
COMMENT

AN EVALUATION OF EMINENT DOMAIN AND A NATIONAL CARBON CAPTURE AND GEOLOGIC SEQUESTRATION PROGRAM: REDEFINING THE SPACE BELOW

INTRODUCTION

On October 12th, 2009, United States Secretary of Energy Steven Chu wrote a letter to his international colleagues calling for swift action in curbing climate change through carbon capture and sequestration.¹ He wrote, “[W]e must make it our goal to advance carbon capture and storage technology to the point where widespread, affordable deployment can begin in 8 to 10 years.”² Chu concluded by stating that “[w]hile the challenge we face is enormous, . . . scientific innovation can provide the answers we need. This is an aggressive goal, but the climate problem compels us to act with fierce urgency.”³

The factors necessitating change are all converging at one time—population growth, and the growth of industrialized societies throughout the world, increased carbon dioxide (“CO₂”) emissions causing global warming.⁴ This combination of forces is leading to certain and powerful change. As John Holdren, Director of the White House Office of Science and Technology Policy and onetime President of the American Association for the Advancement of Science, noted:

[B]ased on an immense edifice of painstaking studies published in the world’s leading peer-reviewed scientific journals, [the following are] conclusions about global climatic disruption—that it’s real, that it’s accelerating, that it’s already doing significant harm, that human activities are

1. Letter from Steven Chu, Sec’y of Energy, U.S. Dep’t. of Energy, to Colleagues (Oct. 12, 2009), http://www.netl.doe.gov/publications/press/2009/ccs_letter_s1.pdf.

2. *Id.*

3. *Id.*

4. See THOMAS L. FRIEDMAN, HOT, FLAT AND CROWDED 67 (2008) (“While the total population of the planet will increase by about 1 billion people in the next 12 years, the ranks of the middle class will swell by as many as 1.8 billion.”).

responsible for most of it, that tipping points into really catastrophic disruption likely lurk along the 'business as usual' trajectory, and that there is much that could be done to reduce the danger at an affordable cost if only we would get started⁵

As our world stands at the precipice of change and injury,⁶ a combination of different mechanisms will be necessary to stop it from rapidly continuing down the path toward destruction. Carbon capture and geologic sequestration ("CCS") is a strategy that will likely be utilized, along with others, to change the world's present course.⁷

Make no mistake, CCS is just one piece of the puzzle necessary to avoiding the looming disaster in our planet's future. But, especially in the short term, it could be a critical piece of that puzzle.⁸ The American Clean Energy and Security Act of 2009, recently passed by the House and currently being considered by the Senate, would support Secretary Chu's request nationally by pledging investments in CCS technology and directing the Environmental Protection Agency ("EPA") to create a comprehensive strategy for its implementation.⁹ As Chu noted, such a program will have to be implemented quickly and on a large scale.¹⁰ If the United States follows its own call for action, there will be a need for a national CCS program in order to create the necessary infrastructure and regulations quickly and effectively.¹¹ This Comment, while designed to specifically address eminent-domain

5. *Id.* at 124–25.

6. *See id.* at 76 ("There will be too many Americans—old-style Americans. And the earth can't handle that."); INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: SYNTHESIS REPORT 30 (2007), available at http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf ("Warming of the climate system is unequivocal . . .") [hereinafter SYNTHESIS REPORT]; Letter from Steven Chu to Colleagues, *supra* note 1 ("The world is on a perilous course that poses clear threats to the well-being and economic prosperity of our people.").

7. *See* MIDWEST REG'L CARBON SEQUESTRATION P'SHIP, ABOUT GEOLOGIC CARBON SEQUESTRATION (2006), <http://216.109.210.162/Geologic.aspx> ("As part of a broader portfolio of technologies, geologic sequestration appears to be capable of playing an important role in stabilizing CO₂ concentrations in the atmosphere.") [hereinafter ABOUT GEOLOGIC CARBON SEQUESTRATION].

8. S. Pacala & R. Socolow, *Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies*, 305 SCIENCE 968, 968–69 (2004).

9. American Clean Energy and Security Act of 2009, H.R. 2454, 111th Cong. §§ 111–16 (2009).

10. *See* Letter from Steven Chu to Colleagues, *supra* note 1 (citing an eight-to-ten-year maximum timeline and the need for "aggressive global effort").

11. *See* PAUL W. PARFOMAK, CONG. RESEARCH SERV., COMMUNITY ACCEPTANCE OF CARBON CAPTURE AND SEQUESTRATION INFRASTRUCTURE: SITING CHALLENGES (2008) ("Congressional policy makers are becoming aware that a national program of carbon capture and sequestration could require an extensive new network of carbon-related infrastructure.").

issues, suggests a fresh legal perspective on CCS for the EPA to utilize in fulfilling the likely forthcoming congressional mandate to create a comprehensive strategy for a national CCS program.

I. BACKGROUND

A. Carbon Capture and Geologic Sequestration

Carbon capture is the process of separating and trapping CO₂ from industrial activities so that it is not released into the atmosphere.¹² The CO₂ is then converted into a liquid form for storage.¹³ There are two main types of carbon sequestration—terrestrial and geologic, with this Comment focusing on the latter. Terrestrial sequestration is the storage of CO₂ in biological materials.¹⁴ Carbon capture and geologic sequestration is a system of capturing a large portion of a facility's carbon emissions (estimates are usually around 80–95%) and then putting them into “deep underground formations.”¹⁵ Some potential formations into which the CO₂ can be injected are oil and gas reservoirs, unmineable coal beds, and deep saline aquifers.¹⁶

All three of these potential sites for CCS storage deserve a brief explanation, although this Comment focuses primarily on the deep saline aquifers and the more extensive property issues raised by CCS in this area. At present, CCS is already occurring in relation to oil and gas reservoirs, where it is used as a part of “enhanced oil recovery technology.”¹⁷ CO₂ injection is used to increase the flow and potential returns from depleted oil and gas reservoirs.¹⁸ Many scholars believe that geologic areas currently using CO₂ injection for enhanced oil recovery show promise as future permanent CCS sites.¹⁹ Unmineable coal beds present a similar option because the

12. ABOUT GEOLOGIC CARBON SEQUESTRATION, *supra* note 7 (“CO₂ can be separated and captured as a byproduct of fossil fuel, used for energy generation and numerous industrial processes. Currently a variety of technologies are in use or under development for separation and capture.”).

13. INTERSTATE OIL & GAS COMPACT COMM'N, CO₂ GEOLOGICAL SEQUESTRATION TASK FORCE: A REGULATORY FRAMEWORK FOR CARBON CAPTURE & GEOLOGICAL STORAGE 13 (2005) (on file with author) (“Consequently . . . the storage of CO₂ will involve . . . the liquid phase . . .”) [hereinafter GEOLOGICAL SEQUESTRATION TASK FORCE].

14. MIDWEST REG'L CARBON SEQUESTRATION P'SHIP, CARBON SEQUESTRATION 1 (2009), <http://216.109.210.162/userdata/Fact%20Sheets/Carbon%20Sequestration.pdf>.

15. *Id.*

16. MIDWEST REG'L CARBON SEQUESTRATION P'SHIP, GEOLOGIC SEQUESTRATION OF CARBON DIOXIDE 2–3 (2009), <http://216.109.210.162/userdata/Fact%20Sheets/Geologic%20Sequestration.pdf> [hereinafter GEOLOGIC SEQUESTRATION OF CARBON DIOXIDE].

17. *Id.* at 2.

18. *Id.*

19. *Id.* (“Depleted reservoirs can make attractive CO₂ sequestration targets since they have already proven their ability to contain oil, gas and water for

injection of CO₂ into these coal beds could lead to enhanced recovery of methane while also providing storage space for CO₂.²⁰ Although not ready for immediate implementation, there are a few testing sites evaluating the use of CCS in these coal beds.²¹

However, most experts believe that deep saline aquifers—essentially saltwater formations that are far below the surface of the earth—provide the best opportunity for CCS, although there are no cost-reducing by-products created.²² Belief in this geologic formation's use as a storage site stems from knowledge of these reservoirs' capacity and (typically) close proximity to many CO₂ producers.²³ These reservoirs can extend to a depth of approximately 1000 to 3000 meters (or about 3000 to 10,000 feet).²⁴ Deep saline reservoirs are a subset of deep pore space.²⁵ While some believe that different property rights govern pore space versus saline aquifers,²⁶ the main issue addressed in this Comment is underground pore space generally, whether that pore space happens to be a saline aquifer or otherwise. Therefore, these two concepts will be considered together.

With regard to the transportation of captured CO₂, it can be condensed to liquid form that has properties similar to natural gas.²⁷ It can then be transported to a distant sequestration site—although many current CCS proposals involve building plants in close proximity to sequestration sites.²⁸ At present, close proximity to sequestration sites is preferred because transportation mechanisms are limited and would have to be greatly improved if a CCS system were to require the transportation of CO₂ great distances across the country.²⁹ After being injected deep into the earth, the CO₂ is permanently trapped under a layer of impermeable cap rock that prevents its escape. Because CO₂ is a “fugitive” substance—meaning that it naturally migrates laterally and vertically “throughout the

millions of years and their geologic character is well defined by previous exploration efforts.”).

20. *Id.* at 2–3.

21. *Id.*

22. See ABOUT GEOLOGIC CARBON SEQUESTRATION, *supra* note 7.

23. *Id.*

24. Jan Martin Nordbotten et al., *Injection and Storage of CO₂ in Deep Saline Aquifers: Analytical Solution for CO₂ Plume Evolution During Injection*, 58 *TRANSPORT POROUS MEDIA* 339, 342 (2005).

25. See Elizabeth J. Wilson & Mark A. de Figueiredo, *Geologic Carbon Dioxide Sequestration: An Analysis of Subsurface Property Law*, 36 *ELR NEWS & ANALYSIS* 10114, 10115 (2006) (defining pore space as the “void[] within the rock”).

26. Victor B. Flatt, *Paving the Legal Path for Carbon Sequestration from Coal*, 19 *DUKE ENVTL. L. & POL'Y F.* 211, 234 (2009); Wilson & de Figueiredo, *supra* note 25, at 10117.

27. GEOLOGICAL SEQUESTRATION TASK FORCE, *supra* note 13, at 30.

28. Flatt, *supra* note 26, at 217.

29. *Id.*

pore space”—this cap rock is an extremely important component of any viable CCS system.³⁰

B. National CCS Program

A national program will be necessary for a variety of reasons—clarity of law,³¹ limitation of competition between states (subterranean aquifers are very large and rarely contained in a single state),³² the speed with which the program must be set up,³³ and the efficiency of monitoring and implementing such a massive program through the use of a national agency.³⁴ Key components of the American Clean Energy and Security Act being considered by the Senate focus on national implementation of CCS,³⁵ and the Secretary of Energy supports this approach.³⁶ In addition, the EPA has addressed the issue in a proposed rule.³⁷ Federal legislation, implementation, regulation, and enforcement of CCS are necessary to the success of the program based on the factors listed above. Having a state-by-state system of CCS does not make sense in light of the scale of such a proposed system and its necessary infrastructure. A single, national system has been applied to other environmental programs with success.³⁸

The Interstate Oil and Gas Compact Commission (“IOGCC”) believes that given the states’ experience with “[enhanced oil recovery], natural-gas storage and acid-gas injection, future CO₂ regulations should build upon the regulatory frameworks already tested and in place in state . . . statutes and regulations.”³⁹ Part of the IOGCC’s reasoning comes from the fact that “[s]tate agencies have a long and successful history of regulating the injection of fluids and gasses into the subsurface under the Underground

30. *Id.* at 221.

31. *See id.* at 239. Professor Flatt’s article recognizes that some federal legislation will be needed, especially where there is no developed body of law for the property issues involved.

32. *See, e.g.*, Big Sky Carbon Sequestration Partnership, Saline Aquifers: Upper Paleozoic, Northern Great Plains Aquifer System (Jan. 19, 2010), <http://www.bigskyco2.org/carbonatlas/mapgallery/uppaleoaq> (showing one particular aquifer system spanning three states).

33. Letter from Steven Chu to Colleagues, *supra* note 1.

34. *See* Flatt, *supra* note 26, at 215, 218.

35. American Clean Energy and Security Act of 2009, H.R. Res. 2454, 111th Cong. § I(B) (2009).

36. Letter from Steven Chu to Colleagues, *supra* note 1.

37. *See generally* Proposed Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO₂) Geologic Sequestration (GS) Wells, 73 Fed. Reg. 43492 (proposed July 25, 2008) (to be codified at 40 C.F.R. pts. 144, 146) [hereinafter Proposed Federal Requirements].

38. *See, e.g.*, EPA, Summary of Clean Air Act, <http://www.epa.gov/lawsregs/laws/caa.html> (last visited Mar. 26, 2010) (describing the national scope of the Clean Air Act).

39. GEOLOGICAL SEQUESTRATION TASK FORCE, *supra* note 13, at 35.

Injection Control (“UIC”) Program.”⁴⁰ As the IOGCC concedes, however, the UIC is a federal program, not a state-created one.⁴¹ It is unclear why the states’ operations under a federal statute preclude the need for a separate federal statute governing CO₂⁴²—especially since a national CCS program will be on a much wider scale than the UIC program and will have to be completed quickly to ensure its success. Under the current UIC regulatory system, CO₂ sequestration injection wells are classified as Class V, the “unspecified” category.⁴³ The proposed EPA rule would create a new class of well, although that was not the original aim of the UIC statute.⁴⁴ A program as large and important as a national CCS program should not be squeezed into the “unspecified” class of injection wells or into a new class of well under the UIC.⁴⁵ Such a program needs its own mandate.

The IOGCC’s own recommendation of “clarity and transparency” in all statutory and regulatory development could hardly be accomplished in the disjointed environment of multistate regulation.⁴⁶ State regulation of CO₂ injection is illogical for many reasons, but most important is that pore space, especially saline aquifers, does not stop at state borders. A federal CCS program would avoid this issue through the centralization of power over the program.⁴⁷ Certainly the cooperation of states will be necessary to ensure the success of a national CCS program. But having fifty different programs or trying to squeeze an extensive CCS program into the confines of the UIC would lead to unnecessary confusion and delay.

If a national system of CCS is created, there will still be various hurdles that must be cleared before the system is effective. The exact science and engineering of CCS must be fully determined and vetted before beginning its implementation on a large scale,⁴⁸ although scientists and engineers are already progressing rapidly toward this goal.⁴⁹ Furthermore, any potential problems caused by

40. *Id.*

41. *Id.*

42. EPA, Basic Information about Injection Wells, <http://www.epa.gov/safewater/uic/basicinformation.html> (last visited Mar. 15, 2010). In fact, the EPA’s website notes that “[i]njection wells are overseen by either a state agency or one of EPA’s regional offices.” So IOGCC’s reasoning may fail to account for dual regulation by states and the EPA.

43. *See* EPA, Classes of Wells, <http://www.epa.gov/safewater/uic/wells.html> (last visited Mar. 15, 2010).

44. *See* Proposed Federal Requirements, *supra* note 37, at 43502.

45. *Id.*

46. GEOLOGICAL SEQUESTRATION TASK FORCE, *supra* note 13, at 35.

47. *See, e.g.*, U.S. CONST. art. I, § 8, cl. 3.

48. *See, e.g.*, Nordbotten et al., *supra* note 24 at 340–41 (noting several problems with current CCS knowledge that must be solved before a viable CCS system can be implemented).

49. *See, e.g.*, *MIT Develops Initial Step Toward Carbon Sequestration*,

CCS must be determined and addressed before a program is begun nationwide because dealing with problems after sequestering the CO₂ in the earth would likely be difficult to do without accidental release.⁵⁰ Failure to ensure the safety of CCS before its implementation on a wide scale would be an immature way of dealing with a sophisticated problem. Regulatory and testing mechanisms will be needed to ensure that the system works and continues to be effective.⁵¹ A system of liability for harms resulting from CCS in the future will have to be created so that the nascent CCS industry will have the confidence to invest in sequestration infrastructure.⁵² There must also be a good deal of public-relations work to inform the public about CCS in an effort to assuage fears that CCS will create cataclysmic events (given that the idea of pumping a chemical compound into the earth is sure to make a fair number of citizens feel uneasy).⁵³ And, as this Comment shows, there will likely be property-law issues created by a national CCS program.⁵⁴

C. Condemnation of Private Property for Public Use

“[M]ost of the research on [CCS] has focused on the technical and economic difficulties of cost effective CCS . . . [but the] legal issues have received less attention.”⁵⁵ Research that has touched on the property rights involved with CCS has noted the difficulties in dealing with these new property issues.⁵⁶ As is the case with any large national land-purchase program, some landowners will resist selling their property. As James Rogers recently noted at the Wake Forest University “Energizing the Future” conference, “[T]here’s a new term out there—NUMBY. Not *Under My Back Yard*.”⁵⁷ This resistance will likely necessitate the use of eminent domain to ensure that a national program designed to curb the effects of global warming is not disrupted by a few holdouts.⁵⁸

A government (federal or state) acts upon its eminent-domain⁵⁹

NEWSRX HEALTH & SCI., Oct. 25, 2009, at 77.

50. Nordbotten et al., *supra* note 24, at 340.

51. Flatt, *supra* note 26, at 240.

52. *Id.* at 220.

53. PARFOMAK, *supra* note 11, at 4–5.

54. Flatt, *supra* note 26, at 229.

55. *Id.* at 213–14.

56. *Id.* at 229.

57. James Rogers, Chairman of the Bd., President, and Chief Executive Officer, Duke Energy, Address at Wake Forest University Conference: Energizing the Future (Feb. 10, 2010).

58. See PARFOMAK, *supra* note 11, at 19–20 (describing the likely political difficulties involved with invoking eminent-domain statutes); Flatt, *supra* note 26, at 236–37.

59. BLACK’S LAW DICTIONARY 601 (9th ed. 2009) (“The inherent power of a governmental entity to take privately owned property, esp. land, and convert it to public use, subject to reasonable compensation for the taking.”).

or the condemnation-of-land⁶⁰ powers when it takes property or property rights from a landowner for public use. This power is not derived from the U.S. Constitution but from the powers of the sovereign under common law.⁶¹ While not derived from the Constitution, the power of eminent domain is expressly limited by our nation's founding document. The Fifth Amendment states that private property shall not "be taken for public use, without just compensation."⁶² The Fifth Amendment thus recognizes the two major issues found in eminent-domain cases—public use and just compensation.⁶³

The Supreme Court has broadly interpreted the concept of public use.⁶⁴ While many groups disagree with the Supreme Court's interpretation of the public-purpose aspect of eminent-domain cases—especially with regard to *Kelo v. City of New London*⁶⁵—the simple truth is that federal courts have historically given great deference to legislatures in determining whether a taking serves a "public purpose."⁶⁶ The oft-quoted example of a "typical" private use is when the government takes property from landowner A and gives it to landowner B for B to have and enjoy.⁶⁷ *Kelo* and *Hawaii Housing Authority v. Midkiff* involved programs similar to this "typical" private use but both were found to have a valid public purpose.⁶⁸

Just compensation is a denser issue. The main rule propounded by cases and by the government is that just compensation is typically the fair market value of the property—that is, what the property would be worth if it were sold by its owner on the open market.⁶⁹ There are also important sub-issues, such as determining

60. *Id.* at 332 ("The determination and declaration that certain property (esp. land) is assigned to public use, subject to reasonable compensation . . .").

61. *Shoemaker v. United States*, 147 U.S. 282, 299 (1893) (noting the "sovereign power of eminent domain").

62. U.S. CONST. amend. V.

63. See JULIUS L. SACKMAN ET AL., NICHOLS ON EMINENT DOMAIN § 1.3 (3d ed. 2009) (explaining the origin of eminent domain and its recognition and limitations in the Fifth Amendment).

64. See, e.g., *Kelo v. City of New London*, 545 U.S. 469, 484 (2005) (holding that a transfer of property from a homeowner to a business as part of a redevelopment plan satisfied the public-use requirement).

65. See KERMIT ROOSEVELT III, THE MYTH OF JUDICIAL ACTIVISM 138 (2006) (determining that "despite the outraged [public] reaction, the Court's decision was entirely unremarkable").

66. See, e.g., *Kelo*, 545 U.S. at 480 (noting a "longstanding policy of deference" to local legislative judgments in this field).

67. *Id.* at 477.

68. *Id.* at 475 (noting that the property owned in *Kelo* was being taken because it was in the development area); *Haw. Hous. Auth. v. Midkiff*, 467 U.S. 229, 233 (1984) (explaining that the Land Reform Act of 1967 was designed to put property into a greater number of people's hands).

69. See *United States v. Reynolds*, 397 U.S. 14, 16 (1970).

who actually owns the property.⁷⁰ For example, the valuation is different in a partial taking, which occurs where the property owner retains some part of his property rights and the government only takes a portion of those rights.⁷¹ The value of a partial taking will usually be determined by comparing the price of a property before and after the taking.⁷²

The method of taking is also important to consider—there are direct takings via eminent domain and the condemnation of land, and there are also inverse takings and regulatory takings.⁷³ A direct taking is where the acquiring body (usually an agency) files a declaration of taking in court and then proceeds to assert its property rights after being granted leave by the court.⁷⁴ In a “quick take,” just compensation will be determined later, but possession passes immediately.⁷⁵ When a landowner’s property has been physically entered without the government paying just compensation or filing a declaration of taking, the landowner may file an inverse taking.⁷⁶ A regulatory taking, also recoverable under an inverse proceeding, occurs when a regulation is overly burdensome and deprives property of its value or necessitates a physical entry.⁷⁷

The Constitution guarantees just compensation regardless of the method of taking.⁷⁸ As the leading treatise on eminent domain states, “Whenever private property has been taken or damaged for public use without compensation, . . . [the Fifth Amendment] affords a basis for an action by the injured party to recover in a suit the just compensation that ought to have been paid before the taking or damaging occurred.”⁷⁹ So, whether the government deals with the takings proactively (as it almost always tries to do) or not, it is bound by the Constitution to provide just compensation to the property owner. While this will not affect the value of the property taken, the prospect of inverse takings might come into play in a CCS program with regard to pore space ownership and the future unexpected migration of sequestered CO₂.⁸⁰

This Comment considers the questions and problems regarding takings law that will likely arise from a national CCS program, and

70. See *Lucas v. South Carolina*, 505 U.S. 1003, 1027 (1992).

71. See *United States v. 33.92356 Acres of Land*, 585 F.3d 1, 10 (1st Cir. 2009) (explaining how to determine if a partial taking has occurred).

72. See *id.* at 9–10 (describing how to value a partial taking).

73. SACKMAN ET AL., *supra* note 63, § 8.01.

74. See, e.g., *E. Tenn. Natural Gas Co. v. Sage*, 361 F.3d 808, 821 (4th Cir. 2004).

75. *Id.* at 821–22.

76. SACKMAN ET AL., *supra* note 63, § 8.01.

77. *Id.*

78. *Id.*

79. *Id.*

80. Flatt, *supra* note 26, at 221.

it will touch on three main issues: (1) whether a CCS program would satisfy the public-use element necessary for constitutional takings, (2) problems with determining just compensation for CCS sites, and (3) the role of inverse takings in a national CCS program. The primary focus of this Comment is the second issue. Professors Steinzor and Shapiro, interpreting a popular political-science theory, have noted that “while catastrophic events can serve as catalysts for change, they only work when effective solutions are available and when the national political atmosphere is receptive to those changes.”⁸¹ Global warming may be a catastrophic event serving as a catalyst for change. The aggressive eight-to-ten-year timeline urged by Secretary Chu should be viewed as an outer limit because the causes of global warming and its effects will get worse before they get better. This Comment brings important issues to the forefront of a burgeoning national endeavor with the hope of recognizing and addressing problems before it is too late.

II. THE PUBLIC USE OF UNDERGROUND AREAS FOR THE SEQUESTRATION OF CO₂

Under the Fifth Amendment, any property taken by the federal government must be taken for public use.⁸² As the most recent Supreme Court opinion on the issue stated, “A State may transfer property from one private party to another if future ‘use by the public’ is the purpose of the taking.”⁸³ The Court has explained that “[a] purely private taking could not withstand the scrutiny of the public use requirement; it would serve no legitimate purpose of government and would thus be void.”⁸⁴ In *Midkiff*, a case where the public utility of the taking was challenged, the Hawaiian government had allowed lessees to gain complete ownership of the property on which they were living from their lessors by requesting that the state government condemn the property.⁸⁵ Although this scheme essentially transferred the property from landowner A to landowner B, this was held to be a valid public purpose because each specific transfer was done pursuant to a general government plan for property acquisition.⁸⁶ As *Midkiff* noted, “There is . . . a role for courts to play in reviewing . . . what constitutes a public use But . . . it is ‘an extremely narrow’ one.”⁸⁷

81. RENA STEINZOR & SIDNEY SHAPIRO, *THE PEOPLE’S AGENTS AND THE BATTLE TO PROTECT THE AMERICAN PUBLIC: SPECIAL INTERESTS, GOVERNMENT, AND THREATS TO HEALTH, SAFETY AND THE ENVIRONMENT* (manuscript at 8-5) (forthcoming June 2010) (citing JOHN W. KINGDON, *AGENDAS, ALTERNATIVES, AND PUBLIC POLICIES* (2d ed. 1995)).

82. *E.g.*, *Brown v. Legal Found. of Wash.*, 538 U.S. 216, 231 (2003).

83. *Kelo v. City of New London*, 545 U.S. 469, 477 (2005).

84. *Haw. Hous. Auth. v. Midkiff*, 467 U.S. 229, 245 (1984).

85. *Id.* at 233–35.

86. *Id.* at 244.

87. *Id.* at 240 (quoting *Berman v. Parker*, 348 U.S. 26, 32 (1954)).

If a national CCS program is created, it will be necessary to give an agency or CCS companies the ability to condemn property.⁸⁸ In any public program of this magnitude, some property owners will always stand in the way—either because they disagree with the program or because they feel they deserve more compensation than what is offered. Thus, property owned by landowners unwilling to sell would be condemned by the government and given to companies running the national CCS program. This would preferably be done pursuant to CCS-specific legislation, because attempts to bend statutes designed for other purposes would likely create public outcry and be closely scrutinized by the courts. Without clear legislation on the issue, courts might struggle to find that CCS has a legislatively designated “public purpose” similar to that seen in *Midkiff*⁸⁹ and the practice could be found unconstitutional.

If legislation were passed authorizing the use of eminent domain in conjunction with implementing CCS nationally, then the “public purpose” requirement would be satisfied and the practice would be constitutional. The *Kelo* rule, which uses the term “future use by the public,”⁹⁰ would allow eminent domain for CCS despite the fact that the property will not actually be *used* by the public in the traditional sense of the word.⁹¹ The *Kelo* Court found that condemned property did not literally have to be used by the general public but rather that it had to be used for a public purpose.⁹² Land taken for use by the CCS industry—property and easements for pipelines, underground pore space, and ground-level property for new factories and injection facilities—will not be available for public use. Rather, the property likely will be transferred to companies charged with implementing CCS. But, as long as these companies are working toward a public purpose, there should not be any problems with court challenges. Several cases, including *Kelo*, have authorized the giving of condemned property to commercial entities.⁹³

88. The scholarly literature seems to recognize this fact. However, some commentators have argued that eminent domain for CCS should be modeled after the Natural Gas Act of 1938 despite the fact that the Natural Gas Act does not explicitly give authority to use eminent domain to acquire sites for the storage of natural gas. Eminent-domain power under the Natural Gas Act was judicially imputed from the statute. See PARFOMAK, *supra* note 11, at 20; Flatt, *supra* note 26, at 239.

89. *Midkiff*, 467 U.S. at 244.

90. *Kelo v. City of New London*, 545 U.S. 469, 477 (2005) (internal quotations omitted).

91. See WEBSTER'S NEW WORLD DICTIONARY 710 (2003) (defining “use” as “to put into action or service”).

92. *Kelo*, 545 U.S. at 479–80.

93. See *id.* at 483–84 (giving property to a business as part of a business redevelopment plan); *Strickley v. Highland Boy Gold Mining Co.*, 200 U.S. 527, 531 (1906) (recognizing “the inadequacy of use by the general public as a universal test” where an easement was given to a mining company).

Finding a public use in a national CCS scheme would not be difficult. The public purpose would be to protect the citizens of the United States from the negative effects of global warming. If the legislature has determined that such action is necessary to protect the public, a court should not enter its own opinion of whether CCS is a viable solution for climate change. Rather, it should defer to the determination of the legislature.⁹⁴ Although this particular public purpose likely has not been used in the past to justify the use of eminent domain, “[the Court’s] jurisprudence has . . . evolved over time in response to changed circumstances.”⁹⁵ A national plan for CCS would be a similar justification and would satisfy the public-use requirement of eminent domain.

III. DETERMINING JUST COMPENSATION FOR PROPERTY TAKEN FOR USE IN A NATIONAL CCS PROGRAM

The biggest issue in any eminent-domain proceeding is determining just compensation. With regard to a CCS program, there are several issues, some unique to the sequestration of CO₂, which must be discussed when calculating just compensation. These include (1) deciding which property should be taken by the government, (2) determining who owns the property being taken, and (3) formulating the proper method of measuring just compensation of this property. In other words, what? From whom? And at what cost? The bulk of this Part deals with using eminent domain to acquire subterranean property rights necessary for the implementation of CCS nationally. The use of eminent domain for both the creation of a national CO₂ pipeline infrastructure and new CO₂ capture-equipped power plants, while very important aspects of a workable CCS system,⁹⁶ do not present any unique just-compensation issues⁹⁷ and will not be addressed.⁹⁸

A. *What Property Should Be Taken by the Government as Part of a National CCS Program?*

Three primary locations for sequestration have been proposed: enhanced oil recovery (“EOR”) sites, unmineable coal beds, and deep pore space—specifically, saline aquifers.⁹⁹ Many early geologic sequestration projects will likely be through the EOR system (which

94. See *Kelo*, 545 U.S. at 482.

95. *Id.*

96. See, e.g., GEOLOGICAL SEQUESTRATION TASK FORCE, *supra* note 13, at 24–25 (describing technical issues dealing with the transportation of the CO₂).

97. See PARFOMAK, *supra* note 11, at 13–14 (noting the potential use of eminent domain for pipeline and power-plant siting).

98. While no condemnation proceeding is the same, and new and difficult issues arise with every particular taking, this Comment is designed to focus on the unique issue of takings related to deep pore space.

99. GEOLOGIC SEQUESTRATION OF CARBON DIOXIDE, *supra* note 16, at 2–3.

is already in place),¹⁰⁰ but there are important differences between sequestration for EOR and for permanent CCS. Namely, the goal of EOR is to increase oil production while the goal of CCS is to store CO₂ underground permanently.¹⁰¹ Although EOR operations may change their methodology to allow for greater amounts of permanent sequestration, these projects will likely continue to be evaluated under the law already governing this field. As Professors Wilson and de Figueiredo note, “The laws, property rights, statutes, and regulations that specifically govern oil and gas production may not apply to [geologic sequestration in] saline aquifers.”¹⁰² EOR will be a good starting point for CCS in its early stages and it will be helpful from a technical perspective of how to implement CCS. But its fundamental differences from long-term CCS in deep pore space limit its usefulness in determining what property is needed for a national CCS system. A similar parallel can be drawn with respect to unmineable coal beds where the CO₂ will be pumped in and, utilizing the density of CO₂, methane will be recovered.¹⁰³ Unlike EOR, sequestration of CO₂ in unmineable coal beds will be designed as a permanent venture from the beginning.¹⁰⁴ However, because sequestration in coal beds is designed to enhance recovery of a natural resource, this law likely will be more closely aligned with EOR than with CCS in deep pore space.

The future of a national CCS program will rest on the ability to utilize deep pore space—namely saline aquifers—for the storage of CO₂.¹⁰⁵ To complete the injection of CO₂ into these aquifers, the CCS company or agency must forcibly inject CO₂ deep into the earth without allowing it to escape through the injection site or through other nearby deep wells.¹⁰⁶ The company or agency doing this injection must have the legal right to do so—especially because resistance from the surface owners should be expected. At first glance, it would seem that mineral rights to the property in question must be procured before any CCS activity can take place.¹⁰⁷ However, this assumption is incorrect for two reasons.

First, as Professors Wilson and de Figueiredo note, “Property rights of saline aquifers without hydrocarbons present [such as oil, coal, etc.] depend on a legal regime founded on groundwater rights and ownership of the subsurface.”¹⁰⁸ Second, mineral rights are insufficient because they represent the right to take, rather than the

100. Wilson & de Figueiredo, *supra* note 25, at 10119.

101. *Id.*

102. *Id.*

103. GEOLOGIC SEQUESTRATION OF CARBON DIOXIDE, *supra* note 16, at 2–3.

104. *Id.* at 1.

105. *See* Wilson & de Figueiredo, *supra* note 25.

106. Nordbotten et al., *supra* note 24 at 340–41.

107. *See* Wilson & de Figueiredo, *supra* note 25, at 10116.

108. *Id.* at 10117.

right to inject or fill.¹⁰⁹ The groundwater-rights-and-ownership system proposed by Wilson and de Figueiredo seems to be a more accurate model, but, upon closer inspection, these rights have a problem similar to mineral rights.¹¹⁰ The five doctrines offered by Wilson and de Figueiredo for determining the extent of groundwater rights and ownership of the subsurface are “(1) absolute dominion; (2) reasonable use; (3) correlative rights; (4) the restatement rule; or (5) prior appropriation.”¹¹¹ Like mineral rights, groundwater rights delineate the right to *take*, not the right to *fill*, subterranean space.¹¹² Of the five doctrines followed by states with regard to ownership of groundwater rights, only the first—absolute dominion—could encompass the right to inject CO₂ into the subsurface.¹¹³ Yet, read in conjunction with the rest of the groundwater doctrines, it appears that the absolute-dominion doctrine only applies to a surface owner’s use of the groundwater below his property. The remaining doctrines focus on a surface owner’s ability to remove the groundwater and in what amount he or she may do so.¹¹⁴

Properly addressing which property rights should be acquired for CCS, with full understanding of the potentially massive spread of CCS throughout the country, will have to involve subsurface property rights beyond those considered under mineral rights and groundwater rights. These mineral and groundwater rights will still be necessary, however, to ensure that the sequestered CO₂ will not be disturbed. While not implemented on a scale like that proposed for CCS, the sequestration of hazardous waste and natural gas provides a helpful comparison with respect to what property must be acquired.¹¹⁵ To ensure that CCS is being done legally, the subterranean pore space—as distinct from the mineral and groundwater rights—must be acquired from whoever owns it. By acquiring these subterranean rights, a CCS company will ensure its ability to inject and sequester CO₂ in a saline aquifer deep below the earth’s surface.

In sum, a CCS company or the acquiring agency must acquire (1) the mineral rights, (2) the groundwater rights, and (3) the

109. See, e.g., *United States v. Atomic Fuel Coal Co.*, 383 F.2d 1, 4 (4th Cir. 1967) (“Interests in mining rights may be divided generally into two classes; (1) Title to minerals in place with such easements as may be necessary for their removal, and (2) the right to acquire ownership of minerals by severance although title to the property is in another.” (quoting 1 RALEIGH C. MINOR & FREDERICK RIBBLE, *MINOR ON REAL PROPERTY* 71–74 (Frederick Ribble ed., Michie 2d ed. 1928) (1908))).

110. Wilson & de Figueiredo, *supra* note 25, at 10117.

111. *Id.*

112. *Id.*

113. *Id.*

114. *Id.*

115. *Id.* at 10123 (debating which legal paradigm will be chosen—hazardous waste or natural-gas storage).

subterranean pore space from their respective owners to ensure its ability to sequester CO₂ indefinitely without disruption.

B. Who Owns the Condemned Property?

In order to fulfill the constitutional requirement of providing just compensation for property taken for public use, it is necessary to determine who owns the property needed to implement a CCS program. Mineral rights and groundwater rights will be acquired from their owner as established by existing law on the subject.¹¹⁶ The major issue to be addressed here will be determining who owns the deep pore space, and this Comment reaches a different result from the weight of existing scholarship.¹¹⁷ Because the right to permanently store CO₂ (or anything else) deep below the earth's surface is not customarily recognized as a property right,¹¹⁸ this question is not easy to answer. But the determination of who, if anyone, owns the deep pore space must be addressed by the condemnor before moving forward with a wide-scale CCS program.

1. The Right to Permanently Store CO₂ in Deep Pore Space

Previous scholarship regarding the property issues associated with CCS has focused on the issue of who owns this subsurface and has the right to store CO₂ there.¹¹⁹ Professor Flatt, citing to the IOGCC Task Force, finds that while “[case law] governing short-term storage of natural gas is the most useful for the consideration of CCS[,] . . . [each potentially applicable] legal paradigm should be examined because each adds to the understanding of the complexity of the property rights at issue.”¹²⁰ In contrast, this Comment details why the law regarding the permanent injection of hazardous waste is a more useful analog as it more closely parallels the probable design of a CCS program. The best way to ascertain CO₂-sequestration rights is to evaluate CCS on its own terms while at the same time gleaning information from previous methodologies when applicable. As a leading treatise on eminent domain points out, “What is defined as property is not fixed, but is subject to changing meanings as society and law evolves.”¹²¹ CCS is a program expected to last thousands of years that will utilize new technology and space in our world in ways that were unimaginable a hundred

116. Again, while not an easy endeavor by any means, this will not present any new questions of law related to the use of eminent domain in this field.

117. See, e.g., Owen L. Anderson, *Geologic CO₂ Sequestration: Who Owns the Pore Space?*, 9 WYO. L. REV. 97 (2009); Flatt, *supra* note 26; Wilson & de Figueiredo, *supra* note 25.

118. See Wilson & de Figueiredo, *supra* note 25, at 10119–20.

119. See, e.g., Anderson, *supra* note 116; Flatt, *supra* note 26; Wilson & de Figueiredo, *supra* note 25.

120. Flatt, *supra* note 26, at 230–31 (citing GEOLOGICAL SEQUESTRATION TASK FORCE, *supra* note 13, at 15).

121. SACKMAN, *supra* note 63, § 5.01 (2009).

years ago. It would be a disservice to our judicial system to ignore the reality of CCS. With that in mind, the potentially applicable “legal paradigms” will be evaluated.

a. *Potential Legal Analogies*

i. *Mineral Rights*. Mineral rights are generally viewed in two ways: “(1) Title to minerals in place with such easements as may be necessary for their removal, and (2) the right to acquire ownership of minerals by severance although title to the property is in another.”¹²² Because mineral rights are concerned the removal of mineral deposits below the surface of the land, they terminate once all minerals have been removed.¹²³ This will be discussed further in the context of natural-gas storage.

ii. *Enhanced Oil Recovery*. There are two main property rules that apply to EOR. The first is the negative rule of capture. This rule states that “less valuable substances can migrate through the subsurface and replace more valuable substances without incurred liability.”¹²⁴ So, when an EOR project displaces an adjacent landowner’s oil (a valuable substance) with CO₂ (a less valuable substance), the adjacent landowner does not have a claim against the EOR-using landowner despite the resulting decrease in the value of the substance under his or her land. The second rule regards field unitization, which occurs when a state or local government forces an oil driller to acquire mineral rights from a high percentage (usually over 80%) of owners of an oil field.¹²⁵ If the driller gains the requisite percentage of the landowners’ rights, then any remaining owners cannot recover against the driller if the driller uses EOR and it intrudes upon the remaining owners’ property and deprives them of oil.¹²⁶ They only have the option to “petition for inclusion in the unit.”¹²⁷

iii. *Groundwater Rights*. Law governing groundwater rights generally encompasses aquifers and can be presumed to apply to saline aquifers as well (although there would be little reason to remove the contents of these aquifers because the brine contained in them have no benefit).¹²⁸ “In general, states follow one of five major

122. *United States v. Atomic Fuel Coal Co.*, 383 F.2d 1, 4 (4th Cir. 1967) (quoting 1 RALEIGH C. MINOR & FREDERICK RIBBLE, *MINOR ON REAL PROPERTY* 71–74 (Frederick Ribble ed., Michie 2d ed. 1928) (1908)).

123. *See* Flatt, *supra* note 26, at 233 (describing the American rule of mineral rights to pore space).

124. *Wilson & de Figueiredo*, *supra* note 25, at 10118.

125. *Id.*

126. *Id.*

127. *Id.* (citing *Phillips Petrol. Co. v. Stryker*, 723 So. 2d 585, 591 (Ala. 1998)); *see also* Flatt, *supra* note 26, at 245.

128. Flatt, *supra* note 26, at 234.

doctrines with respect to ownership of groundwater rights: (1) absolute dominion; (2) reasonable use; (3) correlative rights; (4) the restatement rule; or (5) prior appropriation.¹²⁹ As summarized by Flatt, the absolute-dominion rule gives a surface owner title to everything below his property.¹³⁰ Rights (2)–(4) give the property owner some degree of reasonable use of the property—the owner can use the groundwater without restriction “as long as that use is reasonable and beneficial to the land itself.”¹³¹ The prior-appropriation rule is essentially a “race” rule under which the first user of the groundwater establishes ownership over all others.¹³²

iv. *Natural-Gas Storage*.¹³³ There is a split in the law between the American and English rules regarding the ownership of pore space for natural-gas storage.¹³⁴ The American rule says that the surface owner owns the depleted pore space once the mineral-rights owner has removed all minerals.¹³⁵ Conversely, under the English rule, the mineral-rights owner retains ownership of the depleted pore space after removing minerals from the subsurface.¹³⁶ No national consensus has been reached on the issue. The law governing natural-gas storage, arising from the Natural Gas Act of 1938,¹³⁷ provides for the use of eminent domain for the construction of subsurface storage areas.¹³⁸ It should be noted, however, that unlike CCS, natural-gas storage is only temporary and is designed for eventual removal and use of the gas.¹³⁹

v. *Hazardous-Waste Injection*. Injection of hazardous waste occurs on a much smaller scale than any proposed plan for CCS, but the process is similar in permanence and placement. There are two major cases on this issue—*Chance v. BP Chemicals, Inc.*¹⁴⁰ and *Mongrue v. Monsanto Co.*¹⁴¹ In *Chance*, the court

129. Wilson & de Figueiredo, *supra* note 25, at 10117.

130. Flatt, *supra* note 26, at 235.

131. *Id.*

132. *Id.*

133. Natural-gas storage occurs in locations similar to those proposed for CCS. See Wilson & de Figueiredo, *supra* note 25, at 10121 (“Natural gas is stored underground in depleted oil and gas reservoirs, salt caverns, or suitable natural aquifers.”).

134. Flatt, *supra* note 26, at 233–34. Several states follow the American rule while Kentucky, along with most of Canada, follows the English rule. Although the English rule is not as widespread in the United States yet, it is possible that it could be more widely adopted by some of the many states who have yet to address the issue. *Id.*

135. *Id.* at 233.

136. *Id.* at 234.

137. 15 U.S.C. § 717 (2006).

138. *Columbia Gas Transmission Corp. v. Exclusive Gas Storage Easement*, 776 F.2d 125, 128 (6th Cir. 1985).

139. Flatt, *supra* note 26, at 232.

140. *Chance v. BP Chems., Inc.*, 670 N.E.2d 985 (Ohio 1996).

analogized ownership of deep subsurface areas to the ownership of air high above one's property.¹⁴² The court recited the common-law rule of *cujus est colum, ejus est usque ad coelum et ad inferos* ("To whomsoever the soil belongs, he owns also to the sky and to the depths. The owner of a piece of land owns everything above and below it to an indefinite extent."¹⁴³).¹⁴³ This idea was ultimately rejected by the court, as it has been by states throughout the country and by the federal government, in favor of the modern rule extinguishing the infinite extension of property rights.¹⁴⁴ The *Chance* court determined that, much like the curtailment of air rights, a surface owner only owns the subsurface property to the extent they would reasonably and foreseeably use the subsurface property.¹⁴⁵ The *Mongrue* court dealt with a similar issue and appeared to recognize the potential for subsurface rights related to the migration of hazardous wastes, but it decided the case on the injector's lack of eminent-domain power instead.¹⁴⁶

b. *Evaluating the Analogies.* This Comment refers to the use of federal eminent domain to implement a national system of CCS. However, the five previous examples all dealt with state property law. The relationship between federal and state law in federal eminent-domain proceedings has been described by the Supreme Court as follows: "Though the meaning of 'property' . . . in the Fifth Amendment is a federal question, it will normally obtain its content by reference to local law."¹⁴⁷ Further, as the Uniform Appraisal Standards for Federal Land Acquisitions notes, "This does not mean, however, that every local idiosyncrasy or artificiality in a state's concepts, or the incidents thereof, necessarily will be accepted."¹⁴⁸ Because this Comment examines the potential use of CCS-related eminent domain on a national level, the state law explained above will be helpful, but it is not controlling.

The articles by Wilson and de Figueiredo and by Professor Flatt seem to support the use of natural-gas storage as the most applicable comparison to ownership of pore space for CCS going into the future.¹⁴⁹ The IOGCC, a group created to evaluate the

141. *Mongrue v. Monsanto Co.*, 249 F.3d 422 (5th Cir. 2001).

142. *Chance*, 670 N.E.2d at 991.

143. *Id.* (citing BLACK'S LAW DICTIONARY 378 (6th ed. 1990)).

144. *Id.*; see also *United States v. Causby*, 328 U.S. 256, 261 (1946) ("[T]hat doctrine has no place in the modern world.").

145. *Chance*, 670 N.E.2d at 991-92.

146. *Mongrue*, 249 F.3d at 431.

147. INTERAGENCY LAND ACQUISITION CONFERENCE, UNIFORM APPRAISAL STANDARDS FOR FEDERAL LAND ACQUISITIONS B-1 (Appraisal Inst. 2000) (quoting *United States ex rel. T.V.A. v. Powelson*, 319 U.S. 266, 279 (1943)).

148. *Id.* (quoting *Nebraska v. United States*, 164 F.2d 866, 868 (8th Cir. 1947)).

149. While these authors do not explicitly state this opinion, in their general conclusion sections they concentrate most heavily on the comparison between

implementation of CCS, also supports the use of natural gas as the most applicable comparison.¹⁵⁰ These three articles constitute the current universe of academic literature on the matter of who owns the property rights to pore space and deep saline aquifers.¹⁵¹ However, these articles fail to evaluate deep-pore-space ownership under airspace-ownership law—something this Comment does. And while each of the five comparisons in these articles¹⁵² is helpful in some way, only the storage of hazardous waste compares to CCS with regard to its major tenets—that is, the *storage* of CO₂ for an *indefinite* period of time for the purpose of removing that CO₂ from our atmosphere. The other four comparisons—mineral rights, groundwater, EOR and natural gas storage—miss this important target. They all center on the removal of substances from the earth rather than storing something there indefinitely. This is clear with mineral rights, groundwater rights, and enhanced oil recovery—all of which center on the removal of a valuable commodity from the earth.

The argument is muddied with natural-gas “storage.” Yet, the term storage is not used in the same way that it is used with CCS because natural-gas storage is strictly a short-term project. Natural-gas storage is cyclical (gas is stored for the winter) and, although natural gas is also stored in aquifers, the storage is inherently different from that proposed under CCS because of this short-term goal. This important difference is shown by cases holding that the owners of natural gas who inject the gas into the subsurface for future recovery do not lose title to the gas.¹⁵³ Case law in this area focuses on ownership of the natural gas in the subsurface, not on ownership of the subsurface space itself. While ownership of injected CO₂ is undetermined,¹⁵⁴ whoever does own the CO₂ will not own it for profit in the way that natural gas is owned. Ownership will be for liability purposes only. Thus, natural-gas

natural-gas storage and CCS. Flatt, in particular, cites to the IOGCC Task Force’s opinion that natural-gas storage is “the most useful for the consideration of CCS.” Flatt, *supra* note 26, at 245; *see also* Wilson & de Figueiredo, *supra* note 25, at 10121–23.

150. INTERSTATE OIL & GAS COMPACT COMM’N, STORAGE OF CARBON DIOXIDE IN GEOLOGIC STRUCTURES: A LEGAL AND REGULATORY GUIDE FOR STATES AND PROVINCES 15 (2007).

151. There is a fourth article addressing the ownership of pore space. *See* Anderson, *supra* note 116. This article is generally neglected in this Comment because it focuses on Texas property law and would have only confused the issues discussed herein. Oddly, the author of this article accepts the “*cujus est solum*” common-law maxim as the current state of property law. *Id.* at 99.

152. *See supra* Part III.B.1.a.

153. *E.g.*, White v. N.Y. State Natural Gas Corp., 190 F. Supp. 342, 349 (W.D. Pa. 1960); Lone Star Gas Co. v. J.W. Murchinson, 353 S.W.2d 870, 879 (Tex. App. 1962).

154. *See* Flatt, *supra* note 26, at 239–40 (noting the need for federal legislation addressing the issue of long-term ownership of injected CO₂).

property law, focusing on the ownership of the gas itself, is an obscured derivation of mineral-rights law and should not be relied upon to the extent the previously cited articles believe it should. Even the seemingly useful comparison of the American and English approaches to ownership of the pore space is inaccurate because of differences in the origin of natural-gas storage law and, subsequently, the American and English rules.¹⁵⁵

c. *Better Analogies—Hazardous Waste and Airspace.* The law surrounding hazardous-waste injection, albeit a much smaller body of law, provides the best analogy to CCS because a “harmful” substance is trapped in the subsurface for an indefinite amount of time in order to remove that substance from the surface. Under the leading case on the issue, *Chance v. BP Chemicals*, subsurface rights terminate at an undefined point below the surface.¹⁵⁶ The reasoning of this rule comes from the curtailment of common-law property rights above and below surface property.¹⁵⁷ In *Chance*, the court analogized the deep subsurface rights implicated by hazardous-waste storage to a surface owner’s rights to the airspace above his property.¹⁵⁸ Although only briefly mentioned in Wilson and de Figueiredo’s article, air rights actually provide a well-suited analogy to deep subsurface rights for CCS.¹⁵⁹ Airspace property-rights law can be applied to CCS to offer a different legal paradigm directly applicable to the extension of property rights attached to surface rights—just in the other direction.

In *United States v. Causby*, the Supreme Court looked into a landowner’s claim that an airport’s flight paths constituted a taking of their property under the Fifth and Fourteenth Amendments.¹⁶⁰ The *Causby* Court found that flights passing eighty-three feet above the ground constituted a compensable taking of the landowner’s property despite the fact that the planes never actually made physical contact with any structures or trees on the property.¹⁶¹ The Court rejected the doctrine of *cujus est solum* and found that Congress had declared the air a public highway.¹⁶² However, because the flight paths of the planes had destroyed the landowner’s “right to possess and exploit the land—that is to say, his beneficial ownership of it,” the landowner was owed compensation for the property taken by the government.¹⁶³ The Court found that “[t]he landowner owns at least as much of the space above the ground as

155. Wilson & de Figueiredo, *supra* note 25, at 10122–23.

156. *Chance v. BP Chems., Inc.*, 670 N.E.2d 985, 992 (Ohio 1996).

157. *Id.* at 991.

158. *Id.* at 992.

159. Wilson & de Figueiredo, *supra* note 25, at 10120.

160. *United States v. Causby*, 328 U.S. 256, 258 (1946).

161. *Id.* at 258–59, 265.

162. *Id.* at 260–61.

163. *Id.* at 261–62.

he can occupy or use in connection with the land.”¹⁶⁴

Underlying the Court’s decision were two major principles. First, the Court believed that the basis of the property rights were the surface rights of the landowner.¹⁶⁵ It interpreted the flights over the property, not with respect to the ownership of the air itself, but with respect to the landowner’s use of the surface property.¹⁶⁶ Thus, when the Court limited the common-law extension of property rights above and below the surface, the surface was the focal point. Second, the Court reached its decision with full recognition that these changes in property ownership were, at least partially, the result of societal changes.¹⁶⁷ The Court reasoned that, because “[t]he airplane is part of the modern environment of life . . . [t]he airspace, apart from the immediate reaches above the land, is part of the public domain.”¹⁶⁸ As the *Chance* court later noted, “[O]wnership rights in today’s world are not so clear-cut as they were before the advent of airplanes and injection wells.”¹⁶⁹ The *Causby* and *Chance* courts failed to delineate the precise limits between private property and the public domain, however, instead basing these limits on the effect on the property’s surface.¹⁷⁰

Other scholarly articles on this subject fail to evaluate pore-space ownership through analogy to airspace property rights, instead focusing almost exclusively on property ownership underneath the surface.¹⁷¹ Yet, as displayed by the *Causby* and *Chance* courts, the relevant reference point is not the direction—up or down—but rather the distance from the surface and the possibility of interference with the landowner’s enjoyment of the surface.¹⁷² While the *Causby* decision related to superadjacent rights,¹⁷³ subjacent rights for support of the surface property have been recognized in other contexts.¹⁷⁴ Acceptance of the idea that surface owners do not own the land below them indefinitely but

164. *Id.* at 264.

165. The Court often reiterated that there was a taking *despite* the lack of conventional entry upon the land—but only because the effect was similar to a conventional entry. *Id.* at 264–65. This reasoning seems to center around the use of the property despite the owner not occupying the area where the planes flew.

166. *Id.*

167. *Id.* at 266.

168. *Id.*

169. *Chance v. BP Chems., Inc.*, 670 N.E.2d 985, 992 (Ohio 1996).

170. *Causby*, 328 U.S. at 265; *Chance*, 670 N.E.2d at 992.

171. The Wilson and de Figueiredo article touches on the subject of airspace property rights but fails to go into detail on the subject. See Wilson and de Figueiredo *supra* note 25, at 10120.

172. *Causby*, 328 U.S. at 265; *Chance*, 670 N.E.2d at 993.

173. *Causby*, 328 U.S. at 265.

174. *Keystone Bituminous Coal Ass’n v. DeBenedictis*, 480 U.S. 470, 500–01 (1987) (“[T]he support estate has value only insofar as it protects or enhances the value of the estate with which it is associated.”).

instead own only a support estate in the land below their surface lots would bring subterranean land rights in line with the reasoning of *Causby*.

The common-law maxim of full extension of property rights above and below the surface did not differentiate between the two directions,¹⁷⁵ and the reasoning of the other articles on this issue fails to account for this.¹⁷⁶ The analogies used in the other articles—mineral rights, groundwater rights, EOR rights, and natural-gas-storage rights—all have removal as the end goal.¹⁷⁷ All of them deal with *taking* something from the earth, and all deal with who owns the *substance*, not the space.¹⁷⁸ On the other hand, the hazardous-waste-storage cases and the airspace cases deal with who owns the *space*, not the substance.¹⁷⁹ These cases deal with *putting in*—a flight path and wastewater—rather than *taking out*. Both of these areas of law recognize limitations on the extent of ownership above and below the surface, something also implicitly recognized in subjacent-support property rights.¹⁸⁰

d. *Looking Ahead (and Below)*. Property and ownership are not stagnant issues; they change over time and, as the *Causby* case shows, with scientific progress.¹⁸¹ An effective CCS program will be an extensive undertaking—it will, as noted earlier,¹⁸² likely require significant national involvement and a new infrastructure. A partial CCS system will not achieve the desired results. There needs to be a revolution of thought within our society and, subsequently, within our legal system. This will be similar to the

175. *Id.*

176. Flatt, *supra* note 26, at 237–38 (failing to account for the additional legal paradigm of air rights); Wilson & de Figueiredo, *supra* note 25, at 10120 (mentioning air rights briefly but failing to fully explore their applicability).

177. *See Chance*, 670 N.E.2d at 991 (“[A]ppellee’s injection well operation has nothing to do with the extraction or storage of oil or gas For [this] reason, we also reject appellants’ argument that this court’s opinion in *Columbia Gas Transm. Corp. v. Exclusive Natural Gas Storage Easement* . . . , which involved the determination of compensation due for the appropriation of an underground gas storage easement, is relevant to the resolution of this case.”).

178. *See id.* (finding that the law regarding oil and gas extraction is fundamentally dissimilar to the law regarding injection of hazardous waste).

179. In fact, the *Causby* Court analogized the flight paths of the planes to the erection of an elevated railway over the landowner’s property—which the Court believed was clearly a taking. The Court held that “[w]hile the owner does not in any physical manner occupy that stratum of airspace or make use of it in the conventional sense, he does use it in somewhat the same sense that space left between buildings for the purpose of light and air is used.” *United States v. Causby*, 328 U.S. 256, 265 (1946).

180. *See Keystone*, 480 U.S. at 500–01 (noting that the support estate does not extend forever, but only to a depth where it will support the surface).

181. SACKMAN ET AL., *supra* note 63, at § 5.01.

182. *See supra* Part I.B.

revolution created by air travel, in which the skies suddenly played a different role as they became the highways of flight. The subterranean deep pore space should be viewed as an open storage container in much the same way the sky is looked at as an open highway. Of course, such a revolution of thought must occur quickly because of the imminence of climate change and the need to create a CCS program quickly.

Future courts should follow the general guidance set forth under airspace-takings law rather than attempting to squeeze CCS law into the form of other subterranean property rights. The result of this will be similar to the *Chance* and *Causby* decisions—at some depth (without a specific depth being delineated), pore space will be so far below the surface that its use will be undetectable to the landowner at the surface above. If sequestration below the earth has no effect on the ground far above (or no cognizable effect, similar to an airplane flying high in the air and marring someone’s view), then this will not affect the property rights of the landowner above. CCS sites are expected to be between 3000 and 10,000 feet below the surface.¹⁸³ There should be *no property interest* in the pore space taken by CCS at this depth.

Because there are no property rights in the pore space at this depth, no property rights must be taken from the surface owners.¹⁸⁴ While there will be no rights to acquire with respect to the right to store CO₂ in the deep pore space, any companies injecting CO₂ into deep pore space should obtain all mineral rights and groundwater rights to ensure that no other parties can later claim to have the ability to disturb a sequestration site. The surface rights will, of course, have to be obtained at points of entry and for testing wells. But, with regard to the rights to the deep pore space—to change the words of the *Causby* Court for this new situation—the pore space, *apart from the immediate reaches below the land, is part of the public domain.*¹⁸⁵

183. See, e.g., Nordbotten et al., *supra* note 24, at 342.

184. The author would like to note that this result could be different in Wyoming and Montana, which have passed legislation declaring the surface owner as the owner of the pore space. See Wyo. Stat. § 34-1-152 (2010); Mont. Code Ann. § 82-11-180 (2009) (“If the ownership of the geologic storage reservoir cannot be determined from the deeds or severance documents related to the property by reviewing statutory or common law, it is presumed that the surface owner owns the geologic storage reservoir.”). Determining the effect of federal legislation declaring pore space to be a public good, as this Comment recommends, on a surface owner’s property rights under these state laws is beyond the scope of this Comment.

185. See *Causby*, 328 U.S. at 266 (“The airspace, apart from the immediate reaches above the land, is part of the public domain.”).

2. *The Movement of CO₂ Beneath the Subsurface*

Based on the reasoning of the previous Subpart,¹⁸⁶ which determined that no one owns the deep-pore-space property rights, CCS injection companies will not have to worry about liability regarding the lateral movement of CO₂. If CO₂ moves toward the surface, however, some potential property rights will be implicated at a depth where the CO₂ could reasonably have an effect on a landowner's surface rights.¹⁸⁷ Thus, unless there is evidence that there might be significant vertical movement of the CO₂ towards the surface, the companies responsible for the liability created by the CO₂ will not have to worry about the movement of the CO₂ horizontally. This will remove a significant hurdle to the eventual implementation of CCS—the possibility of limitless liability.¹⁸⁸ Although the idea of CO₂ moving below the surface may conjure frightening images of “rogue” CO₂ flowing through the pore space, this issue is best dealt with on the engineering side rather than through property rights. Property ownership cannot be extended simply to curb people's fear of the unknown.

C. *Determining the Proper Measure of Just Compensation*

The previous Subpart reached the conclusion that no property would be taken by the use of deep pore space for CCS, and therefore, there was no compensable taking under the Fifth Amendment.¹⁸⁹ This is especially important considering that a widespread CCS program will signify a fundamental shift in environmental policy that will force changes in how we think about our world. Yet, this determination does go against the current weight of the limited scholarship on this subject. Understanding that a court may find another opinion more persuasive or be unwilling to accept the changing nature of subsurface property rights, it is important to address what methodology should be followed in determining just compensation, if necessary. For purposes of this determination, the surface owner will be presumed to be the owner of the deep pore space.¹⁹⁰

186. *See supra* Part III.B.1.d.

187. *Chance v. BP Chems., Inc.*, 670 N.E.2d 985, 992 (Ohio 1996). (“If appellee's act of placing the injectate into the rock interferes with appellants' reasonable and foreseeable use of their properties, appellee could be liable . . .”).

188. *See* Flatt, *supra* note 26, at 220 (describing the uncertainty regarding liability).

189. *See supra* Part III.B.1.d.

190. *See id.* at 233–34 (noting that there is no consensus on the issue, but that “a majority of states adopt the view that the surface owner has rights to the spent reservoir space”).

1. *Just Compensation Generally*

As a general rule, a property owner “is entitled to the fair market value of the property at the time of the taking” in order to satisfy the constitutional requirement of just compensation under the Fifth Amendment.¹⁹¹ “[J]ust compensation in a condemnation case and the concept of fair market value include value attributable to any use to which the property is adapted and might be put, and that compensation may be awarded upon the basis of the most advantageous and valuable use.”¹⁹² This rule is commonly referred to as valuing property based on its “highest and best use.”¹⁹³ In determining what the highest and best use of a particular property is, the following factors, among others, should be considered: “a study of the community, the neighborhood, zoning, market factors, the site, and its improvements.”¹⁹⁴ A court will “[presume] the highest and best use of a property to be its current use,”¹⁹⁵ unless the landowner can show it to be otherwise. With regard to other potential uses, the Supreme Court has ruled that “[e]lements affecting value that depend upon events . . . which, while within the realm of possibility, are not fairly shown to be reasonably probable, should be excluded from consideration, for that would be to allow mere speculation and conjecture to become a guide for the ascertainment of value.”¹⁹⁶

2. *Partial Takings*

When a partial taking of property occurs, the determination of just compensation is more complicated.¹⁹⁷ Because the landowner is “entitled to be put in as good a position pecuniarily as if his property has not been taken,”¹⁹⁸ courts have determined that “an appropriate measure of damages in a partial-taking case is the difference between the value of the parent tract before the taking and its value after the taking.”¹⁹⁹ Assuming the deep pore space is owned by the

191. *United States v. Reynolds*, 397 U.S. 14, 16 (1970).

192. *United States v. 158.24 Acres of Land*, 696 F.2d 559, 562 (8th Cir. 1982).

193. *See* SACKMAN, ET AL., *supra* note 63, § 13.01.

194. *Id.*

195. *E. Tenn. Natural Gas Co. v. 7.74 Acres*, 228 F. App'x. 323, 327 (4th Cir. 2007).

196. *United States v. Olson*, 292 U.S. 246, 257 (1934).

197. SACKMAN, ET AL., *supra* note 63, § 14.01 (“Partial takings are typically far more complex than total takings . . .”).

198. *Olson*, 292 U.S. at 255.

199. *United States v. 8.41 Acres of Land*, 680 F.2d 388, 392 (5th Cir. 1982). Note that the Fifth Circuit requires the use of the before-after valuation method. Other circuits follow this approach. *See, e.g.*, *United States v. 9.20 Acres of Land*, 638 F.2d 1123, 1126–27 (8th Cir. 1981) (“In partial taking cases, the proper measure of compensation is the difference between the fair and reasonable market value of the entire ownership immediately before the taking and the fair and reasonable market value of what is left immediately after the

surface owner, courts should consider the federal government's acquisition of this property a partial taking.

Before compensation can be given for a partial taking, the unity of the property should be established. As a leading eminent-domain treatise notes, "Traditionally, there are three elements to establishing a unity between separate parcels: (1) unity of ownership; (2) contiguity; and (3) unity of use. Of these standards, unity of use is the primary criterion in determining unity of a condemnee's lands."²⁰⁰ Evaluating these three elements does not make complete sense, of course, because the unity-of-use element will not be satisfied with respect to deep pore space,²⁰¹ further supporting this Comment's determination that the surface owner does not own the deep pore space beneath his or her property.²⁰² While a property owner could make a claim that the deep pore space below his home has a unity of use with his property (as a foundation for it), such a claim would only be valid at a depth where disturbance of the earth would have an effect on the surface.²⁰³ So, in order for the courts to evaluate the taking of deep pore space, they would have to ignore the unity-of-use element and rest solely on the contiguity and unity-of-ownership requirements. Or courts could create a legal fantasy that property, from a height of a few hundred feet above the ground to several thousand feet below the ground, has a singular use. Such a result should be avoided and should yield to acceptance of changing perceptions of property and ownership.

Yet, if courts determine that a surface owner's property rights extend thousands of feet down into the earth and that there is a unity of use between the surface and the deep pore space below, then the resulting just compensation due to the surface owner would still be minimal. This conclusion rests on the assumption, as does the rest of this Comment, that CCS will not be approved as a method of curbing climate change if it will substantially affect the surface property above.²⁰⁴ The difference between the property's value before and after the deep pore space is taken likely will be

taking.").

200. SACKMAN, ET AL., *supra* note 63, § 14B.03.

201. *See id.* ("As will be noted by careful analysis of fact patterns in numerous cases, although courts will deny recovery in various jurisdictions based upon technical defects in ownership and contiguity, they are more reluctant to deny damage where a strong case is made under the facts for unity of use.").

202. *See supra* Part III.B.1.

203. Such an argument would be similar to a property owner making a claim that high-flying planes disrupted the amount of light to his property. This argument would only succeed where an actual disruption in the amount of light reaching the surface could be shown.

204. *See, e.g., MIT Develops Initial Step Toward Carbon Sequestration, supra* note 49 (describing a recent step in the elaborate process of making CCS feasible on a large scale).

insignificant. Any amount of just compensation given to a landowner would not be truly representative of the resulting valuation difference. Instead, it would likely arise from a perception that *somebody* deserves to be paid for this space. In this sense, the American perception of property and space must be changed.

3. *Compensation for Fear*

One potential route of recovery would be through the “fear” doctrine. Under federal condemnation law, “if fear of a hazard would affect the price a knowledgeable and prudent buyer would pay to a similarly well-informed seller, diminution in value caused by that fear may be recoverable as part of just compensation.”²⁰⁵ This would be an opportunity for argument regarding whether fears of unexpected negative effects from the CCS affect the price of the surface property. Yet, as the court in *United States v. 760.807 Acres of Land* noted, this “requirement that the fears affect the actions of knowledgeable and prudent sellers and purchasers is dictated by [*Olson v. United States*], which precludes severance damages for fears based wholly on speculation and conjecture.”²⁰⁶ Landowners would likely be unable to show that CCS, having been determined to be safe by the United States government, would have an actual effect on a “knowledgeable and prudent” property buyer. Any knowledgeable and prudent property buyer would understand the safeness of CCS, and, therefore, there would not be any price reduction of the property caused by this speculative fear.

4. *Applying Just Compensation*

Appraising property is a complicated profession, and the author of this Comment is not an appraiser. Any determination of the fair market value would be done by a licensed appraiser following the Uniform Appraisal Standards for Federal Land Acquisitions.²⁰⁷ Yet, without appraising a particular parcel of property, general rules can be set forth for a type of property. These general rules are created by looking at the nonspeculative uses of the property. For deep pore space, there are none except for, potentially, the storage of CO₂ and hazardous waste. And even if these are potential uses, they would require a large amount of permitting and approval that the landowner would have to show he was likely to obtain within a short amount of time.²⁰⁸ Also, it should be noted that this Comment only

205. *United States v. 760.807 Acres of Land*, 731 F.2d 1443, 1447 (9th Cir. 1984).

206. *Id.*

207. INTERAGENCY LAND ACQUISITION CONFERENCE, UNIFORM APPRAISAL STANDARDS FOR FEDERAL LAND ACQUISITIONS (2000).

208. See SACKMAN, ET AL., *supra* note 63, § 13.04 (“It is generally held that the value of property is to be considered as of the taking date, but it has also been said that the value should contain a factor for the likelihood of a zoning

focuses on the fair market value of the subterranean pore space. The owners of the mineral rights and groundwater rights would still have to be compensated. These rights are severable so acquisition of such rights would not be a partial taking. With regard to the pore space, however, the lack of compensation due to any owner means there would be no difference in the end economic result of CCS regardless of whether a court determines that someone does or does not have a property right to the pore space.

IV. INVERSE CONDEMNATION

There are two types of inverse condemnation: uncompensated physical takings and regulatory takings. An uncompensated physical taking is a “physical invasion of private property by the government or by a third party under authority of the government.”²⁰⁹ A regulatory taking, generally much harder to prove,²¹⁰ occurs when government regulation overreaches. The “oft-cited maxim [for regulatory takings is] that, while property may be regulated to a certain extent, if regulation goes too far it will be recognized as a taking.”²¹¹ The two types of inverse condemnation are not exclusive. In fact, regulatory takings have been further divided into two types by the Supreme Court: “regulations that compel the property owner to suffer a physical ‘invasion’ of his property”²¹² and those “where regulation denies all economically beneficial or productive use of land.”²¹³

This Comment concludes that there will likely be no compensable taking of property with regard to the deep pore space that will be used for CCS, either because no one owns the deep pore space or because it is worthless. The federal government should file declarations of taking for the mineral rights and groundwater rights before beginning a CCS program in a specific area. But, rather than attempt to find someone to compensate for the deep pore space, the federal government might prefer to allow companies to operate CCS facilities under a permitting system. Landowners believing they have a claim for just compensation could file inverse-condemnation claims if the deep pore space below their land is being used for CCS. The United States could defend against the claims on the grounds noted above. Any of the three types of inverse condemnation—uncompensated physical invasion, regulation compelling physical

change. This concept has been called the doctrine of reasonable probability of rezoning.”).

209. J.D. EATON, REAL ESTATE VALUATION IN LITIGATION 371 (1995).

210. *Id.*

211. *Lucas v. South Carolina*, 505 U.S. 1003, 1014 (1992) (internal quotations omitted).

212. *Id.* at 1015 (recognizing that the taking under *Causby* would fit under this model).

213. *Id.*

invasion, or regulation depriving the landowner of all economically beneficial use of his land—could be a potential route of recovery for the landowner in an inverse-condemnation suit. This will ultimately depend on how the national CCS program is structured, which cannot be fully predicted at this point.

Any attempt by a landowner to recover for an inverse condemnation will likely fail for the reasons already detailed in this Comment. The surface owner does not own the deep pore space beneath his or her property.²¹⁴ Even if the surface owner were determined to own the pore space beneath his or her property, any physical invasion would be evaluated under the partial-taking analysis above and would reach the same result—no compensation for the landowner.²¹⁵

V. CONCLUSIONS AND RECOMMENDATIONS

CCS is one arrow in the quiver of federal options for altering the current climatic course of the world. If utilized quickly on a large scale, CCS could provide a much-needed period during which green technologies can progress, and emissions could be reduced to an acceptable level worldwide. A large amount of subterranean space will be necessary to accomplish such a goal. Obtaining this space will not be as difficult as expected, however, because it is likely that no individual owns the property right to inject or store anything in the ground. To clarify this fact, Congress should pass a bill declaring the subterranean pore space to be a public good, like it did with airspace.²¹⁶ The federal government, through the EPA (because of its similar work with the UIC),²¹⁷ should create a regulatory scheme through the use of permitting for companies wishing to set up CCS sites.

The EPA, as the acquiring agency, should also work with these companies to ensure that they have the necessary property interests—that is, mineral and groundwater rights—to proactively limit future disturbances. The federal government should take the position that no surface owner has property rights in the deep subterranean pore space. Therefore, this area should not be included in any declaration of taking. Any claims by surface-property or mineral-rights owners for just compensation for the pore space should be addressed through inverse-condemnation proceedings. This will centralize the cases in the United States

214. *See supra* Part III.B.1.

215. *See supra* Part III.C.2.

216. Air Space Commerce Act of 1926, ch. 344, § 10, 44 Stat. 568 (“[N]avigable airspace shall be subject to a public right of freedom of interstate and foreign air navigation . . .”); *see also* *United States v. Causby*, 328 U.S. 256, 260 (1946) (quoting the same language from the now superseded Air Commerce Act of 1926).

217. *See supra* notes 41–44 and accompanying text.

Court of Federal Claims, which handles Fifth Amendment Takings Claims against the United States (providing another incentive for a national CCS program).²¹⁸ After a few adverse rulings, surface owners' claims will be more easily dismissed.

Other articles have focused on property issues related to trespass and liability. While this Comment focuses on property issues from the perspective of the use of eminent domain, its conclusions can easily be extended to these other areas. The hope of this Comment is to provide another paradigm for evaluating CCS as a national plan. The previous articles on this issue seem stuck on fitting CCS into an existing methodology. Although this is certainly the typical path of legal evolution, it need not be followed blindly. The widespread use of CCS will transform our world by utilizing previously unused areas of the earth, giving our society the necessary time to develop the technology needed to move into a future with greatly reduced greenhouse emissions. This will not be an easy transition. Rather than acting as if this is just another underground-property issue, the legal community should treat CCS as it deserves to be treated—like something completely different. As the airplane was to the air, CCS will be to the ground.

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218. 28 U.S.C. § 1491(a)(1) (2006) (“The United States Court of Federal Claims shall have jurisdiction to render judgment upon any claim against the United States founded . . . upon the Constitution . . .”).

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