Proposed Liability Framework for Geological Sequestration of Carbon Dioxide

Working Paper

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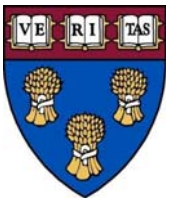

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Executive Summary

Harvard Law School's Emmett Environmental Law and Policy Clinic* supports immediate large-scale carbon capture and sequestration ("CCS") demonstration projects as part of a larger national and global effort to address climate change. Large-scale CCS projects (those that sequester at least 1.5 million tons of captured carbon dioxide ("CO_2") annually) must be demonstrated soon to confirm CCS as a viable strategy to combat climate change and to show the commitment of the United States to achieving meaningful reductions in domestic CO_2 emissions.

Uncertainty regarding a long-term liability framework for sequestration sites poses a barrier to rapid deployment of large-scale demonstration projects in a variety of geological formations and public perception about long-term responsibility for sequestration sites may also present a barrier to later, post-demonstration projects. Because we believe that CCS demonstration projects need to be deployed immediately, we propose liability-based *incentives* to encourage large-scale demonstration projects, even in the absence of a price or cap on CO_2 emissions. For post-demonstration projects, we propose a detailed liability framework to *provide certainty, assuage public concerns,* and *remove barriers* to these projects.

However, while we believe that creating incentives for demonstrations and removing barriers to post-demonstration projects are necessary, we do not believe that it is necessary or appropriate for the federal government to take on unfunded responsibility for sequestration sites. Therefore, we propose, as part of a detailed liability framework for sequestration sites, an industry-financed trust fund that will cover claims above liability limits for demonstration projects, allow for cost-sharing for catastrophic incidents at post-demonstration projects, and pay for both long-term stewardship and post-closure liability claims at demonstration and post-demonstration projects. Under our proposal, it is unlikely that the federal government will have to pay anything to cover sequestration site liabilities.

Our proposal includes the following elements to encourage the development of CCS as a climate change mitigation strategy:

- caps on liability for up to ten early demonstration projects, with amounts above the cap paid by an industry-financed fund (the "CCS Trust Fund");
- cost-sharing between post-demonstration sequestration site owners/operators and the industry-financed CCS Trust Fund in the event of catastrophic damages during the operational period;

* The Emmett Environmental Law and Policy Clinic at Harvard Law School (EELPC) is directed by Wendy B. Jacobs and is dedicated to addressing major environmental issues in the United States and abroad and to providing its students an opportunity to do meaningful, hands-on environmental legal and policy work. Students and clinic staff work on issues such as climate change, pollution reduction, water protection and smart growth.

- for both demonstration and post-demonstration projects, the post-closure transfer of liability to a government entity, with all post-closure liability claims and stewardship costs paid out of the industry-financed CCS Trust Fund;

- establishment of privately operated sequestration sites on public lands to minimize transaction costs, delays, and potential trespass and nuisance claims;

- preemption of nuisance and trespass claims unless actual damages exceed a certain dollar amount;

- a streamlined claims process; and

- certainty and transparency for businesses and the public alike.

Other key aspects of our liability proposal are summarized below. Note that the same requirements and incentives apply whether the sequestration occurs onshore or offshore.[◊]

- While captured CO_2 is being injected, and for at least ten (10) years thereafter, responsibility for liability and stewardship of the site rests with the sequestration site owner/operator.

- The CCS Trust Fund will be financed primarily by annual per-ton sequestration fees and closure assessments. Other funds deposited into the Fund will include penalties for permit violations, amounts received from cost-recovery actions, and interest on the Fund balance.

- The CCS Trust Fund will be available:

    - to cover liability in excess of applicable limits on liability for demonstration projects,

    - for cost-sharing in the event of catastrophic damages during the operational period for post-demonstration projects,

    - to cover the costs of post-closure stewardship and pay for post-closure liability claims,

    - to reimburse certain costs incurred by states,

    - for closure and stewardship costs regarding abandoned sites,

    - to purchase insurance policies, and

[◊] This paper only addresses sequestration in secure geological formations. It does not address terrestrial sequestration or injection of captured CO_2 into the water column of the ocean.

- to provide funding necessary to establish sequestration sites on and under public lands.

- All sequestration permits are conditioned on substantial financial liability assurances, including minimum insurance requirements and bonding requirements, demonstrated annually by sequestration site owners/operators.

- A CCS Oversight Board sets minimum financial assurance requirements and reviews annual demonstrations of financial assurance, manages and invests the Fund, adjusts the schedule of fees, consults regarding closure assessments, and reviews and adjudicates requests for Fund disbursements. The Board will consist of representatives with staggered terms from: the Treasury Department, the Environmental Protection Agency ("EPA"), Department of Energy ("DOE"), Department of the Interior ("DOI"), the Department of Justice, several states with ongoing CCS activities, the insurance and surety industries, and equal numbers of concerned citizens, environmental advocacy organizations, and CCS owners/operators.

- All claims for personal injury, property damage, or natural resource damages from incidents at or relating to geological sequestration sites must be submitted to a claims resolution panel made up of three members of the Board. The panel will appoint special masters to adjudicate claims for compensation under a no-fault system. Claimants may appeal the special master's decision to the panel. After the panel issues its final decision, claimants may accept the panel's decision or elect to file a claim in court against the owner or operator.

Our proposal both expands on and deviates from the work of others. We have endeavored to provide descriptions of and attribution to the work of others throughout this paper. We note where there is consensus, where there is disagreement, and where there has been little or no attention paid to an issue. For example, the Emmett Environmental Law and Policy Clinic ("EELPC") believes that not enough attention has been paid to the possibility that deep saline aquifers may be called upon to serve multiple, potentially conflicting functions in the future: as storage reservoirs for captured CO_2; as sources of metals and minerals such as lithium; and, after treatment and desalinization, as agricultural and/or drinking water supplies. Accordingly, our CCS liability proposal takes this concern into account and makes provision for restoring such aquifers if and when needed. Should early sequestration projects suggest that these deep aquifers become unusable or extensively damaged due to displacement or contamination, then provision is made in our proposal to discourage or prevent the use of such aquifers by future sequestration projects.

There are various types of risks associated with CCS, including unanticipated migration of sequestered CO_2, contamination of water supplies (shallow and deep), displacement of water supplies, seismic activity, and leaks of CO_2 to the atmosphere. Until large-scale CCS projects have operated for decades and been closed for decades, no one can predict with certainty

whether any of these risks will materialize. The purpose of a legal system is to anticipate, allocate, and manage risks—whether remote or likely. Our recommendations address these risks through a liability arrangement that makes CCS projects viable in the near term and for the long term, while making adequate provision to protect public health, safety, and the environment. Our proposal provides certainty and transparency for businesses and others affected by CCS projects.

Table of Contents

1. Background

a. Introduction

In our 2009 paper, "Proposed Roadmap for Overcoming Legal and Financial Obstacles to Carbon Capture and Sequestration"[1] (the "Roadmap"), we outlined legal and financial incentives necessary for the rapid demonstration of geological sequestration. In this paper, we expand one set of ideas presented in the Roadmap, namely, our ideas regarding clarification of the liability regime for sequestration sites. Our liability proposal would apply to sequestration in secure geological formations onshore and beneath the seabed of the oceans. (Our proposal is not designed for terrestrial sequestration or sequestration of captured carbon dioxide in the water column of the ocean.) This liability framework will protect public health, property, and natural resources while removing barriers to carbon capture and sequestration ("CCS").

b. Uncertainty regarding liability is a barrier to CCS

Numerous barriers impede the demonstration of large-scale CCS projects (those that capture and sequester at least 1.5 million tons of carbon dioxide annually).[2] First and foremost is the absence of any national price on or restriction of carbon dioxide ("CO_2") emissions in the United States. Other key barriers include uncertainty about liability; the dearth of pipelines to transport captured CO_2, requiring significant investment in infrastructure; and the transaction costs and impracticality associated with acquisition of huge swaths of pore space, making access to sequestration sites difficult.

Many argue, we believe convincingly, that the prospect of unknown liabilities far in the future is an impediment to getting CCS demonstration projects financed. To overcome this barrier, and because we believe that immediate large-scale demonstration of CCS is necessary to determine if this technology can help mitigate climate change, we propose a limit on liability for initial demonstration projects. The purpose of this liability limit is two-fold: to *overcome barriers* and to *provide incentives* for these projects.

However, while we believe such an incentive is a necessary condition for demonstrations to proceed at the scale necessary, we do not believe that this incentive needs to be funded by the federal government. Instead, we believe that site owners/operators will be willing to pay predictable per-ton sequestration fees during the operational period, in exchange for limits on liability during the operational period, and a transfer of all liability for the project post-closure. Under our proposal, these per-ton fees will be paid into a trust fund, which will be available to cover liability claims that exceed the limit during the operational period and all liability claims post-closure. In sum, without a price on CO_2 (the stick) or a fund to backstop uncertain future liability (the carrot), demonstration of sequestration is not going to happen at the scale necessary to address climate change.

The industry-financed trust fund we propose will also help to overcome another barrier to CCS: significant public uneasiness regarding sequestration of captured CO_2. Until more data are available on the actual (not just predicted) long-term risks of CO_2 sequestration, there is significant public concern regarding CCS. An industry-financed trust fund will help to address these concerns by ensuring that a readily accessible source of funding will be available in the event of a major problem at a sequestration site.

For post-demonstration projects, uncertainty regarding long-term liability may remain a barrier to project financing and to public perception. While liability incentives are not appropriate for these post-demonstration projects, it is appropriate to remove barriers. We therefore propose using the same, industry-financed trust fund for these projects. Liability would not be capped for these projects; rather, the cost of liability claims above a certain threshold would be shared with the industry-financed trust fund, and all post-closure liability would be paid out of the trust fund, as with the demonstration projects. This approach to managing liability should provide certainty and clarity for operators and the public without providing the additional incentive of liability caps, which will no longer be needed for post-demonstration projects.

In sum, the system proposed in this paper uses an industry-financed fund to provide the appropriate incentives, clarity, and removal of barriers, without providing unnecessary incentives or government subsidies.

c. Methodology

We reviewed liability frameworks for sequestration that have been enacted by various U.S. states and by other countries. At least eight states in the U.S. have enacted legislation that addresses some aspects of a liability regime for sequestration.[3] We also reviewed the sequestration liability regimes of Australia and the European Union and studied CCS liability models proposed by a variety of academic and non-governmental organizations. Finally, we analyzed liability frameworks enacted, *inter alia*, in the contexts of hazardous waste disposal, oil spill response, management of nuclear power plants, ocean dumping, and the underground injection control program. We identified a comprehensive list of issues that need to be addressed in a liability framework for CCS. We then compared the various approaches that have been proposed or adopted to address each of these issues. Through this comparison, we identified areas where consensus is building, areas where there is a wide variation in approaches, and areas where there is a gap in discussions and/or statutory action. We also identified issues as to which lessons could be learned from experience with liability frameworks in other contexts, such as oil spill response.

In March 2010, we circulated an early draft of this paper. In June 2010, we hosted a workshop to discuss these issues and a more refined draft of the paper with experts from government (state and federal), the private sector, and non-governmental organizations. The report summarizing the workshop is available at:

http://www.law.harvard.edu/academics/clinical/elpc/publications/publications.html. Based on these reviews, comparisons, discussions, and lessons learned, we make our recommendations.

d. The significance of CCS

There is broad consensus in scientific, business, and political circles that CCS must be demonstrated quickly on a large scale because it is likely to be an important technology for reducing CO_2 emissions throughout the world. Indeed, a number of commentators predict that it may be impossible to achieve significant emissions reductions, in the United States and abroad, without the use of CCS.[4]

CCS is the most promising technology for reducing coal-generated CO_2 emissions. The United States has large coal reserves and, at present, coal-generated electricity is less expensive than other energy sources. Currently, almost half of the domestic energy supply is generated from coal.[5] It is thus not realistic to expect that coal will be eliminated from the U.S. fuel supply in the next few decades. Hence, CCS offers a potentially significant opportunity for reducing CO_2 emissions from this source while other non-CO_2 emitting sources of energy are developed and refined.

CCS has the potential to preserve and create jobs and enhance energy security. CCS offers the potential to preserve and create high-quality domestic jobs in the coal sector, and the technology, manufacturing, and construction industries. If the United States develops substantial CCS expertise quickly, it can also export technologies and expertise to other countries as they develop CCS technology. The creation of an accessible stream of captured CO_2 will also support continued domestic production of oil and gas through enhanced oil and gas recovery.[6]

e. Guiding principles

The following principles guide our recommendations:

Speed is critical. Getting large-scale CCS demonstration projects up and running quickly is critical if the United States is to achieve meaningful mitigation of climate change in the near term. The International Energy Agency calculates that nearly 600 CCS projects must be in place in North America by 2050 for CCS to contribute significantly to mitigating climate change.[7] We will not know, however, if such extensive deployment of CCS is achievable until large-scale demonstrations have been successfully implemented.

A liability regime must balance competing interests. While CCS must be deployed quickly, protecting public health and the environment during deployment are essential as well. A liability framework for sequestration must balance the needs of businesses that invest in CCS and desire certainty that their liability will be clearly delineated and

bounded with the public interest in ensuring that any harm to persons, property, or natural resources is minimized, mitigated, and compensated.[8]

Other environmental goals matter. CCS policies should balance climate change benefits with impacts on other environmental goals. Liability for geological sequestration should take into account factors such as environmental justice and the risks of groundwater displacement and contamination, in order to ensure that geological sequestration is carried out in an environmentally and socially responsible manner. These factors (and others) may weigh in favor of sequestration in offshore sub-seabed formations and in several onshore repositories on public lands.

Post-closure responsibility for sequestration facilities should be addressed at the national level. The creation of an industry-financed national post-closure trust fund will enable the pooling of sufficient resources for responsible post-closure stewardship of sequestration facilities. It will also provide sufficient resources for compensation payments for any post-closure leaks. There should also be a substantive role for the states post-closure because of state expertise with local geology.

f. Definitions

In the CCS literature, there is wide variation in the way many key terms are used.[9] For clarity, following are definitions of the key terms used in this paper:

CCS Alternative Claims Resolution Process. A no-fault alternative to the traditional tort litigation system for the resolution of claims for personal injury, property damage, and natural resource damages caused by geological sequestration. This claims process is modeled after other no-fault claims systems, such as the National Vaccine Injury Compensation Program. The process will be overseen by a three-member panel of the CCS Oversight Board. Claimants will have the option to pursue court action at the conclusion of the claims resolution process.

CCS Oversight Board (the "Board"). An organization comprising experts on finance, risk management, environmental protection (including water protection and management), geology, and CCS, and including affected states, residents, and businesses. The Board's functions will be as follows: to manage, invest, and provide financial oversight of the CCS Trust Fund; to set and periodically adjust fees; to set minimum financial assurance requirements and review financial assurance demonstrations from owners and operators; to consult regarding closure assessments; to pursue cost-recovery actions; to purchase insurance as appropriate; and to authorize disbursements from the Fund.

CCS Trust Fund (the "Fund"). A federal trust fund financed primarily through fees paid by sequestration site owners and operators, including a per-ton fee on all CO_2 that is sequestered and a closure assessment. The Fund will be used for several purposes: proper closure of abandoned sequestration sites if necessary; payment of certain damage

claims; post-closure stewardship; purchase of insurance policies; emergency corrective actions and remediation to prevent a threat to public health, safety, or the environment; and establishment of regional sequestration sites on public lands.

Certificate of closure. A certificate obtained by the owner/ operator after demonstrating to the federal government (or a state regulatory agency if granted primacy by the relevant federal agency) that the sequestration site has been properly closed and that the CO_2 at the site has been and will continue to be properly sequestered. After the federal government issues a certificate of closure for a site, liability for damages and responsibility for stewardship shifts to the federal government, or potentially to the state government if a state wishes to be responsible for long-term stewardship and has the expertise to do so.

Damages. Injury to persons, property, and natural resources, including certain economic losses, as a direct result of the sequestration of captured CO_2 pursuant to a sequestration permit.

Geological sequestration site (or "sequestration site"). The sequestration site and facilities at the site, specifically: the geological sequestration unit, captured CO_2 sequestered in the unit, CO_2 injection wells, monitoring wells, underground equipment, and surface buildings and equipment used in the sequestration operation. The site includes all areas where the CO_2 is predicted (by the models on which the permit is based) to migrate over time. Captured CO_2 that migrates in an unpredicted and uncontrolled manner beyond the boundaries of the site remains the property and responsibility of the sequestration site owner/operator.

Geological sequestration unit (or "sequestration unit"). Any secure geological formation, either onshore or offshore, suitable for injection and long-term sequestration of CO_2, including saline formations, hydrocarbon formations, basalt formations, and unmineable coal seams.

Liability. "Liability" refers to (a) liability for damages under statutes, regulations, or common law and (b) responsibility for carrying out site stewardship. "Liability" does not refer to responsibility under a cap-and-trade regime if sequestered CO_2 escapes to the atmosphere.

Operational period. The period including selection of the CCS site, facility construction, CO_2 injections, well capping and other closure operations upon cessation of injections, and stewardship activities until such time as the owner/ operator receives a certificate of closure, which triggers commencement of the post-closure period.

Owner/operator ("O/O"). The party who owns or operates a geological sequestration site and has certain specified responsibilities for the site, including liability during the

operational period. If the owner and operator are separate entities, they share joint and several liability.

Post-closure period. The period after the O/O has received a certificate of closure. During this period, the federal government becomes responsible for liability and stewardship.

Post-closure stewardship. All stewardship activities that are performed after the site receives a certificate of closure.

Regional geological sequestration site. A geological sequestration unit that accepts captured CO_2 from multiple emitters and is accessed through a regional CO_2 pipeline system. We propose that several such sites be located on public lands.

Sequestration permit. Every sequestration site O/O is required to obtain a permit from the relevant federal agency (EPA, DOE, or DOI), or a state agency if granted primacy by the relevant federal agency, prior to commencing construction of facilities at the site.

Significant irregularity. Significant irregularity means any irregularity in the injection or sequestration operations or in the condition of the sequestration site itself, which implies the risk of leakage or risk to the environment or human health.[10]

Stewardship. Stewardship includes monitoring, measurement, and verification ("MMV"), corrective action, remediation, and related activities at the site, including repairing mechanical leaks and plugging and abandoning wells. Stewardship is the responsibility of the O/O until receipt of the certificate of closure, at which time responsibility for stewardship passes to the federal or state government. If CO_2 migrates beyond the site boundaries, the CO_2 remains the property of the O/O (or the federal or state government if title has transferred post-closure), and the O/O or the federal or state government will remain responsible for mitigating this situation.

2. Overview of Responsible Entities

a. Private entities

In our proposal, consistent with most existing environmental regulatory programs and the proposals of many commentators, the O/O bears primary responsibility for liability and stewardship during the operational period.[11] During the operational period, the O/O is liable for damages to persons, property, and natural resources, including certain economic losses, as a direct result of the sequestration of captured CO_2 pursuant to a sequestration permit. The O/O is also responsible for stewardship of the site after injections end, until the O/O receives a certificate of closure for the site. During the operational period, the O/O must maintain and provide annual proof of financial assurance, in an amount and type considered adequate by the CCS Oversight Board. Details of the liability scheme are discussed in Section 3; details of the CCS Alternative Claims Resolution Process are discussed in Section 5. Responsibilities of the CO_2 generator, capturer, compressor, and transporter will be determined by contract with the O/O.

b. Government entities

Several government entities will bear responsibilities for regulating CCS. We propose that EPA, DOI, or DOE be the lead agency, or, if granted primacy by the federal government, a state agency may serve as the lead agency. The lead agency will be responsible for:

- issuing sequestration permits and reviewing the permits every 5 years;
- suspending, modifying, or withdrawing permits in the case of leakage, significant irregularities, non-compliance with permit conditions, or if it appears necessary to protect public health and the environment, on the basis of evolving technological and scientific findings;
- inspecting sequestration sites (regardless of which agency is the lead agency, DOI and state agencies will have inspection rights for projects on federal and state lands, respectively, and DOE will have inspection rights for federally-funded projects);
- issuing certificates of closure; and
- post-closure stewardship.

c. Public-private entity

A new CCS Oversight Board[12] will be responsible for:

- establishing minimum financial assurance requirements,[13] and reviewing and approving annual O/O financial assurance demonstrations;
- financial management of the CCS Trust Fund, including periodic fee adjustments as necessary to ensure the adequacy of the Fund and fairness to O/Os;
- reviewing and authorizing federal and state agency requests for reimbursement for corrective action, remediation, and post-closure stewardship; and
- overseeing the CCS Alternative Claims Resolution Process through a three-member panel of the Board (see Section 5 for more details).

We propose that the CCS Oversight Board consist of individuals who have expertise and/or experience with one or more aspects of carbon capture and sequestration. The Board will include representatives with staggered terms from:

- the Treasury Department;
- EPA, DOE, and DOI;
- Department of Justice;
- several states with ongoing CCS activities;
- insurance and surety industries; and
- equal numbers of concerned citizens (drawn from communities that are hosting or will host CCS projects), environmental advocacy organizations, and O/O representatives.

3. Responsibilities Over the Lifecycle of a Sequestration Project

Because CCS projects pose unique legal and regulatory challenges that cannot be adequately addressed by any existing legal framework, we believe that Congress should establish a comprehensive, stand-alone legal framework for sequestration. Under existing law, sequestration projects may proceed by obtaining a permit for Class V experimental technology wells under the Underground Injection Control ("UIC") regulations.[14] EPA has proposed but not yet finalized a regulation identifying sequestration wells as a new class of injection well (Class VI) under the Safe Drinking Water Act.[15] For the sake of efficiency, it may be appropriate for the technical requirements of the UIC regulations to apply to CCS injection wells (whether onshore or offshore). However, we believe that the liability and financial assurance regimes of the UIC regulations are *not* appropriate for CO_2 sequestration projects.[16] For instance, the UIC regulations define an underground source of drinking water as only those aquifers that contain fewer than 10,000 mg/L total dissolved solids.[17] This does not provide sufficient protection for briny aquifers that could be treated and used (and, indeed, may be needed) for drinking water or agricultural purposes in the future. The UIC regulations also do not protect smaller, private drinking water supplies.[18] Finally, the UIC regulations do not apply to activities beyond state territorial waters—generally three miles offshore—therefore making these regulations inapplicable to projects on the Outer Continental Shelf.[19] A stand-alone CCS legal framework is necessary to address these and other concerns.

a. Pre-operational responsibilities

In our proposal, to receive a permit, a sequestration project O/O must meet numerous specified criteria. Upon meeting these criteria and receiving a permit, the O/O will be deemed to have complied with the UIC regulations and with a host of other statutes and regulations. For instance, the O/O must demonstrate that the captured CO_2 meets a certain purity level before the captured CO_2 may be sequestered. Captured CO_2 that meets this purity level will not be considered a hazardous waste under the Resource Conservation and Recovery Act ("RCRA") or a hazardous substance under the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"). Therefore, for projects permitted under our proposed statutory language, RCRA and CERCLA will not apply to the sequestered CO_2 unless the captured CO_2 fails to meet the purity requirements. See Section 5(c) of our model "CCS Liability Act of 2010" in Appendix A for proposed statutory language.

Many others have written extensively on what the technical and siting requirements should be to receive a sequestration permit.[20] We also addressed aspects of this issue in our comments to EPA regarding EPA's proposed regulations for Class VI UIC wells.[21] While an extensive discussion of permitting requirements is not appropriate here, we

note that permit requirements should include proof that the O/O has obtained adequate financial assurance.

b. Liability for damages during the operational period

We propose that liability for damages with respect to sequestration projects be placed mostly on the site's O/O, with partial cost-sharing in limited instances with an industry-financed trust fund.[22] Liability for up to ten early, large-scale demonstration projects will be capped, with any excess to be paid from the industry-financed fund.[23] As explained earlier, this liability-limiting incentive for early demonstration projects is recommended because the rapid deployment of diversely located, commercial-scale demonstrations is crucial to determining whether CCS is a viable climate mitigation strategy and, if so, what types of geological sequestration units are the safest and most secure.[24]

(i) Cost-sharing between owner/operator and industry-financed trust fund

Claims for personal injuries, property damage, and natural resource damage that occur as a direct result of sequestration projects are paid through a tiered process based on the total amount of damages. Claims are paid first by the O/O up to a certain limit (which is lower for up to 10 demonstration projects). The second tier of damages is paid by the industry-financed trust fund. For demonstration projects, this is the final tier. For post-demonstration projects, there is a third tier of damages for which the O/O is again responsible. Because the Fund is financed primarily by a per-ton sequestration fee keyed to the amount of CO_2 sequestered, payments by the Fund allow cost-sharing among all O/Os.[25] See Figure 1 for a description of this proposal. In the absence of data regarding the expected costs of damages that may occur at a sequestration site, we propose the dollar amounts below as placeholders and to spark discussion regarding what the appropriate amounts may be.[26]

Figure 1. Proposal for paying claims for damages

	Demonstration projects (up to 10 projects)	***Commercial projects (deployed after demonstrations)***
Step 1: Owner/Operator Liability	Liable to limits of financial assurance mechanisms ($50 million*)	Liable to limits of financial assurance mechanisms ($50 million*) + an additional sum ($20 million*)
Step 2: Industry-Financed Trust Fund	All remaining liability	Trust Fund pays the next tier of claims ($20 million*)
Step 3: Owner/Operator Liability	n/a	All remaining liability**

* The specific dollar amounts put forward here are meant to spark discussion and are not meant as definitive proposals. One source that may prove instructive for estimating the correct numbers is the report of Wyoming's Carbon Sequestration Working Group.[27]

** The Board also has the option to purchase insurance, using money from the Fund, to cover the final tiers of costs of any catastrophic incident.

In the Roadmap, we recommended limiting liability and providing indemnities for a handful of large, geologically diverse sequestration demonstration projects.[28] As we fleshed out the details of an industry-financed trust fund while preparing this white paper, we concluded that it will be possible to design the Fund so as to obviate the need for indemnities and still provide limited liability for early, large demonstration projects. We continue to recommend that DOE, DOI, and EPA cooperate to identify up to ten large, geographically diverse demonstration sites (on- and offshore), drawing on the experience gained through the DOE Regional Carbon Sequestration Partnerships, the Clean Coal Power Initiative, and state sequestration initiatives. Ideally, at least two such sites should be offshore and at least three beneath federally-owned or federally-acquired lands onshore.

(ii) Reporting, notification, and stewardship

During the operational period, the O/O has the following additional responsibilities:

- *Reporting.* The O/O must submit annual reports to the lead federal agency or to the state if the state has been granted primacy. Such reports will include results of the monitoring that the O/O is undertaking at the site, comparisons of data collected with modeled predictions, the quantities and composition of the CO_2 streams injected at the site, and proof of the acquisition and maintenance of the required financial assurances.[29]

- *Notification of leaks or irregularities*. The O/O must notify the federal government (or the state if the state has been granted primacy) of leaks or significant irregularities.

- *Stewardship*. After injections at the site cease, the O/O remains responsible for stewardship of the site until the O/O receives a certificate of closure for the site.

c. Post-closure transfer of liability

Damages may result from the unplanned and uncontrolled release or migration of CO_2 from a sequestration site decades after closure of the site, long after the expected corporate life of the O/O. There is consensus among many commentators that a mechanism for transferring liability for damages to a governmental entity after certification of closure is appropriate.[30] Several states, including Louisiana, Montana, North Dakota, and Texas, provide for transfer of liability to the state after a closure process, although Montana and North Dakota assume that responsibility will ultimately be transferred to the federal government.[31] The European Union ("EU") and Australian frameworks also provide for transfer of liability to a governmental entity.[32] At least two states, however, do not assume liability post-closure (Washington and Wyoming), and the proposed UIC regulations for Class VI geological sequestration wells do not contemplate any transfer of liability.[33]

The main issues that we believe require discussion are: (1) when liability should transfer to the federal government (or state government, if this is determined to be appropriate), and under what criteria; (2) how payment for post-transfer damages should be funded and paid; and (3) how existing and emerging state frameworks should be merged into a federal system.

(i) Timing of and criteria for transfer of liability

Sequestration liability frameworks that have been enacted by states and foreign jurisdictions vary widely regarding how much time must pass before responsibility for long-term stewardship is transferred to the government. For instance, Louisiana and North Dakota require the O/O to monitor the site for at least 10 years after injections are complete before liability may transfer; Australia requires 15 years; the EU requires at least 20 years of post-injection monitoring; and Montana requires a post-injection waiting period of at least 30 years. All require that certain criteria, in addition to the minimum waiting period, be met before transfer.[34]

This variation in timelines reflects the lack of data on the long-term behavior of closed sequestration sites and the long-term risks posed by such sites. From our vantage point and in light of the uncertainty, we recommend a twofold approach:

- First, provide for a minimum time period after injections cease during which stewardship responsibilities and liability for damages remain with the O/O. We

propose a minimum time period of 10 years. Setting a timeline that is too long may lead to problems if an O/O ceases to exist before liability transfers. It would be preferable for liability to transfer through a controlled process, rather than by default upon an O/O going out of business.

- Second, after this minimum time period, engage in a site-specific evaluation to determine whether risks at the site have decreased sufficiently that it is appropriate to transfer liability and stewardship to the federal (or state) government.

We propose that this site-specific determination should be based on the following criteria. The transfer of liability and stewardship should not occur until the O/O:

- is in full compliance with permits and laws governing the site and has made all required payments into the Fund;

- shows that the CO_2 at the site has become stable or—if it is migrating or may migrate—that any migration will not cross the geological sequestration unit boundary;[35] and

- shows that it has resolved all pending claims regarding its operation of the sequestration site.

Other requirements may be appropriate; we propose these as a starting point for discussion. In addition, if sequestration is in a saline aquifer, and the lead agency determines that the groundwater in the aquifer may potentially be needed for drinking water or agricultural uses in the future, the lead agency, in consultation with the Board, will have the authority to require that the O/O pay into the Fund a closure assessment to cover the cost of future restoration and/or take measures to restore the groundwater as an additional condition prior to transfer of responsibility.

(ii) Payment of damages after transfer of liability

After the transfer of liability, all damage awards are paid out of the CCS Trust Fund. Claims are made through the CCS Alternative Claims Resolution Process described in Section 5.

4. Violations and Enforcement

a. Lead agency enforcement authority

Our model statute incorporates several elements from RCRA and CERCLA that relate to violations and enforcement. For instance, the lead agency may issue compliance orders, with violators subject to civil penalties. Our proposed liability framework also allows the lead agency to suspend, modify, or withdraw a sequestration permit in the event of:

- leakage of captured CO_2 from or significant irregularities at the site;
- O/O failure to comply with laws, regulations, and/or permit conditions; or
- new information and/or changed circumstances in science and technology, as is currently the case under most federal environmental statutes.[36]

If a permit is withdrawn, the lead agency will determine whether to continue or halt CO_2 injections at the site. If the lead agency decides to allow or itself undertake continued CO_2 injections at the site, the lead agency will temporarily take over all legal obligations, monitoring and corrective measures, and preventive and remedial action at the site. In such a case, the lead agency will take action to recover any costs incurred from the former O/O of the site, including by drawing on the O/O's financial assurance mechanisms. If these mechanisms are insufficient, the lead agency may request reimbursement from the Fund.

b. Citizen suits

During the operational period, citizens may sue for an injunction in the event of an O/O's violation of a statute or sequestration permit, or in the event the relevant state or federal agency violates a statute. After the transfer of liability, citizens may sue for an injunction in the event the relevant state or federal agency violates a statute.

Figure 2 summarizes our recommendations regarding violations and enforcement.

Figure 2. Recommendation: Violations and Enforcement

Issue	*Recommendation*
Compliance orders; civil action	Lead agency has the power to issue compliance orders, with violators subject to civil penalties, or to bring a civil action against violators of any requirement[37]
Injunctive relief	Lead agency may seek injunctive relief against any person (including any past or present generator, capturer, compressor, or O/O of a sequestration site) upon evidence that the past or present actions may present an imminent and substantial endangerment to health or the environment[38]
Citizen suits	Available during the operational period (for injunction against the O/O or the relevant agency) and after transfer of liability (for injunction against the relevant agency)[39]
Access entry	– O/Os must provide the federal government access to any geological sequestration site upon request[40] – If a state has an authorized geological sequestration program, O/Os must also provide state representatives with access – DOE may inspect DOE-funded projects; DOI may inspect projects on federal land
Inspections	A team of EPA, DOE, and DOI personnel must inspect each geological sequestration facility at least every two years for the first 20 years after enactment of the statute[41]

5. CCS Alternative Claims Resolution Process

To encourage the deployment of CCS, Congress should create an alternative claims resolution mechanism and preempt certain state tort law "nuisance" claims relating to sequestration sites.[42] The creation of an alternative claims resolution process will benefit both site O/Os and injured individuals: it will provide the industry with predictable and limited liability, while injured individuals will benefit from a faster claims process with a lower standard of proof than traditional tort litigation. The fund to be created in the process will also be available to provide recourse for individuals who may be injured by sequestration sites decades in the future, when the current O/Os of CCS facilities may no longer exist.

The elements of an alternative claims resolution process are derived from several other state and federal programs.[43] For instance, state workers' compensation programs impose strict liability on employers for workplace injuries, in return limiting the compensation available to workers and eliminating workers' recourse to tort litigation. Claims are usually heard by an administrative law judge or panel. If a worker's claim is granted, he or she receives compensation for medical expenses and lost earnings, as well as scheduled damages for permanent disabilities.[44] States typically require employers to obtain workers' compensation insurance with an authorized insurance carrier or to be self-insured, either individually or as part of a group.[45]

The National Vaccine Injury Compensation Program offers another type of alternative to the traditional tort system for dealing with claims of vaccine-related injury. Rather than filing a lawsuit against a vaccine manufacturer or health care provider in the civil tort system, an individual claiming injury from vaccines must first file a petition for no-fault compensation with the U.S. Court of Federal Claims. Special masters conduct hearings to determine whether the claimant is entitled to compensation and, if so, how much. Certain injuries are presumed to be caused by the vaccine if they happen within a specific time period after receiving the vaccine. If the claimant rejects the special master's determination, the claimant may file a lawsuit. Claims are paid by a trust fund, which is funded by a $0.75 excise tax on each disease prevented in a dose of vaccine.[46] The program was intended to contribute to improving immunization rates, ensuring an adequate supply of vaccines, stabilizing vaccine costs, encouraging new and improved vaccines, and reducing the burden and uncertainty of litigation.[47]

a. Elements of the proposed CCS Alternative Claims Resolution Process

We propose a CCS Alternative Claims Resolution Process with the following elements:

- Claims are reviewed by a special master, appointed by a panel of the CCS Oversight Board.

- It is a no-fault system. A claimant must prove only that the injury occurred as a result of an incident at or relating to a sequestration site.

- Claimants may receive compensation for both economic and non-economic harms, as well as reasonable attorneys' fees, but no punitive damages.

- Payments to claimants are made out of the CCS Trust Fund, described in more detail in Section 6.

- State-law tort claims for trespass or nuisance resulting in damages of less than a certain dollar amount (exact amount to be determined) are preempted.[48]

- A federal cause of action is created for individuals injured by sequestration incidents. Claimants must first exhaust the administrative claims resolution process before they are permitted to file a court action.

b. Owner/operator may pursue an action for contribution

If an O/O is held liable for damages either by a three-member claims resolution panel of the CCS Oversight Board or by a court, the O/O may pursue an action for contribution against any generator, capturer, compressor, or transporter.

6. CCS Trust Fund

We propose a national CCS Trust Fund, financed primarily by annual fees and closure assessments paid by O/Os. The Fund will be used for a number of purposes during both the operational period and the post-closure period, including payment of damage claims in excess of applicable limits on liability, certain costs incurred by states or the federal government, establishment of federally-owned sequestration sites, closure and stewardship of abandoned CCS facilities, compensation for post-closure damages, and post-closure stewardship.

a. Federal fund v. state funds

A federal trust fund is appropriate to ensure that there will be sufficient resources to manage CCS sites over the hundreds of years that the sequestered CO_2 may pose a threat (however small) of escape.[49]

Some commentators favor state-level trust funds. For instance, the Interstate Oil and Gas Compact Commission ("IOGCC") suggests that states are best positioned to provide the necessary "cradle to grave" regulatory oversight of geologic sequestration based on states' experience with trust funds for abandoned and orphaned oil and gas wells.[50] However, the Fund that we propose will have several authorized uses beyond addressing abandoned and orphaned CCS sites, such as long-term post-closure stewardship of all CCS sites and emergency corrective action or remediation at operational sites. A federal fund will be better positioned to achieve the multiple goals envisioned for the Fund. A federal fund will also be better positioned to resolve issues regarding sites that cross state lines, whether by design or inadvertently.

At least six states have already created trust funds for CCS.[51] Two of these states, Montana and North Dakota, contemplate in their statutes that the federal government will eventually assume responsibility for long-term monitoring and management of closed sequestration sites.[52] Money that has been deposited into state funds could be transferred to the national Fund, with appropriate credits under the federal system given to O/Os who paid into the state systems.[53]

b. Financing the Fund

(i) Funding mechanisms will be similar to the Oil Spill Liability Trust Fund and the Superfund compensation trust fund under CERCLA

The Oil Spill Liability Trust Fund ("OSLTF") is funded by a per-barrel tax on petroleum produced in or imported to the U.S., while Superfund was initially funded by a tax on industry (a petroleum excise tax, a chemical feedstock tax, and a corporate environmental tax, all of which expired in 1995). Both funds are also financed through

cost recovery from responsible parties, interest on the fund principal, penalties, and, in the case of CERCLA, punitive damages.[54]

We propose similar funding mechanisms for the CCS Trust Fund:

- a fee assessed on each ton of CO_2 injected at a geological sequestration site;
- site-specific closure assessments paid as a condition of receiving a certificate of closure;
- cost recovery from responsible parties during the operational phase;
- penalties from enforcement actions; and
- interest on the fund principal.

We expect that any system regulating CO_2 sequestration will also require permit fees to accompany a sequestration permit application. We recommend that such permit application fees be paid directly to the lead agency, not into the Fund.

(ii) A per-ton fee need not produce a trust fund that is "too large"

Some commentators express concern that collecting fees for each ton of CO_2 injected at a sequestration site will produce a trust fund that is "too large," resulting in an inefficient use of resources and contributing to issues of moral hazard.[55] Indeed, there are examples of federal trust funds that have grown "too large," including the Vaccine Injury Compensation Fund and the Harbor Maintenance Fund.[56]

With respect to the CCS Trust Fund, this concern is misplaced because the trust fund will not be left to grow unchecked until the first sequestration sites enter the post-closure period several decades from now. Under our proposal, money in the Fund will be used for several important pre-closure purposes, including pre-closure claims (covering claims above a liability limit for demonstration projects), closure and stewardship of abandoned sites, corrective action in instances where a sequestration permit has been withdrawn, administrative costs, and establishment of federally-owned sequestration sites.

In addition, this analysis fails adequately to take into account the lack of data to predict the probability, frequency, and severity of future CO_2 leakage, and the financial consequences of such leakage, including unforeseen problems that may occur from interaction among sites as more and more sequestration sites are brought online.[57] This analysis also overlooks risks other than leakage of CO_2 (such as possible contamination of groundwater).

We therefore believe that a per-ton fee is appropriate. Our proposal also includes mechanisms to adjust the fee over time if necessary.[58] See section 7(f) of our model "CCS Liability Act of 2010" in Appendix A for proposed statutory language.

(iii) The fee should be assessed only on sequestered CO_2

Another possible model would be to assess a fee on a broader spectrum of entities that are responsible for CO_2 emissions, along the lines of the Oil Spill Liability Trust Fund. That fund is financed by a per-barrel tax on all oil imported into or produced in the U.S., not simply oil that travels on a vessel or is transported through a deepwater port. Similarly, the CCS Trust Fund might be financed through a fee on all major CO_2 emitters, including coal-fired power plants and industrial sources. However, such a system would be more complex and time-consuming to implement. Therefore, because one of the guiding principles of our work is that "speed is critical" in deploying commercial-scale CCS, we advocate assessing the fee only on sequestration site O/Os and not on all CO_2 emitters, at least until Congress makes a final decision about whether and how to set a price on CO_2 emissions.

c. Authorized uses of the Fund

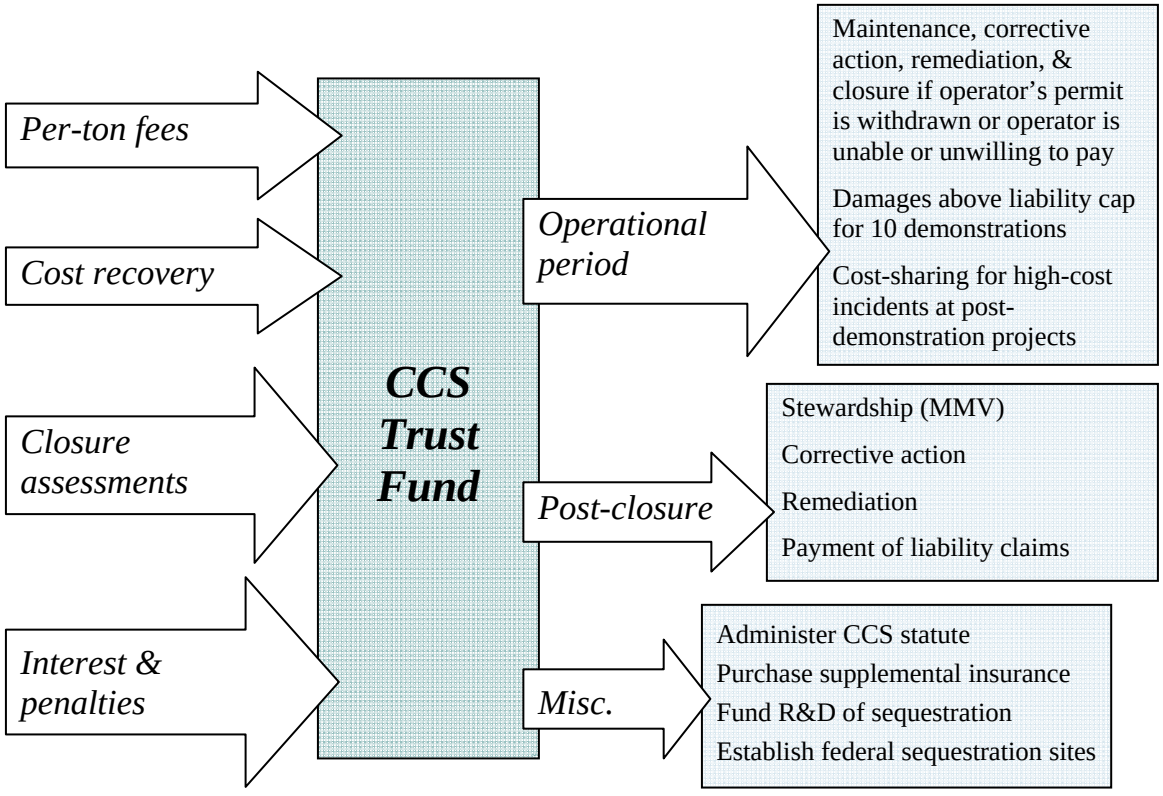
As touched upon above, we propose a variety of uses for the industry-financed CCS Trust Fund:

- During the operational period, the Fund may be drawn down as follows:
    - If the federal government withdraws an O/O's permit, the Fund may be used to maintain the site until the O/O can correct the problem or until site closure, with costs to be paid back by the O/O ("cost recovery").
    - In instances where the O/O is unable or unwilling to pay, the Fund may be used for site closure, corrective action, remediation, and long-term stewardship.
    - Emergency corrective action and remediation, to be carried out by state or federal agencies if necessary, with all costs and expenses to be reimbursed by the O/O.
    - Payment of a portion of claims for damages above the O/O's financial assurance limits, as described in Section 3.b above.
    - Payment of all claims for damages above liability limits for up to ten early, large demonstration projects, as described in Section 3.b above.
- During a site's post-closure period, the Fund will be available for:
    - stewardship;
    - corrective action;
    - remediation;
    - payment of liability claims; and
    - natural resource restoration (including groundwater remediation).

- The Fund will also be available for the following additional purposes:
    - administer the CCS statute;
    - purchase insurance for future sequestration site liability;
    - fund R&D of sequestration;
    - establish regional sequestration sites on federally-owned land, including acquiring adjacent private land through eminent domain if appropriate;
    - fund R&D of other technologies to reduce GHG emissions;[59] and
    - purchase and request cancellation of allowances under a federal cap-and-trade system.

Figure 3 depicts the proposed funding mechanisms for the CCS Trust Fund and the proposed uses of Fund monies.

Figure 3. Proposed funding and uses of the CCS Trust Fund



d. Setting fees

To accelerate the deployment of CCS, the initial per-ton sequestration fee should be set by statute, rather than through a potentially lengthy and litigated rulemaking process. However, since this fee may be too high or too low to provide the appropriate signals to CCS operators, the Board, in consultation with the federal government, should review and, as appropriate, adjust the per-ton fees every five years after operators begin paying such fees.[60] It will be important to ensure that the mechanism for periodic adjustment is strong and self-implementing. Experience with the Oil Spill Liability Trust Fund suggests that oversight of any periodic adjustments that are required by statute will be critical for ensuring that adjustments are made as provided for.[61]

Some propose that the per-ton sequestration fee be a "risk-adjusted" fee, such that the O/O pays a fee that imputes the expected and/or maximum probable loss value that may arise from that particular site, or pool of sites.[62] We believe that a site-based "risk-adjusted" fee is too administratively complex to implement and is unlikely to arrive at the "right" fee, given the dearth of data on long-term risks and predictions that risks at sequestration sites are expected to be low-frequency events. However, varying fees based on differing regional or geological characteristics would be appropriate. Different geology functions differently and geologic formations vary in different parts of the country. A system to manage the risks and liabilities of CCS should take this variation into account. We therefore recommend a fee, or schedule of fees, set by statute. Such a schedule could establish different fees for different regions or types of geologic formations with provisions for periodic adjustments. While some argue that a site-specific risk-based per-ton fee is essential to provide an incentive for site O/Os to choose the best sequestration sites, we believe that our proposal contains sufficient incentives to ensure that O/Os choose the best sites. Namely, the O/O is liable for all damages at the site during the operational period (when risks are expected to be the highest), with caps only for the first few demonstration projects and limited cost-sharing for post-demonstration projects. Any added incentive provided by a risk-based per-ton fee for a particular site is outweighed by the administrative complexity of such an option, which would be likely to trigger regulatory, legal, and policy disputes, adding unnecessary cost, delay, and likely cancellation of projects. Rather than attempting to grade sequestration sites based on relative levels of risk, we should instead rely on a strong permitting system that only issues permits to those sites that meet a high threshold level of safety and should consider options for establishing appropriate fees for different regions or types of geological formations.

We also note that industry stakeholders raise concerns that use of "risk-adjusted" fees could subject them to additional liability since a court might look at the assessment of a higher fee as an indication that the owner/operator chose a risky site.[63] These concerns regarding the assumption of additional liability as a result of labeling these fees "risk-

adjusted" could be dealt with semantically. For example, fees might be referred to as "geology-based."

The proposed statutory language[64] gives the Board flexibility to consider policy goals when adjusting the per-ton sequestration fees. For instance, if future data on the specific risks of sequestration in various geological formations indicate that some formations are inherently riskier than others, the Board may provide an incentive for the selection of certain formations through the per-ton fee system. The Board may also use a fee system based on other criteria, such as whether the site will demonstrate new capture or sequestration technologies, whether the captured CO_2 is from a retrofitted power plant or from a new-build source, or whether the sequestration takes place on publicly-owned land. The Board may create such a tiered fee system only if the Board determines that it will best advance knowledge regarding CCS and/or will best further the environmental interests of the country, and the Board will be otherwise limited in how much the fees may be raised or lowered. In no case will the Board be able to relieve an operator from per-ton fees altogether; each operator must pay some non-zero amount for each ton of CO_2 injected.

(i) Per-ton sequestration fees

We propose an initial annual per-ton sequestration fee of $0.50 per ton for CO_2.[65]

(ii) Closure assessment

The amount of the closure assessment will be determined by the lead federal agency (EPA, DOE, or DOI) in consultation with the Board on a site-by-site basis and should be calculated to cover 30 years of post-closure stewardship.[66] The closure assessment will be the appropriate time to take into account site risk, after decades of data on the site are available for review. For instance, a closure assessment for sequestration in saline aquifers, or another geological storage unit where groundwater may be affected, should include additional amounts to remediate groundwater in the future should such remediation become necessary. For a site that can demonstrate an exemplary safety record during its operational period, a smaller closure assessment may be assessed.

Some have expressed concern that a site-specific closure assessment will add too much uncertainty to a sequestration project.[67] We believe this added uncertainty is manageable.[68] In addition, for sites that have been screened and selected carefully and maintained properly, the closure assessment should be minimal (therefore providing an incentive for appropriate site selection). For sites that have not been chosen carefully or maintained properly, the closure assessment may be larger. The alternative to a site-specific closure assessment is performance-based closure requirements which require that all risk has been addressed before a closure certificate may be issued. This, too, adds uncertainty at the end of a project. We believe some amount of uncertainty is an unavoidable consequence of a system whereby liability transfers to the government at

some point, and the system must ensure that all known risks and problems are addressed prior to transfer.

e. Minimum and maximum balances of the Fund

We propose an initial minimum balance for the Fund of $50 million.[69] The Fund may borrow from the U.S. Treasury to meet this minimum.[70] Once 100 million tons of CO_2 have been sequestered pursuant to the new statute,[71] the minimum balance will increase by $50 million during the sequestration of the next 100 million tons. These automatic increases will continue, with the required minimum Fund balance increasing by $50 million for each additional 100 million tons of sequestered CO_2. As more information on the risks of CCS becomes available, the Board, in consultation with the relevant federal agencies, can override this automatic increase mechanism and authorize increases or decreases in the minimum fund balance.

An overall maximum balance for the Fund may be appropriate in the future. However, until more data become available on the extent and frequency of the actual long-term risks of geological sequestration, the Fund balance should not be capped and the collection of fees should not be suspended. Instead of capping the Fund at this time, before the risks of sequestration are better understood, the Board should have discretion to direct money in the Fund to purposes such as purchase of insurance and other financial assurance to address potential liability for sequestration sites operated on federal property, sites as to which the owner/ operator fails financially, and/or the purchase and subsequent cancellation of allowances under a future greenhouse gas cap-and-trade system.[72]

Figure 4 depicts how a Fund structured under our proposal may grow, based only on the deposit of per-ton sequestration fees, through 2020. This figure uses President Obama's goal of having 5 to 10 commercial demonstration projects online by 2016, as well as projections made in the International Energy Agency's ("IEA") report "Technology Roadmap: Carbon Capture and Storage." The IEA's report suggests that 29 CCS projects, sequestering over 4 million tons of captured CO_2 per year, will need to be deployed in North America by the year 2020 in order to meet the goal of reaching a 50% reduction (from 2005 levels) in greenhouse gas emissions by 2050.[73]

Figure 4 is clearly simplified, in that it accounts only for per-ton fees, does not account for any expenditures from the Fund, and does not account for interest earned on amounts deposited into the Fund. However, it does provide some rough perspective on what a CCS Trust Fund might look like over the next several years under our proposal.

Figure 4. Rough depiction of the amount of per-ton sequestration fees that may be deposited into Fund, not accounting for interest accrued or expenditures from the Fund.

Year	Number of projects*	CO_2 sequestered per project (million metric tons)*	Total CO_2 sequestered/ year (million metric tons)*	Per-ton sequestration fee	Per-ton fees deposited (millions)
2015	3	2	6	$0.50	$3.0
*2016***	8	2	16	$0.50	$8.0
2017	12	3	36	$0.50	$18.0
2018	16	4.2	67	$0.50	$33.6
2019	22	4.2	92	$0.50	$46.2
2020	29	4.2	121	$0.50	$60.9
	Cumulative total as of 2020		**339*****		**$169.7**

* The total number of CCS projects by 2020 (29) and the total CO_2 sequestered per year (121 million metric tons per year by 2020) are from the IEA Blue Map scenario for North America.[74] The number of CCS projects and amount of CO_2 sequestered per project in prior years are estimates.

** The estimated number of projects operational by 2016 is consistent with President Obama's goal of bringing 5 to 10 demonstration projects online by 2016.[75]

*** Discrepancy in cumulative total is due to rounding.

7. Conclusion

There are various types of risks associated with CCS, including unanticipated migration of sequestered CO_2, contamination of water supplies (shallow and deep), displacement of water supplies, seismic activity, and leaks of CO_2 to the atmosphere. Until large-scale CCS projects have operated for decades and been closed for decades, no one can predict with certainty whether any of these risks will materialize. The purpose of a legal system is to anticipate, allocate, and manage risks—whether remote or likely. Our recommendations address these risks through a liability arrangement that makes CCS projects viable in the near term and for the long term, while making adequate provision to protect public health, safety and the environment. Our proposal provides certainty and transparency for businesses and others affected by CCS projects.

ENDNOTES

1 WENDY B. JACOBS, LEAH COHEN, LARA KOSTAKIDIS-LIANOS AND SARA RUNDELL, PROPOSED ROADMAP FOR OVERCOMING LEGAL AND FINANCIAL OBSTACLES TO CARBON CAPTURE AND SEQUESTRATION (2009) [hereinafter "ROADMAP"]. The Emmett Environmental Law and Policy Clinic also submitted comments with respect to EPA's Proposed Rule for Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO2) Geologic Sequestration (GS) Wells.

[2] *See, e.g.*, ROADMAP, *supra* note **Error! Bookmark not defined.**; GLOBAL CCS INSTITUTE, STRATEGIC ANALYSIS OF THE GLOBAL STATUS OF CARBON CAPTURE AND STORAGE – REPORT 5: SYNTHESIS REPORT 30 (2009) [hereinafter SYNTHESIS REPORT]; INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: MITIGATION OF CLIMATE CHANGE 19 (2007).

[3] These states are Illinois, Kansas, Louisiana, Montana, North Dakota, Texas, Washington, and Wyoming.

[4] *See, e.g.*, SYNTHESIS REPORT, *supra* note 2, at 5; INTERNATIONAL ENERGY AGENCY ("IEA"), TECHNOLOGY ROADMAP: CARBON CAPTURE AND STORAGE (2009); Carbon Sequestration Leadership Forum, About the CSLF, http://www.cslforum.org/aboutus/index.html?cid=nav_about (last visited Nov. 4, 2010); CO_2 Capture Project, What is the CO_2 Capture Project? http://www.co2captureproject.org/aboutus.html (last visited Nov. 4, 2010).

[5] For the rolling 12 months ending in January 2010, coal accounted for 1.8 billion MW hours of electricity generation in the U.S., out of about 4 billion MW hours in total. U.S. Energy Information Administration, Net Generation by Energy Source: Total (All Sectors), Table 1.1, http://www.eia.doe.gov/cneaf/electricity/epm/table1_1.html (last visited Apr. 23, 2010).

[6] *See, e.g.*, U.S. Department of Energy, Enhanced oil recovery/CO2 injection, http://fossil.energy.gov/programs/oilgas/eor/ (last visited Nov. 4, 2010).

[7] IEA, *supra* note 4, Figure 4, at 14.

[8] One study of the DOE Regional Carbon Sequestration Partnerships Program found that issues surrounding long-term liability have created significant barriers to deployment of CCS projects, leading to delays and in one case cancellation of a project. CRAIG A. HART, ADVANCING CARBON SEQUESTRATION RESEARCH IN AN UNCERTAIN LEGAL AND

REGULATORY ENVIRONMENT: A STUDY OF PHASE II OF THE DOE REGIONAL CARBON SEQUESTRATION PARTNERSHIPS PROGRAM (2009).

[9] *See, e.g.*, Sarah M. Forbes et al., *WRI CCS Guidelines and Emerging Geologic Sequestration Regulations: A Comparative Assessment*, 1 ENERGY PROCEDIA 1759, 1761 (2009) (noting that the term "post-closure" is used three different ways in the three CCS frameworks compared); *see also* Chiara Trabucchi, Michael Donlan & Sarah Wade, *A Multi-disciplinary Framework to Monetize Financial Consequences Arising from CCS Projects and Motivate Effective Financial Responsibility*, 4 INT'L J. GREENHOUSE GAS CONTROL 388 (2010), ("The term 'liability' has been poorly defined in the context of CCS projects, and often is used as a catch-all category.").

[10] This definition is adapted from the European Union directive on the geological storage of carbon dioxide. *See* Council Directive 2009/31/EC, 2009 O.J. (L 140/120) art. 3(17).

[11] *See, e.g.*, ELIZABETH J. WILSON ET AL., WRI, LIABILITY AND FINANCIAL RESPONSIBILITY FRAMEWORKS FOR CARBON CAPTURE AND SEQUESTRATION (2007); CCSREG PROJECT, CARBON CAPTURE AND SEQUESTRATION: FRAMING THE ISSUES FOR REGULATION (2009); TASK FORCE ON CARBON CAPTURE AND STORAGE, INTERSTATE OIL AND GAS COMPACT COMMISSION ("IOGCC"), STORAGE OF CARBON DIOXIDE IN GEOLOGIC STRUCTURES: A LEGAL AND REGULATORY GUIDE FOR STATES AND PROVINCES (2007); Alexandra B. Klass & Elizabeth J. Wilson, *Climate Change and Carbon Sequestration: Assessing a Liability Regime for Long-term Storage of Carbon Dioxide*, 58 EMORY L.J. 103 (2008); Victor B. Flatt, *Paving the Legal Path for Carbon Sequestration from Coal*, 19 DUKE ENVTL. L. & POL'Y F. 212 (2009); THE PROGRAM TO FACILITATE INTERAGENCY ENVIRONMENTAL COOPERATION, UNIV. OF HOUSTON LAW CTR., WHITE PAPER IN SUPPORT OF PROPOSED CARBON GEOLOGIC SEQUESTRATION LEGISLATION, http://www.law.uh.edu/eenrcenter/documents/CCSwhitepaper.pdf (last visited Nov. 4, 2010) [hereinafter UNIV. OF HOUSTON LAW CTR.].

[12] Other proposals for an oversight board include Chiara Trabucchi & Lindene Patton, *Storing Carbon: Options for Liability Risk Management, Financial Responsibility*, BUREAU OF NATIONAL AFFAIRS, NATIONAL ENVIRONMENT DAILY (2008); UNIV. OF HOUSTON LAW CTR., *supra* note 11; Klass & Wilson, *supra* note 11.

[13] We expect that these minimum requirements will include both instruments that cover *liability*, such as insurance (insurance coverage and premiums are based on an assessment of risk) and/or sureties (surety bond premiums are issued based on credit principles), as well as instruments that cover *activities*, such as performance bonds to cover well plugging and site closure.

[14] U.S. Environmental Protection Agency, Using the Class V Experimental Technology Well Classification for Pilot Geologic Sequestration Projects – UIC Program Guidance (UICPG #83), March 1, 2007 at 3.

[15] Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO_2) Geologic Sequestration Wells," 73 Fed. Reg. 43492 (proposed July 25, 2008) (to be codified at 40 C.F.R. pts. 144 and 146) [hereinafter, "Proposed Class VI UIC Requirements"].

[16] Other commentators disagree. For instance, CCSReg Project advocates for modifying and supplementing the UIC rules, rather than new, freestanding geological sequestration legislation. CCSREG PROJECT, POLICY BRIEF: COMPREHENSIVE REGULATION OF GEOLOGIC SEQUESTRATION (2009).

[17] 40 C.F.R. §144.3 provides: "[U]SDW means an aquifer or its portion:

(a)(1) Which supplies any public water system; or

(2) Which contains a sufficient quantity of ground water to supply a public water system; and

(i) Currently supplies drinking water for human consumption; or

(ii) Contains fewer than 10,000 mg/L total dissolved solids; and

(b) Which is not an exempted aquifer."

[18] Thus, the definition of "USDW" also excludes any aquifer that contains fewer than 10,000 mg/L total dissolved solids but does not contain "a sufficient quantity of groundwater to supply a public water system." *Id.* This would exclude from protection aquifers and wells that would not be sufficient to supply public water systems but that are used for smaller, private systems. "The term 'public water system' means a system for the provision to the public of piped water for human consumption, if such system has at least fifteen service connections or regularly serves at least twenty-five individuals." 42 U.S.C. § 300F(4).

[19] *See, e.g.,* Proposed Class VI UIC Requirements, *supra* note 15, 73 Fed. Reg. at 43496-43497 (stating that the "proposal applies to injection wells in the U.S. including those in State territorial waters," but that "[w]ells up to three miles offshore may be subject to other authorities or may require approval under other authorities such as the Marine Protection, Research, and Sanctuaries Act (MPRSA)…").

[20] *See, e.g.*, WORLD RESOURCES INSTITUTE, CCS GUIDELINES (2008); CCSREG PROJECT, *supra* note 11; UNIV. OF HOUSTON LAW CTR., *supra* note 11.

[21] Comments of Harvard Environmental Law and Policy Clinic to EPA regarding EPA's proposed regulations for Class VI UIC wells, at 36-37.

[22] Other than the regimes enacted by Illinois and Texas during competition for FutureGen, all other jurisdictions we reviewed require the operator to remain liable during the

operational period. With respect to FutureGen, Illinois promised to procure an insurance policy, at the state's expense, to insure the FutureGen operator against any losses stemming from civil liability resulting from the storage, escape, release, or migration of sequestered CO_2, with the exception of any liability arising out of the pre-injection activity of the operator. The state also promised to indemnify the FutureGen operator from any losses stemming from such an action, to the extent the loss is not covered under such an insurance policy. 2007 Ill. Laws 18, § 25. Texas had agreed to acquire title to the CO_2 captured by the proposed FutureGen project, relieving the operator of liability for the captured CO_2 during the injection and post-injection periods. TEX. NAT. RES. CODE ANN. §§ 119.001-119.004 (2009).

[23] An alternative approach to limiting liability for demonstration projects is set forth in proposed Senate bill S. 1013, as introduced by Sen. Bingaman on May 7, 2009, at § 2. Under this proposed legislation, the Secretary of Energy would have the authority to indemnify the operator of a demonstration project (up to 10 such demonstration projects would be allowed) to demonstrate large-scale (> 1MtCO_2/year) sequestration projects involving CO_2 captured from industrial sources.

[24] In the Roadmap, we suggested various incentives for such demonstration projects, including tailoring existing federal grants, tax credits, loan guarantees, and tax-exempt bonds to better target the immediate needs of sequestration projects, and providing amnesty to a select number of strategically located (geologically and geographically) existing coal-fired power plants that may be out of compliance with the Clean Air Act in exchange for commitments to retrofit plants for capture and sequestration. ROADMAP, *supra* note **Error! Bookmark not defined.**, at 3. We continue to support these proposals.

[25] This structure is similar to that of the Oil Pollution Act, which provides for a tax on every barrel of petroleum produced in or imported into the U.S. These taxes are placed into a fund, the Oil Spill Liability Trust Fund, which is used in part to pay damage claims that exceed the liability caps established by statute. The oil spill in the Gulf, and the adequacy or inadequacy of the Oil Spill Liability Trust Fund in addressing liability from that spill, may prove instructive in structuring a CCS Trust Fund.

[26] Wyoming's Carbon Sequestration Working Group has estimated that the financial assurance requirement for a project injecting two to four million tons of CO_2 per year, over 30 years, should be about $77 million. Their recommended ranges for a mid-sized operation through post-closure are estimated at: $40-50 million for bonding, and $25-45 million for insurance. REPORT AND RECOMMENDATIONS OF THE CARBON SEQUESTRATION WORKING GROUP TO THE JOINT MINERALS, BUSINESS AND ECONOMIC DEVELOPMENT COMMITTEE AND THE JOINT JUDICIAL COMMITTEE OF THE WYOMING STATE LEGISLATURE (2009) [hereinafter "WYO. CARBON SEQUESTRATION WORKING GROUP"].

[27] *Id.*

[28] ROADMAP, *supra* note **Error! Bookmark not defined.**, at 18-19.

[29] These reporting requirements are adopted from the European Union's sequestration framework. *See* Council Directive 2009/31/EC, 2009 O.J. (L 140/124) art. 14.

[30] For further discussion, *see* WORLD RESOURCES INSTITUTE, *supra* note 20, at 104; Trabucchi & Patton, *supra* note 12, at III.A.; IOGCC, *supra* note 11, at 11; and INTERNATIONAL RISK GOVERNANCE COUNCIL, POLICY BRIEF: REGULATION OF CARBON CAPTURE AND STORAGE 7 (2008).

[31] LA. REV. STAT. ANN. § 30:1109(A)(1) (2010); MONT. CODE ANN., § 82-11-183 (effective on the date that Montana's board of oil and gas conservation is granted primacy to administer activities at carbon dioxide sequestration wells by the U.S. EPA) ("monitoring and managing the geologic storage reservoir and the stored carbon dioxide is the state's responsibility to be overseen by the board until the federal government assumes responsibility for the long-term monitoring and management of geologic storage reservoirs and stored carbon dioxide"); N.D. CENT. CODE § 38-22-17 (2010) ("Monitoring and managing the storage facility is the state's responsibility to be overseen by the commission until such time as the federal government assumes responsibility for the long-term monitoring and management of storage facilities."); TEX. HEALTH & SAFETY CODE § 382.508 (2009).

[32] Council Directive 2009/31/EC, 2009 O.J. (L 140/125) art. 18; Offshore Petroleum and Gas Storage Act 2006, ch. 3, pt. 3.4, div. 8, secs. 400-401 (Austl.).

[33] WYO. STAT. ANN. § 35-11-318(d) (explaining that the existence of a state fund to pay for long-term stewardship does not "constitute an assumption of any liability by the state for geologic sequestration sites or the carbon dioxide and associated constituents injected into those sites"); WASH. ADMIN. CODE § 173-407-100 et seq. (2010); Proposed Class VI UIC Requirements, *supra* note 15. Wyoming's Carbon Sequestration Working Group believes that a federal model to address the long-term stewardship phase risk is "necessary and appropriate" because CO2 emissions are not bound by state lines and the storage of CO2 is in the public interest. The Working Group found that a privately funded, publicly managed Wyoming Trust Fund might be considered, but only on the condition that a federal trust fund is also created to assume liability in the long-term stewardship period. WYO. CARBON SEQUESTRATION WORKING GROUP, *supra* note 26.

[34] LA. REV. STAT. ANN. § 30:1109(A)(1) (2010); N.D. CENT. CODE § 38-22-17(6)(e) (2010); Offshore Petroleum and Gas Storage Act 2006, ch. 3, pt. 3.4, div. 8, sec. 399 (Austl.); Council Directive 2009/31/EC, 2009 O.J. (L 140) art. 18; MONT. CODE ANN., § 82-11-183 (effective on the date that Montana's board of oil and gas conservation is granted primacy to administer activities at carbon dioxide sequestration wells by the U.S. EPA). For further discussion of this issue, *see* Forbes et al., *supra* note 9, at 1766 ("The requirements for post-

closure and responsibility for sites over the long term is an area that all three frameworks [WRI, EU, and EPA] in some ways fall short.").

[35] We recognize that the scientific community has to provide content for concepts, such as when CO_2 at the sequestration site has become stable.

[36] This model is based on the EU Directive. Council Directive 2009/31/EC, 2009 O.J. (L 140/122) art. 11.

[37] For comparison, *see* RCRA, 42 U.S.C. § 6928(a).

[38] For comparison, *see id.* § 6973.

[39] For comparison, *see id.* § 6972.

[40] For comparison, *see id.* § 6927(a).

[41] For comparison, *see id.* § 6927.

[42] A somewhat similar proposal with respect to the long-term stewardship phase only has been made by CCSREG PROJECT, POLICY BRIEF: COMPENSATION, LIABILITY AND LONG-TERM STEWARDSHIP FOR CCS (2009).

[43] One question to consider is whether a streamlined claims process should be reserved for claims made by an individual, while multi-plaintiff claims would be better dealt with through the standard litigation channels.

[44] *See generally* Martin Minkowitz, *Introduction to the Workers' Compensation Law,* 460 PLI/Lit 7 (1993).

[45] *See, e.g.*, N.Y. State Workers' Compensation Bd., Understanding Workers' Compensation Insurance, http://www.wcb.state.ny.us/content/main/Employers/understandInsurance.jsp (last visited Nov. 4, 2010); Cal. Dep't of Indus. Relations, Div. of Workers' Compensation, Employer Information, http://www.dir.ca.gov/dwc/Employer.htm (last visited Nov. 4, 2010).

[46] *See* Appendix E for more details.

[47] *See* U.S. Dep't of Health and Human Services, Health Resources and Services Admin., National Vaccine Injury Compensation Program (VICP): About VICP, http://www.hrsa.gov/vaccinecompensation/ (last visited Nov. 4, 2010); Recommendations of the Administrative Conference Regarding Administrative Practice and Procedure, 56 Fed. Reg. 33,850 (July 24, 1991).

[48] As with the other proposals in this white paper that include specific dollar amounts, we suggest specific amounts for purposes of encouraging discussion. We do not profess that this dollar amount is necessarily the "correct" amount.

[49] CCSREG PROJECT, *supra* note 11, Chapter 7, also notes that a federal stewardship fund provides greater resources and enhanced risk-spreading than state-level stewardship funds. The authors of this report also note that a national fund, funded by CCS site operators, is a better mechanism to handle contingencies than a post hoc federal bailout, covered by all taxpayers.

[50] IOGCC, *supra* note 11, at 11.

[51] These states are Kansas, Louisiana, Montana, North Dakota, Texas, and Wyoming. *See* Appendix C for more information on these trust funds.

[52] N.D. CENT. CODE § 38-22-17(6)(e) (2010); MONT. CODE ANN. § 82-11-183(8)(e) (effective on the date that Montana's board of oil and gas conservation is granted primacy to administer activities at carbon dioxide sequestration wells by the U.S. EPA).

[53] Another option would be to reimburse the O/Os for the money they have paid into state-operated funds.

[54] *See* 26 U.S.C. § 9509; National Pollution Funds Center, The Oil Spill Liability Trust Fund (OSLTF), http://www.uscg.mil/npfc/About_NPFC/osltf.asp (last visited Nov. 4, 2010); U.S. GENERAL ACCOUNTING OFFICE, SUPERFUND PROGRAM: CURRENT STATUS AND FUTURE FISCAL CHALLENGES (2003).

[55] *See, e.g.*, James J. Dooley, Chiara Trabucchi & Lindene Patton, *Design Considerations for Financing a National Trust to Advance the Deployment of Geologic CO_2 Storage and Motivate Best Practices*, 4 INT'L J. GREENHOUSE GAS CONTROL 381 (2009) ("Establishing a blanket, fixed fee to be paid by all CO_2 storage operators regardless of their individual site characteristics, operational methods and potential for consequences not only contributes to issues of moral hazard, but results in an opportunity cost of capital that otherwise could be invested for productive economic purposes.").

[56] For example, the Vaccine Injury Compensation Fund has historically received more in vaccine excise taxes than it has paid out in claims and related administrative costs, and the fund balance was approximately $2.9 billion in 2009. Executive Office of the President, Balances of Budget Authority, Budget of the U.S. Government, Fiscal Year 2011, Table 9, http://www.gpo.gov/fdsys/pkg/BUDGET-2011-BALANCES/pdf/BUDGET-2011-BALANCES.pdf (last visited Nov. 4, 2010). Likewise, the Harbor Maintenance Fund has also been allowed to grow out of alignment with the corresponding services, resulting in a large and growing surplus in the fund. U.S. GOV'T ACCOUNTABILITY OFFICE, FEDERAL

USER FEES: SUBSTANTIVE REVIEWS NEEDED TO ALIGN PORT-RELATED FEES WITH THE PROGRAMS THEY SUPPORT 24 (2008).

[57] The oil spill in the Gulf of Mexico may provide an important lesson not to underestimate environmental risks in cases where we have a lack of adequate data on actual risks.

[58] Another mechanism to keep the size of the Fund in check would be a reimbursement system to O/Os that have paid per-ton fees into the Fund, in the event that experience with the Fund demonstrates that the fees are inappropriately high in comparison with the expenditures from the Fund.

[59] We note that some commentators at the June 21, 2010 Expert Workshop Addressing CCS Liability, Oversight, and Trust Fund Issues disagreed with the idea of using trust funds to establish sequestration sites on public lands and to fund R&D of other technologies to reduce GHG emissions.

[60] Proposed U.S. Senate bill S. 1502 also allows for such adjustments, based on the number and estimated value of claims against the Fund, the likelihood or risk of an incident resulting in liability, the estimated quantity of CO_2 to be injected into geological storage units by all storage facilities, and the impact on the commercial and economic viability of CO_2 storage facilities.

[61] The statute creating the OSLTF requires that adjustments to the liability limits in the statute be adjusted every three years to reflect significant increases in the consumer price index. However, a Government Accountability Office report found that no such adjustments were made between 1990 and 2006, even though the consumer price index rose approximately 54 percent during this time. U.S. GOV'T ACCOUNTABILITY OFFICE, MARITIME TRANSPORTATION: MAJOR OIL SPILLS OCCUR INFREQUENTLY, BUT RISKS TO THE FEDERAL OIL SPILL FUND REMAIN 32 (2007).

[62] Dooley et al., *supra* note 55.

[63] Views expressed during the June 21, 2010 Expert Workshop Addressing CCS Liability, Oversight, and Trust Fund Issues.

[64] *See* section 7(f) of our model "CCS Liability Act of 2010" in Appendix A for proposed statutory language.

[65] Other per-ton fees have been assessed by Louisiana, which sets a per-ton fee such that the O/O pays $5 million into the state fund over ten years (LA. REV. STAT. ANN. § 30:1110(C) (2010)) and Kansas, which charges the O/O a quarterly fee of 5 cents per ton of CO_2 injected (KAN. ADMIN. REGS. § 82–3-1119 (2010)).

[66] The EU framework assesses a closure fee equal to 30 years of monitoring at the site. Council Directive 2009/31/EC, 2009 O.J. (L 140/126) art. 20. Note that the EU system does not appear to impose a per-ton fee in addition to the closure assessment.

[67] View expressed during the June 21, 2010 Expert Workshop Addressing CCS Liability, Oversight, and Trust Fund Issues.

[68] Corporate SEC filings, such as SEC form 10-K, routinely acknowledge that costs may change as the law evolves and/or as circumstances change.

[69] As with the other specific dollar amounts and other specific numbers in this paper, we include specific numbers not because we believe these numbers to be correct but in order to spark discussion regarding what the correct numbers should be.

[70] The authorizing legislation for the Oil Spill Liability Trust Fund allowed that trust fund to borrow up to $1 billion from Treasury during the first several years of the program. 26 U.S.C. § 9509(d) (2010). The National Flood Insurance program also allows borrowing by the fund from the U.S. Treasury. 42 U.S.C. § 4016 (2010).

[71] This might occur when, as a simplified example, eleven sites have been sequestering approximately 1.5 million tons CO_2/year for six years.

[72] Similarly, Louisiana allows money from the state fund to be used for research and development in connection with carbon sequestration technology and methods. LA. REV. STAT. ANN. § 30:1110(F).

[73] The International Energy Agency's "Technology Roadmap" for CCS provides one set of estimates of how much CO_2 needs to be sequestered over time. *See* IEA, *supra* note 4, Figures 8 and 10. This roadmap suggests that, by 2020, North America will need to have 29 operational CCS projects (17 in the power sector, and 12 in industry and upstream), sequestering 121 $MtCO_2$/year (77 $MtCO_2$/year in the power sector, and 44 $MtCO_2$/year in industry and upstream). This suggests that each of the 29 projects will sequester, on average, more than 4 $MtCO_2$/year.

[74] *See* IEA, *supra* note 4, Figures 8 and 10.

[75] *See* A Comprehensive Federal Strategy on Carbon Capture and Storage, 75 Fed. Reg. 6,087, 6,087-88 (Feb. 5, 2010).