SUMMARY AND DISCUSSION OF CURRENT REGULATORY FRAMEWORK

Capture and Separation

Numerous U.S. federal and state regulations deal with emissions from industrial and energy plants. None of these regulations classifies CO_2 as a pollutant; there are no regulations governing CO_2 emissions into the atmosphere. While the United States has not yet promulgated any regulations addressing CO_2 emissions, its Global Climate Change Initiative aims to reduce greenhouse gas intensity by 18% by 2012 by means of voluntary industry efforts.

CO_2 is not regulated, studied, nor suspected as a toxic substance by the following federal agencies or regulations:

- Clean Air Act, 1970, 1990.
- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), 1972.
- Resource Conservation and Recovery Act (RCRA), 1976.
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund), 1980.
- Superfund Amendments and Reauthorization Act (SARA) 1986,
- National Toxicology Program, U.S. Department of Health and Human Services.
- Agency for Toxic Substances and Disease Registry (ATSDR), U.S. Department of Health and Human Services.
- National Institute of Occupational Safety and Health (NIOSH) within the Centers for Disease Control and Prevention (CDC).
- National Institute of Environmental Health Sciences in the National Institutes of Health
- National Center for Toxicological Research (NCTR) in the FDA.

Surface risks of CO_2 exposure are typically handled by state environmental health and safety regulatory agencies. The U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) has specified the maximum allowable average exposure to CO_2 in an 8-hour workday at 0.5% (5000 ppm). Most industrial and safety regulations for CO_2 focus on engineering controls and specifications for transportation, storage containers, and pipelines.

In Canada, CO_2 capture activities are regulated through specific codes of conduct related to the movement and transportation of CO_2. These regulations are considered adequate for a newly emergent CO_2 capture industry; however, they may require further evaluation in relation to the unique properties of CO_2, long-term exposure to materials, and the high volume of CO_2 processed for storage activities.

Current laws, guidelines, and standards for human and environmental health have been developed in the context of short-term exposure to relatively small volumes of CO_2. Review of these guidelines is necessary to ensure safe operations in the context of both longer-term environmental exposure and specific occupational health and safety requirements associated with exposure to higher concentrations of CO_2.

CO_2 Transport

PIPELINE TRANSMISSION

The U.S. Department of Transportation Office (DOT) of Pipeline Safety (OPS) regulates the pipeline movement of CO_2 under Title 49 of the Code of Federal Regulations Part 195 (49 CFR 195). Permitting for pipeline construction falls under numerous jurisdictions and varies by state. Existing CO_2 pipelines are privately owned and therefore access for CO_2 transport is currently unregulated. When CO_2 is transported by rail, road, or ship, other rules, regulations, and agencies have authority and, in some cases, there would be overlapping jurisdiction.

The federal pipeline safety regulations: 1) ensure safety in design, construction, inspection, testing, operation, and maintenance of natural gas and hazardous liquid pipeline facilities and in the sitting, construction, operation, and maintenance of liquefied natural gas (LNG) facilities; 2) set out parameters for administering the pipeline safety program; 3) require pipeline operators to implement and maintain antidrug and alcohol misuse prevention programs for employees who perform safety-sensitive functions; and 4) delineate requirements for onshore oil pipeline response plans. The regulations are written as minimum performance standards, setting the level of safety to be attained while allowing the pipeline operators discretion in achieving that level. (DOT, 2004).

Canada's National Energy Board, by means of the Onshore Pipelines Regulations, regulates onshore pipeline transmission of CO_2 across provincial or international boundaries. These regulations set out technical and safety requirements for all aspects of a pipeline's life cycle. Any incidents concerning pipelines are reported to the Canadian Transportation Safety Board.

PIPELINE CONSTRUCTION PERMITTING

Permitting for construction of CO_2 pipelines falls under various jurisdictions and numerous permits may be required.

In most cases, a pipeline route application is submitted to the permitting authority. Various aspects of the proposed pipeline construction must be addressed in the application. These aspects include, but are not limited to, right-of-way and easements and potential cultural, human health, environmental, and ecological impacts. Crossing various waterbodies and wetlands, federal lands, tribal lands, roadways, and railroads may, and often does, require permits from state, provincial, and local agencies.

Existing rules and practices for CO_2 transport appear to be adequate for CO_2 capture and storage projects. The transportation of dense-phase CO_2 has been practiced for at least 30 years and now is incorporated into steel pipeline standards. Further development of the standards may be required to accommodate higher volumes of CO_2 and potential implications of pipeline leaks.

Underground Injection

UNITED STATES SAFE DRINKING WATER ACT (SWDA) UNDERGROUND INJECTION CONTROL (UIC) PROGRAM

Underground fluid injection is currently regulated by the U.S. Environmental Protection Agency (EPA) under the Safe Drinking Water Act (SDWA) Underground Injection Control (UIC) Program, established to protect current and future underground sources of drinking water (USDWs) from contamination. Under the UIC Program, minimum federal standards were established for five distinct classes of injection wells (Table 1) (40 CFR 144-148), which either could be adopted by state programs or implemented by the EPA directly (Table 2).

In the 1980 reauthorization of the SDWA, two important provisions were made relating to the oil and gas industry. The first asserts that states need only regulate Class II oil- and gas-associated injection wells in an "effective manner," while requiring states to meet or exceed standards for all other classes of wells. This provision, which removed uniformity in regulations throughout the United States, may have significant impact on the feasibility of geologic CO_2 sequestration under the current regulatory framework.

Table 1. EPA UIC Program Injection Well Classification System (EPA, 2002)

Well Class	Injection Well Description	Approximate Inventory
I	Injection of hazardous waste, nonhazardous liquid, or municipal wastewater beneath the lowermost USDW.	500 (123 hazardous)
II	Disposal of fluids associated with the production of oil and natural gas, injection of fluids for EOR, and injection of liquid hydrocarbons for storage.	~147,000
III	Injection of fluids for the extraction of minerals including in situ mining of sulfur, uranium, or other metals and solution mining of salts or potash.	~17,000
IV	Injection of hazardous or radioactive waste into or above a USDW (banned unless injecting as part of authorized remediation).	40 sites
V	Injection wells not covered in Classes I–IV, typically involving shallow injection of nonhazardous liquids.	>500,000–685,000

The second provision of the 1980 reauthorization allowed the exemption of natural gas injection for storage from regulation, based on the rationale that federal oversight might inhibit the needed expansion of gas storage. EPA has delegated to most states the regulation and monitoring of underground natural gas storage facilities. State programs are required to adequately address environmental health and safety issues, specifically, protection of USDWs from endangerment by injection and storage of natural gas.

TABLE 2. ENFORCEMENT OF UIC PROGRAM FOR PCOR PARTNERSHIP REGION

Iowa – EPA Region 7 (Classes I–V)

Nebraska Department of Environmental Quality (Classes I, III–V); Nebraska Oil and Gas Conservation Commission (Class II)

North Dakota Department of Health (Classes I, IV, V); North Dakota Industrial Commission (Classes II and III)

Minnesota – EPA Region 5 (Classes I–V)

Missouri Department of Natural Resources (Classes I–V)

Montana – EPA Region 8 (Classes I, III–V); Montana Board of Oil and Gas Conservation (Class II)

South Dakota – EPA Region 8 (Classes I, III–V); South Dakota Department of Environment and Natural Resources (Class II)

Wisconsin Department of Natural Resources (Classes I–V)

Wyoming Department of Environmental Quality (Classes I, III–V); Wyoming Oil and Gas Conservation Commission (Class II)

CO_2 injection typically has been regulated in conjunction with enhanced oil recovery (EOR) operation under Class II injection well requirements. There is no regulatory framework that specifically addresses injection of CO_2 for long-term storage. It is uncertain if injection requirements for the explicit purpose of long-term CO_2 storage will be tailored to formation type and in accordance with state rules and regulations, or if uniform nationwide regulations for all formation types will be developed.

SUMMARY OF INTERSTATE OIL AND GAS COMPACT COMMISSION STATE SURVEY ON CO_2 SEQUESTRATION

The Interstate Oil and Gas Compact Commission (IOGCC) Geological CO_2 Sequestration Task Force, working with member states and the seven Regional Carbon Sequestration Partnerships, has been tasked with the development of regulatory guidelines for CO_2 sequestration. The primary objectives of the Task Force are 1) examination of the technical, policy, and regulatory issues related to safe and effective storage of CO_2 in the subsurface (oil and natural gas fields, coalbeds, and saline aquifers), whether for enhanced hydrocarbon recovery or permanent storage and 2) production of a final assessment of the current regulatory framework likely applicable to geologic CO_2 sequestration and recommended regulatory guidelines and guidance documents, laying the groundwork for a state-regulated, but nationally consistent, system for the geologic sequestration of CO_2 consistent with national and international laws and protocols (IOGCC, 2003).

The IOGCC CO_2 Task Force final report will be posted on the PCOR Partnership Web site as soon as it is made available to the Regional Carbon Sequestration Partnerships. Table 1

provides responses of IOGCC member states to the following questions posed in a survey conducted by the CO_2 Task Force.

Questions:

- Has your state defined or classified CO_2 in any legislation or regulation dealing with CO_2 released to the atmosphere?

- Are you now using, or have you in the past used, industrial CO_2 emissions for EOR or enhanced gas recovery (EGR)? If so, how are or were these projects regulated (UIC Program Injection Well Class, etc.)?

- If you do not have current projects or have not had past projects, how would you expect to regulate future CO_2 EOR or EGR utilizing industrial CO_2 (UIC Program [well class], gas storage, EOR/EGR project, etc.)?

- If your state were to be approached by a company for the purpose of the underground injection of CO_2 for long-term geological storage (non-EOR/EGR), how would you anticipate your state would regulate the project (i.e., UIC Program Injection Well Class)?

State	Has Defined CO_2	Have Used Industrial CO_2 for EOR/EGR	UIC Injection Well Class for EOR/EGR	Anticipated UIC Injection Well Class for Non-EOR/EGR
Missouri	No	No	II	V
Montana	No	No	II	II
Nebraska	No	No	II	
North Dakota	No	No	II	II
South Dakota	No	No	II	II
Wyoming	No	Yes	II	I

CANADIAN REGULATORY FRAMEWORK FOR INJECTION

Standards and procedures for injection wells have been developed around safe practices required for drilling, closure, and abandonment of oil and gas, sour gas, sulfur, and/or water wells. The infrastructure used for CO_2 flooding, including injection wells, is the same as that used for primary and secondary recovery phases of oil production. There are currently no well construction and abandonment practices specific to CO_2 injection facilities. In most cases, minimal construction requirements are set to protect nonsaline sources of groundwater from contamination.

Existing regulations related to underground storage were developed primarily for petroleum and natural gas and have no provisions for the storage of CO_2. While natural gas storage regulations may provide guidance for CO_2 storage projects, they were not intended for the type of long-term storage required for effective CO_2 sequestration.

While regulatory requirements for measurement, monitoring, and verification (MM&V) of CO_2 storage may be adapted from existing regulations for enhanced-recovery operations, natural

gas storage, and waste disposal, they do not adequately address the need for verifying the safe and effective long-term storage of CO_2. Provincial and federal environmental assessment and protection acts, as well as occupational health and safety acts, aim to protect human and environmental health. Both provincial and federal acts might be expected to apply to CO_2 sequestration projects because of the local site of the storage reservoir and the national interest in reducing CO_2 emissions to the atmosphere.

Long-Term Management and Liability for Geologic Storage

The regulatory framework for CO_2 sequestration must adequately address long-term liability and responsibility. Given the long timescales involved in geological storage, it is unreasonable to expect liability to rest solely with the private sector. To assure adequate long-term management practices, government oversight is necessary. Such government assurance could be provided through government administration of industry-funded programs. Financial considerations and transfer of liability for long-term management must be addressed in the near term. If there are no clear methods for transferring financial responsibility, private entities will be reluctant to commit resources to geologic storage even if obliged to do so under requirements for lowering emissions.

Current state, provincial, and federal liability structures for oil and gas production, natural gas storage, radon exposure, low-level radioactive waste (LLRW) storage and disposal, and hazardous waste storage and disposal may provide some guidance for CO_2 sequestration. In addition, the transportation and injection of CO_2 for EOR operations have been commonplace in oil and gas production for decades, and the liability associated with operational impacts is effectively managed today.