1.0 INTRODUCTION AND BACKGROUND

1.1 Introduction

Petro Source Corporation (PSC) proposes to construct and operate approximately 155 miles of 12-inch liquid carbon dioxide (CO_2) pipeline from the Bairoil Terminal on the existing Wyoming-Dakota CO_2 Pipeline in Fremont County, Wyoming, to a point in the Hartzog Draw Unit oil field in Campbell County, Wyoming. The route for this pipeline extension was previously analyzed in the Bairoil/Dakota Carbon Dioxide Projects Environmental Impact Statement (EIS) finalized in February 1986 (Bureau of Land Management [BLM] 1986a). For consistency purposes, the same milepost (MP) designations (MP 112 at the Bairoil Terminal to MP 267 at the Hartzog Draw Unit oil field) are used in this document. A new 7-mile lateral pipeline (8-inch diameter) also would be constructed to the Salt Creek oil field in Natrona County. The CO_2 transported by the pipeline would be used for Enhanced Oil Recovery (EOR) at the existing Salt Creek, Sussex, and Hartzog Draw Units and other potential oil fields.

This Environmental Assessment (EA) has been prepared under the direction of the BLM, serving as the lead agency in compliance with the National Environmental Policy Act of 1969 (NEPA). This document follows the guidelines promulgated by the Council on Environmental Quality (CEQ) for implementing the procedural provisions of NEPA (40 Code of Federal Regulations [CFR] 1500-1508) and BLM's NEPA Handbook (H-1790-1). This EA is being prepared as an updated document following the previously prepared Exxon Wyoming-Dakota Pipeline Segment 2and Hartzog Draw Unit CO_2 Projects EA (BLM 1991).

This chapter of the EA provides the history and background of past proposals and previously constructed projects leading to the proposed PSC Pipeline Project analyzed in this EA. It also presents the purpose and need for the project including a general discussion of EOR and an overview of CO_2 use in the EOR process. In addition, Chapter 1.0 describes the project location and identifies other authorizing actions necessary for the project to be constructed. A complete description of the Proposed Action is provided in Chapter 2.0.

1.2 Project History and Background

In 1984, Exxon (now ExxonMobil) applied to the BLM for a CO_2 pipeline route, which was located west of Green River, Wyoming, to a point known as the Bairoil Terminal at MP 112 and then into Bairoil terminating at the Amoco oil field. In early 1985, Exxon submitted an additional application for a CO_2 pipeline from Bairoil Terminal to Tioga, North Dakota.

During the same period, Amoco also applied for pipeline rights-of-way (ROWs) to transport CO_2 from the Rangley Pipeline to Bairoil and later for an additional segment to parallel the Rangely Pipeline back to the Rock Springs meter station at Interstate 80 (I-80) west of Rock Springs, Wyoming. At that time, Amoco also was negotiating with Exxon to transport CO_2 to the Bairoil Terminal where Amoco would construct the CO_2 spur line into Bairoil for its EOR project at the Amoco Bairoil oil field.

In conjunction with Exxon's original proposal to transport CO_2 across the southeast corner of Montana to its destination near Tioga, North Dakota, Shell also submitted a ROW application for CO_2 distribution pipelines near Baker, Montana. The proposed distribution lines would originate at the ExxonMobil truckline.

The applications of these three companies were compiled and analyzed as a single Proposed Action in the Bairoil/Dakota Carbon Dioxide Projects Draft EIS prepared by the BLM and issued in September 1985. The Bairoil/Dakota EIS also analyzed various alternatives to the Proposed Action including the Single Bairoil Pipeline Alternative, wherein only one of the two competing pipelines from the Rangely Pipeline near Green River to Bairoil Terminal and one of two CO_2 spur lines from Bairoil Terminal to Bairoil would be constructed.

The Exxon Wyoming-Dakota Pipeline Segment 2 and Hartzog Draw Unit CO_2 Projects EA analyzed the impacts of constructing and operating 155 miles of 20-inch CO_2 pipeline from the Bairoil Terminal to Hartzog. This project also included a gas gathering system and distribution system to injection wells. The EA was issued in March 1991, and the Record of Decision was signed in May 1991. Although some cultural resource mitigation was completed for this project, it was not constructed. As part of mitigation for the 1991 EA, cultural resource mitigation was implemented that involved reroutes at three sites: Trona Shed (MP 187.6 to MP 189.3), Morton Ranch (MP 172.8 to MP 173.9), and Loshe (MP 243.9 to MP 244.1) (Western Wyoming College 1991a,b,c). These reroutes are included as part of the Proposed Action for the PSC CO_2 Pipeline Project. PSC signed a memorandum of understanding with ExxonMobil and officially took over the project on November 30, 1998; PSC plans to construct and operate the CO_2 pipeline as discussed above. Due to the time interval between the 1991 EA and this proposal, BLM requires a new EA that contains updated information on all environmental resources.

1.3 Purpose and Need for the Proposed Action

The primary purpose of this proposed project is to transport CO_2 from the existing ExxonMobil pipeline terminus at the Bairoil Terminal to various oil fields for use in EOR processing. A secondary purpose is to market CO_2 produced at the existing ExxonMobil Shute Creek natural

gas processing plant near Opal, Wyoming, about 120 miles west of Bairoil Terminal, thus reducing CO_2 venting at the plant.

Initial volumes of CO_2 carried by the pipeline extension are projected to range from approximately 15 to 50 million standard cubic feet per day (MMSCFD). The long range outlook is for the pipeline to transport a total of 150 to 200 MMSCFD to future intermediate delivery points and along extensions to the system. However, there are many economic and technical factors that could affect the ultimate maximum throughput of CO_2 in this system.

Implementation of the EOR projects at the oil fields would result in increased incremental production of oil that would not be recoverable by existing operations. This incremental production would extend the economic life of the fields and benefit both state and local economies.

1.3.1 Value of Enhanced Oil Recovery

When an oil field is first discovered, it is typically brought into production using primary production methods where the natural pressure of the reservoir or pumping is used to bring oil to the surface. As the oil is produced, natural reservoir pressure declines over time, and there is a decrease in oil production from the field. Until the 1930s, primary production was the only practical means of production used in the United States. Under primary production, the ultimate recovery of oil is dependent on reservoir shape, permeability, and properties of the oil, as well as economic factors related to production costs versus rate of return. Typically, primary production results in the recovery of approximately 15 percent of the original-oil-in-place (BLM 1989). Once the natural reservoir pressure is sufficiently lowered, it may become economical to use secondary recovery techniques. Secondary recovery involves the injection of a fluid into the reservoir to replace the natural pressure lost during primary production. The most common type of secondary recovery used in Wyoming is waterflooding. Water is relatively inexpensive to obtain and inject and works well in displacing some oils from the reservoir and increasing reservoir pressure. Waterflooding was first applied 100 years ago, but it was not until the 1950s that it gained widespread use. Waterflooding can result in an incremental increase of up to 25 percent recovery, raising total recovery (primary and secondary) up to 40 percent of the original-oil-in-place. However, at the completion of secondary recovery, some 60 percent or more of the original oil still remains locked in the ground.

There are several types of enhanced (tertiary) oil recovery techniques currently being used throughout the United States. Johnson (1982) estimated that available EOR techniques could result in the addition of 18 to 53 billion barrels oil to our domestic reserves. Of these methods, CO_2 flooding shows the widest applicability and would likely result in the largest incremental oil recovery.

Enhanced oil recovery, and in particular CO_2 flooding, is expected to play a very important role in the future of Wyoming's oil industry. Basko (1987) estimated that Wyoming conservatively has 400 million barrels of recoverable enhanced oil. That is equal to about half of Wyoming's crude oil reserves (BLM 1989).

1.3.2 Use of CO_2 in Enhanced Oil Recovery

Carbon dioxide is a common, ordinary compound usually thought of as a gas, although it is quite easily converted to a solid or liquid. In its gaseous state, CO_2 is approximately 1.5 times heavier than air at standard conditions. Carbon dioxide can be hazardous in some situations. Frostbite may result from contact with dry ice or liquid CO_2. Carbon dioxide also can act as a simple asphyxiant. Concentrations of 10 percent (100,000 parts per million [ppm]) can produce unconsciousness from oxygen deficiency. A concentration of 5 percent (50,000 ppm) may produce shortness of breath and headache. Continuous exposure to 1.5 percent (15,000 ppm) may cause changes in some physiological processes (Sittig 1981).

Increased CO_2 concentrations in the atmosphere are believed to contribute to the greenhouse effect, and there is concern that massive increases in CO_2 emissions may potentially lead to global warming over time.

Injection of CO_2 to increase oil recovery was first patented in 1952. Large-scale commercial floods using CO_2 exist in Texas, Mississippi, Colorado, New Mexico, Oklahoma, and Wyoming. The first commercial application of CO_2 flooding in Wyoming was Amoco's Bairoil Project, which began injection of CO_2 in October 1986 (BLM 1989).

Carbon dioxide works to increase the volume of recoverable oil in a number of ways. In most reservoirs, CO_2 is easily miscible with the oil and can be thoroughly mixed at relatively low pressures. Once mixed, it is highly soluble. As it dissolves, it swells the oil, yielding a 10 to 30 percent increase in volume (Miller and Jones 1981). This swelling forces more oil out of the reservoir pores, making it available for recovery. In addition, CO_2 decreases the viscosity of oil, allowing it to flow more freely. CO_2 also aids recovery by solution gas drive. Just as CO_2 goes into solution with an increase in reservoir pressure, gas will come out of solution and continue to drive oil into the wellbore. Finally, the slightly acidic nature of the CO_2-water mixture promotes certain injectivity changes. Clays are stabilized due to a reduction in pH, and injectivity is improved in carbonates by partially dissolving the reservoir rock and increasing permeability. In certain cases, CO_2 also may reduce permeability.

Flooding an oil reservoir with CO_2 utilizes the same type of equipment and processes installed for waterflooding. During CO_2 flooding, the gas is injected into the reservoir through a series of

injection wells. After a slug of CO_2 large enough to maintain a solvent bank between the CO_2 and the oil is injected, a slug of water is introduced behind the CO_2. The alternating injection of CO_2 and water is referred to as water alternating gas process. The water pushes the CO_2 slug and oil bank to the producing wells where it can be recovered.

1.4 Location of the Proposed Action

The CO_2 Pipeline Project proposed by PSC would be located in four Wyoming counties (Fremont, Natrona, Johnson, and Campbell) and three BLM Field Office areas (Lander, Casper, and Buffalo). A map showing the location of the proposed pipeline route is presented in Figure 1-1.

1.5 Authorizing Actions

PSC's proposed project would require federal, state, and local authorizations for many aspects of project construction, operation, maintenance, and abandonment. It is the applicant's intent to fulfill all requirements of any applicable statutes, regulations and policies. Table 1-1 lists permits, approvals, and reviews necessary for implementation of the Proposed Action.

In order to obtain a ROW grant from federal land management agencies or easements across private land, several steps must be taken. For federally administered lands, an applicant must submit a ROW application to the appropriate federal agency along with a processing fee to cover the costs of processing the application and granting and administering the ROW. The agency then prepares an environmental document (such as this EA) as required under NEPA to determine potential impacts on all lands (regardless of ownership) that may occur as a result of implementing the Proposed Action.

Mitigation of adverse impacts is proposed by the applicant as part of the project design. In addition to these commitments, the agency requires standard protective measures on federal lands.

After the EA is prepared and the agency preferred alternative is selected, the BLM prepares a Decision Record. The Decision Record documents and provides the legal record for any decisions made regarding the requested ROW on federal lands.

Before the ROW can be granted, PSC must prepare a Plan of Development (POD) detailing construction of all project facilities on federal land. This POD must be submitted to the authorizing agencies for approval. POD approval is concurrent with the ROW approval. The POD contains site-specific procedures based on the types of terrain, soils, vegetation, land use, and climatic conditions encountered for the following areas of concern:

Table 1-1
Federal, State, and Local Permits, Approvals, and Reviews Required for Construction and Operation of the Proposed PSC CO_2 Pipeline Project

Agency	Nature of Action	Authority
FEDERAL PERMITS, APPROVALS, AND REVIEWS		
U.S. Department of the Interior Bureau of Land Management	Grant rights-of-way and issue temporary use permits	Section 28 of the Mineral Leasing Act of 1920
	Issue materials sales contracts	Materials Act of 1947, as amended; 30 U.S.C. 601, 602; 43 CFR 3600
	Issue antiquities and cultural resource use permit to excavate or remove cultural resources on federal lands	Antiquities Act of 1906, 16 U.S.C. Section 431-433; Archaeological Resources Public Protection Act of 1979, 16 U.S.C. Section 470aa-47011; 43 CFR Part 3
	Approve pesticide use proposal	BLM Manuel 9011.1, Guidelines for Conducting Chemical Pest Control Program
U.S. Fish and Wildlife Service	Section 7 Consultation process for endangered or threatened species	Endangered Species Act of 1973; 16 U.S.C. 1531 et seq.
U.S. Department of Transportation Federal Highway Administration (DOT)	Issue permits to cross federal-aid highways	23 U.S.C. Sections 116, 123, 23 CFR Part 645 Subpart B
U.S. Department of the Army Corps of Engineers	Issue Section 404 permit for placement of dredged or filled material in waters of the United States	Section 404 of the Clean Water Act of 1972 (40 CFR 122-123); 33 U.S.C. Section 1344; 33 CFR Parts 323, 325
	Issue Section 10 permit for crossing navigable water in the United States	Section 10 of the Rivers and Harbors Act of 1899, 33 U.S.C. 401-413
U.S. Department of the Treasury Bureau of Alcohol, Tobacco and Firearms	Issue permits to purchase, store, and use explosives	Section 1102(a) of the Organized Crime Control Act of 1970, 18 U.S.C. Section 841-848; 27 CFR Part 181
Advisory Council on Historic Preservation	Review and compliance activities as defined in the MOA	Section 106 National Preservation Act (16 U.S.C. 470) (36 CFR Part 80)

Table 1-1 (Continued)

Agency	Nature of Action	Authority
STATE OF WYOMING		
Department of Environmental Quality – Water Quality Division	Issue National Pollution Discharge Elimination System Permit for discharges; prepare Storm Water Pollution Prevention Plan	Wyoming Environmental Quality Act, W.S. 35-11-301
Wyoming Highway Department	Issue permits for oversize and overweight loads	Chapters 17 and 20 of the Wyoming Highway Department Rules and Regulations
	Issue encroachment permits	Chapter 12 of the Wyoming Highway Department Rules and Regulations
State Land Board	Issue easements to cross state lands	W.S. 35-20 and 36-20
Wyoming State Engineer's Office	Grant permit to appropriate water for hydrostatic testing, dust control, and other uses	W.S.41-121 through 147
State Historic Preservation Office	Review and compliance activities as defined in the Memorandum of Agreement	Section 106 National Preservation Act (16 U.S.C. 470) (36 CFR Part 80)
Wyoming Public Service Commission	Issue certificate of public convenience and necessity	W.S. 1977 and Wyoming Administrative Procedures Act
County Commissioners	Road crossing permits, land use permits, and licenses	County zoning regulations
County Health Departments	Temporary sanitation facilities	County sanitation requirements

- Engineering proposals and construction drawings
- Fire protection
- Erosion control, revegetation, and restoration
- Water resources
- Transportation
- Communications
- Cultural resources
- Threatened or endangered species
- Wildlife mitigation
- Blasting
- Dust control
- Weed control
- Health and safety
- Construction schedule
- Construction facilities and housing
- Pipeline testing
- Construction monitoring
- Operations and maintenance
- Abandonment

Prior to construction, the applicant would be required to conduct site-specific surveys on the proposed ROW, temporary use areas (TUAs), and ancillary facilities for sensitive plants and animals, including threatened and endangered species and federally protected raptors; jurisdictional wetlands and waters of the U.S.; cultural, historical, and paleontological resources; noxious weeds and topsoil stripping depths. The BLM then applies stipulations to protect site-specific resources. When possible, these stipulations are incorporated into the POD.

The process used by pipeline companies to obtain easements across private lands is different from that used for state or federal lands. The company's ROW agent first contacts the landowner for permission to determine the proposed pipeline's centerline across the owner's property. At the same time, the ROW agent seeks the landowner's permission to conduct the same surveys required to obtain permits to cross federal and state lands (such as cultural and wildlife surveys).

A plat is prepared after the surveyor obtains the necessary data for locating the pipeline. This plat shows the relationship of the planned pipeline to the property boundaries. The ROW agent again meets with the landowner to initiate negotiations for an easement across the property.

Across federal, state and private lands, PSC has requested a 30-foot-wide permanent easement and an additional 45-foot-wide temporary construction easement on level terrain. Temporary use areas would be required at crossings of the Sweetwater River, highways (287, 20/26 etc.), and railroads. Construction techniques and rehabilitation procedures would be the same on private and public lands, or as specified by the landowner.

1.6 Conformance with Land Use Plans

The proposed project would be located within the BLM's Lander, Casper, and Buffalo Field Office areas, each of which has an approved Resource Management Plan (RMP) (BLM 1984a,1985c, 1986b). The Proposed Action is in conformance with these plans. In addition, the proposed project is in conformance with designated corridors. None of the project disturbance area is located within areas where ROWs are prohibited. The RMPs do identify restrictions on ROW placement (e.g., Interstate 25 [I-25] segments). However, linear projects are allowed to cross I-25. Specific land use plan and applicable statutory/regulatory information is provided in Chapter 3.0.

1.7 Project Interrelationships

1.7.1 Interrelated Projects

Development of the PSC CO_2 Pipeline Project would be related to EOR activities at the Salt Creek, Sussex, and Hartzog Draw oil fields (see Figure 1-1). EOR in the Salt Creek and Sussex oil fields would be initiated during the Phase I portion of the PSC CO_2 Pipeline Project, while activities in the Hartzog Draw field would occur during Phase II. Initially, the following operators would be the first to implement EOR activities at their wells: ExxonMobil (Hartzog Draw), Howell (Salt Creek), and Westport (Sussex). After 2 or 3 years, other operators with active wells may include the EOR process as part of their operation. A summary of recent production in these fields is provided in Table 1-2.

Table 1-2
Summary of Oil Production in the Salt Creek, Sussex, and Hartzog Draw Oil Fields

Oil Production Information	Salt Creek	Sussex	Hartzog Draw
Number of Producing Wells in 1999	841	24	151
Production Initiated (Year)	1889	1948	1976
Barrels of Oil Produced in 1999	2,035,382	135,992	2,297,211
Barrels of Oil Produced Since Inception	659,473,013	71,377,274	100,312,401

Source of Information: Wyoming Oil and Gas Commission (1999).

Based on discussions with major operators in the fields (Nelms 2000; Geiger 2000), construction activities would be limited to previously disturbed land. The types of changes that would occur in each of the oil fields as a result of the construction activities include the following:

- Aboveground pipeline (2- to 6-inch diameter) connection to the CO_2 source;
- New buried injection lines (2- to 6-inch diameter steel);
- New buried gathering lines (6-inch steel for water and 6-inch steel for gas);
- New buried return gathering line (10- to 20-inch fiberglass for CO_2 gas);
- New CO_2 distribution header (approximately 40 feet x 40 feet);
- New CO_2 processing plant; and
- New compressor station.

Trenching would be required for the injection and gathering lines, with the depth of approximately 4 to 6 feet and width of 1 to 2 feet. No new roads would be required as part of the EOR process.

New activities associated with operation activities in these fields would result from the CO_2 processing plant. Since the EOR activities would occur at existing active wells, no new development would occur. Current production and vehicle traffic would occur within each field.

1.7.2 Special Management Areas

The proposed CO_2 pipeline route would pass within less than 100 feet of the BLM's Miller Springs and Split Rock Wilderness Study Areas (WSAs), previously called the Sweetwater Rocks WSAs (MP 134 to 140) in Natrona County, Wyoming (see Chapter 3.0). These areas were evaluated in the Lander Final Wilderness Environmental Impact Statement (BLM 1990), and both areas were recommended for nonwilderness uses.

The pipeline also would pass through the Green Mountain and Salt Creek Areas of Critical Environmental Concern (ACEC). See Chapters 3.0 and 4.0, Land Use and Recreation, for additional discussion of these special management areas.