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Estimates of CO_2 Storage Capacity in Selected Oil Fields of the Northern Great Plains Region of North America

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ABSTRACT

The carbon dioxide (CO_2) sequestration capacities of selected oil fields in the Williston Basin, Powder River Basin, and Denver-Julesberg Basin in the northern Great Plains region of North America were estimated as part of the Plains CO_2 Reduction (PCOR) Partnership regional characterization. The estimates were developed using readily available reservoir characterization data obtained from the petroleum regulatory agencies and/or geological surveys from the oil-producing states and provinces of the PCOR Partnership region. Reconnaissance-level sequestration capacities were calculated using two methods depending on the nature of the readily available reservoir characterization data for each field. Maximum storage capacities were estimated for reservoirs where detailed data on original oil in place, cumulative production, reservoir thickness, porosity, temperature, pressure, and water saturation were available. The initial reconnaissance-level estimates indicate that more than 1100 oil fields within the three basins have a capacity to sequester nearly 10 billion tons of CO_2, with the potential to produce more than 2 billion bbl of incremental oil through CO_2-flood enhanced oil recovery activities.

INTRODUCTION

As one of seven Regional Carbon Sequestration Partnerships established by the U.S. Department of Energy, the Plains CO_2 Reduction (PCOR) Partnership was tasked with identifying cost-effective carbon dioxide (CO_2) sequestration systems for a 1.3 million-mi^2 (3.3 million-km^2) region in the northern Great Plains of North America (Figure 1). In phase I of the project, the PCOR Partnership was focused on characterizing the technical issues, enhancing the public's understanding of CO_2 sequestration, identifying the most promising opportunities

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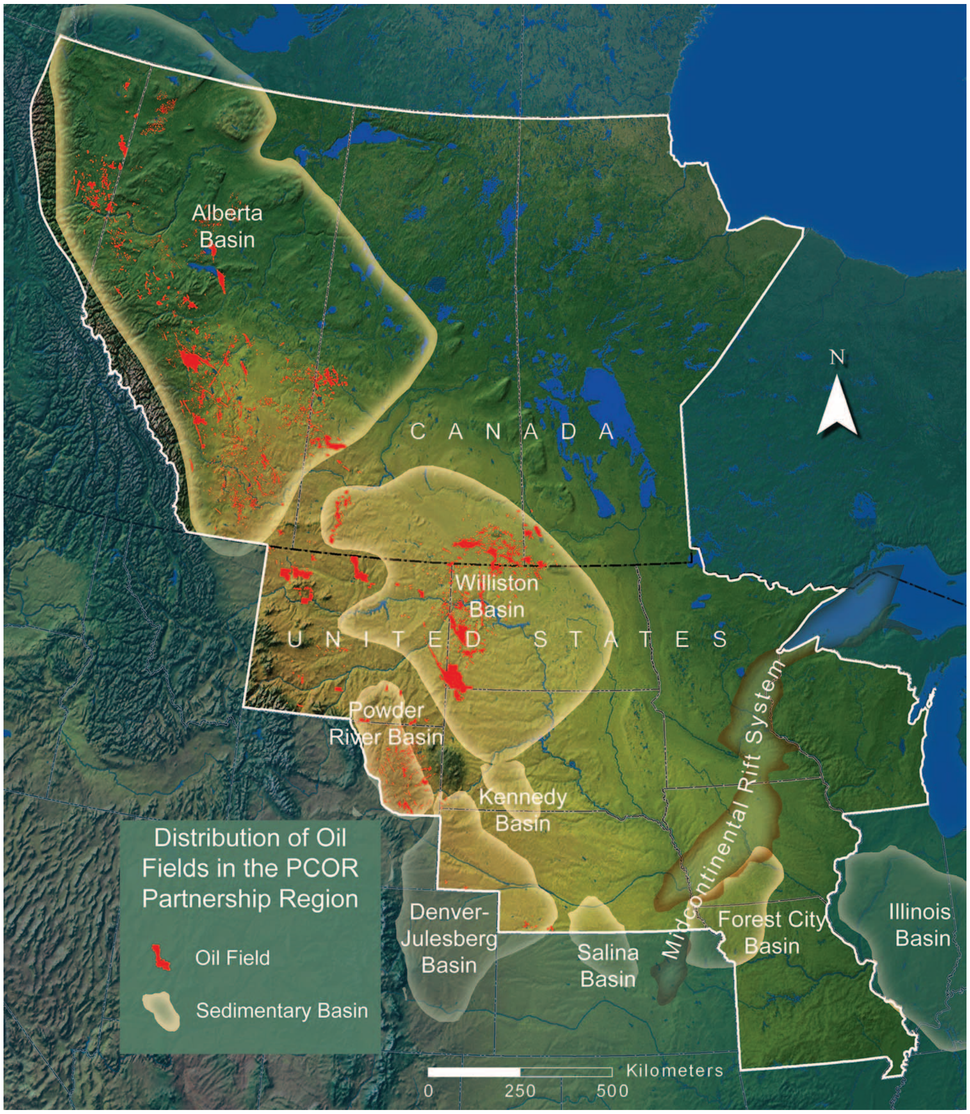

FIGURE 1. Plains CO_2 Reduction (PCOR) Partnership region. The region includes nine U.S. states and four Canadian provinces. Most of the region is home to significant oil production.

for sequestration in the region, and detailing an action plan for the demonstration of regional CO_2 sequestration opportunities.

The sequestration potential of oil fields in the Williston, Powder River, and Denver-Julesberg basins was evaluated as part of the PCOR Partnership's phase I activities (Figure 2). Preliminary calculations, based on readily available data sources, were made to determine the quantity of CO_2 that could potentially be sequestered and the amount of incremental oil that could be produced in pools that are currently undergoing secondary recovery or considered to be depleted because they have reached their economic maximum production limit. In the case of fields that are considered depleted, it is assumed that a high percentage of the original oil in place (OOIP) is still remaining as a result of the inability to effectively sweep the reservoir using primary and secondary recovery techniques. Because of the physical size of the region and the number of oil pools it contains, an initial cutoff point had to be assigned to begin the screening process. Efforts were focused on those fields with a cumulative oil production history of at least 800,000 bbl. Although somewhat arbitrary, this value indicates that a field is productive and may respond well to CO_2 flooding and hold significant capacity for CO_2 storage. As enhanced oil recovery (EOR) and sequestration opportunities arise, fields will be evaluated with regard to their proximity to the source and storage capacity relative to the quantity of CO_2 available.

The results of this report are primarily based on the present status of oil production and provide a reconnaissance-level determination of (1) how much CO_2 can potentially be sequestered in geologic reservoirs and (2) how much incremental oil might be produced from sequestration activities. Two methods were used to determine the capacity of oil fields throughout the region. Tables found in this chapter have been compiled from the regional analysis and are generally a reflection of the

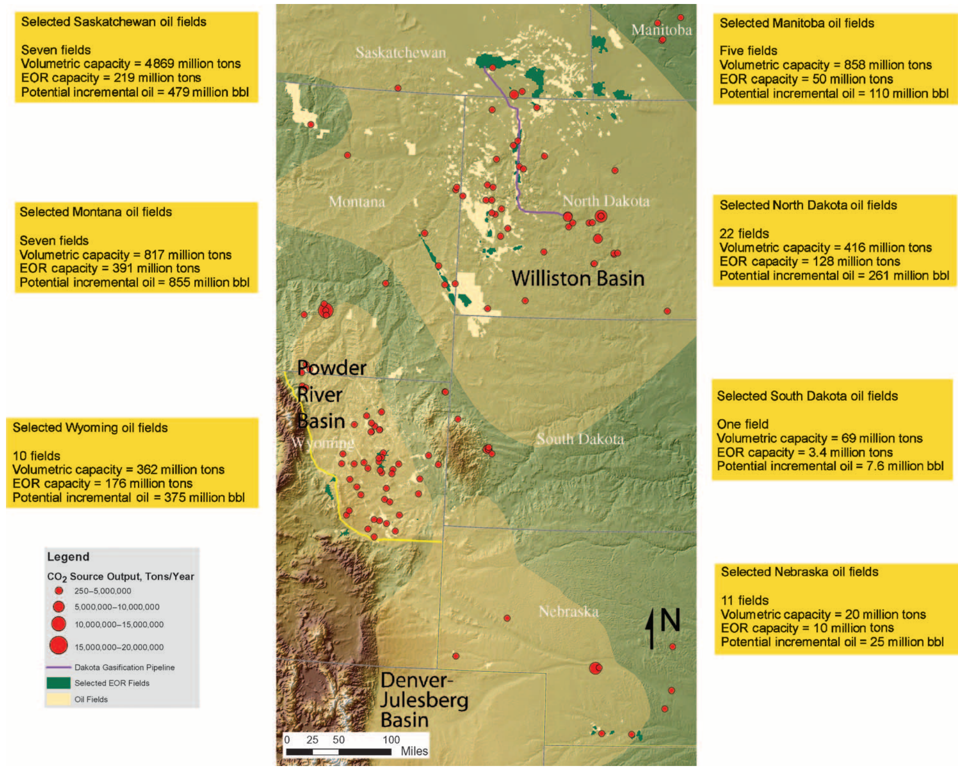

FIGURE 2. Summary of CO_2 enhanced oil recovery (EOR) and sequestration potential in the Williston, Powder River, and Denver-Julesberg basins.

pools that are considered to have the greatest potential to be considered for CO_2 sequestration. These tables offer a comparison of selected fields through EOR activities and CO_2 sequestration activities.

SEQUESTRATION THROUGH ENHANCED OIL RECOVERY

Carbon sequestration through EOR is one of the first mechanisms to be used as a long-term strategy for reducing anthropogenic CO_2 from greenhouse gas emissions. Over the past decade, anthropogenic CO_2 has been used for EOR at the Salt Creek field in Wyoming and the Weyburn field in Saskatchewan. The oil and gas industry has also been involved in EOR through miscible flooding using natural sources of CO_2 for more than 30 yr in Texas (Jarrell et al., 2002). This knowledge has direct application to CO_2 sequestration. Historically, CO_2 EOR schemes have been engineered to reduce the amount of CO_2 needed for injection while maximizing incremental oil production. Based on rock and fluid properties, about 80% of the oil reservoirs worldwide have been estimated to be candidates for CO_2-based EOR (Kovscek, 2002). Given favorable market conditions and the appropriate regulation of CO_2, these reservoirs will become prime candidates for sequestration.

To estimate the potential for CO_2 sequestration through EOR, performing a reconnaissance-level examination of the geologic and engineering characteristics of many of the oil fields within the Williston, Powder River, and Denver-Julesberg basins first was necessary. These data were acquired from state agencies that regulate oil and gas and from state geological organizations, which have compiled volumes of oil-field characteristics that are otherwise difficult to obtain. The data include the key variables needed for evaluating the use of CO_2 for EOR and additional rock and fluid properties necessary for determining geologic sequestration in depleted reservoirs. The level of detail within each data set was widely variable between each of the states and provinces. Some agencies were able to readily provide detailed geologic and engineering reports for each pool within every field in their jurisdiction, whereas other agencies were only able to provide very basic reservoir data.

METHODOLOGY

Methods Used for CO_2 Sequestration Capacity Through Enhanced Oil Recovery: The Enhanced Oil Recovery Method

The EOR method employs a two-step approach to develop estimates of (1) the amount of CO_2 that could theoretically be sequestered and (2) the volume of incremental oil that could be produced as a result of CO_2-flood EOR activities. The following list of reservoir and fluid properties was suggested by Bachu et al. (2004) and provides a simple guideline for screening reservoirs for CO_2 EOR:

- Oil gravity between 27° and 48° (American Petroleum Institute)
- Temperature between 32 and 121°C (90 and 250°F)
- Reservoir pressure greater than 77.3 kg/cm^2 (1100 psi)
- Pressure greater by at least 14 kg/cm^2 (200 psi) than the minimum miscibility pressure (102–153 kg/cm^2 [1450–2175 psi])
- Oil saturation greater than 25%

This study considers these properties as well as the overall production history of the field, secondary recovery performance, depth to production, rock properties, and characteristics of the produced fluid.

In evaluating the sequestration capacity for unitized pools, some assumptions had to be made. The first major assumption was to simplify the process for projecting the oil recovery potential from injection of CO_2. Shaw and Bachu (2002) noted that incremental recovery could be between 7 and 23% of the OOIP through successful miscible flooding techniques, whereas Nelms and Burke (2004) suggested a value of 7–11%. The calculations used herein assume an average value of 12% incremental recovery of the OOIP. Where OOIP was not available, cumulative production was used to estimate the potential incremental recovery from CO_2 EOR. This was estimated by assuming that 25% incremental recovery from cumulative production is achievable (Petroleum Technology Transfer Council, 1999). Next, the quantity of CO_2 necessary to recover the incremental oil was needed. Nelms and Burke (2004) discussed the quantity of CO_2 required for EOR. The purchase requirement they used was 13 mcf per barrel of oil recovered. Of this purchase quantity, about 3–5 mcf per barrel of oil will be recovered at the surface and reinjected after separation. This evaluation uses 8 mcf/bbl incremental oil recovered. The total quantity of CO_2 injected for tertiary recovery should be the amount left in the reservoir for long-term storage.

The calculation used to estimate CO_2 sequestration capacity through EOR is as follows:

$$Q = \mathrm{OOIP} \times 0.12 \times 8000$$

where Q is the CO_2 remaining in the reservoir after the flooding process is complete (ft^3), OOIP is the original oil in place (stock tank barrel [stb]), 0.12 is the estimated recovery of oil from CO_2 flood (%), and 8000 is the CO_2 purchase requirement to produce 1 bbl of oil from CO_2 flooding (ft^3).

Storage of CO_2 through EOR can be increased through alternate engineering practices that vary the injection schemes used, using horizontal wells instead of vertical, and using completion techniques favorable for long-term storage while enhancing production (Jessen et al., 2005). Jessen et al. suggested several additional methods for increasing storage through EOR, including the optimization of water injection rates and water alternating gas ratios, aquifer injection of recycled gas, and using CO_2 to repressurize fields in postproduction. Ultimately, market factors, including CO_2 availability, price of oil, price of steel, emplacement of carbon credit markets, and overall demand, will greatly influence the implementation of CO_2 EOR projects in the future.

Sequestration in Oil Reservoirs Not Currently Undergoing Enhanced Oil Recovery: The Volumetric Method

Carbon sequestration through EOR may be economically feasible in the near future and, in turn, may help develop the network of infrastructure necessary to transmit CO_2 to potential storage sites. The PCOR Partnership region includes many thousands of pools in thousands of oil fields, many of which may not be suitable for enhanced recovery options. In this case, considering the potential for CO_2 storage in the available pore space is important. This is the focus of the volumetric method for estimating storage capacity. As in many oil-producing basins, the basins in this study area have many levels of producing horizons stacked one atop the next, generally separated by impermeable strata. If used for storage of anthropogenic CO_2, these stacked reservoirs hold tremendous potential for sequestration. The method of estimating the capacity is based on the available pore space and assumes that injected CO_2 will replace the existing fluid.

This approach is a starting point for estimating capacity and will reflect a maximum theoretical value. In practice, the actual sequestration capacity of these fields will be much lower. Sweep efficiency, which must be determined on a field-by-field basis, will be the primary factor affecting the actual capacity of oil fields.

Using the same production criterion of 800,000 bbl (cumulative field production) that was used on the EOR pools, a database of geologic and fluid characteristics was developed for the region. Data that were compiled for the EOR study were also used in this part of the evaluation. In calculating the sequestration capacity, the following criteria were used:

- Field surface area
- Average pay thickness
- Average porosity
- Reservoir temperature
- Initial reservoir pressure

Field area, thickness, and porosity were used to determine the pore volume of the producing reservoir. Reservoir temperature and pressure were used to determine the density of CO_2 at reservoir conditions.

The calculation used to estimate the volumetric CO_2 sequestration capacity of oil fields is as follows:

$$Q = A \times T \times \varphi \times \rho_{CO_2} \times (1 - S_w)$$

where Q is the storage capacity of the oil reservoir (lb CO_2), A is the field area (ft^2), T is the producing interval thickness (ft), φ is the average reservoir porosity (%), ρ_{CO_2} is the density of CO_2 (lb/ft^3), and $(1 - S_w)$ is the saturation of oil where S_w is the initial reservoir water saturation (%).

This calculation yields the maximum storage capacity of an oil-bearing reservoir in pounds of CO_2, which in turn has been converted to tons.

The volumetric methodology also considers the following: (1) the estimated capacity represents the sum of each producing pool within a field; (2) this calculation yields the maximum storage capacity of an oil-bearing reservoir; (3) the field area considered represents the entire boundary of the oil field; (4) the thickness, porosity, and water saturation figures used represent the reported reservoir thickness; (5) CO_2 density has been estimated based on reported temperature and pressure values; (6) where temperature and pressure were not available, depth was used to estimate their value; and (7) in the absence of water saturation data, the water saturation was estimated to be 50%. Although actual sequestration volumes will be significantly less, this means of developing approximate sequestration volumes has been used in prior studies (Bradshaw et al., 2004).

WILLISTON BASIN SEQUESTRATION CAPACITIES

North Dakota

Because many of the largest opportunities for CO_2 sequestration in the Williston Basin are located in North Dakota, and the North Dakota Department of Mineral Resources Oil and Gas Division maintains relatively detailed reservoir characteristics in user-friendly computer format, a more comprehensive evaluation was conducted on North Dakota oil fields. For EOR, only those unitized fields that have gone through or are currently in a secondary recovery phase were considered. In general, secondary performance data are necessary to accurately predict tertiary performance. The specific pools were selected through a joint meeting between the Energy and Environmental Research Center and the North Dakota Department of Mineral Resources Oil and Gas Division and the North Dakota Geological Survey as being good candidates for CO_2 EOR. Table 1 lists 22 unitized pools in North Dakota and shows the results of each methodology as applied. Table 1 indicates the volumetric storage capacity, potential for EOR incremental oil recovery, as well as the volume of CO_2 that can be sequestered through the process. More than 600 pools have currently been evaluated in North Dakota using these methods.

South Dakota

Although several fields in South Dakota were considered, only the Buffalo field was selected for this study. Cumulative production in the state is approaching 40 million bbl of oil from which nearly 30 million bbl of oil comes from this field. With only the southern edge of the Williston Basin extending into South Dakota, production in this state is relatively minor compared to its neighbors. This does not mean that opportunities for EOR and sequestration through CO_2 flooding in South Dakota do not exist. The Buffalo field is undergoing a high-pressure air injection flood (fireflood), which has increased production dramatically. Similar potential for increased production may be possible using CO_2 without the risk of damaging the reservoir. Table 2 shows the potential for CO_2 sequestration in the Buffalo field.

Montana

One of the greatest opportunities in Montana exists in the Cedar Creek anticline. This relatively large structure in the southeast corner of the state has historically been the major oil-producing site in the state. Additional production is seen to the north of the Cedar Creek anticline primarily along the North Dakota border. This provides an ideal situation for a CO_2 pipeline network that delivers CO_2 to a central location and disperses it to fields ready for CO_2 EOR. With the current level of production and drilling activity, the Montana part of the Williston Basin clearly holds significant reserves and can clearly benefit from CO_2 EOR. This activity will help to provide insight into the development of carbon credit-trading markets and, in turn, provide a system whereby CO_2 sequestration into depleted oil fields becomes economically viable. Table 3 shows the selected Montana fields and their producing formations, with their approximate sequestration capacity.

Manitoba

Manitoba's CO_2 sequestration capacity is based on the OOIP figures for the best-producing unitized pools. Manitoba will be a prime candidate for CO_2 sequestration because of the physical size of the fields on production. These large fields will become ideal candidates to store large volumes of CO_2 once EOR has ceased. Table 4 shows the selected Manitoba unitized pools and their EOR and sequestration potentials.

TABLE 1. North Dakota oil pools evaluated for CO_2 sequestration capacity and potential incremental oil production.

Field Name	*Producing Pool (s)*	*Volumetric Capacity (million tons)*	*Enhanced Oil Recovery Capacity (million tons)*	*Incremental Oil Production (million stb)*
Beaver Lodge	Madison	111	21	44
	Devonian			
	Silurian			
	Ordovician			
Cedar Hills South	Red River B	49	21	43
Tioga	Madison	39	13	26
Big Stick	Madison	31	10	20
Charlson North	Madison	30	5	10
Antelope	Madison	19	7	14
	Devonian			
Newburg	Spearfish-Charles	18	6	12
Dickinson	Heath	15	4	7
North Elkhorn	Madison	14	3	7
Charlson South	Madison	11	1	1
Rough Rider East	Madison	11	2	4
Rival	Madison	11	5	9
Clear Creek	Madison	10	2	3
Blue Buttes	Madison	9	5	11
Fryburg	Heath-Madison	9	9	19
Lignite	Madison	7	2	4
Wiley	Glenburn	5	5	12
Bear Creek	Duperow	5	1	2
Medora	Heath-Madison	4	3	7
Fryburg South	Tyler	3	1	3
Mohall	Madison	3	1	2
Tracy Mountain	Tyler	2	0.5	1
Total		416	128	261

Saskatchewan

Carbon dioxide sequestration is being conducted in Saskatchewan by the International Energy Agency Weyburn CO_2 Monitoring and Storage Project. Approximately 22 mmt of CO_2 is estimated to be injected into the Mississippian Midale reservoir of the Weyburn field. The result of injection will be the net storage of approximately 15 mmt when considering the combustion of the oil produced by the flood and the CO_2 produced in compression and transmission of CO_2 to the site (Whittaker, 2004). With this in mind, several additional unitized oil fields that traverse the Saskatchewan part of the Williston Basin were examined to calculate their CO_2 sequestration potential. A general cross section across the Saskatchewan part of the Williston Basin was chosen, and the larger fields were evaluated based on OOIP value. Table 5 shows the quantities determined from the calculation and is based on data collected from the 2002 Reservoir Annual produced by Saskatchewan Energy and Mines (Reservoir Annual, 2002).

TABLE 2. South Dakota oil pools evaluated for CO_2 sequestration capacity and potential incremental oil production.

Field Name	*Producing Formation (s)*	*Volumetric Capacity (million tons)*	*Enhanced Oil Recovery Capacity (million tons)*	*Incremental Oil Production (million stb)*
Buffalo	Red River	69	3.4	7.6

TABLE 3. Montana oil pools evaluated for CO_2 sequestration capacity and potential incremental oil production.

Field Name	*Producing Pool (s)*	*Volumetric Capacity (million tons)*	*Enhanced Oil Recovery Capacity (million tons)*	*Incremental Oil Production (million stb)*
Pine	Interlake	282	133	292
	Red River			
Cabin Creek	Interlake	189	80	174
	Red River			
	Madison			
Little Beaver East	Red River	118	52	114
	Madison			
Poplar East	Kibbey	90	66	144
	Madison			
Pennel	Interlake	84	37	81
	Red River			
	Madison			
Monarch	Interlake	34	15	34
	Red River			
Dwyer	Madison	19	7	16
Total		817	391	855

POWDER RIVER BASIN SEQUESTRATION CAPACITIES

Wyoming

Data for Wyoming oil fields were obtained from the Wyoming Geological Association and the Wyoming Oil and Gas Conservation Commission. Like the Williston Basin, the Powder River Basin holds tremendous potential for EOR through CO_2 miscible flooding and, in turn, CO_2 sequestration. De Bruin (2001) summarized the potential for CO_2 EOR in Wyoming and recommended many fields as good candidates. Table 6 shows these fields and their potential for CO_2 EOR and sequestration. With the large number of sources and CO_2 pipelines in place and more being considered for expansion, Wyoming will certainly be a target for EOR-based sequestration.

DENVER-JULESBERG BASIN SEQUESTRATION CAPACITIES

Nebraska

The Nebraska CO_2 market will benefit from the production of ethanol, which produces a relatively pure stream of CO_2. Data for this evaluation were obtained

TABLE 4. Manitoba oil pools evaluated for CO_2 sequestration capacity and potential incremental oil production.

Field Name	*Producing Pool (s)*	*Volumetric Capacity (million tons)*	*Enhanced Oil Recovery Capacity (million tons)*	*Incremental Oil Production (stb)*
Waskada	Lower Amaranth	448	14	30
Daly	Lodgepole Bakken	158	7	15
Virden	Lodgepole	150	24	53
	Lower Amaranth	86	4	9
Pierson	Mission Canyon			
Tilston	Mission Canyon	16	2	3
Total		858	50	110

stb = Stock tank barrel.

Table 5. Saskatchewan oil pools evaluated for CO_2 sequestration capacity and potential incremental oil production.

Field Name	*Producing Pool (s)*	*Volumetric Capacity (million tons)*	*Enhanced Oil Recovery Capacity (million tons)*	*Incremental Oil Production (million stb)*
Steelman	Frobisher	2101	58	126
	Midale			
	Winnipegosis			
Weyburn	Frobisher	1597	85	187
	Midale			
Midale	Frobisher	699	49	108
	Midale			
	Red River			
Benson	Frobisher	270	9	20
	Midale			
	Winnipegosis			
Pinto	Frobisher	99	8	19
	Midale			
Workman	Frobisher	91	9	19
	Midale			
Tableland	Winnipegosis	13	0	1
Total		4869	219	479

from the Nebraska Oil and Gas Commission. With production declining in the state, CO_2 EOR can provide the economic incentive that may boost production. Table 7 shows the selected Nebraska oil fields and their potential for EOR and sequestration.

Key Issues to Consider

The volumes of potentially sequestered CO_2 determined here are general reconnaissance values. Actual sequestration volumes will be significantly smaller. To calculate a more exact sequestration capacity for a reservoir, a case-by-case systematic analysis, including detailed geologic characterization, production history, and modeling efforts, is necessary. The process of oilfield unitization, prior to water flooding, can be looked at as a guide for developing specific geological sequestration targets. Specifically, a detailed production history, including updated OOIP, projected cumulative primary and cumulative secondary recovery, injection statistics, and produced-water chemistry, must be obtained. In addition, from a regulatory and royalty standpoint, a detailed protocol regarding mineral value will need to be developed prior to permanent sequestration in abandoned fields and units. The protocol will include (1) value to mineral owners for produced fluid, (2) value to mineral owners for storage, (3) liability in ownership of sequestered CO_2, and (4) liability for leakage through preexisting properly and improperly abandoned wellbores. These risk assessment and economic feasibility studies will need to be part of a thorough evaluation. Furthermore, CO_2 source proximity, availability, and industry support must be considered as crucial aspects to geologic sequestration.

CONCLUSION

Screening criteria for field candidates were based on the cumulative recovery of the oil reservoir. Fields that have been unitized and have had success in the secondary phase of recovery are considered good candidates for CO_2 sequestration through EOR. Estimates are based in part on the assumption that all of the injected gas will remain in the reservoir for long-term storage when tertiary recovery ends. The remaining nonunitized fields may be excellent candidates for additional storage and could potentially have the fluid in the pore space replaced by CO_2, with revenue from any incremental oil recovery helping to offset the cost of injection.

Sequestration capacity estimates were developed for more than 1000 oil fields in north-central North America as part of the PCOR Partnership's regional CO_2 sequestration characterization activities. The results generated by the volumetric method indicate that there

Table 6. Wyoming oil pools evaluated for CO_2 sequestration capacity and potential incremental oil production.

Field Name	*Producing Formation (s)*	*Volumetric Capacity (million tons)*	*Enhanced Oil Recovery Capacity (million tons)*	*Incremental Oil Production (million stb)*
Glenrock South	Dakota	97	43	94
	Dakota (Glenrock)			
	Lower Muddy			
	Muddy			
	Muddy (unit B)			
Sussex	1st Frontier	56	31	67
	2nd Frontier			
	Lakota			
	Parkman			
	Shannon			
	Sussex			
	Teapot			
Hilight	Minnelusa	55	24	53
	Muddy			
Hartzog Draw	Shannon	53	19	42
Meadow Creek	1st Frontier	38	26	56
	2nd Frontier			
	Lakota			
	Shannon			
	Sussex			
	Tensleep			
Salt Creek	Lakota	25	13	23
	Sundance			
	Tensleep			
Raven Creek	Minnesula	14	7	15
Rozet	Minnesula	13	8	15
	Muddy			
House Creek	Sussex	6	2	5
Gas Draw	Muddy	4	2	5
Total		362	176	375

may be more than 10 billion tons of CO_2 storage capacity in the 1091 fields evaluated (Table 8). The results of the EOR-based evaluations for 63 fields in the Williston, Powder River, and Denver-Julesberg basins, shown in this chapter, suggest that more than 950 million tons of CO_2 could be sequestered by CO_2-flood EOR operations, possibly resulting in more than 2 billion bbl of incremental oil production (Figure 2). If these same fields are used for CO_2 sequestration purposes, the total storage potential could rise as high as 7 billion tons. These CO_2 sequestration capacity estimates are reconnaissance level only and are based on a theoretical maximum, best-case scenario approach to the evaluation of geologic sinks and are meant to illustrate the potential value of these types of sinks with respect to their ultimate storage. The estimates generated during phase I of the PCOR Partnership provide order-of-magnitude-level CO_2 capacity estimates for more than 1000 geologic locations in the PCOR Partnership region that were previously unavailable.

ACKNOWLEDGMENTS

The Plains CO_2 Reduction Partnership is a collaborative effort of public and private sector stakeholders working toward a better understanding of the technical and economic feasibility of capturing and storing (sequestering) anthropogenic CO_2 emissions from stationary sources in the central interior of North America. It is

TABLE 7. Nebraska oil pools evaluated for CO_2 sequestration capacity and potential incremental oil production.

Field Name	*Producing Pool (s)*	*Volumetric Capacity (million tons)*	*Enhanced Oil Recovery Capacity (million tons)*	*Incremental Oil Production (million stb)*
Culbertson	Lansing-Kansas City	4.9	1.2	2.6
Kleinholz	Wykert sandstone	3.3	1.4	3.0
Meeker Canal	Lansing-Kansas City	2.8	1.0	2.2
Dry Creek	Lansing-Kansas City	2.7	1.4	3.0
Bush Creek	Lansing-Kansas City	1.6	1.0	5.2
Silver Creek	Lansing-Kansas City	1.1	0.9	2.0
Boevau Canyon	Lansing-Kansas City	1.1	0.9	1.9
Ackman	Lansing-Kansas City	0.8	0.7	1.6
Husker	Lansing-Kansas City	0.7	0.6	1.3
Dry Creek North	Lansing-Kansas City	0.6	0.5	1.2
Bishop	Lansing-Kansas City	0.3	0.3	0.6
Total		20	10	25

TABLE 8. Total storage capacity of pools evaluated using the volumetric methodology.

Basin	*Number of Pools Evaluated*	*Potential Storage Capacity in Evaluated Fields (tons)*
Williston	845	>9 billion
Powder River	225	>1 billion
Denver-Julesberg	21	>14 million

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