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PAVING THE WAY FOR CLEAN COAL: THE EPA'S CONDITIONAL EXCLUSION OF CARBON CAPTURE AND STORAGE FACILITIES FROM HAZARDOUS WASTE REGULATION UNDER RCRA

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Carbon capture and storage ("CCS") is an emerging climate change mitigation strategy involving the permanent underground storage of carbon dioxide captured from emission sources like power plants. The Environmental Protection Agency recently finalized a rule (the "Conditional Exclusion") that excludes CCS operations from all hazardous waste regulations under the Resource, Conservation, and Recovery Act. Instead of these regulations, capture facilities and geologic sequestration wells must comply with similarly comprehensive and more specifically tailored requirements developed under the Safe Drinking Water Act, which should provide adequate protection of both humans and the environment. The Conditional Exclusion provides necessary regulatory certainty for the industries that might use CCS in the future and eliminates one of the many financial impediments to its implementation. However, while the Conditional Exclusion is a prudent and effective way to encourage CCS, widespread deployment is unlikely in the coming decades absent more comprehensive federal action and vast improvements rendering capture technologies more economically feasible.

I. INTRODUCTION

Both the government and the scientific community are beginning to agree on the realities of climate change and the various ways that humankind contributes to it.[1] Most notably, the

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[1] *See* Hazardous Waste Management System: Identification and Listing of Hazardous Waste: Carbon Dioxide (CO_2) Streams in Geologic Sequestration Activities, 76 Fed. Reg. 48,073, 48,076 (proposed Aug. 8, 2011) [hereinafter

burning of fossil fuels for energy releases large amounts of harmful greenhouse gasses ("GHGs"), such as carbon dioxide ("CO_2"), into the atmosphere.[2] Coal-fired power plants, while reliable and affordable domestic energy sources, are the largest contributors to GHG emissions in the United States.[3] In order to protect the future of the planet while continuing to utilize this important domestic energy resource, coal must be cleaned up.

One solution to this problem is *carbon capture and storage* ("CCS"), which involves capturing CO_2 from stationary sources, such as power plants, and injecting it deep underground for permanent storage.[4] If widely implemented, CCS could be an important climate change mitigation strategy.[5] However, large-scale deployment of CCS remains elusive due to various legal and

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Proposed Conditional Exclusion] ("There is now clear evidence that the Earth's climate is warming . . . . Most of this recent warming is very likely the result of human activities."); Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2013: The Physical Science Basis*, *in* THE FIFTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (Stocker et al. eds., Cambridge University Press, 2013), *available at* http://www.climatechange2013.org/images/report/WG1AR5_ALL_FINAL.pdf (featuring over 1,500 pages of contributions from 259 authors in 39 countries and assessing the most current understandings of the science behind climate change). The latter source is the most recent of a series of comprehensive reports on the science and impacts of climate change, which the IPCC first published in 1990. *Reports*, IPCC, https://ipcc.ch/publications_and_data/publications_and_data_reports.shtml (last visited Feb. 27, 2014).

[2] *See* Proposed Conditional Exclusion, 76 Fed. Reg. at 48,076 ("Many human activities (such as the combustion of fossil fuels) release greenhouse gases (GHGs) into the atmosphere. The levels of several of these gases, including CO_2, have reached concentrations not seen on Earth in hundreds of thousands of years.").

[3] INTERAGENCY CARBON CAPTURE AND STORAGE TASK FORCE, REPORT OF THE INTERAGENCY TASK FORCE ON CARBON CAPTURE AND STORAGE 7 (2010) [hereinafter INTERAGENCY TASK FORCE REPORT], *available at* http://www.epa.gov/climatechange/Downloads/ccs/CCS-Task-Force-Report-2010.pdf.

[4] *See Carbon Dioxide Capture and Sequestration*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/climatechange/ccs/index.html (last updated Sept. 20, 2013).

[5] *See, e.g.*, Proposed Conditional Exclusion, 76 Fed. Reg. at 48,076 ("CCS has the potential to be key to achieving domestic GHG emissions reductions . . . . Other options include, but are not limited to, energy conservation, efficiency improvements, and the use of alternative fuels and renewable energy sources, including solar and wind power.").

economic barriers. Over the past decade, various national and international research institutions and governmental bodies have thoroughly documented the promise and problems surrounding CCS implementation.[6] These reports collectively support the use of CCS as an effective way to reduce GHG emissions while acknowledging the substantial barriers—primarily economic—to its current deployment.[7] Additionally, the United States has taken an active role in exploring and promoting CCS research through federal funding.[8] Most recently, the federal government has begun

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[6] *See, e.g.*, INTERAGENCY TASK FORCE REPORT, *supra* note 3 (discussing the state of CCS technology, focusing on the current barriers to CCS deployment and commercialization, and suggesting approaches for addressing these barriers); Bert Metz et al. eds., INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, SPECIAL REPORT: CARBON DIOXIDE CAPTURE AND STORAGE (2005) [hereinafter IPCC REPORT], *available at* http://www.ipcc-wg3.de/special-reports/.files-images/SRCCS-WholeReport.pdf (detailing the scientific and technological bases of CCS technologies); MASSACHUSETTS INSTITUTE OF TECHNOLOGY, THE FUTURE OF COAL (2007), *available at* http://web.mit.edu/coal/The_Future_of_Coal.pdf (discussing CCS in the context of coal energy production and CO_2 emissions); U.S. DEP'T OF ENERGY, DOE/NETL ADVANCED CARBON DIOXIDE CAPTURE R&D PROGRAM: TECHNOLOGY UPDATE (2013), *available at* http://www. netl.doe.gov/File%20Library/Research/Coal/carbon%20capture/handbook/CO2-Capture-Tech-Update-2013.pdf (detailing the efforts of the Department of Energy and National Energy Technology Laboratory in encouraging research and development for CCS projects); CONGRESSIONAL BUDGET OFFICE, FEDERAL EFFORTS TO REDUCE THE COST OF CAPTURING AND STORING CARBON DIOXIDE 7 (2012) [hereinafter CBO REPORT] *available at* http://cbo.gov/sites/default/files/cbofiles/attachments/43357-06-28CarbonCapture.pdf (summarizing the CBO's findings as to the economic viability of CCS and various solutions to economic barriers).

[7] *See supra* note 6.

[8] *See* CBO REPORT, *supra* note 6, at 5 ("[The Department of Energy ("DOE")] encourages the advancement of CCS technologies through spending for projects to demonstrate the feasibility of using current CCS technology in commercial-scale power plants and by funding R&D activities to develop future generations of more advanced and more efficient equipment. In addition, the federal government encourages the use of CCS by providing tax credits for private utilities that choose to invest in and produce electricity from CCS-equipped plants. . . . [The DOE] received a large infusion of funds from the American Recovery and Reinvestment Act of 2009, which provided $3.4 billion for DOE's CCS efforts (bringing the total funding in 2009 for [CCS] to $4.1 billion).").

However, these direct federal incentives must be taken in context, which detracts from their significance. *See id.* at 13 ("As CBO's illustrative to address some of the regulatory challenges to CCS through targeted rulemakings by the Environmental Protection Agency ("EPA").[9] In December 2013, the EPA promulgated a final rule (the "Conditional Exclusion")[10] conditionally excluding CCS from potentially costly hazardous waste regulations under the Resource Conservation and Recovery Act ("RCRA").[11]

This Recent Development focuses on the impacts of the Conditional Exclusion considered against the backdrop of the much larger and complex issues surrounding CCS.[12] By addressing legal uncertainty and eliminating potential costs early in the implementation of CCS, the Conditional Exclusion effectively paves the way for future development. While the rule eliminates only one of many barriers to CCS, it reflects a markedly proactive effort by the EPA to make this climate change mitigation strategy more attractive and feasible to developers through targeted administrative action.

Part II of this Recent Development examines the technology behind CCS, its current implementation status, and some of the barriers preventing its effective utilization. Part III discusses several pertinent regulatory schemes that affect CCS, namely the

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calculations suggest, the amount of current federal spending is small relative to the magnitude of the investment necessary to make CCS-equipped plants economically competitive, and DOE's current activities are unlikely to provide the amount of learning that would drive down the technology's costs.").

[9] *See infra* notes 10 (RCRA Final Conditional Exclusion), 50 (UIC Class VI Well Rule), 121–22 (GHG reporting rules), 157 (proposed NSPS standards) and accompanying text.

[10] Hazardous Waste Management System: Conditional Exclusion for Carbon Dioxide (CO_2) Streams in Geologic Sequestration Activities, 79 Fed. Reg. 350 (Jan. 3, 2014) (to be codified at 40 C.F.R. pts. 9, 260, 261) [hereinafter Final Conditional Exclusion].

[11] 42 U.S.C. §§ 6901–6992k (2012).

[12] For a more complete discussion of the issues surrounding CCS, see generally Jonas J. Monast, Brooks R. Pearson, & Lincoln F. Pratson, *A Cooperative Federalism Framework for CCS Regulation*, 7 ENVTL. & ENERGY L. & POL'Y J. 1 (2012) (offering an excellent overview of the economic and legal problems involved in CCS regulation at both the federal and state levels); INTERAGENCY TASK FORCE REPORT, *supra* note 3 (exploring in depth the current barriers to CCS deployment and analyzing numerous legal and regulatory strategies to overcome these barriers).

EPA's control over drinking water and injection wells, and the EPA's regulation of hazardous wastes under RCRA. Part IV describes the inception and content of the EPA's Conditional Exclusion of CO_2 streams in CCS operations from hazardous waste regulations. Part V rationalizes the propriety of the Conditional Exclusion by addressing the EPA's justifications as well as other concerns over removing all RCRA controls. Part VI turns to the anticipated impacts of the Conditional Exclusion, as well as the policy agenda that it and related rules reveal. Finally, Part VII concludes by summarizing the Conditional Exclusion's overall significance for the future of clean coal.

II. CCS TECHNOLOGY AND IMPLEMENTATION

This part provides an introduction to CCS technology and its current implementation.[13] To start, it is important to clarify exactly what CCS refers to. *Carbon capture and storage*[14] refers to a specific set of climate change mitigation strategies comprised of three distinct phases: (1) capture of CO_2 from stationary sources; (2) transport through pipelines; and (3) storage in deep underground wells.[15] The end-goal of geologic sequestration ("GS")—whereby captured CO_2 remains stored underground and thus permanently removed from the atmosphere—is central to the definition of CCS and distinguishes CCS from other carbon capture technologies. For example, Enhanced Oil Recovery ("EOR") also involves the injection of gases—such as captured CO_2—into an oil or gas reservoir to help displace trapped fuel and boost productivity.[16] This particular result distinguishes EOR from CCS; EOR is

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[13] For a thorough description of the various technologies involved in CCS, see, for example, IPCC REPORT, *supra* note 6, at 105–318 (explaining in detail the technologies involved in the capture, transport, and storage of CO_2).

[14] Both *carbon capture and storage* and *carbon capture and sequestration*, used alternately by different entities, refer to the exact same set of processes. However, CCS should be distinguished from other related terms, such as "carbon sequestration," which refers to various other processes of capturing atmospheric CO_2. *See Carbon Dioxide Capture and Sequestration*, *supra* note 4.

[15] Proposed Conditional Exclusion, 76 Fed. Reg. 48,073, 48,075–76 (Aug. 8, 2011).

[16] *See Enhanced Oil Recovery*, ENERGY.GOV, http://energy.gov/fe/science-innovation/oil-gas/enhanced-oil-recovery (last visited Mar. 23, 2014).

fundamentally motivated by increased fossil fuel consumption rather than reduced emissions.[17] However, the importance of EOR should not be overlooked; EOR has historically dominated the carbon capture market and consequently is largely responsible for the development of the technology behind CCS.[18] Nonetheless, this Recent Development focuses exclusively on CCS processes resulting in GS.[19]

A. *Technology*

The first phase of CCS involves the capture of CO_2 from stationary sources: most notably power plants, but also various industrial facilities.[20] Three approaches currently exist for capturing CO_2 and preventing its atmospheric release: (1) post-combustion systems; (2) oxy-fuel combustion; and (3) pre-combustion systems.[21] These technologies separate CO_2 from other byproducts of production and concentrate the CO_2 into a stream ready for transport.[22] Currently available technologies can potentially remove eighty-five to ninety percent of a power plant's CO_2 emissions.[23] However, a number of impurities may also be captured alongside CO_2 as a byproduct of either the coal combustion or the specific

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[17] *See id*.

[18] *See infra* notes 35–37 and accompanying text.

[19] This is largely because the Conditional Exclusion does not apply to EOR but rather only to CCS involving GS. *See infra* notes 150–51 and accompanying text.

[20] IPCC REPORT, *supra* note 6, at 107 ("CO_2 capture and storage is most applicable to large, centralized sources like power plants and large industries."). For example, industrial facilities with significant CO_2 emissions include ethyl alcohol and nitrogenous fertilizer manufacturers. Proposed Conditional Exclusion, 76 Fed. Reg. at 48,089.

[21] IPCC REPORT, *supra* note 6, at 107 ("*Post-combustion* systems separate CO_2 from the flue gases produced by combustion of a primary fuel (coal, natural gas, oil or biomass) in air. *Oxy-fuel combustion* uses oxygen instead of air for combustion, producing a flue gas that is mainly H_2O and CO_2 and which is readily captured. This is an option still under development. *Pre-combustion* systems process the primary fuel in a reactor to produce separate streams of CO_2 for storage and H_2 which is used as a fuel. Other industrial processes, including processes for the production of low-carbon or carbon-free fuels, employ one or more of these same basic capture methods.").

[22] *Id.*

[23] *Id.*

capture technology used.[24] The presence of these impurities has spawned numerous concerns, including whether captured CO_2 streams would be considered hazardous.[25]

Next, the captured CO_2 stream is dehydrated to remove corrosive moisture[26] and compressed into a *supercritical* state that shares characteristics of both liquid and gas.[27] The supercritical CO_2 is then transported to its ultimate disposal site via pipeline.[28] While other forms of transport are theoretically possible, they are considered logistically impractical because of the extreme volumes of CO_2 involved in CCS.[29]

Finally, the CO_2 stream arrives at its injection site for permanent sequestration.[30] A number of different subsurface geologic formations could potentially accommodate CO_2 injections, including depleted oil and gas reservoirs, coal formations, and most importantly, saline formations.[31] In order to reach these formations, one or more injection

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[24] *See id*. at 114 ("Flue gases coming from coal combustion [and captured in post-combustion systems] will contain not only CO_2, N_2, O_2 and H_2O, but also air pollutants such as SO_x, NO_x, particulates, HCl, HF, mercury, other metals and other trace organic and inorganic contaminants."); *id.* at 122 ("Impurities in the CO_2 [from oxy-fuel combustion capture] are gas components such as SO_x, NO_x, HCl and Hg derived from the fuel used, and the inert gas components, such as nitrogen, argon and oxygen, derived from the oxygen feed or air leakage into the system.").

[25] *See infra* note 75 and accompanying text.

[26] Proposed Conditional Exclusion, 76 Fed. Reg. 48,073, 48,081 (Aug. 8, 2011).

[27] *See id*. at 48,076.

[28] *Id*.

[29] PAUL W. PARFOMAK & PETER FOLGER, CARBON DIOXIDE (CO_2) PIPELINES FOR CARBON SEQUESTRATION: EMERGING POLICY ISSUES 1 (2008), *available at* http://www.regulations.gov/#!documentDetail;D=EPA-HQ-RCRA-2010-0695-0009 (follow "view document" link for full text) ("Transporting captured CO_2 in relatively limited quantities is possible by truck, rail, and ship, but moving the enormous quantities of CO_2 implied by a widespread implementation of CCS technologies would likely require a dedicated interstate pipeline network.").

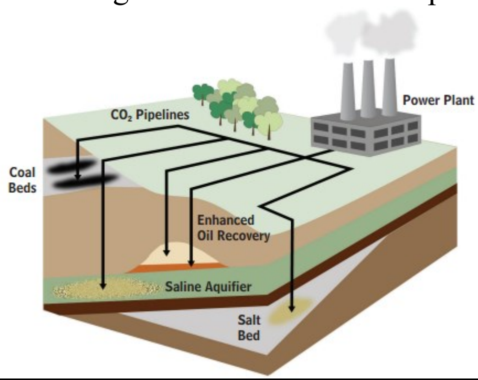
[30] *See* IPCC REPORT, *supra* note 6, at 199.

[31] *Id*. at 197. The report provides:

> Depleted oil and gas reservoirs, possibly coal formations and particularly saline formations (deep underground porous reservoir rocks saturated with brackish water or brine), can be used for storage of CO_2. . . . Storage of CO_2 in coal beds, in conjunction with enhanced coal bed methane (ECBM) production, is potentially attractive because

wells must be drilled.[32] Once it is injected, nearly all of the CO_2 is permanently trapped by various physical and geochemical processes, and the CO_2 actually becomes less likely to escape over time.[33]

Figure 1. Diagram of Possible CCS Operations[34]



> of the prospect of enhanced production of methane, the cleanest of the fossil fuels. This technology, however, is not well developed and a better understanding of injection and storage processes in coals is needed. Carbon dioxide storage in depleted oil and gas reservoirs is very promising in some areas, because these structures are well known and significant infrastructures are already in place. Nevertheless, relatively few hydrocarbon reservoirs are currently depleted or near depletion and CO_2 storage will have to be staged to fit the time of reservoir availability. Deep saline formations are believed to have by far the largest capacity for CO_2 storage and are much more widespread than other options.

Id.

[32] Proposed Conditional Exclusion, 76 Fed. Reg. at 48,076.

[33] IPCC REPORT, *supra* note 6, at 197. The report provides:

> [I]t is considered likely that 99% or more of the injected CO_2 will be retained for 1000 years. . . . Carbon dioxide can remain trapped underground by virtue of a number of mechanisms, such as: trapping below an impermeable, confining layer (caprock); retention as an immobile phase trapped in the pore spaces of the storage formation; dissolution in the *in situ* formation fluids; and/or adsorption onto organic matter in coal and shale. Additionally, it may be trapped by reacting with the minerals in the storage formation and caprock to produce carbonate minerals. . . . Moreover, CO_2 becomes less mobile over time as a result of multiple trapping mechanisms, further lowering the prospect of leakage.

Id.

[34] MICHAEL MANN & LEE R. KUMP, DIRE PREDICTIONS: UNDERSTANDING GLOBAL WARMING (Prentice Hall, 2009).

B. *Implementation*

In theory, each of these technologies and strategies are relatively well-understood.[35] However, their application and success varies widely. Successful pipeline transport of supercritical CO_2 has been established through decades of experience with EOR applications.[36] Similarly, although large volumes of CO_2 have not been permanently sequestered in the past, the technology behind GS is well-settled.[37] On the other hand, the capture technologies that could be used at large power plants have yet to be perfected and remain extremely costly to install and operate.[38] The Congressional Budget Office estimates that a coal-fired power plant employing carbon capture technology would have seventy-six percent higher capital costs than traditional "dirty" coal plants

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[35] *See* IPCC REPORT, *supra* note 6, at 48 ("Technologies for the capture of CO_2 are relatively well understood today based on industrial experience in a variety of applications [such as EOR]. Similarly, there are no major technical or knowledge barriers to the adoption of pipeline transport, or to the adoption of geological storage of captured CO_2.").

[36] *See* Proposed Conditional Exclusion, 76 Fed. Reg. at 48,082 ("In the United States, there are approximately 3,600 miles of dedicated CO_2 pipelines, carrying about 50 million metric tons of CO_2 per year, primarily for EOR activities in the oil and gas industry. Experience and knowledge gained by the oil and gas industry, which has used CO_2 pipelines over the past 35 years to transport large volumes of CO_2 to oil fields, is directly applicable to carbon capture and GS operations and, thus, there is much experience with this activity.").

[37] *See id.* at 48,076 ("[Storage technologies] have been developed and refined by the oil and gas and chemical manufacturing industries over the past several decades."); *id*. at 48,084 (noting that the UIC program, discussed *infra* Part III.A, has over twenty-five years of experience in regulating the injection of fluids); IPCC REPORT, *supra* note 6, at 197 ("Well-drilling technology, injection technology, computer simulation of storage reservoir dynamics and monitoring methods can potentially be adapted from existing applications to meet the needs of geological storage.").

[38] *See* CBO REPORT, *supra* note 6, at 7 ("The equipment a CCS plant requires to capture and compress CO_2 is large, complex, and expensive; and [c]apturing and compressing CO_2 consumes a substantial fraction of the plant's total output. Consequently, to produce the same amount of electricity for consumers, a plant with CCS capabilities has to be bigger than a plant without them.").

that do nothing to capture CO_2 emissions.[39] Additionally, operating costs at CCS plants are higher than traditional coal plants due to lost operating efficiency.[40] This financial impediment remains a significant obstacle to the deployment of CCS, though not the only one.[41]

Beyond these individual concerns, the novelty of large-scale, fully-integrated CCS systems presents a barrier to entry. Perfecting a technology like CCS through extensive investment, experience, and research is critical to reducing its cost and improving its viability.[42] However, as of 2012, the EPA has identified between thirteen and nineteen active and planned carbon capture facilities that could potentially manage CCS operations, the vast majority of which are currently involved in EOR rather than GS.[43] Moreover,

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[39] *Id*. ("According to the [Congressional Budget Office]'s analysis, average capital costs for a CCS-equipped plant would be 76 percent higher than those for a conventional plant: $3,070 per kilowatt of capacity compared with $1,740 per kilowatt.").

[40] *Id*. ("A CCS-equipped plant would also be more expensive to operate than a non-CCS-equipped plant would be because it would have to burn more fuel during the process of capturing and compressing the CO_2.").

[41] A full discussion of the economic disincentives to CCS is beyond the scope of this Recent Development. However, those mentioned in this subpart are arguably the most significant. *See* Monast et al., *supra* note 12, at 3–4 (citations omitted) ("The barriers that tend to receive the most attention include the overall cost of the CCS process, the need for more advanced technologies to capture emissions, and liability for long-term storage.").

[42] *See* CBO STUDY, *supra* note 6, at 13–14 ("Even with broad deployment, such earlier technologies as the removal of sulfur dioxide from utilities' emissions have required decades of experience and extensive research and development—as well as a substantial amount of investment—before costs were reduced.").

[43] *See* ECONOMICS AND RISK ANALYSIS STAFF, U.S. ENVTL. PROT. AGENCY, ASSESSMENT OF THE POTENTIAL COSTS, BENEFITS, AND OTHER IMPACTS: HAZARDOUS WASTE MANAGEMENT SYSTEM: CONDITIONAL EXCLUSION FOR CARBON DIOXIDE (CO_2) STREAMS IN GEOLOGIC SEQUESTRATION ACTIVITIES: FINAL RULE 19–21 (2013) [hereinafter ASSESSMENT OF THE CONDITIONAL EXCLUSION], *available at* http://www.regulations.gov/#!documentDetail;D=EPA-HQ-RCRA-2010-0695-0092 (follow "view document" link for full text).

These facilities include coal power plants, natural gas power plants, nitrogenous fertilizer plants, and an ethyl alcohol manufacturing plant. Only one operational facility is currently implementing GS, while five others are anticipated to begin the EPA "does not anticipate a significant expansion in CCS management of CO_2 over the next several years."[44] Thus, the lack of a proven means of implementing CCS as an integrated system further discourages necessary innovation.[45]

Another significant barrier to the utilization of CCS technology is the United States' legal framework—or the lack thereof—governing CCS. In addition to failing to incentivize CCS appropriately,[46] the applicability of existing regulatory schemes can present potentially fatal regulatory uncertainty.[47] Broadly speaking, this regulatory uncertainty commonly forces utilities to postpone energy generation investments in novel solutions like CCS.[48] The following part

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GS within the decade. Ten sites are currently capturing CO_2 for EOR, and the EPA assumes that these will transition to GS within twenty years. The current and future status of a few other facilities is uncertain. *See id*.

[44] *Id*. at 6.

[45] *See* IPCC REPORT, *supra* note 6, at 48. ("[T]he integration of capture, transport and storage in full-scale projects is needed to gain the knowledge and experience required for a more widespread deployment of CCS technologies. R&D is also needed to improve knowledge of emerging concepts and enabling technologies for CO_2 capture that have the potential to significantly reduce the costs of capture for new and existing facilities. More specifically, there are knowledge gaps relating to large coal-based and natural gas-based power plants with CO_2 capture on the order of several hundred megawatts (or several Mt CO_2). Demonstration of CO_2 capture on this scale is needed to establish the reliability and environmental performance of different types of power systems with capture, to reduce the costs of CCS, and to improve confidence in the cost estimates.").

[46] *See* INTERAGENCY TASK FORCE REPORT, *supra* note 3, at 10 ("The lack of comprehensive climate change legislation is *the* key barrier to CCS deployment. Without a carbon price and appropriate financial incentives for new technologies, there is no stable framework for investment in low-carbon technologies such as CCS.") (emphasis added).

[47] *See id*. ("Even with financial support, challenges such as legal and regulatory uncertainty can hinder the development of CCS projects. Regulatory uncertainty has been widely identified as a barrier to CCS deployment.").

[48] *See* Jonas J. Monast & Sarah K. Adair, *A Triple Bottom Line for Electric Utility Regulation: Aligning State-Level Energy, Environmental, and Consumer Protection Goals*, 38 COLUM. J. ENVTL. L. 1, 25 (2013) ("The political and regulatory processes are more difficult to predict, leading utilities and [public utility commissions] to delay investments until there is sufficient policy certainty to ensure that the investment is necessary and will meet the new [environmental] standards.").

highlights a few of the existing regulatory schemes most directly related to CCS, and subsequent parts discuss how the EPA's recent Conditional Exclusion helps to reduce some of the regulatory uncertainty associated with CCS deployment.

III. THE CURRENT LEGAL AND REGULATORY FRAMEWORK APPLICABLE TO CCS

There is currently no federal statutory law directly governing CCS. Instead, numerous state and federal programs, often operating independently, hinder the immediate viability of CCS by adding cost, complexity, and confusion for potential adopters of the technology.[49] While this Recent Development does not provide an exhaustive list of the laws and regulations that potentially affect CCS, it does explore the legal schemes most pertinent to the EPA's Conditional Exclusion. These include the EPA's control over underground injection wells and the EPA's management of hazardous wastes under RCRA.

[49] CCS invokes a complex patchwork of state and federal incentives and regulations. States are becoming more active in directly regulating CCS, often incentivizing their development through control over taxes, permitting, and property rights. *See* Monast et al., *supra* note 12, at 11–13. On the other hand, the various federal programs affecting CCS—generally environmental laws—more often inhibit the growth of this technology through potentially burdensome permitting liability schemes. *See id.* at 15–16. Nonetheless, as discussed below, the EPA has taken some elementary steps to incentivize CCS in the absence of specific federal legislation, such as with its recent Conditional Exclusion. *See infra* Part III.A. For a more comprehensive analysis of the numerous regulatory frameworks surrounding CCS implementation, see INTERAGENCY TASK FORCE REPORT, *supra* note 3, at 56–75; Monast et al., *supra* note 12, at 11–17.

Although outside the scope of this Recent Development, the Comprehensive Emergency Response, Compensation, and Liability Act ("CERCLA" or "Superfund"), 42 U.S.C. §§ 9601–75, is worth mentioning here. CERCLA imposes retroactive joint and several liability on a wide range of responsible parties following the release of a hazardous substance. *See* CERCLA § 107(a), 42 U.S.C. § 9607(a) (2012). As such, CERCLA could potentially be a source of long-term liability for the various entities involved in CCS projects; this potential and the uncertainty associated with it is another barrier to implementing CCS. *See* Monast et al., *supra* note 12, at 16.

A. *The Underground Injection Control Program and CCS*

The most foundational federal program regulating CCS comes from a lengthy rule, the "UIC Class VI Well Rule,"[50] promulgated in 2010 by the EPA under its Underground Injection Control ("UIC") program. The UIC program was established under the Safe Drinking Water Act ("SDWA")[51] in order to prevent contamination of underground sources of drinking water ("USDWs").[52] The EPA accomplishes this through specific controls over different classes of wells used for storing or disposing various fluids.[53] For example, Class I wells are used for the injection of hazardous wastes (among other things) below the lowest USDWs, Class II wells are used for injecting fluids in EOR activities, and Class V wells have been used for a few experimental GS pilot projects.[54]

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[50] Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO_2) Geologic Sequestration (GS) Wells, 75 Fed. Reg. 77,230 (Dec. 10, 2010) (to be codified at 40 C.F.R. pts. 124, 144, 145, 146, 147) [hereinafter UIC Class VI Well Rule].

[51] 42 U.S.C. §§ 300f–300j-26 (2012).

[52] See 42 U.S.C. § 300h(d)(2) (2012) ("Underground injection endangers drinking water sources if such injection may result in the presence in underground water which supplies or can reasonably be expected to supply any public water system of any contaminant, and if the presence of such contaminant may result in such system's not complying with any national primary drinking water regulation or may otherwise adversely affect the health of persons.").

[53] *See* Proposed Conditional Exclusion, 76 Fed. Reg. 48,073, 48,084 (Aug. 8, 2011) ("Pursuant to [42 U.S.C. § 300h(d)(2)], the UIC program requirements for all well classes, promulgated under the authority of the SDWA, are designed to comprehensively ensure that an injection well is appropriately sited, operated, tested, monitored, and closed in a manner that ensures USDW protection and does not otherwise adversely affect the health of persons.").

[54] *See* UIC Class VI Well Rule, 75 Fed. Reg. at 77,243–44. The Class VI Well Rule allows for the conversion of Class I, II, and V wells into Class VI wells, provided all the requirements for Class VI wells are met. *See id*. at 77,291 (to be codified at 40 C.F.R. pt. 146.81(c)) ("This subpart also applies to owners or operators of permit- or rule-authorized Class I, Class II, or Class V experimental carbon dioxide injection projects who seek to apply for a Class VI geologic sequestration permit for their well or wells. Owners or operators seeking to convert existing Class I, Class II, or Class V experimental wells to Class VI geologic sequestration wells must demonstrate to the Director that the wells were engineered and constructed to meet the requirements at § 146.86(a) and ensure protection of USDWs . . . .").

The UIC Class VI Well Rule established a new class of wells—Class VI—reserved specifically for the long-term subsurface storage of CO_2 from CCS facilities.[55] The rule's requirements are specifically tailored to address the unique nature of CO_2 injection for GS, including "the large CO_2 injection volumes anticipated at GS projects, the relative buoyancy of CO_2, [CO_2's] mobility within subsurface geologic formations, [CO_2's] corrosivity in the presence of water, and the potential presence of impurities in the captured CO_2 stream."[56] The rule's permitting system establishes a thorough set of controls over Class VI injection wells which govern: site characterization to ensure that the wells are located in appropriate geologic formations; appropriate well construction; analysis of the physical and chemical properties of the CO_2 stream; pre- and post-injection monitoring of the CO_2 stream, well integrity, groundwater quality, and movement of the CO_2 plume; and "[f]inancial responsibility requirements to ensure that funds will be available for all corrective action, injection well plugging, post-injection site care [ ], site closure, and emergency and remedial response."[57]

Consistent with the UIC program, these controls are specifically designed to protect USDWs.[58] Despite this limited objective, and the fact that the UIC Class VI Well Rule regulates only a single aspect of CCS, the rule nonetheless has a broad impact on the future of CCS development. By establishing extensive controls over GS—the phase of CCS invoking the most

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[55] *Id*. at 77,233.

[56] *Id*. The EPA's consideration of the uniqueness of CO_2 GS is central to the adequacy of the controls established. *See id*. ("Due to [these unique features], the [EPA] has determined that tailored requirements, modeled on the existing UIC regulatory framework, are necessary to manage the unique nature of CO_2 injection for GS."). For a more thorough discussion of the unique risks necessitating the creation of a new class of injection wells, see *id*. at 77,234–35. For discussion of how the UIC Class VI well requirements appropriately address these risks, see *infra* notes 57 and 110–15 and accompanying text.

[57] *Id*. at 77,233. For a comprehensive description of the UIC Class VI Rule's requirements and the rationales behind them, see *id*. at 77,274–75. For a shorter summary of these requirements, see Proposed Conditional Exclusion, 76 Fed. Reg. at 48,084–85.

[58] UIC Class VI Well Rule, 75 Fed. Reg. at 77,233.

concern and arguably involving the most potential harm to the environment—this rule provides a necessary framework for ensuring that CCS is a viable solution to the nation's clean energy needs.[59] Further, the rule's comprehensive regulation of Class VI wells is largely responsible for the EPA's decision to conditionally exclude CCS from RCRA, as discussed below.[60]

B. *RCRA's Hazardous Waste Regulation and CCS*

RCRA—specifically Subtitle C—regulates hazardous wastes using a "cradle-to-grave" approach, tracking and regulating a waste product during its generation, transport, treatment, storage, and eventual disposal.[61] The threshold determination for RCRA applicability is a material's characterization as a "solid waste."[62] This definition broadly encompasses "any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material . . . ."[63] From there, a solid waste can be considered hazardous either if it is a specifically identified "listed" waste,[64] or if it exhibits one or more of the following characteristics of hazardous waste: ignitability, corrosivity, reactivity, or toxicity.[65]

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[59] Recognition of this potential largely drove the formulation of the UIC Class VI Well Rule. *See id*. at 77,230 ("This rule will help ensure consistency in permitting underground injection of CO_2 at GS operations across the United States and provide requirements to prevent endangerment of USDWs in anticipation of the eventual use of GS to reduce CO_2 emissions to the atmosphere and to mitigate climate change.").

[60] *See infra* Part V.

[61] U.S. ENVTL. PROT. AGENCY, 25 YEARS OF RCRA: BUILDING ON OUR PAST TO PROTECT OUR FUTURE 3 (2001), *available at* http://www.epa.gov/osw/inforesources/pubs/k02027.pdf.

[62] *What is a RCRA hazardous waste?*, U.S. ENVTL. PROT. AGENCY, http://waste.supportportal.com/link/portal/23002/23023/Article/22091/What-is-a-RCRA-hazardous-waste (last updated Sept. 12, 2013) ("To be considered a hazardous waste, a material must first be classified as a solid waste.").

[63] 42 U.S.C. § 6903(27) (2012).

[64] *See* 40 C.F.R. §§ 261.30–.33 (2013) (listing four categories of specific hazardous wastes).

[65] *See* 40 C.F.R. §§ 261.21–.24 (2013) (explaining the physical properties leading to a waste's classification as ignitable, corrosive, reactive, or toxic).

The hazardous waste obligations imposed under RCRA vary significantly according to an entity's classification as a generator, a transporter, or a treatment, storage, and disposal facility ("TSDF"). Among other things, generators of waste are required to determine whether its waste is hazardous and create a tracking manifest that follows the waste after it is transported off-site.[66] Transporters are generally held to similar recordkeeping requirements under RCRA.[67] TSDFs, on the other hand, are subject to far more onerous requirements, including: mandatory permitting; general facility operation and design standards; detailed closure and post-closure plans; groundwater monitoring; corrective action requirements; and demonstrations of financial soundness for up to thirty years post-closure in order to deal with groundwater contamination and potential third-party liability.[68] Because "[a] hazardous waste TSDF is the ultimate, maximally regulated entity,"[69] avoiding classification as a TSDF is understandably a serious priority for those dealing with hazardous wastes.[70]

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[66] *See* Standards Applicable to Generators of Hazardous Waste, 40 C.F.R. § 262 (2013).

[67] *See id.* § 263.

[68] *See id.* § 264. Interim-status TSDFs are subject to similar standards in § 265.

[69] James T. O'Reilly & Lorre Barbara Cuzze, *Environmental Law and Business in the 21st Century: Trash or Treasure? Industrial Recycling and International Barriers to the Movement of Hazardous Wastes*, 22 IOWA J. CORP. L. 507, 512 (1997).

[70] *See, e.g.*, Kenneth D. Woodrow & Michael W. Steinberg, *Responsibilities of Generators of Hazardous Waste*, *in* 4A-29 ENVIRONMENTAL LAW PRACTICE GUIDE § 29.03 (MB 2013) ("[G]enerators will work diligently to avoid becoming TSD facilities . . . ."); Deborah A. Sivas, *RCRA Comprehensively Regulates the Handling of Hazardous Waste*, *in* 1-20 BROWNFIELDS LAW AND PRACTICE § 20.02[3] (MB 2013) ("Obtaining, and then complying with, RCRA TSD permits can be a nightmare for a brownfields developer; all possible steps should be taken to avoid this status.").

Generation and transport facilities often become TSDFs by storing hazardous waste on-site for too long. *See* 40 C.F.R. § 262.34 (2013) (noting storage time limits of 90, 180 and 270 days for different types of generators); 40 C.F.R. § 263.12 (2013) ("A transporter who stores manifested shipments of hazardous waste . . . for a period of ten days or less is not subject to regulation [as a TSDF] . . . .").

There is considerable debate as to whether CCS operations would ever fall under the thumb of this regulatory regime. First, some commenters have raised concerns as to whether the supercritical CO_2 injectate meets the definition of a solid waste.[71] However, the EPA has conclusively rejected these concerns and continues to view geologically sequestered CO_2 streams as falling within the plain meaning of "other discarded material."[72]

Even more contentious debate surrounds whether or not the CO_2 streams could be considered a hazardous waste.[73] Because supercritical CO_2 streams are not specifically listed in the regulations, they could only be considered hazardous if they satisfied one of the signature characteristics noted above.[74] Individual CO_2 streams could potentially exhibit toxic characteristics due to contaminants incidental to the capture process, such as arsenic, mercury, and selenium.[75] Moreover, even relatively pure CO_2 streams

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[71] Final Conditional Exclusion, 79 Fed. Reg. 350, 354–55 (Jan. 3, 2014) ("Some commenters argued that CO_2 is not a contained gas and, therefore, does not meet the RCRA statutory definition of solid waste. Some commenters also noted that CO_2 is a commodity that has commercial/beneficial uses, including use in enhanced oil or gas recovery (EOR/EGR) and manufacturing operations and, therefore, argued that it should not be classified as a waste. . . . Still other commenters cited dictionary definitions of the terms used in EPA regulations, concluding that CO_2 sent to Class VI facilities is not *discarded, abandoned,* or *recycled.*").

[72] *Id*. at 355 ("Like the listed 'solid, liquid, semisolid, or contained gaseous material' specifically referenced, CO_2 streams sequestered for purposes of GS 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. They are, therefore, RCRA statutory solid wastes."); Proposed Conditional Exclusion, 76 Fed. Reg. 48,073, 48,077 (Aug. 8, 2011) ("An entity involved in the CCS process may generate CO_2 that qualifies as a solid waste under the RCRA hazardous waste regulations *by making the decision to discard the material through abandonment by disposing of the material*. Once the decision is made that the supercritical CO_2 stream will be sent to a UIC Class VI well for discard, EPA considers this material to be a solid waste.") (emphasis added) (citation omitted).

[73] *See* Final Conditional Exclusion, 79 Fed. Reg. at 355–56.

[74] Alternatively, the CO_2 stream could be classified as hazardous if it was mixed with a listed hazardous waste. 40 C.F.R. § 261.3(a)(iv) (2013).

[75] *See* Proposed Conditional Exclusion, 76 Fed. Reg. at 48,079 ("These estimates [of CO_2 stream composition] indicate that captured CO_2 could contain . . . low

have the potential to be corrosive in the presence of water.[76] This potential, however, is far from determinative; the EPA has freely acknowledged its uncertainty over whether CO_2 streams could be considered hazardous and therefore subject to RCRA.[77] While the EPA is unwilling to make a categorical determination as to this controversial issue,[78] it nonetheless "believes that the RCRA hazardous waste regulations *can* apply to CO_2 streams being geologically sequestered."[79]

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concentrations of hazardous constituents [including arsenic, barium, cadmium, chromium, mercury, lead, and selenium]."); INTERAGENCY TASK FORCE REPORT, *supra* note 3, at 59 ("CO_2 captured from sectors amenable to CCS, such as electric generating facilities, could contain toxic chemical constituents such as arsenic, mercury, and selenium."); Monast et al., *supra* note 12, at 15 ("Depending on the concentrations of impurities in the injectate, such as mercury and hydrogen sulfide, supercritical CO_2 may exhibit characteristics of toxicity.").

[76] Proposed Conditional Exclusion, 76 Fed. Reg. at 48,084.

[77] *See id*. at 48,079 ("At this time, EPA has little information to conclude that CO_2 streams would qualify as RCRA hazardous wastes, which would make them subject to EPA's comprehensive RCRA hazardous waste management regulations."); Final Conditional Exclusion, 79 Fed. Reg. at 361 ("The proposed rule requested that commenters provide characterization data relevant to whether CO_2 streams meet the definition of RCRA hazardous waste . . . . In response to our request, EPA received no new information or data that would indicate what percentage of captured CO_2 streams would be defined as a RCRA hazardous waste. Therefore, there remains a degree of uncertainty as to what percentage of CO_2 streams might be defined as RCRA hazardous waste.").

[78] Notably, in formulating the Conditional Exclusion discussed below, the EPA sidestepped any blanket determination as to whether CO_2 streams would be considered hazardous, largely based on the fact that "the types of impurities and their concentrations would likely vary by facility, coal composition, plant operating conditions, and pollutant removal and carbon capture technologies." UIC Class VI Well Rule, 75 Fed. Reg. 77,230, 77,260 (Dec. 10, 2010). Further, the EPA noted that "it is not required to affirmatively demonstrate, as part of this rulemaking, that a particular CO_2 stream, or a portion of all CO_2 streams, necessarily qualifies as RCRA hazardous waste. . . . EPA's analysis and conclusions are independent of, and thus unaffected by, the question of whether a stream is classified as a hazardous waste under EPA's RCRA regulations." Final Conditional Exclusion, 79 Fed. Reg. at 356.

[79] Proposed Conditional Exclusion, 76 Fed. Reg. at 48,077 (emphasis added).

Provided CO_2 streams are considered a hazardous waste, all actors involved in CCS operations (except for pipeline managers)[80] would be subject to control under RCRA. Capture facilities—such as power plants—would be considered generators of hazardous waste[81] and would thus be required to identify whether their CO_2 streams are hazardous.[82] Moreover, if capture facilities treated their CO_2 streams in order to remove hazardous impurities prior to transport and sequestration, they would be classified as TSDFs, as this would necessarily involve both waste treatment and some degree of waste storage.[83] Geologic sequestration facilities

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[80] The transportation of hazardous wastes via pipeline—as CCS CO_2 streams are likely to be—is entirely outside the jurisdiction of RCRA, and instead controlled by the Department of Transportation ("DOT"). *See id*. at 48,082 (citing 49 C.F.R. §§ 172.101, 173.115(b) (2013)) ("EPA notes that there are no RCRA hazardous waste standards for pipelines, unless the pipelines are ancillary to a regulated hazardous waste tank, which does not appear to be the case here. . . . Carbon dioxide itself is listed under the DOT regulations as a Class 2.2 hazardous material (non-flammable gas). . . . By this designation as a hazardous material, CO_2 becomes subject to regulations established by DOT for the safe and secure transportation of hazardous materials in commerce."); *see also* Transportation of Hazardous Liquids by Pipeline, 49 C.F.R. § 195 (2013) (governing pipeline design, construction, testing, operation and maintenance, and corrosion control, among other things).

[81] INTERAGENCY TASK FORCE REPORT, *supra* note 3, at app. F-3 ("Among the possible points of 'generation' are: (1) the point at which CO_2 is captured as a gas, (2) the point at which CO_2 is compressed to form a supercritical fluid (exhibiting the properties of both a liquid and gas), and (3) the point at which CO_2 is injected as a supercritical fluid.").

[82] Proposed Conditional Exclusion, 76 Fed. Reg. at 48,089 ("In the baseline (absence of the [Conditional Exclusion]), generators of the captured CO_2 streams would have to determine if their CO_2 stream(s) is (are) a RCRA hazardous waste."). This could be accomplished in two ways: by directly "sampling and analyzing gaseous emissions to identify and quantify hazardous constituents," or by indirectly determining "the hazard[ous] characteristics of a waste, in light of the materials or processes used" based on the generator's professional knowledge. *Id.* at 48,078.

[83] *See* comment to 40 C.F.R. § 264.1(d) (2013) ("These part 264 [TSDF] regulations do apply to the above-ground treatment or storage of hazardous waste before it is injected underground.").

Capture facilities would be required to treat their hazardous CO_2 streams in order to use UIC Class VI wells. *See* Proposed Conditional Exclusion, 76 Fed. Reg. at 48,089 ("Depending upon this determination [of a CO_2 stream as operating injection wells would be subject to a less burdensome portion of RCRA's TSDF regulations, which merely supplement the more specific controls under the UIC program.[84]

The potential magnitude of these obligations, added to the uncertainty that surrounds them, has been an object of concern throughout the industry; RCRA applicability has been cited by numerous sources as another significant barrier to the deployment of CCS.[85] These concerns largely drove the formulation of EPA's most recent rule, as discussed in the following part.

IV. THE EPA'S CONDITIONAL EXCLUSION OF CCS CO_2 STREAMS FROM RCRA

Over the past few years, the EPA has been fully apprised of the potential for RCRA applicability to discourage the implementation of CCS technologies, both by sources within the government and industry participants. The EPA first received public comments

hazardous], a capture facility is most likely to engage in one of four baseline management practices: (1) For CO_2 streams that are determined to be nonhazardous waste, transport the material to a sequestration facility for injection in a Class VI well; for CO_2 streams that are determined to be hazardous waste, either (2) cease capturing the CO_2 stream—that is, continue to allow the CO_2 stream to be emitted into the atmosphere; or (3) transport the CO_2 stream to a sequestration facility for injection in a Class I hazardous well; or (4) treat the CO_2 stream so that it is no longer hazardous and transport it to a sequestration facility for injection in a Class VI well.").

[84] *See* § 264.1(d) ("The [TSDF] requirements of this part apply to a person disposing of hazardous waste by means of underground injection subject to a permit issued under an Underground Injection Control (UIC) program approved or promulgated under the Safe Drinking Water Act only to the extent they are required by § 144.14 of this chapter.").

[85] *See, e.g.*, INTERAGENCY TASK FORCE REPORT, *supra* note 3, at 59 ("Various groups and studies have characterized potential RCRA applicability as a possible barrier to CCS deployment due to its complex regulatory regime."); Proposed Conditional Exclusion, 76 Fed. Reg. at 48,077 ("[C]ommenters have cited the potential for RCRA hazardous waste requirements to attach to some CO_2 streams . . . as a significant impediment to widespread deployment of CCS technologies."); Monast et al., *supra* note 12, at 16 ("The majority of academic and government writing on the subject posits that applying CERCLA and RCRA liability to CCS will render projects untenable by driving up operational costs and risk premiums.").

from the industry during the formulation of its UIC Class VI Well Rule in 2010 when industry representatives voiced concerns over the continued uncertainties of RCRA applicability to CCS CO_2 streams.[86] Later that year, the Interagency Task Force on CCS, commissioned by President Obama, formally recommended that the EPA address the applicability of RCRA to CCS technologies in order to remove some of the regulatory uncertainty surrounding the fledgling industry.[87]

In response to these concerns, and because the EPA "has set out a goal to provide the regulatory certainty needed to foster industry adoption of CCS,"[88] the EPA proposed a rule clarifying the relationship between RCRA and CCS facilities in August 2011.[89] More than two years later, the EPA adopted its final rule,[90]

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[86] Final Conditional Exclusion, 79 Fed. Reg. 350, 352 (Jan. 3, 2014) ("During the development of that UIC Class VI final rule, EPA was made aware that the participants in the CCS industry were asking for clarification on how the RCRA hazardous waste requirements apply to CO_2 streams that are geologically sequestered."). These concerns over applicability were based on whether or not CO_2 streams could be characterized as a hazardous waste. *See supra* Part III.B.

The industry's concern over the burdens of RCRA application is even more evident in public comments to the proposed conditional exclusion, where industry participants pushed for a total exclusion from RCRA, beyond that which the EPA proposed. *EPA Readies Carbon Capture Policies, Signaling Action On GHG Agenda*, GLOBAL CCS INSTITUTE (May 3, 2013), http://www.globalccsinstitute.com/institute/news/epa-readies-carbon-capture-policies-signaling-action-ghg-agenda ("In their comments on EPA's 2011 RCRA proposal, industry groups called for a broad waiver, charging that the narrower exemption that the EPA proposed will result in a 'regulatory morass' of greater uncertainty, stigmatize the promising technology, render owners and operators vulnerable to citizen suits, and increase regulatory burdens for CO_2 injection activities, including enhanced oil recovery and other industrial uses of CO_2.").

[87] INTERAGENCY TASK FORCE REPORT, *supra* note 3, at 12 ("By late 2010, EPA should . . . propose a [RCRA] applicability rule for CO_2 that is captured from an emission source for purposes of sequestration.").

[88] Proposed Conditional Exclusion, 76 Fed. Reg. at 48,077.

[89] Proposed Conditional Exclusion, 76 Fed. Reg. 48,073 (proposed Aug. 8, 2011) (to be codified at 40 C.F.R. pts. 260, 261). The rule was a direct response to industry concerns. *See id*. at 48,077 ("[C]ommenters have cited the potential for RCRA hazardous waste requirements to attach to some CO_2 streams . . . as a significant impediment to widespread deployment of CCS technologies. Today's

which was officially published to the Federal Register on January 3, 2014 and became effective on March 4, 2014.[91] The final Conditional Exclusion essentially mirrors all the substantive elements of the proposed rule, with only minor modifications.[92]

The Conditional Exclusion first introduces a new definition to the Code of Federal Regulations: "*Carbon dioxide stream* means 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."[93] The inclusion of "incidental associated substances" within the definition is an important acknowledgement of the potential for toxic chemicals to be included in a captured CO_2 stream, as well as a concession that this is a necessary evil of the

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proposal seeks to address this concern and provide regulatory clarity through a revised RCRA regulatory approach for CO_2 streams.").

The proposed rule was generally greeted with enthusiasm and support. Final Conditional Exclusion, 79 Fed. Reg. at 354 ("In response to the proposed rule, EPA received 29 distinct comments. The commenters represented a variety of organizations, including electric utilities, energy companies, the oil and gas industry, environmental groups, two states, and the public. Nearly all commenters supported EPA's decision to clarify the regulatory scheme applicable to CO_2 management for CCS. Many commenters generally supported EPA's proposed conditional exclusion.").

[90] This delay in developing the final rule is somewhat perplexing, and the EPA has offered no explanation. *See* Tamar Hallerman, *EPA Delays Rollout of CO_2 Hazardous Waste Exclusion*, GHG MONITOR (Apr. 19, 2013), http://ghgnews.com/index.cfm/epa-delays-rollout-of-co2-hazardous-waste-exclusion/ ("The [EPA] spokeswoman would not comment on why the rule was delayed . . . .").

[91] Final Conditional Exclusion, 79 Fed. Reg. at 351.

[92] *See id*. at 354 ("These revisions do not change how the conditional exclusion is implemented under today's final rule."). The final rule added language requiring compliance with state pipeline regulations in the limited situations where DOT regulations do not apply. *Id.* Additionally, the final rule required two separate certification statements instead of one, so that both generators and well operators attest to compliance, and also required that these statements be publicly available via the web. *Id*.

[93] *Id*. at 364 (to be codified at 40 C.F.R. pt. 260.10). This definition is substantially similar to the definition used in the UIC Program. *See* 40 C.F.R. § 146.81(d) (2013).

process.[94] The rule's drafters were careful to clarify that the addition of other potentially hazardous substances would disqualify a CO_2 stream from this exclusion.[95]

From there, the majority of the Conditional Exclusion amends 40 C.F.R. § 261.4, which lists EPA's exclusions to RCRA.[96] Using a traditional legal tool, a new subsection (h) excludes CCS CO_2 streams from the definition of hazardous waste, and therefore from the traditional RCRA requirements.[97] However, in order to qualify for this exclusion, CCS facilities must satisfy a number of supplemental requirements. First, the CO_2 stream must comply with all applicable Department of Transportation ("DOT") pipeline

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[94] *See* Final Conditional Exclusion, 79 Fed. Reg. at 359 ("One commenter stated the definition as written is critical to ensure that the conditional exemption is practicable, as any captured CO_2 stream will contain some substances from the source materials and the capture process."). As discussed *supra* note 24 and accompanying text, the presence of impurities resulting in the capture process is nearly unavoidable, and these chemicals must be included with the injected CO_2 stream.

[95] *See* Final Conditional Exclusion, 79 Fed. Reg. at 359.

[96] 40 C.F.R. § 261.4 (2013). Section 261.4 contains numerous exceptions to RCRA. Subsection 261.4(a) specifically excludes a number of materials from the definition of *solid* wastes, and subsection (b) similarly lists various materials excluded from the definition of *hazardous* wastes; these exclusions place these materials entirely outside RCRA's management of hazardous waste. *Id.* Subsection (c) exempts some hazardous wastes from certain RCRA requirements, and subsections (d), (e), and (f) exempt water and waste samples from some RCRA requirements. *Id.* Subsection (g), similar to the new subsection (h) added by this Conditional Exclusion, conditionally excludes dredged material from classification as hazardous waste, provided additional external permitting requirements are satisfied. *Id.*

The EPA explained that it has authority to create such conditional exclusions "where it determines that a waste might pose a hazard only under limited management scenarios, and other regulatory programs already address such scenarios." Final Conditional Exclusion, 79 Fed. Reg. at 353 (citations omitted). The EPA justified its position on the basis that "section 3001 of RCRA . . . give[s] [the EPA] broad flexibility in fashioning criteria for hazardous wastes to enter or exit the subtitle C regulatory system," as well as the observation that "[a]t least three decision by the U.S. Court of Appeals for the D.C. Circuit provide support for this approach to regulating wastes as hazardous waste only where necessary to protect human health and the environment." *Id*.

[97] Final Conditional Exclusion, 79 Fed. Reg. at 364 (to be codified at 40 C.F.R. pt. 261.4(h)).

safety laws and regulations, as well as any additional state requirements, during its transportation.[98] Second, the CO_2 stream's injection must follow all UIC Class VI well requirements.[99] Third, no additional hazardous wastes—other than those included in the definition of "carbon dioxide stream"—may be mixed with the stream.[100] Finally, generators of carbon dioxide streams as well as UIC Class VI well owners or operators must annually sign and publish a certification statement attesting compliance with the above conditions.[101] Once a facility complies with these four requirements, its CO_2 stream is excluded from RCRA regulation by virtue of it not being treated as a hazardous waste.[102]

V. JUSTIFICATIONS AND PROPRIETY OF THE CONDITIONAL EXCLUSION

The EPA acted appropriately and justifiably in excluding CCS from regulation under RCRA. The EPA's rationale for approving the Conditional Exclusion is straightforward: the EPA "believes that the management of these CO_2 streams, *when meeting certain conditions*, does not present a substantial risk to human health or the environment, and therefore additional regulation pursuant to RCRA's hazardous waste regulations is unnecessary."[103] The most important of these conditions are the UIC Class VI well requirements governing the storage phase of CCS, which largely address the concerns that RCRA normally would. This part, consequently, explores the various controls governing the

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[98] *Id*. (to be codified at 40 C.F.R. pt. 261.4(h)(1)). The DOT pipeline safety laws are codified at 49 U.S.C. §§ 60101–60301 (2012), and the DOT regulations are listed at 9 C.F.R. §§ 190–99 (2013).

[99] Final Conditional Exclusion, 79 Fed. Reg. at 364 (to be codified at 40 C.F.R. pt. 261.4(h)(2)); *see also supra* note 57 and accompanying text (listing the UIC Class VI well requirements).

[100] Final Conditional Exclusion, 79 Fed. Reg. at 364. (to be codified at 40 C.F.R. pt. 261.4(h)(3)); s*ee also supra* notes 93–94 and accompanying text (discussing the definition of carbon dioxide stream).

[101] Final Conditional Exclusion, 79 Fed. Reg. at 364. (to be codified at 40 C.F.R. pt. 261.4(h)(4)).

[102] *See id.* (to be codified at 40 C.F.R. pt. 261.4(h)).

[103] *Id*. at 350–51 (emphasis added).

generation and transport of the CO_2 streams.[104] Overall, as the EPA claims, the existing regulatory programs appear to provide adequate safeguards to ensure the controlled deployment of CCS in the absence of RCRA. Moreover, the EPA is mandated by statute "to avoid duplication, to the maximum extent practicable" between RCRA and a number of other environmental statutes, including the SDWA.[105] Thus, the Conditional Exclusion is arguably not only a prudent move by the EPA, but also a necessary one.

The long-term storage of CO_2 underground is perhaps the most controversial aspect of CCS. As such, one might suggest that the intensive regulatory regime governing TSDFs would be the most appropriate way to ensure that disposal is conducted safely and that the GS facilities are held responsible for any spills or contamination. However, because all CCS operations would (by definition) ultimately dispose of CO_2 via GS, their licensing necessarily will require adherence to Class VI standards.[106] Because the regulations established by the UIC Class VI Well Rule are similarly comprehensive to RCRA's control over TSDFs, and

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[104] The Preamble to the Proposed Conditional Exclusion Rule contains a fairly thorough review of the various factors in the EPA's consideration of whether the removal of RCRA requirements would be prudent. *See* Proposed Conditional Exclusion, 76 Fed. Reg. 48,073, 48,079–89 (Aug. 8, 2011).

[105] 42 U.S.C. § 6905(b)(1) (2012).

[106] Even existing Class I (deep hazardous and nonhazardous), II (EOR), and V (experimental) wells currently used for GS would likely be required to transition to Class VI standards. *See* UIC Class VI Well Rule, 75 Fed. Reg. 77,230, 77,291 (Dec. 10, 2010) (to be codified at 40 C.F.R. pt. 146.81(c)) ("This subpart also applies to owners or operators of permit- or rule-authorized Class I, Class II, or Class V experimental carbon dioxide injection projects who seek to apply for a Class VI geologic sequestration permit for their well or wells."); *id*. at 77,245 ("Wells previously permitted as Class I wells for GS . . . must apply for Class VI permits within one year of promulgation . . . ."); *id*. ("Owners and operators of Class II wells that are injecting carbon dioxide for the primary purpose of long-term storage into an oil and gas reservoir must apply for and obtain a Class VI permit where there is an increased risk to USDWs compared to traditional Class II operations using CO_2."); *id*. ("Today's rule, at § 146.81(c), requires owners or operators of Class V experimental technology wells no longer being used for experimental purposes (*e.g.*, wells that will continue injection of CO_2 for the purpose of GS) to apply for Class VI permits within one year of rule promulgation and to comply with the requirements of today's rule.").

far more specifically tailored to the unique nature of CCS,[107] the EPA determined that "RCRA subtitle C regulation would be duplicative and unnecessary."[108]

Compared side-by-side, the Class VI requirements do cover the most important controls on hazardous waste disposal usually afforded by RCRA.[109] Class VI well standards ensure the safe placement and construction of injection wells, similar to the facility operation and design standards under RCRA.[110] Both programs provide for groundwater monitoring,[111] perhaps the primary concern with the safety of GS. Further, both UIC and RCRA require significant closure and post-closure plans and assurances,[112] as well as emergency and remedial responses.[113] Both programs also require demonstrations of financial responsibility for all such activities and potential sources of liability.[114] Therefore,

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[107] *See supra* note 56 and accompanying text.

[108] Final Conditional Exclusion, 79 Fed. Reg. at 353 ("EPA discussed the UIC Class VI injection well requirements, which are specifically designed to ensure that the CO_2 (and any incidental associated substances derived from the source materials and the capture process) will be isolated within the injection zone. EPA concluded that the elimination of exposure routes through these requirements, which are implemented through a SDWA UIC permit, will ensure protection of human health and the environment such that RCRA subtitle C regulation would be duplicative and unnecessary.").

[109] Further, as the EPA noted, "in some instances, a point-by-point comparison may not even be appropriate." *Id*. at 356.

[110] *Compare* 40 C.F.R. § 146.83 (2013) (UIC minimum criteria for siting), § 146.86 (UIC injection well construction requirements), § 146.89 (UIC mechanical integrity), *and* § 146.88 (UIC injection well operating requirements), *with* §§ 264.10–.19 (RCRA general facility standards).

[111] *See* § 146.90 (UIC testing and monitoring requirements); § 264.97 (RCRA general ground-water monitoring requirements).

[112] *See* § 146.92 (UIC injection well plugging); § 146.93 (UIC post-injection site care and site closure); §§ 246.110–264.120 (RCRA closure and post-closure requirements).

[113] *See* § 146.94 (UIC emergency and remedial response); §§ 264.50–.56 (RCRA contingency plan and emergency procedures).

[114] *See* § 146.85 (UIC financial responsibility); §§ 264.140–.151 (RCRA financial requirements). While RCRA explicitly requires financial assurances against third-party liability, § 264.147, the UIC Class VI program does not explicitly do so. Such long-term liability of Class VI well owners and operators does not appear to have been conclusively established. However, "an owner or

the UIC Class VI well requirements appear to be a sufficient substitute for RCRA control with regard to the protection of water sources. In fact, despite general concerns with the thoroughness of the EPA's review, no commenters rejected the EPA's conclusion that the Class VI requirements are sufficiently protective, nor did any commenters point to specific gaps in protection.[115]

Although it may be the most substantial change, the removal of RCRA's control over hazardous waste disposal is not the only area of concern. The absence of certain tracking requirements—including the hazardous waste manifest, vital to tracking a hazardous waste from "cradle to the grave" under RCRA—might also require consideration.[116] However, even without the Conditional Exclusion, typical CCS CO_2 streams transported via pipeline would neither trigger RCRA's manifest requirement nor its transportation controls.[117] The EPA does not consider this a problem, as existing DOT pipeline regulations adequately cover transport safety and some degree of tracking.[118] The absence of

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operator [of a Class VI well] may always be subject to an order the Administrator deems necessary to protect the health of persons . . . after site closure if there is fluid migration that causes or threatens imminent and substantial endangerment to a USDW. . . . The order may include commencing a civil action for appropriate relief." UIC Class VI Well Rule, 75 Fed. Reg. 77,230, 77,272 (Dec. 10, 2010).

[115] Final Conditional Exclusion, 79 Fed. Reg. 350, 356 (Jan. 3, 2014).

[116] *See* Proposed Conditional Exclusion, 76 Fed. Reg. 48,073, 48,083 (Aug. 8, 2011).

[117] Because pipeline delivery is not considered "transportation" under RCRA and because the manifest requirement is only triggered by the transport of a hazardous waste, CCS CO_2 streams transported via pipeline would never require a tracking manifest under RCRA. Proposed Conditional Exclusion, 76 Fed. Reg. at 48,081, 48,081n.29, 48,083.

For the same reason, none of RCRA's requirement on transporters would apply to typical CO_2 streams, and instead only the DOT pipeline regulations would apply. Final Conditional Exclusion, 79 Fed. Reg. at 352. *See also supra* note 80 (explaining the basis for DOT control over supercritical CO_2 stream transport).

[118] *See* Final Conditional Exclusion, 79 Fed. Reg. at 352. ("EPA concluded that applicable DOT requirements (which apply to supercritical CO_2 streams regardless of whether or not these materials meet the definition of hazardous waste) will ensure that CO_2 streams are managed in a manner that addresses the potential risks to human health and the environment that these materials may

manifest and tracking requirements is further justified by other existing reporting requirements, namely the EPA's Greenhouse Gas Reporting Program,[119] established in 2009 under the Clean Air Act.[120] Under this program, carbon capture facilities are required to report the amount of CO_2 sequestered and the ultimate downstream use of the CO_2 stream, such as GS or EOR.[121] Similarly, GS facilities are required to report basic information about CO_2 received, injected underground, and leaked.[122] These reporting requirements, along with specific UIC Class VI reporting requirements,[123] make up for the lack of traditional RCRA tracking methods.

Despite the apparent safeguards in place, the American public may have lingering concerns with the concept of injecting unknown gasses and fluids into the ground, as often discussed in the fracking debate.[124] While the initial difficulty in determining exactly what impurities exist in a CO_2 stream might bolster these fears, UIC Class VI well requirements should dispel them. The specific chemical composition of CO_2 streams must be analyzed

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pose, prior to arrival at a Class VI injection well facility."); Proposed Conditional Exclusion, 76 Fed. Reg. at 48,083 ("[T]he DOT hazardous materials shipping paper ensures that important information regarding the CO_2 stream accompanies the shipment . . . . EPA believes . . . that today's proposed rule [including its required certification statement] will provide adequate incentive to ensure that the CO_2 stream is delivered to a UIC Class VI facility . . . .").

[119] Mandatory Greenhouse Gas Reporting, 40 C.F.R. § 98 (2013).

[120] 42 U.S.C. §§ 7401–7671q (2012).

[121] Suppliers of Carbon Dioxide, 40 C.F.R. §§ 98.420–.428 (subpart PP) (2013).

[122] Geologic Sequestration of Carbon Dioxide, 40 C.F.R. §§ 98.440–.449 (subpart RR) (2013).

[123] *See* 40 C.F.R. § 146.91 (2013) (requiring reports as to the volume of injected CO_2 streams and any changes in the composition of CO_2 streams and monthly volumes of CO_2 streams, among other things).

[124] Sharon Begley, *Study raises new concern about earthquakes and fracking fluids*, REUTERS (July 11, 2013), http://www.reuters.com/article/2013/07/11/us-science-fracking-earthquakes-idUSBRE96A0TZ20130711 ("Fracking opponents' main concern is that it will release toxic chemicals into water supplies, said John Armstrong, a spokesman for New Yorkers Against Fracking, an advocacy group.").

prior to injection, and this information is taken into account during permitting in order to assure adequate protection of USDWs.[125]

Many of the foregoing concerns are compounded by the overall novelty of CCS systems.[126] The EPA attempted to assuage some of these concerns by incorporating an "adaptive approach" into the Conditional Exclusion, whereby the EPA will consider new research and data as it becomes available, as well as potential changes to the Conditional Exclusion.[127] Further, although efficient capture technologies are still developing and successful large-scale application of CCS remains somewhat elusive, the science and technology behind GS is fairly well-developed.[128] The time-tested principles of underground fluid storage, the UIC requirements specifically tailored to the unique nature of CO_2 streams, and the various other existing regulatory programs collectively render any additional control under RCRA unnecessary.

VI. IMPACTS AND POLICY IMPLICATIONS OF THE CONDITIONAL EXCLUSION

In addition to appropriately exempting CCS from regulation under the RCRA, the Conditional Exclusion is also a crucial step for increasing the viability of CCS and reducing CO_2 emissions. As explained in Subpart A, all affected industries will benefit from increased regulatory certainty and the removal of potential costs. However, these benefits alone are not enough to overcome the lingering economic impediments preventing the current large-scale deployment of CCS. Nonetheless, as discussed in Subpart B, the scope and extent of the Conditional Exclusion, together with other related rules from the EPA, offer insight into the proactive climate-change mitigation policy behind the EPA's actions.

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[125] UIC Class VI Well Rule, 75 Fed. Reg. 77,230, 77259 (Dec. 10, 2010).

[126] *See* Final Conditional Exclusion, 79 Fed. Reg. 350, 355–56 (Jan. 3, 2014) ("EPA believes these concerns exist as a result of the unique circumstances associated with addressing the applicability of RCRA to CCS at such an early stage in the development of CCS."); *supra* note 43 and accompanying text (explaining the current status of CCS implementation).

[127] Final Conditional Exclusion, 79 Fed. Reg. 350, 359 (Jan. 3, 2014).

[128] *See supra* note 37 and accompanying text.

A. *Impacts on the Regulated Industries*

While the Conditional Exclusion does not eliminate all the impediments to widespread deployment of CCS, it is nonetheless a significant step for two reasons. First, it directly impacts some of the players involved in CCS by removing potentially cost-prohibitive elements of RCRA regulation. Second, it provides some of the regulatory certainty necessary for the expansion of a fledgling industry. These changes could help get CCS off the ground and pave the way for the future of clean coal, provided other regulatory and financial barriers are addressed.

The substantive impacts of the Conditional Exclusion arise from the removal of RCRA controls and thus only affect entities that would have been subject to RCRA in the first place.[129] Of all entities involved in CCS, the generators of CO_2 streams—that is, the capture facilities like coal-fired power plants—would receive the greatest reduction in regulatory compliance costs,[130] as described below. Sequestration facilities would also receive marginal cost reductions in the removal of some duplicative RCRA controls.[131] Since pipeline transportation has always been outside

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[129] *See* Final Conditional Exclusion, 79 Fed. Reg. at 355 ("Finally, EPA notes that the conditional exclusion has a limited effect on the regulated community directly and the exclusion imposes no affirmative obligations upon them. Generators of non-hazardous waste CO_2 streams are not subject to the RCRA subtitle C regulations, and they are not obligated to make use of this conditional exclusion (although they still may choose to do so in situations where, for example, the generator may be uncertain regarding the hazardous waste status of the CO_2 stream). Moreover, because use of the conditional exclusion is voluntary, even those generators who characterize their streams as RCRA hazardous waste may continue to manage their streams as RCRA hazardous wastes from the point of generation. The only effect is upon those persons who choose to comply with the terms of the conditional exclusion.").

[130] ASSESSMENT OF THE CONDITIONAL EXCLUSION, *supra* note 43, at 12 (noting that capture facilities will account for over 99% of total cost savings).

[131] *See id*. at 11 ("CO_2 sequestration facilities managing RCRA hazardous CO_2 streams in an Underground Injection Control (UIC) Class VI well would also realize savings related to hazardous waste determination, and compliance with the training, planning, and reporting requirements."). The EPA estimated between eight and twelve thousand dollars of undiscounted annual net savings for sequestration facilities as a result of the Conditional Exclusion. *Id*. at 13.

the scope of RCRA control, the Conditional Exclusion will have no impact on that industry.[132]

If capture facilities were subject to RCRA control, the first step required of them would be to determine whether their CO_2 streams were hazardous.[133] If the waste turned out to be non-hazardous, capture facilities could simply transport the CO_2 stream to a Class VI well facility without incurring any additional costs or controls.[134] Conversely, if the waste *was* hazardous, generators could not inject the CO_2 stream into a Class VI well[135] and would have to pursue one of the following three options: (1) abort carbon capture and continue releasing all CO_2 into the atmosphere; (2) transport the captured CO_2 stream to a Class I hazardous well; or (3) treat the CO_2 stream to remove hazardous constituents and transport it to a Class VI well.[136] Of these, only the last option would be compatible with the large-scale deployment of CCS.[137] Capture facilities involved in CCS would thus be subject to the treatment costs themselves, as well as the significant regulatory costs of compliance with RCRA's TSDF controls.[138]

This estimate was spread over between six and nine potentially affected sequestration facilities. *Id*. at 8.

[132] *See id*. at 8 ("Because the most efficient and most commonly used method of transporting CO_2 is by pipeline (as confirmed by commenters on the proposal), our analysis assumes that all CO_2 transportation is done via pipelines both in the baseline and under the final rule. Thus, as with the proposal, no incremental impacts to CO_2 transporters are estimated or expected under the final rule."); Proposed Conditional Exclusion, 76 Fed. Reg. 48,073, 48,090 (Aug. 8, 2011).

[133] *See supra* note 82 and accompanying text.

[134] *See* Proposed Conditional Exclusion, 76 Fed. Reg. at 48,089. If this was likely in all cases, there would be no need for the Conditional Exclusion.

[135] *See* 40 C.F.R. § 146.81(d) ("This subpart [governing UIC Class VI Wells] does not apply to any carbon dioxide stream that meets the definition of a hazardous waste under 40 CFR part 261.").

[136] *See* ASSESSMENT OF THE CONDITIONAL EXCLUSION, *supra* note 43, at 10; Proposed Conditional Exclusion, 76 Fed. Reg. at 48,089.

[137] The first option explicitly involves *not* employing CCS at all, and the second option is not feasible in the long run, because Class I wells are not specifically tailored to the unique demands of CO_2 storage. *See supra* text accompanying note 54 and note 56.

[138] *See supra* text accompanying note 68.

In contrast, with the Conditional Exclusion in place, capture facilities are now able to send their CO_2 streams to Class VI wells without any preliminary testing, hazardous waste treatment, or compliance with associated hazardous waste regulations.[139] The EPA projects that between thirteen and nineteen capture facilities could be affected in this manner.[140] Moreover, the EPA estimates that the Conditional Exclusion will result in around five to seven million dollars of non-discounted annual net savings for the average generator.[141] However, this average only reflects a small fraction of the cost avoided by capture facilities engaging in waste treatment, whose savings could be thirty times that projected by the EPA.[142] This being the case, the Conditional Exclusion eliminates a potentially substantial financial impediment to CCS implementation.

As discussed above, one of the primary concerns leading to the formulation of the Conditional Exemption was the uncertainty surrounding RCRA's applicability to CCS projects.[143] The onerous financial burdens on generators (discussed above) would pose no problem if CO_2 streams were not considered hazardous; however, even the minor chance that capture facilities might be subject to RCRA's TSDF requirements could forestall future CCS deployment.[144] Considering this, the Conditional Exclusion's elimination of uncertainty is itself quite important, especially at this early juncture where companies have more reasons than not to

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[139] *See* ASSESSMENT OF THE CONDITIONAL EXCLUSION, *supra* note 43, at 11; Proposed Conditional Exclusion, 76 Fed. Reg. at 48,090.

[140] *See* ASSESSMENT OF THE CONDITIONAL EXCLUSION, *supra* note 43, at 6–7.

[141] *See id*. at 13.

[142] The EPA based its analysis on the assumption that only 10 percent of captured CO_2 would be considered hazardous and that only one-third of these capture facilities would treat their hazardous waste prior to transmission to a Class VI well facility. *See id*. at 10. Further, "avoided CO_2 treatment costs were found to account for approximately 99.9 percent of all cost savings to capture facilities." *See id*. at 12. Therefore, only 3.33 percent of the capture facilities included in the EPA's projection were responsible for nearly all of the cost savings in that category. As a result, the average figure reflects a thirty-fold reduction of the costs avoided by capture facilities engaged in treatment.

[143] *See supra* notes 86, 87 and accompanying text.

[144] *See supra* notes 47, 48, 85 and accompanying text.

avoid experimenting with carbon capture. Thus, the EPA's conclusion that the Conditional Exclusion will "facilitate the deployment of GS by providing additional regulatory certainty"[145] is well-founded.

The Conditional Exclusion's benefits, while substantial, must nonetheless be considered alongside the many forces still hindering large-scale CCS development. As noted by the EPA:

> The future market for CO_2 capture depends, to a large extent, on the degree to which Federal and state governments pass legislation and adopt regulations designed to restrict or penalize CO_2 emissions. Aside from research and subsidized pilot projects, a facility is unlikely to install the expensive technology necessary to capture CO_2 from emissions until it is required, or there is an economic reason to do so . . . . [B]ased upon current market conditions and the existing regulatory framework, . . . it appears unlikely that there will be any significant expansion in CCS management for CO_2 over the next several years.[146]

Hence, despite the barriers removed by the Conditional Exclusion, CCS is unlikely to take off unless carbon capture technology becomes much more economically feasible for power plants to install and use,[147] or if the government forces power plants to adopt the technology through stricter controls on GHG emissions.[148]

B. *Policy Implications*

Notwithstanding these lingering impediments, the EPA backs its Conditional Exclusion with an optimistic policy rationale, noting that the EPA is encouraging GS as "a key climate change mitigation technology" necessary to reduce the GHG levels causing global warming.[149] This stated motivation is largely confirmed by an examination of the Conditional Exclusion's

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[145] Final Conditional Exclusion, 79 Fed. Reg. 350, 351 (Jan. 3, 2014).

[146] ASSESSMENT OF THE CONDITIONAL EXCLUSION, *supra* note 43, at 5–6.

[147] *See supra* notes 38–40 and accompanying text.

[148] *See infra* notes 157–60 and accompanying text (discussing the EPA's most recent New Source Performance Standards, which would begin to do just that for newly constructed coal power plants).

[149] Proposed Conditional Exclusion, 76 Fed. Reg. 48,073, 48,077 (Aug. 8, 2011).

limited scope, its timing relative to CCS deployment, and other related EPA actions.

The Conditional Exclusion applies only to CCS operations; that is, facilities capturing CO_2 for the purpose of long-term storage.[150] Notably, it does not extend to CO_2 streams captured for use in EOR.[151] While both applications involve reduced emissions of CO_2 from power plants and other generators, only CCS—specifically, its GS component—results in the permanent removal of the gas from our atmosphere.[152] On the contrary, the CO_2 captured for EOR operations would inevitably be used to extract more fossil fuels, which themselves would contribute to further GHG emissions.[153] Thus, specifically choosing to foster GS over EOR reveals an implicit policy choice to support only the uses of carbon capture technology that actually reduce GHG emissions over the long run.

Additionally, the fact that EPA is admittedly "addressing the applicability of RCRA to CCS at such an early stage in the development of CCS"[154] suggests a proactive enthusiasm indicative of a broad federal priority to promote CCS as a way to combat climate change. This conclusion is supported by the EPA's other recent rulemakings relating to CCS, including its UIC Class VI Well Rule[155] and its inclusion of CCS operations within its GHG reporting program.[156] Additionally, the EPA has attempted to more directly incentivize CCS in another recently proposed rule, which

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[150] Final Conditional Exclusion, 79 Fed. Reg. at 355 ("[T]his conditional exclusion is not intended to affect the regulatory status of CO_2 streams that are injected into wells other than UIC Class VI wells.").

[151] *Id*. Notwithstanding the EPA's reluctance to extend the Conditional Exclusion to these facilities, the EPA did acknowledge that "should CO_2 be used for its intended purpose as it is injected into UIC Class II wells for the purpose of EOR/EGR, it is EPA's expectation that such an injection process would not generally be a waste management activity." *Id*. at 355.

[152] *See supra* note 33 and accompanying text.

[153] *See supra* notes 16, 17 and accompanying text.

[154] *Id*. at 355–56.

[155] *See supra* Part III.A.

[156] *See supra* notes 121–22 and accompanying text.

dictates new GHG emission standards for new power plants.[157] Although not yet finalized,[158] the rule essentially requires all new coal-fired power plants to adopt partial CCS systems, based on the premise that this technology is the best system of emission reduction.[159] This requirement has proven controversial and will likely be heavily contested by the industry.[160] Nonetheless, it further evinces EPA's support for the development of CCS and desire to curb GHG emissions from traditional power sources.

VII. CONCLUSION

The EPA's Conditional Exclusion of CCS operations from hazardous waste regulation under RCRA is both prudent and impactful. The EPA has adequately addressed the potential problems inherent in removing a major regulatory framework such that the Conditional Exclusion will threaten neither the earth nor its human residents. Moreover, the Conditional Exclusion should result in tangible benefits to prospective capture and sequestration facilities by removing one of the primary regulatory disincentives to CCS development. All in all, it represents a good faith effort by the EPA to encourage CCS as much as practicable at this time and is an

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[157] Standards of Performance for Greenhouse Gas Emissions from New Stationary Source Electric Utility Generating Units, 79 Fed. Reg. 1430 (Jan. 8, 2014) (to be codified at 40 C.F.R. pts. 50, 70, 71, 98).

[158] After receiving comments through March 10, 2014, the EPA will conduct a regulatory review and eventually publish a final rule. *Id*. at 1430.

[159] *Id*. at 1432–33.

[160] The EPA proposed a similar rule in 2012 that drew extreme concern, garnishing 2.5 million comments. Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units, 77 Fed. Reg. 22,392, 22,392 (Apr. 13, 2012). In response, EPA withdrew its initial proposal and redrafted a new rule. Withdrawal of Proposed Standards of Performance for Greenhouse Gas Emissions From new Stationary Sources: Electric Utility Generating Units, 79 Fed. Reg. 1352 (Jan. 8, 2014). While the most recent proposal addresses some of the original concerns, industry groups find the imposition of CCS technology to be infeasible and challenge that the technology has in fact been adequately demonstrated. *See* Barbara Vergetis Lundin, *EPA NSPS finally posts to Federal Register*, FIERCEENERGY (Jan. 8, 2014), http://www.fierceenergy.com/story/epa-nsps-finally-posts-federal-register/2014-01-08. Further discussion of this proposed rule is outside the scope of this Recent Development.

important step in paving the way for clean coal. Even if the Conditional Exclusion does not remove all the regulatory and economic barriers preventing widespread implementation of this technology, it at least provides stable ground for future exploration.

Clean coal appears to be the only type of coal that has a future in the United States, and CCS is the technology with the greatest potential to make clean coal a reality. As such, it should be encouraged to the maximum extent feasible. However, only time will tell whether coal can survive in the coming decades through the use of CCS or whether it will be outcompeted by natural gas and renewable energy sources.[161]

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[161] The latter may be more likely, especially as natural gas is projected to overtake coal as the nation's primary energy source according to the U.S. Energy Information Administration's most recent predictions. *See* U.S. ENERGY INFORMATION ADMINISTRATION, AEO2014 EARLY RELEASE OVERVIEW: EXECUTIVE SUMMARY 2 (Dec. 2013), *available at* http://www.eia.gov/forecasts/aeo/er/pdf/0383er%282014%29.pdf. If this were to occur, it might not necessarily be the end of CCS, which could also be used to further reduce the emissions from natural gas-fired power plants. *See* CBO REPORT, *supra* note 6, at 13. The report provides:

> CCS technology could be adopted at plants that use natural gas rather than coal for electricity generation. In fact, the cost of using CCS at natural gas-fired plants would probably be less than the cost of using it at coal-fired plants. In particular, although much of the capture and compression equipment integral to the CCS approach is the same for both types of plants (and the transportation and storage facilities are identical), natural gas-fired plants would require less equipment because they produce fewer CO_2 emissions . . . . However, firms today have no incentive to install CCS technology in natural gas-fired plants. It is not economically viable now, and no policies are in place to encourage utilities to purchase the additional equipment and incur the higher costs for producing electricity that CCS technology currently entails.

Id.