that Alabama's *EPA-approved* underground injection control program regulates hydraulic fracturing of coal beds associated with methane gas production as underground injection in compliance with the requirements of the Safe Drinking Water Act and 40 C.F.R. Part 145.[32]

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[29] *In re LEAF*, Docket No. 98-06929 (11th Cir. filed Nov. 23, 1999).

[30] *In re LEAF*, No. 98-06929 (11th Cir. Order Jan. 11, 1999).

[31] *In re LEAF*, Docket No. 98-06929 (11th Cir. Feb. 18, 1999), *modified* (April 28, 1999 & August 10, 1999). The process mirrors that provided in 40 C.F.R. § 145.34.

[32] Letter from John H. Hankinson, Jr. to Donald F. Oltz (Mar. 19, 1999).

On April 15, 1999, the State of Alabama, by and through the State Oil and Gas Board of Alabama, submitted its demonstration. The demonstration included the Board's March 5, 1999 emergency rules, but failed to demonstrate that the *EPA-approved* underground injection control program regulates hydraulic fracturing of coal beds associated with coal bed methane gas production as underground injection in compliance with the requirements of the Safe Drinking Water Act and 40 C.F.R. Part 145. The Board's demonstration also did not request that EPA approve the emergency rules as a revision to the underground injection control program. Consequently, on May 18, 1999, EPA notified the State Oil and Gas Board that the *EPA-approved* underground injection control program is not yet in compliance with the Safe Drinking Water Act.[33]

On May 21, 1999, EPA published notice of its intent to withdraw approval of Alabama's Class II underground injection control program.[34] A public hearing was commenced on July 28, 1999 but terminated under order of the local Fire Marshall due to overcrowding. On August 10, 1999, EPA published notice that the public hearing was being rescheduled for September 9, 1999 and extended the period for submission of written comments through September 16, 1999.[35] On August 20, 1999, the State Oil and Gas Board made permanent the March 5, 1999 emergency rules with some modifications suggested by EPA. However, the Board again failed to submit the rules to EPA for approval as a revision to the underground injection control program. After considering all comments, and the State's failure to obtain EPA approval of revisions to its program, on September 23, 1999, EPA notified the State Oil and Gas Board of Alabama that "the State is still not in compliance" and that the program deficiencies must be corrected within 90 days "or the Class II UIC Program will be withdrawn."[36]

On October 6, 1999, the State Oil and Gas Board of Alabama submitted a program revision package to EPA seeking approval of its revised underground injection control program. On October 22, 1999, EPA published notice of its preliminary determination to approve Alabama's revised underground injection control program.[37] On December 22, 1999, EPA approved the State Oil and Gas Board of Alabama's revised underground injection control program.[38] LEAF has filed a petition for review with the U.S. Court of Appeals for the Eleventh Circuit.[39]

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[33] Letter from John H. Hankinson, Jr. to Donald F. Oltz (May 18, 1999).

[34] 64 Fed. Reg. 27744 (1999).

[35] 64 Fed. Reg. 43329 (1999).

[36] Letter from John H. Hankinson, Jr. to Donald F. Oltz (Sept. 23, 1999).

[37] 64 Fed. Reg. 56986 (1999).

[38] 65 Fed. Reg. 2889 (2000).

[39] *LEAF v. U.S. EPA*, Docket No. 00-10381-D (filed Jan. 25, 2000).

LEAF maintains that the State Oil and Gas Board of Alabama's revised underground injection control program suffers from several remaining deficiencies which the EPA has thus far chosen to ignore. These include:

1. Alabama's revised underground injection control program does not meet many of the technical requirements of 40 C.F.R. Part 145 because the Board (and EPA) contend that hydraulic fracturing is not subject to those requirements. Instead, the agencies contend that hydraulic fracturing is subject to the more flexible requirements applicable to certain oil and gas activities. However, Congress restricted these more flexible requirements to the injection of brine brought to the surface in connection with oil and gas production; the injection of fluids for secondary recovery of oil or gas; and the injection of fluids for tertiary recovery of oil or natural gas. Hydraulic fracturing is none of these activities; therefore the more flexible requirements are not applicable. The applicable requirements are 40 C.F.R. Part 145, which the State program does not meet.

2. Alabama's revised underground injection control program fails to regulate hydraulic fracturing of coal beds as Class II injection wells in compliance with 40 C.F.R. §§ 145.11(a)(2). The failure to designate coalbed methane wells as Class II injection wells results in many of the technical requirements in 40 C.F.R. Part 145 not being applicable to coalbed methane wells.

3. Alabama's revised underground injection control program fails to require that hydraulic fracturing of coal beds be authorized by permits in compliance with 40 C.F.R. §§ 145.11(a)(10). The failure to require permits means that many protective conditions, normally imposed by a permit, will not be imposed on the hydraulic fracturing of coalbed methane wells.

4. Alabama's revised underground injection control program fails to require public participation in the permitting of hydraulic fracturing of coal beds in compliance with 40 C.F.R. §§ 145.11(a)(28). No public comment period is provided on the State's intention to approve hydraulic fracturing at a coalbed methane well.

5. Alabama's revised underground injection control program fails to require proper construction (casing and cementing) of coalbed methane wells in compliance with 40 C.F.R. § 145.11(a)(20). Without adequate casing and cementing, underground sources of drinking water can be contaminated.

6. Alabama's revised underground injection control program fails to establish construction requirements to ensure the separation of the injection zone from underground sources of drinking water in compliance with 40 C.F.R. § 145.11(a)(20). Impermeable natural barriers (e.g., dense geologic formations) are required to separate the injection zone from all underground sources of drinking water. Alabama's program does not require separation from *all* underground sources of drinking water.

7. Alabama's revised underground injection control program fails to prohibit the movement of fluids into underground sources of drinking water in compliance with 40 C.F.R. §§ 145.11(a)(6) and 145.11(a)(20). Rather than prohibiting movement of injected fluids into underground sources of drinking water, Alabama's program allows injection directly into underground sources of drinking water.

8. Alabama's revised underground injection control program fails to require periodic mechanical integrity testing of wells to ensure that fluids are not escaping into the subsurface at unintended depths in compliance with 40 C.F.R. § 145.11(a)(19). Such mechanical integrity testing is supposed to be required every five years.

9. Alabama's revised underground injection control program fails to require the identification of all known wells (producing wells, injection wells, abandoned wells, dry holes, water wells, and core wells) in the area of review (1/4 mile radius) in compliance with 40 C.F.R. § 145.11(a)(23) and fails to require corrective action for abandoned wells which might become conduits for the vertical migration of injected fluids. Only drinking water wells are required to be identified. The thousands of abandoned and unplugged core wells in the region are ignored.

10. Alabama's revised underground injection control program fails to require monitoring of the nature of the injected fluids in compliance with 40 C.F.R. § 145.11(a)(22). A certification that the hydraulic fracturing fluids meet drinking water standards is required if the injection is directly into an underground source of drinking water, but for all but a few of the constituents of hydraulic fracturing fluids, drinking water standards do not exist. The certification will not yield information on the nature of injected fluids.

11. Alabama's revised underground injection control program fails to include enforcement remedies that do not require proof of mental state (intentional, knowing) in compliance with 40 C.F.R. § 145.13. Instead, Alabama's program requires that a violation be knowing and willful before any monetary penalty can be imposed.

12. Alabama's revised underground injection control program fails to provide for public participation in enforcement (e.g., notice and comment on proposed settlements of enforcement actions) in compliance with 40 C.F.R. § 145.13(d).

13. Alabama's revised underground injection control program fails to provide for enforcement remedies against the State and it's agencies in compliance with 40 C.F.R. § 145.13. The State's constitutional immunity from suit precludes any judicial enforcement proceedings against the State or its agencies.