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NOTE

Waste Management vs. Climate Mitigation: How CO₂ Sparked a Clash of Environmental Values

Wesley Dyer*

I. INTRODUCTION

The looming threats of climate change dominate global politics, national and economic security, science, and environmental policy. As such, global, national, regional, local, federal, and state strategies are being developed to slow and mitigate the devastating effects of a warming climate. One such strategy that is slowly being used on a global and national scale is geologic sequestration, where carbon dioxide (CO₂) is captured, compressed to a supercritical state, and injected underground for permanent removal from the atmosphere. At the same time, the Resource Conservation and Recovery Act (RCRA) regulates the transport, storage, and disposal of solid and hazardous waste, in which certain supercritical CO₂ streams are included. The United States Environmental Protection Agency (EPA) has exempted CO₂ streams from hazardous waste regulations (RCRA Subtitle C) as long as the streams are injected into Class VI underground injection control (UIC) wells under specified procedures and

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conditions. However, EPA kept supercritical CO₂ streams within the definition of solid waste, thereby retaining some RCRA liability. There is an inevitable conflict between the policy goals of reducing greenhouse gas emissions and responsibly managing waste disposal, and this is particularly illustrated through EPA's conditional exemption and Class VI UIC well regulations. Adding to the conflict, there are some legal challenges to EPA's position that CO₂ streams may be considered a solid waste. Part II of this paper defines "solid waste." Part III explains the conditional exemption of CO₂ streams from hazardous waste regulation. Part IV describes the UIC program and examines how this illustrates the RCRA-climate mitigation clash. Part V explores the legal challenges to EPA's conditional exemption and comments briefly on their merits.

II. DEFINITION OF A SOLID WASTE

Solid waste has both a statutory and regulatory definition.¹ The regulatory definition for solid waste begins with "any discarded material."² EPA clarified that "discarded material" meant abandoned, recycled, or considered inherently waste-like.³ EPA further noted that disposing of a material constitutes discarding through abandonment.⁴ The courts have somewhat streamlined this definition of "discarded" by holding that Congress intended to use the ordinary sense of the word: "disposed of," "thrown away" or "abandoned."⁵ Both regulatory and judicial constructions of the meaning of "discarded" boil down to disposal, which the statute defines as:

1. See RCRA § 1004(27), 42 U.S.C. § 6903(27) (2012), for the statutory definition. See 40 C.F.R. § 261.2(a) (2015) for the regulatory definition. The statutory definition usually serves as a check on the regulatory definition when it is unclear whether or not the material in question is discarded and of the type intended to be regulated. See *Am. Mining Cong. v. EPA*, 824 F.2d 1177, 1183–90 (D.C. Cir. 1987).

2. 40 C.F.R. § 261.2(a)(1).

3. *Id.* § 261.2(a)(2)(i).

4. *Id.* § 261.2(b).

5. *Am. Mining Cong.*, 824 F.2d at 1184; see also *Safe Air for Everyone v. Meyer*, 373 F.3d 1035, 1041–42 (9th Cir. 2004); *Am. Petroleum Inst. v. EPA*, 216 F.3d 50, 55–56 (D.C. Cir. 2000); *Ass'n of Battery Recyclers v. EPA*, 208 F.3d 1047, 1051 (D.C. Cir. 2000).

the discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water so that such solid waste or hazardous waste or any constituent thereof may enter the environment or be emitted into the air or discharged into the any waters, including ground waters.⁶

Thus, for the purposes of this paper, “solid waste” includes “solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations”⁷ that has been injected into the land or water in a manner that may result in a discharge into the air or groundwater.

III. **CONDITIONAL EXEMPTION OF CO₂ STREAMS FROM THE DEFINITION OF HAZARDOUS WASTE**

A. **Proposed Rule**

On August 8, 2011, EPA published the proposed rule to exempt supercritical CO₂ streams from the definition of hazardous waste, as long as the streams meet certain conditions.⁸ A few years prior to this proposed rule, EPA became aware that the carbon capture and storage (CCS) industry desired some clarification on how RCRA hazardous waste regulations would

6. RCRA § 1004(3), 42 U.S.C. § 6903(3).

7. *Id.* § 6903(27).

8. Hazardous Waste Management System: Identification and Listing of Hazardous Waste: Carbon Dioxide (CO₂) Streams in Geologic Sequestration Activities, 76 Fed. Reg. 48,073 (proposed Aug. 8, 2011) (to be codified at 40 C.F.R. pt. 260, 261). EPA defined a CO₂ stream as: “Carbon dioxide that has been captured from an emission source (*e.g.*, power plant), plus incidental associated substances derived from the source materials and the capture process, and any substances added to the stream to enable or improve the injection process.” *Id.* at 48,075. EPA defined supercritical CO₂ as CO₂ “that is above its critical temperature (31.1 °C, or 88 °F) and pressure (73.8 bar, or 1070 psi). Supercritical substances have physical properties intermediate to those of gases and liquids.” *Id.* EPA expects the streams will be injected at least 2,625 feet underground. *Id.* at 48,076.

apply to the geologic sequestration of CO₂.⁹ EPA noted “RCRA hazardous waste regulations can apply to CO₂ streams being geologically sequestered”¹⁰ because:

[a] supercritical CO₂ stream injected into a permitted UIC Class VI well for the purposes of [geologic sequestration] is a RCRA solid waste, as it is a “discarded material” within the plain meaning of the term in RCRA § 1004(27). . . . Once the decision is made that the supercritical CO₂ stream will be sent to a UIC Class VI well for discard, EPA considers this material to be a solid waste.¹¹

At that point, the generator of the stream would have to make a hazardous waste determination, and, if hazardous, the waste would be subject to Subtitle C regulation.¹²

EPA proffered the exemption in an effort to facilitate geologic sequestration of CO₂ and to remove any regulatory uncertainty in the applicability of RCRA Subtitle C to CO₂ streams.¹³ Its goal was “to provide the regulatory certainty needed to foster industry adoption of CCS. . . . [P]roviding a consistent regulatory approach to [geologic sequestration] will promote its future use in the United States.”¹⁴ EPA viewed the capture and storage of CO₂ as a potentially useful avenue for meeting domestic greenhouse gas emission reduction goals and mitigating climate change while alternative energy sources are developed.¹⁵

EPA justified granting this conditional exemption on the grounds that existing regulations affecting geologic sequestration of CO₂ streams are sufficient and therefore subjecting CO₂ streams to RCRA Subtitle C regulations would not provide any

9. Hazardous Waste Management System: Conditional Exclusion for Carbon Dioxide (CO₂) Streams in Geologic Sequestration, 79 Fed. Reg. 350, 352 (Jan. 3, 2014) (to be codified at 40 C.F.R. pt. 9, 260, 261).

10. Hazardous Waste Management System: Identification and Listing of Hazardous Waste: Carbon Dioxide (CO₂) Streams in Geologic Sequestration Activities, 76 Fed. Reg. at 48,077.

11. *Id.* at 48,077–78.

12. 40 C.F.R. § 262.11 (2015).

13. Hazardous Waste Management System: Identification and Listing of Hazardous Waste: Carbon Dioxide (CO₂) Streams in Geologic Sequestration Activities, 76 Fed. Reg. at 48,074.

14. *Id.* at 48,077.

15. *Id.* at 48,076.

additional protection to human health or the environment.¹⁶ EPA noted three D.C. Circuit decisions that support its approach of regulating wastes as hazardous only when necessary to protect public health and the environment.¹⁷ In *Military Toxics Project v. EPA*, the court held that EPA's interpretation of RCRA Section 3001(a), allowing conditional exemptions, was "a permissible construction of the statute."¹⁸ The court in *NRDC v. EPA* held that "Congress's broad delegation to EPA to develop criteria for listing hazardous wastes, 42 U.S.C. § 6921(b), indicates that Congress intended the agency to have substantial room to exercise its expertise in determining the appropriate grounds for [listing and regulating hazardous wastes]."¹⁹ In *Edison Electric Industry v. EPA*, the court held, in part, that RCRA Subtitle I regulations over petroleum wastes, being adequate to protect human health and the environment, provided sufficient justification for EPA to defer application of RCRA Subtitle C regulations.²⁰

EPA discussed two rules that directly affect geologic sequestration activity: the greenhouse gas reporting program and the underground injection control (UIC) Class VI²¹ well rule. The greenhouse gas reporting program mandates that the amount of

16. *Id.* at 48,080.

17. *Id.*

18. *Military Toxics Project v. EPA*, 146 F.3d 948, 958 (D.C. Cir. 1998).

19. *NRDC v. EPA*, 25 F.3d 1063, 1070 (D.C. Cir. 1994).

20. *Edison Elec. Inst. v. EPA*, 2 F.3d 438, 453 (D.C. Cir. 1993).

21. EPA has established six types, or classes, of wells for underground injection of materials. The classes were designated based on several factors, including type of fluids injected, injection depth, design, and operating techniques. See *Underground Injection Control Well Classes*, EPA, <http://water.epa.gov/type/groundwater/uic/wells.cfm> [<http://perma.cc/7KUH-2CUW>] (last updated Oct. 5, 2015). Each class has its own set of requirements and performance criteria: Class I is for hazardous wastes, industrial fluids, and municipal wastewater; Class II is for the injection of brines and other fluids for enhanced oil and gas recovery; Class III is for fluids associated with solution mineral mining; Class IV wells are banned unless authorized by a water remediation project because they handle hazardous and radioactive waste; Class V is for anything not covered by I–IV; and Class VI is for the geologic sequestration of CO₂. *Id.* There currently are no Class VI wells in operation. See *Underground Injection Well Inventory*, EPA, <http://www.epa.gov/uic/underground-injection-well-inventory> [<http://perma.cc/WQY3-FX5C>] (last updated Oct. 26, 2015).

CO₂ captured and where the CO₂ goes be reported to EPA.²² The reporting program also requires those entities that inject CO₂ for geologic sequestration to report basic information about the CO₂ received as well as develop and implement an EPA-approved site monitoring, reporting, and verification plan.²³ The UIC Class VI rule was intended to provide certainty to industry and the public about requirements that were applicable to the injection of CO₂ for geologic sequestration, and to ensure that such injection is done in a manner that will not endanger underground drinking water.²⁴ The Class VI rule requires the owner or operator of an injection site to submit proposed operating data for the site prior to the issuance of a permit, including an analysis of the physical and chemical properties of the CO₂ stream.²⁵ The owner or operator must also analyze the CO₂ stream with sufficient frequency to yield data that is representative of the stream's physical and chemical characteristics throughout the operational life of the well.²⁶ Additionally, the owner or operator must submit semi-annual reports that include any changes to the physical, chemical, or other relevant characteristics of the CO₂ stream.²⁷ EPA concluded that the Class VI requirements adequately protect against risks to human health and the environment because they were designed to keep the CO₂ stream and any incidental associated substances isolated in the injection zone.²⁸ EPA explained that the Class VI rule included requirements to "address the unique nature of CO₂ injection for [geologic sequestration]," including the recognition that CO₂ streams could contain impurities that would cause the streams to exhibit the toxicity characteristic.²⁹

22. Hazardous Waste Management System: Identification and Listing of Hazardous Waste: Carbon Dioxide (CO₂) Streams in Geologic Sequestration Activities, 76 Fed. Reg. at 48,077.

23. *Id.*

24. *Id.*

25. 40 C.F.R. § 146.82(a)(7)(iv) (2015).

26. *Id.* § 146.90(a).

27. *Id.* § 146.91(a)(1).

28. Hazardous Waste Management System: Identification and Listing of Hazardous Waste: Carbon Dioxide (CO₂) Streams in Geologic Sequestration Activities, 76 Fed. Reg. at 48,084.

29. *Id.*

EPA also concluded that the Department of Transportation's (DOT) regulations of transporting hazardous materials (both through a pipeline and through other means) would adequately protect human health and the environment.³⁰ Under DOT regulations, carbon dioxide is "a fluid consisting of more than 90 percent carbon dioxide molecules compressed to a supercritical state,"³¹ and is listed as a hazardous material.³² Transport of CO₂ via pipeline is subject to regulations "govern[ing] pipeline design, construction, operation and maintenance, and emergency response planning."³³ EPA believes that DOT's regulations are consistent with RCRA Subtitle C's goal of preventing releases of hazardous materials to protect human health and the environment.³⁴ However, because DOT's regulations do not have an equivalent to RCRA's tracking manifest requirement,³⁵ EPA proposed requiring generators of the CO₂ stream to certify, via a signed statement, the delivery of the stream to a UIC Class VI facility; failure to ensure delivery would risk loss of the exemption.³⁶

EPA did propose a limiting condition on the conditional exemption: no other hazardous waste can be included in any manner with the CO₂ stream.³⁷ If inclusion, mixing, or co-injecting were to occur, the stream would then need to be managed under RCRA as a hazardous waste (and thus could only be injected into a Class I well).³⁸ However, "EPA expects that where facilities have made the significant economic commitment to capture and/or inject CO₂ streams for purposes of [geologic

30. *Id.* at 48,082–83.

31. 49 C.F.R. § 195.2.

32. Hazardous Waste Management System: Identification and Listing of Hazardous Waste: Carbon Dioxide (CO₂) Streams in Geologic Sequestration Activities, 76 Fed. Reg. at 48,082.

33. *Id.*

34. *Id.*

35. See 40 C.F.R. § 263.20 for the hazardous waste manifest system requirements under RCRA.

36. Hazardous Waste Management System: Identification and Listing of Hazardous Waste: Carbon Dioxide (CO₂) Streams in Geologic Sequestration Activities, 76 Fed. Reg. at 48,083.

37. *Id.* at 48,086.

38. *Id.*

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sequestration], such facilities will not wish to jeopardize this arrangement by mixing hazardous waste into the CO₂ stream.”³⁹

B. Final Rule

In its final rule, EPA adopted the proposed rule with three minor changes: (1) language was added to include applicable state pipeline regulations for intrastate pipelines; (2) two certification statements were required, one by the generator and one by the well facility owner or operator; and (3) the certification statements must also be easily accessible on the facility’s website.⁴⁰ The final rule demonstrated that EPA was convinced that existing regulations (the Class VI well rule and DOT’s transportation rules) adequately protected human health and the environment such that a conditional exemption of CO₂ streams from hazardous waste regulation was warranted. EPA also repeatedly made clear that this final rule was limited to supercritical CO₂ streams captured at the source and destined for injection at a Class VI well.⁴¹

EPA addressed several comments in justifying the final rule. One commenter called for EPA to forgo this conditional exemption until it identified both in name and concentration those contaminants that may be injected into the Class VI well as a part of the CO₂ stream.⁴² EPA disagreed, arguing that the injection of CO₂ streams, including whatever incidental substances are present, can be done at the Class VI well in a manner that will protect human health and the environment.⁴³ The Class VI well permitting requirements mandate that the chemical and physical characteristics of the CO₂ stream must be known in order to establish sufficient conditions for confinement within the injection zone.⁴⁴ EPA further stated that it intended

39. *Id.*

40. Hazardous Waste Management System: Conditional Exclusion for Carbon Dioxide (CO₂) Streams in Geologic Sequestration, 79 Fed. Reg. 350, 354 (Jan. 3, 2014) (to be codified at 40 C.F.R. pt. 9, 260, 261).

41. *Id.* at 356.

42. *Id.* at 356–57.

43. *Id.* at 357.

44. *Id.*

to monitor this composition data, and will make changes to the exemption as may be appropriate.⁴⁵

Some commenters were concerned about the potential application of hazardous waste regulations to the sequestered CO₂ streams, should the exemption be lost.⁴⁶ These commenters argued that there was no reason to assume that the streams would exhibit any hazardous characteristics, even if they were solid wastes, and thus there was no purpose to subjecting them to RCRA Subtitle C at all.⁴⁷ EPA addressed these comments by reiterating an indication made in the proposed rule: EPA could not unequivocally say that CO₂ streams would never exhibit a hazardous characteristic because of “the early state of data development in this area.”⁴⁸ In fact, EPA noted the possibility that CO₂ streams could have concentrations of contaminants (*e.g.*, mercury, arsenic) that could cause the stream to exhibit the toxicity characteristic.⁴⁹ EPA sought to provide regulatory clarity in this “early state of data development” by conditionally exempting CO₂ streams from the definition of hazardous waste, even if determined by the generator to exhibit a hazardous characteristic.⁵⁰

EPA acknowledged it is limited in unilaterally providing such clarity.⁵¹ RCRA allows states to administer and enforce hazardous waste programs, with EPA approval.⁵² Once a state is authorized to administer and enforce its own program, the state program operates “in lieu of the Federal program.”⁵³ While EPA can administer and enforce any new requirements or prohibitions within authorized states that have not yet adopted such new

45. *Id.*

46. *See* Hazardous Waste Management System: Conditional Exclusion for Carbon Dioxide (CO₂) Streams in Geologic Sequestration, 79 Fed. Reg. at 355.

47. *Id.*

48. *Id.* at 356.

49. Hazardous Waste Management System: Identification and Listing of Hazardous Waste: Carbon Dioxide (CO₂) Streams in Geologic Sequestration Activities, 76 Fed. Reg. 48,073, 48,083 (proposed Aug. 8, 2011) (to be codified at 40 C.F.R. pt. 260, 261).

50. Hazardous Waste Management System: Conditional Exclusion for Carbon Dioxide (CO₂) Streams in Geologic Sequestration, 79 Fed. Reg. at 356.

51. *See id.* at 360.

52. *See id.*; *see also* RCRA § 3006, 42 U.S.C. § 6926 (2012).

53. RCRA § 3006(b), 42 U.S.C. § 6926(b).

requirements or prohibitions,⁵⁴ this final rule establishes neither a new requirement nor prohibition; instead, it is a conditional exemption of existing rules. Because it provides for a conditional relaxation of the federal hazardous waste program, authorized states do not have to adopt this provision.⁵⁵ Furthermore, authorized states that do not adopt this conditional exclusion “may impose state requirements” as applicable to the supercritical CO₂ streams being generated, transported, or disposed of within the state.⁵⁶

IV. THE UNDERGROUND INJECTION CONTROL WELL PROGRAM

The Underground Injection Control (UIC) Well Program was established by the Safe Drinking Water Act (SDWA).⁵⁷ The purpose of the UIC Program is to protect underground sources of drinking water from contamination from materials injected into the subsurface.⁵⁸ The UIC Program provides for six different kinds of wells (think colloquial wells but on a much deeper, bigger, and more encapsulated scale), ranging from wells for injecting fluids for enhanced oil and gas recovery to wells for injecting hazardous waste materials.⁵⁹ The well classes are designated based on several factors, including type of fluids injected, injection depth, design, and operating techniques.⁶⁰ Each class has its own set of requirements and performance criteria.⁶¹ EPA sets minimum requirements for a UIC program to ensure protection of underground sources of drinking water; states apply to EPA for authority to administer a UIC program within their jurisdiction, with regulations at least as stringent as

54. *Id.* § 6926(g)(1).

55. Hazardous Waste Management System: Conditional Exclusion for Carbon Dioxide (CO₂) Streams in Geologic Sequestration, 79 Fed. Reg. at 360.

56. *Id.*

57. See SDWA § 1421, 42 U.S.C. § 300h-1; 40 C.F.R. § 144.1 (2015).

58. Water Pollution Control; National Primary Drinking Water Requirements, 52 Fed. Reg. 20,672, 20,672 (June 2, 1987) (to be codified at 40 C.F.R. pt. 141–42, 144).

59. See *supra* note 21.

60. See *Underground Injection Control Well Classes*, *supra* note 21; see also 40 C.F.R. § 144.6.

61. See 40 C.F.R. pt. 146; see also *Underground Injection Control Well Classes*, *supra* note 21.

those set by EPA.⁶² EPA has listed every state as needing a UIC program,⁶³ and has authorized thirty-four of the states to implement and enforce the UIC program.⁶⁴ In the final Class VI well rule, EPA reaffirmed that, “in accordance with SWDA [S]ection 1422, all Class VI State programs must be at least as stringent as the minimum Federal requirements.”⁶⁵ However, presently EPA administers the Class VI well program nationally,⁶⁶ as no state has yet been granted primacy. Eventually, though, we probably can expect to see states authorized to have primary regulatory authority over Class VI wells, particularly if carbon capture and storage becomes more prevalent as a mitigation strategy.

A. Class VI Wells

As previously noted, Class VI wells are the newest addition to the UIC program. Class VI wells are to be sited in geologically suitable areas only.⁶⁷ This means the injection zone must have “sufficient areal extent, thickness, porosity, and permeability” to handle the total volume of the CO₂ stream, and the confining zone must not have any transmissive faults or fractures and must be able to contain the pressure and volume of the CO₂ stream without fear of fracturing.⁶⁸ The area of review⁶⁹ for a Class VI

62. Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO₂) Geologic Sequestration (GS) Wells, 75 Fed. Reg. 77,230, 77,241 (Dec. 10, 2010) (to be codified at 40 C.F.R. pt. 124, 144–47); see also SDWA §§ 1421(b)(1), 1422(b), 42 U.S.C. §§ 300h(b)(1), 300h-1(b). There is a bit more leeway in regulatory stringency for Class II primacy. *Id.* § 300h-4(a) (“represents an effective program”).

63. 40 C.F.R. § 144.1(e).

64. *Primary Enforcement Authority for the Underground Injection Control Program*, EPA, <http://water.epa.gov/type/groundwater/uic/Primacy.cfm> [<http://perma.cc/B2SW-NEVB>] (last updated Oct. 5, 2015). EPA shares responsibility with six states and implements the UIC program in nine states. *Id.*

65. Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO₂) Geologic Sequestration (GS) Wells, 75 Fed. Reg. at 77,241.

66. *Id.* When EPA promulgated the final rule for Class VI wells, EPA noted it was monitoring regulatory efforts for geologic sequestration in eighteen states as EPA “develop[ed] guidance on the primacy application and approval process for Class VI wells.” *Id.* at 77,239.

67. 40 C.F.R. § 146.83(a).

68. *Id.* § 146.83(a)(1)–(2).

well is to be determined by a computer model that “accounts for the physical and chemical properties of all phases of the injected carbon dioxide stream and is based on available site characterization, monitoring, and operational data.”⁷⁰ Part of this area of review delineation process involves the owners or operators of the Class VI well to predict the “lateral and vertical migration of the carbon dioxide.”⁷¹ The injection well must be constructed to prevent the movements of the CO₂ stream into underground sources of drinking water and have structural integrity to last the life of the geologic sequestration project.⁷² Before a Class VI well can start operating, whole or sidewall cores must be taken of the injection and confining zones, and pressure fall-off tests and either a pump test or injectivity tests must be conducted.⁷³ The owner or operator of the well also “must record the fluid temperature, pH, conductivity, reservoir pressure, and static fluid level of the injection zone(s).”⁷⁴ Once in operation, injection pressure cannot ever exceed ninety percent of the fracture pressure.⁷⁵ The owner or operator of the well must also continuously record “[t]he injection pressure; the rate, volume, and/or mass, and temperature of the carbon dioxide stream; and the pressure on the annulus”; and have “[a]larms and automatic shut-off systems.”⁷⁶ The CO₂ streams must be analyzed “with sufficient frequency to yield data representative of its chemical and physical characteristics,” monitored for corrosivity on a quarterly basis, periodically monitored for changes in the groundwater quality and geochemistry above the confining zones, undergo “[a] pressure fall-off test at least once every five years,” and tested and monitored to track the movement of the carbon

69. “Area of review means the region surrounding the geologic sequestration project where [underground sources of drinking water] may be endangered by the injection activity.” *Id.* § 146.81(d).

70. *Id.* § 146.84(a).

71. *Id.* § 146.84(c)(1).

72. *Id.* § 146.86(a)(1), (b)(1).

73. 40 C.F.R. § 146.87(b), (e).

74. *Id.* § 146.87(c).

75. *Id.* § 146.88(a).

76. *Id.* § 146.88(e)(1)–(2).

dioxide and any changes in pressure.⁷⁷ The results of this monitoring must be reported on a semi-annual basis.⁷⁸

B. Class I vs. Class VI: Waste Management vs. Climate Mitigation

There is concern that the CO₂ streams injected in Class VI wells could contain hazardous materials or exhibit hazardous characteristics, suggesting that the streams should be injected in Class I⁷⁹ wells. A comparison of the regulations for each class reveals some differences between the two, particularly with respect to siting. Even though not always substantial, the differences in the regulation of Class I and Class VI wells illustrate the present clash between responsible hazardous waste management and reducing greenhouse gas emissions.

The construction requirements for Class I and Class VI wells are nearly identical in substance.⁸⁰ However, Class I wells do have a few additional requirements that are not required of Class VI wells. For example, the casing for Class I wells is required to take into account 120 percent of the calculated annual volume of injected material,⁸¹ likely as an extra precautionary measure to protect underground sources of drinking water (USDWs). The Class I well regulations also mandate that the casing must be able to withstand “[t]he maximum burst and collapse pressures which may be experienced during the construction, operation and closure of the well” as well as “[t]he maximum tensile stress which may be experienced at any point along the length of the casing during the construction, operation, and closure of the

77. *Id.* § 146.90(a), (c), (d), (f), (g).

78. *Id.* § 146.91(a)(7).

79. Class I wells cover the injection of hazardous wastes, industrial non-hazardous liquids, and municipal wastewaters. *Class I Industrial and Municipal Waste Disposal Wells*, EPA, <http://www.epa.gov/uic/class-i-industrial-and-municipal-waste-disposal-wells> [<http://perma.cc/GKR3-48X6>] (last updated Oct. 19, 2015). There are separate regulations for the injection of non-hazardous and hazardous waste. *Id.* For the purposes of this discussion, the Class I wells are assumed to be for the injection of hazardous wastes and thus governed by that set of regulations.

80. Compare 40 C.F.R. § 146.65 (construction requirements for Class I wells), with 40 C.F.R. § 146.86 (construction requirements for Class VI wells).

81. 40 C.F.R. § 146.65(c)(2), (3)(ii).

well.”⁸² It would seem that these additional requirements of Class I wells, especially the latter provision, would be a great benefit for Class VI wells, considering the lack of data and information as well as the presence of uncertainties in injecting supercritical CO₂ for purposes of geologic sequestration.

Siting requirements, on the other hand, are more stringent for Class I wells than Class VI wells.⁸³ The main substantive requirement for siting Class VI wells is that they must be placed in geologically suitable areas.⁸⁴ However, this is just one of many siting requirements for Class I wells. Class I wells must additionally be sited so that the injection zone “has sufficient permeability, porosity, thickness and areal extent to prevent the migration of fluids into USDWs.”⁸⁵ Class I wells must also be sited to ensure injection “into a formation that is beneath the lowermost formation containing . . . an underground source of drinking water.”⁸⁶ The owner or operator of a Class I well must demonstrate that the confining zone “is separated from the base of the lowermost USDW by at least one sequence of permeable and less permeable strata that will provide an added layer of protection for the USDW in the event of fluid movement” or that there is no USDW nearby.⁸⁷ The area of review for the site also must span at least a two-mile radius around the well bore.⁸⁸ Class I wells are subject to these more stringent siting requirements arguably because the materials being injected pose substantial risk to underground sources of drinking water and the public health; however, these requirements also would not have been out of place for Class VI wells. Because regulating the injection CO₂ streams is relatively new, there is not much data available about the exact composition of the streams. Furthermore, the fact that the streams are conditionally exempt from hazardous waste regulations provides reason to subject Class VI wells to a higher level of regulation for siting in order to

82. *Id.* § 146.65(c)(5)(i), (ii).

83. *Compare* 40 C.F.R. § 146.62 (siting requirements for Class I wells), *with* 40 C.F.R. § 146.83 (siting requirements for Class VI wells).

84. *See supra* notes 67–68 and accompanying text.

85. 40 C.F.R. § 146.62(c)(1).

86. *Id.* § 146.62(a).

87. *Id.* § 146.62(d)(1), (3).

88. *Id.* § 146.63.

protect underground drinking water sources and the public health against any potential and unforeseen risks from a potentially hazardous material. That Class VI wells do not have these added protections is illustrative of EPA valuing climate mitigation at the expense of hazardous waste management.

The same is illustrated in the operating requirements: Class I wells are subject to more stringent operating regulations.⁸⁹ Permits for Class I wells must include limitations on the injected waste's acidity, pH, or temperature as well as procedures for preventing pressure imbalances that may cause backflow or blowouts if the waste has the potential to react with the injection formation.⁹⁰ Class I well regulations also spell out requirements for the event of "a release of injected wastes into an unauthorized zone."⁹¹ Again, it would seem logical to have subjected the CO₂ streams of Class VI wells to similar requirements, since some of these CO₂ streams may otherwise meet a hazardous characteristic. Because the streams are to be stored underground for a very long time, it would seem crucial to limit the temperature, pH, or acidity of the CO₂ streams to protect against reactions with the injection formation and potential risks of release. However, EPA clearly preferred the scales for Class VI wells to tip in favor of climate mitigation.

Class VI wells do pick up some of the slack in testing and monitoring requirements; they are more comprehensive than those for Class I wells.⁹² Both well classes require stream analysis adequate and frequent enough to provide representative characteristics of the stream.⁹³ However, Class VI well regulations go further and require continuous monitoring of "injection pressure, rate, and volume; the pressure on the annulus between the tubing and the long string casing; and the annulus fluid volume added."⁹⁴ Furthermore, Class VI

89. *Compare* 40 C.F.R. § 146.67 (operating requirements for Class I wells), *with* 40 C.F.R. § 146.88 (operating requirements for Class VI wells).

90. 40 C.F.R. § 146.67(e)(1).

91. *Id.* § 146.67(i).

92. *Compare* 40 C.F.R. § 146.68 (testing and monitoring requirements for Class I wells), *with* 40 C.F.R. § 146.90 (testing and monitoring requirements for Class VI wells).

93. 40 C.F.R. §§ 146.68(a), 146.90(a).

94. *Id.* § 146.90(b).

regulations require “[p]eriodic monitoring of the ground water quality and geochemical changes above the confining zone(s)”⁹⁵ and allow for monitoring potential endangerment of USDWs at the discretion of the Director.⁹⁶ Class I well regulations lack such provisions, and instead only require information showing that the waste stream will be compatible with the injection zone’s hydrogeology.⁹⁷ Class I regulations do, though, allow for periodic monitoring of ground water quality as desired by the Director.⁹⁸ Both well class regulations require mechanical integrity testing,⁹⁹ and Class VI regulations give the Director the ability to prescribe additional requirements as “necessary to support, upgrade, and improve computational modeling of the area of review evaluation.”¹⁰⁰ It would seem that the Class VI regulations are more stringent here because the underground injection control wells for geologic sequestration are a completely new class of well, and there is currently very little relevant data available;¹⁰¹ it serves EPA’s interest to require more monitoring and testing at this time in order to start building a foundation of data that can be used to fine-tune the regulations in the future. The greater requirements for monitoring and testing of Class VI wells is likely not (at least primarily) motivated by a desire to more responsibly manage potential hazards, especially given the preceding discussion about the construction, siting, and operating requirements.

One aspect in which Class I monitoring and testing regulations are more stringent than those for Class VI is with respect to corrosion. Regulations for both well classes require quarterly monitoring “of the well materials for loss of mass,

95. *Id.* § 146.90(d).

96. *Id.* § 146.90(h). “Director” refers to, for now, the EPA Regional Administrator, though it could expand to include the state or tribal program director as the Class VI well program becomes more established and EPA delegates primacy. *Id.* § 146.3.

97. *Id.* § 146.68(b).

98. *Id.* § 146.68(e)(2)(iii), (iv).

99. 40 C.F.R. §§ 146.68(d), 146.90(e).

100. *Id.* § 146.90(i).

101. See, e.g., Hazardous Waste Management System: Conditional Exclusion for Carbon Dioxide (CO₂) Streams in Geologic Sequestration Activities, 79 Fed. Reg. 350, 356 (Jan. 3, 2014) (to be codified at 40 C.F.R. pt. 9, 260, 261) (“Thus, in light of the early state of data development in this area . . .”).

thickness, cracking, pitting, and other signs of corrosion . . . to ensure that the well components meet the minimum standards for material strength and performance.”¹⁰² However, that is as far as the Class VI regulations go. Class I regulations go on to mandate continuous corrosion monitoring for waste streams known to be corrosive, as well as continuous monitoring of pressure, temperature, and flow rate if a corrosion monitoring program is required.¹⁰³ Even though EPA was mainly concerned with the toxicity characteristic for CO₂ streams,¹⁰⁴ more responsible management of hazardous wastes would call for also including continuous corrosion monitoring for those potentially corrosive CO₂ streams.¹⁰⁵

There is a concern to be had in state implementation and enforcement of Class VI wells, especially given that the CO₂ streams are conditionally exempted from hazardous waste regulations. While in theory the authorized states should all have at least as stringent regulations as the federal requirements, this does not guarantee in practice that they will be so; for instance, one state may be much more willing to enforce the requirements than another. However, state implementation could also be a source of countering the exemption. EPA noted that “states are not required to adopt this provision” because it is “promulgated pursuant to non-[Hazardous and Solid Waste Amendments of

102. 40 C.F.R. § 146.90(c); *id.* § 146.68(c)(3)(ii).

103. *Id.* § 146.68(c)(2), (3)(i).

104. *See, e.g.*, Hazardous Waste Management System: Conditional Exclusion for Carbon Dioxide (CO₂) Streams in Geologic Sequestration Activities, 79 Fed. Reg. at 355. Furthermore, in the proposed rule, EPA did discuss potential constituents within the CO₂ streams that could impact corrosivity. *See* Hazardous Waste Management System: Identification and Listing of Hazardous Waste: Carbon Dioxide (CO₂) Streams in Geologic Sequestration Activities, 76 Fed. Reg. 48,073, 48,079 (proposed Aug. 8, 2011) (to be codified at 40 C.F.R. pt. 260, 261).

105. This obviously would involve site-specific analysis of the geochemical composition of the well site and the specific chemical makeup of the CO₂ stream to be injected into the well during the early permitting stages. However, the relevant data likely will already be available; the additional step of analyzing the corrosivity of the CO₂ stream’s composition on the proposed injection site to determine the frequency of corrosion monitoring (continuous, as in line with Class I well regulations, 40 C.F.R. § 146.68(c)(2), or quarterly, as currently required for Class VI wells, *id.* § 146.90(c)) would be the only substantive requirement further imposed to ensure more responsible hazardous waste management.

1984] authority” and “is less stringent than the federal program.”¹⁰⁶ Therefore, “[a] state that has not adopted the conditional exclusion may impose state requirements, including the uniform hazardous waste manifest requirement (where applicable)” and other state-required RCRA regulations.¹⁰⁷

Comparing Class I and Class VI UIC well regulations sheds light on the current clash between responsible hazardous waste management and reducing greenhouse gas emissions. EPA was faced with a regulatory decision on how to manage supercritical CO₂ streams, which may exhibit hazardous characteristics or have hazardous substances added to them;¹⁰⁸ these streams will then be injected underground where they may pose a threat to drinking water. EPA itself acknowledged the novelty of regulating supercritical CO₂ streams for geologic sequestration, and yet, instead of approaching with caution, EPA exempted such regulation from RCRA’s hazardous waste management:

In light of the early state of data development in this area, EPA intends to bring additional clarity to the regulatory regime through this rule, by establishing a conditional exclusion from the definition of hazardous waste that would apply in the event a generator determines that its CO₂ streams exhibit a RCRA hazardous characteristic.¹⁰⁹

EPA was consciously aware of the lack of substantive data on the composition of supercritical CO₂ streams and how the streams would interact with the hydrogeology. From a hazardous waste management perspective, this seems to be a situation that calls for a better-safe-than-sorry approach: require generators to characterize the supercritical CO₂ stream before injecting it underground and subjecting those hazardous streams to RCRA Subtitle C. Instead, EPA acknowledged the unknowns and exempted the potentially hazardous streams from RCRA’s

106. Hazardous Waste Management System: Conditional Exclusion for Carbon Dioxide (CO₂) Streams in Geologic Sequestration Activities, 79 Fed. Reg. at 360. The Hazardous and Solid Waste Amendments of 1984 added Section 3006(g) to RCRA and granted EPA authority to implement and enforce newly promulgated, more stringent federal standards in states otherwise authorized to carry out RCRA until those states enacted their own equivalent standards. *Id.*

107. *Id.*

108. *See, e.g., id.* at 359.

109. *Id.* at 356.

hazardous waste regulations, thereby implicitly declaring the policy goal of reducing greenhouse gas emissions to be more important than hazardous waste management. Whether this was a right or wrong decision is ultimately an individual perspective and beyond the scope of this paper; this paper merely serves to draw attention. This clash of environmental values is likely to be quite prevalent in the coming days, particularly as we deal increasingly with climate change mitigation and adaptation.

V. LEGAL CHALLENGES: CO₂ STREAMS AND THE DEFINITION OF SOLID WASTE

Though EPA conditionally exempted supercritical CO₂ streams from hazardous waste regulations, EPA maintained that the CO₂ streams in question were still solid wastes because they are a material from industrial, commercial, or mining operations being injected into the land.¹¹⁰ Though EPA exempted the streams that are being properly injected into Class VI wells from the definition of hazardous waste, the generators and well owners or operators may still be liable for imminent and substantial hazards caused or created by the handling, storage, treatment, transportation, or disposal of supercritical CO₂ as a solid waste.¹¹¹ Some commenters on the proposed rule took issue with the remaining liability, arguing first that such liabilities were not applicable because supercritical CO₂ streams were not solid wastes, and second that at the very least EPA should provide an exemption from such liabilities.¹¹² After the rule was finalized,

110. Hazardous Waste Management System: Identification and Listing of Hazardous Waste: Carbon Dioxide (CO₂) Streams in Geologic Sequestration Activities, 76 Fed. Reg. 48,073, 48,077–78 (proposed Aug. 8, 2011) (to be codified at 40 C.F.R. pt. 260, 261).

111. See RCRA § 7003, 42 U.S.C. § 6973 (2012) (“Notwithstanding any other provision of this chapter, upon receipt of evidence that the past or present handling, storage, treatment, transportation or disposal of any solid waste or hazardous waste may present and imminent and substantial endangerment to health or the environment, the Administrator may bring suit . . . against any person . . .”).

112. American Petroleum Institute, Comment Letter on the Proposed Rule to Change the Regulation of Carbon Dioxide Streams in Geologic Sequestration Activities Under RCRA, at 4–7 (Aug. 8, 2011), <http://www.regulations.gov/contentStreamer?documentId=EPA-HQ-RCRA-2010-0695-0077&attachmentNumber=2&disposition=attachment&contentType=pdf> [<http://perma.cc/5KJ2-G9UU>] [hereinafter API Comment].

the American Petroleum Institute, Carbon Sequestration Council, and Southern Company Services (collectively referred to as “API”) filed petitions for review with the D.C. Circuit Court of Appeals, noting that the issue to be raised is whether EPA’s determination that supercritical CO₂ streams are solid wastes was arbitrary and capricious or otherwise not in accordance with the law.¹¹³

A. Arbitrary and Capricious Standard

Courts have held that in order for an agency’s action to be arbitrary and capricious under the Administrative Procedure Act, it must not have any rational basis or explanation.¹¹⁴ In order for API to succeed under this standard, it must show that EPA’s determination that supercritical CO₂ streams are RCRA solid wastes has no rational foundation. Because the relevant statutory and regulatory definitions are clear, as will be discussed below, it is unlikely that API’s claim will succeed under the arbitrary and capricious standard of review.¹¹⁵

B. Disposal Argument

While generally supportive of the conditional exemption, API’s comment on the proposed rule argued that supercritical CO₂ streams are not solid wastes because they are not discarded (abandoned, recycled, inherently waste-like) or of the physical form of solid waste RCRA explicitly seeks to manage.¹¹⁶ API focused mostly on the abandonment, positing that CO₂ streams are not abandoned because the streams are not disposed of.¹¹⁷ To support this proposition, API noted that the activities “geologic sequestration” and “carbon capture and storage” do not have

113. Statement of Issues to be Raised, Carbon Sequestration Council et al. v. EPA (D.C. Cir. 2014) (No. 14-1048).

114. *E.g.*, Am. Petroleum Inst. v. EPA, 216 F.3d 50, 58 (D.C. Cir. 2000) (“[B]ecause the agency has failed to provide a rational explanation for its decision, we hold the decision to be arbitrary and capricious.”); Motor Vehicle Mfrs. Ass’n v. State Farm Mut. Auto. Ins., 463 U.S. 29, 43 (1983) (“In reviewing an agency’s action under the arbitrary and capricious standard, we must affirm the agency if it has articulated a satisfactory explanation for its action including a ‘rational connection between the facts found and the choice made.’”).

115. 5 U.S.C. § 706(2)(A) (2012).

116. API Comment, *supra* note 112, at 5.

117. *Id.* at 6.

“disposal” or any synonym of disposal.¹¹⁸ The plain meanings of these terms do not suggest disposal but rather suggest seclusion and setting apart.¹¹⁹ API also turned the perspective around: “[carbon capture and storage] prevents air emissions from being abandoned or disposed of into the environment”;¹²⁰ something that avoids disposal cannot at the same time be disposal. API further argued that because CO₂ streams were being used commercially for enhanced oil and gas recovery, the streams are not being disposed of.¹²¹

API’s disposal argument completely ignores the law. It is clearly spelled out in 40 C.F.R. § 261.2(a) that one way for a material to be discarded is to be abandoned; one way to be abandoned is to be disposed of. While plain meanings found in English dictionaries can in some situations provide clarity, clear statutory definitions will always trump.¹²² As provided earlier, RCRA explicitly defines “disposal” to include the injection of a material resulting from an industrial, commercial, mining, or agricultural operation into the land.¹²³ This is the case with supercritical CO₂ streams being sequestered in Class VI wells. The CO₂ is captured at the end of an industrial, commercial, mining, or agricultural operation; compressed; and injected in the land at the well site, therefore clearly constituting disposal and falling under the cover of RCRA and its regulations.

Furthermore, the fact that CO₂ streams are used commercially for enhanced oil and gas recovery does not have any bearing on the solid waste determination of the final rule at issue. API neglects the fact that injection of supercritical CO₂ streams for the purposes of enhanced oil and gas recovery is done with Class II wells and governed by the regulations thereof.¹²⁴ EPA also explicitly stated that the scope of this final rule is limited to Class VI wells, and stated that the injection of CO₂ into Class II

118. *Id.*

119. *Id.*

120. *Id.*

121. *Id.* at 7.

122. *See* *Chevron U.S.A., Inc. v. NRDC*, 467 U.S. 837, 842–43 (1984).

123. RCRA § 1004(3), 42 U.S.C. § 6903(3) (2012).

124. *See, e.g., Class II Oil and Gas Related Injection Wells*, EPA, <http://www.epa.gov/uic/class-ii-oil-and-gas-related-injection-wells> [<http://perma.cc/98HH-WG9S>] (last updated Oct. 8, 2015).

wells for enhanced oil and gas recovery “would not generally be a waste management activity.”¹²⁵

C. Physical Form Argument

API pointed to the statutory definition of solid waste, in relevant part, as “other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations”¹²⁶ API noted that supercritical materials are not explicitly provided for, thus rendering them outside of RCRA’s jurisdiction.¹²⁷ API will further argue this point since EPA itself stated in the final rule that “the RCRA definition of solid waste . . . does not speak to materials such as supercritical fluids.”¹²⁸

API’s physical form argument is stronger than its disposal argument because API is correct in the plainest reading of the statutory definition of solid waste: “supercritical fluid” is not listed. However, there are two countervailing semantic arguments that likely outweigh API’s. First, the definition includes “other discarded material,”¹²⁹ suggesting the enumerated types of materials to be considered solid wastes are not exhaustive. Second, the definition uses “including” before the list of forms (“solid, liquid, semisolid, or contained gaseous material”),¹³⁰ which also suggests the lack of exhaustiveness of the following list of forms. That list of forms provides more of an example of the types of “other discarded material” to be regulated rather than setting distinct regulatory boundaries. Additionally, a supercritical material is one that exhibits physical characteristics of both gases and liquids; it would be a strange construction of the statutory definition to exclude those materials with multiple listed physical characteristics.

125. Hazardous Waste Management System: Conditional Exclusion for Carbon Dioxide (CO₂) Streams in Geologic Sequestration Activities, 79 Fed. Reg. 350, 355 (Jan. 3, 2014) (to be codified at 40 C.F.R. pt. 9, 260, 261).

126. API Comment, *supra* note 112, at 5 (quoting 42 U.S.C. § 6903(27)).

127. *Id.*

128. Statement of Issues to be Raised, *supra* note 113 (quoting Hazardous Waste Management System: Conditional Exclusion for Carbon Dioxide (CO₂) Streams in Geologic Sequestration Activities, 79 Fed. Reg. at 355).

129. RCRA § 1004(27), 42 U.S.C. § 6903(27).

130. *Id.*

API's argument here may well be supported by the statement from EPA that "the RCRA definition of solid waste . . . does not speak to materials such as supercritical fluids."¹³¹ While an admittance of inapplicability certainly could be a fair reading of that sentence standing on its own, EPA continued: "Like the listed 'solid, liquid, semisolid, or contained gaseous material' specifically referenced, CO₂ streams sequestered for purposes of [geologic sequestration] are 'other discarded material' from industrial and commercial operations and, therefore, are of a similar kind to the other types of wastes specifically referenced by the definition."¹³² EPA is stating that even though the phrase "supercritical fluids" is not specifically spelled out in the definition, there is still the broader "other discarded material" that does encompass such fluids (particularly given the semantic arguments above).

Because this is an agency interpretation of a statute, *Chevron U.S.A., Inc. v. NRDC*¹³³ provides the test for its validity. The "Chevron Two-Step" requires a court, in evaluating the legitimacy of an agency interpretation of a statute, first to ask whether or not "Congress has directly spoken to the precise question at issue."¹³⁴ Answering this first question involves looking at the language of the statute and Congress' intent. In this case, the answer likely would be no, as Congress has not directly stated whether supercritical fluids are included or excluded from RCRA's jurisdiction. However, if the court accepts the semantic arguments above with respect to "including" and "other discarded material," it is possible to find congressional intent to include supercritical fluids within RCRA's jurisdiction, and the inquiry would stop there. If not, the court would move on to the second part of the "Chevron Two-Step": "whether the agency's [interpretation] is based on a permissible construction of the statute."¹³⁵ This step of the inquiry can see courts giving deference to the agency:

131. Hazardous Waste Management System: Conditional Exclusion for Carbon Dioxide (CO₂) Streams in Geologic Sequestration Activities, 79 Fed. Reg. at 355.

132. *Id.*

133. 467 U.S. 837 (1984).

134. *Id.* at 842.

135. *Id.* at 843.

If Congress has explicitly left a gap for the agency to fill, there is an express delegation of authority to the agency to elucidate a specific provision of the statute by regulation. Such legislative regulations are given controlling weight unless they are arbitrary, capricious, or manifestly contrary to the statute. Sometimes the legislative delegation to an agency on a particular question is implicit rather than explicit. In such a case, a court may not substitute its own construction of a statutory provision for a reasonable interpretation made by the administrator of an agency.¹³⁶

In this case, there would be “a gap for the agency to fill,” namely those materials that would be included under “other discarded materials.” Including supercritical fluids in “other discarded materials” would likely be a reasonable interpretation because supercritical fluids embody physical characteristics of fluids and gases, both of which are also listed in the statutory definition. Furthermore, the injection of supercritical CO₂ streams into Class VI wells fits within the statutory definition of “disposal,” which is a means of meeting the definition of “discarded.”¹³⁷ Therefore, it is likely that a court will uphold EPA’s determination that supercritical CO₂ streams fall within RCRA’s definition of solid waste.

VI. WASTE MANAGEMENT VS. CLIMATE MITIGATION: COMPARING THE UNITED STATES TO EUROPE

As a final broad illustration, it is useful to compare the United States’ conditional exemption and approach to carbon capture and storage via geologic sequestration with the approach taken by the European Union. The European Union approaches carbon capture and storage even more from the policy standpoint of reducing greenhouse gas emissions than the United States. The European Commission created the basic regulatory framework for carbon capture and storage within the European Union in 2003, amended in 2009, and based this framework

136. *Id.* at 843–44.

137. *See supra* Part V-B.

within the existing emissions trading scheme.¹³⁸ In fact, the European Commission's Directive treats carbon capture and storage as a means for countries to meet their emissions allocations.¹³⁹ To this end, CO₂ streams are not considered hazardous waste (or, if they are considered hazardous, the streams do not seem to be thought to pose a threat to public health or the environment in the current regulatory scheme).

In its focus on emissions reduction, the Directive places emphasis on emissions allocation, measurement, and monitoring.¹⁴⁰ However, the Directive directs the individual countries to set the specific requirements.¹⁴¹ To that end, the member-countries of the European Union were to codify the Directive into their laws by June 25, 2011; a year after that deadline, only Spain had done so.¹⁴² As of 2014, Germany, Italy, Poland, Portugal, and parts of Belgium have or are in the process of establishing the Directive into their national law.¹⁴³

Because the regulatory framework present in the European Union is founded solely in the climate mitigation perspective, the European Union's framework is fundamentally different from that of the United States. Europe's carbon capture and storage regulatory framework is situated within and around its emissions trading scheme and has little to no relationship with waste management; in the United States, on the other hand, the carbon

138. See Directive 2009/29, of the European Parliament and of the Council of 23 April 2009 Amending Directive 2003/87/EC so as to Improve and Extend the Greenhouse Gas Emission Allowance Trading Scheme of the Community, 2009 O.J. (L 140) 63, 65 (EC), <http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0063:0087:en:PDF> [<http://perma.cc/EYR6-MECD>].

139. See *id.* at 68–69.

140. See Directive 2003/87/EC, of the European Parliament and of the Council of 13 October 2003 Establishing a Scheme for Greenhouse Gas Emission Allowance Trading Within the Community and Amending Council Directive 96/61/EC, 2003 O.J. (L 275) 32, 43–44 (EC), <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:275:0032:0046:en:PDF> [<http://perma.cc/6XK8-X33V>].

141. See *id.*

142. Int'l Energy Agency, *Carbon Capture and Storage: Legal and Regulatory Review*, at 9 (3d ed. 2012), http://www.iea.org/publications/freepublications/publication/CCS_Review_3rdedition_FINAL.pdf [<http://perma.cc/8K4H-VC6L>].

143. Int'l Energy Agency, *Carbon Capture and Storage: Legal and Regulatory Review*, at 28, 33, 39, 46, 47 (4th ed. 2014), http://www.iea.org/publications/insights/insightpublications/CCSReview_4thEd_FINAL.pdf [<http://perma.cc/35VX-M8ZK>].

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capture and storage regulatory framework is built around waste management and the UIC well program, part of which is also a part of waste management. From a hazardous waste management perspective, the United States' carbon capture and storage regulatory scheme is more desirable than the European Union's because presently the United States is regulating carbon capture and storage from within the waste management scheme. From a perspective of rectifying or minimizing clashes between environmental policies, the European Union's carbon capture and storage regulatory scheme is arguably more desirable because it is born from and focused on solely one environmental policy, inherently avoiding any clash. This might support an argument that the United States should adopt an approach similar to the European Union, meaning the United States should establish an independent climate change regulatory scheme; however, even if the United States were to do that, the question of how carbon capture and storage via geologic sequestration would interplay with RCRA and SDWA would still need to be addressed. In other words, some form of EPA's conditional exemption rule would still have to happen. Given the United States' existing legal and regulatory framework around waste management and climate mitigation, there seems to be only two potential ways to avoid this clash in environmental values in the United States: subject carbon capture and storage via geologic sequestration completely to hazardous waste regulations, or drastically overhaul the regulatory scheme, perhaps at least in part by creating a more comprehensive and independent, but still strongly interrelated, climate regulatory scheme.¹⁴⁴

144. It is entirely possible that it is impossible to avoid this clash of environmental values in full, at least with respect to the injection of supercritical CO₂ streams into the earth. Because these CO₂ streams could very well be hazardous, exempting them from hazardous waste regulation, in whatever form, would always prejudice the environmental value of responsible waste management. However, alleviating that prejudice, *i.e.* subjecting the CO₂ streams to hazardous waste regulation, could prejudice the environmental value of climate mitigation by placing a disincentive on entities from engaging in geologic sequestration. The realistic solution may be the point at which the overall prejudice is minimized; the determination of such a point would seem to depend on how much of the CO₂ streams are hazardous and how much of a disincentive compliance with hazardous waste regulations is.

VII. CONCLUSION

In response to the carbon capture and storage industry desiring clarification about the applicability of RCRA hazardous waste regulations, EPA promulgated the Conditional Exclusion for Carbon Dioxide (CO₂) Streams in Geologic Sequestration Activities, conditionally exempting from the definition of hazardous waste supercritical CO₂ streams injected into Class VI wells for geologic sequestration. EPA reasoned that the existing regulations of Class VI wells, along with DOT's pipeline transportation requirements, were sufficient to protect human health and the environment, making RCRA Subtitle C superfluous. EPA did maintain that CO₂ streams were RCRA solid wastes because they are a material resulting from industrial or commercial operations being injected into the land. API, along with two other groups, has filed a suit raising the issue that EPA's inclusion of CO₂ streams within the definition of solid waste was arbitrary and capricious or otherwise not in accordance with the law. API is likely to argue that the CO₂ streams are not being disposed of and are not in a physical form expressly provided for in the statutory definition of solid waste. The former will most likely fail, but the latter may depend on how the court will read the statutory language.

This final rule sees a conflict between two environmental goals: reducing greenhouse gas emissions and safely managing waste disposal. From the perspective of reducing greenhouse gas emissions, the rule is favorable, though perhaps not quite far-reaching enough (perhaps this perspective would at the extreme allow unfettered injection of CO₂ streams); from the perspective of waste management, the rule may leave something to be desired. The primary purpose of RCRA is to manage and minimize hazardous waste so as to protect human health and the environment. This objective may be compromised if a potentially new source of hazardous waste is precluded from hazardous waste regulations. The European Union, for instance, has its regulation of carbon capture and storage separate, for the most part, from waste management; indeed, the European Union's carbon capture and storage regulatory scheme is a part of its greenhouse gas emissions trading scheme. While this might at first glance suggest the United States could follow suit to avoid a clash in environmental values, this is, in reality, unlikely given

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the United States' current legal and regulatory framework with respect to waste management. Regardless, every conflict must be resolved with compromise, and this is the balance EPA has presently struck. Perhaps as Class VI wells become functional and more widespread and monitoring data becomes more available, EPA will be more able to accurately refine the conditional exemption to minimize this clash in environmental values.