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COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF THE COOPER RIDGE NE QUADRANGLE, SWEETWATER COUNTY, WYOMING

(Report includes 25 plates)

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INTRODUCTION

Purpose

This text is to be used in conjunction with Coal Resource Occurrence (CRO) and Coal Development Potential (CDP) Maps of the Cooper Ridge NE quadrangle, Sweetwater County, Wyoming (25 plates). This report was compiled to support the land planning work of the Bureau of Land Management to provide a systematic coal resource inventory of Federal coal lands in or near Known Recoverable Coal Resource Areas (KRCRA's) in the western United States.

Location

The Cooper Ridge NE 7 1/2-minute quadrangle is in the southern part of Sweetwater County, 19 mi (31 km) east-southeast of the city of Rock Springs, Wyoming.

Accessibility

The northwestern part of the quadrangle is reached by a gravel road that leads to the Brady oil and gas field; the road joins Wyoming Highway 430, 19 mi (31 km) east-southeast of Rock Springs. The road crosses the quadrangle and rejoins Highway 430, 12 mi (19 km) south of the southeastern part of the quadrangle. Most parts of the quadrangle are accessible by unimproved roads and trails that branch laterally from the Brady field road.

Physiography

The Cooper Ridge NE quadrangle is situated in the southeastern part of the Rock Springs coal field in the southeastern part of the Rock Springs uplift. The vegetation consists of sparse grass and patches of sage at lower elevations, and juniper trees along high ridges. Topographic elevations range from 6,800 ft (2,070 m) above sea level along Black Butte Creek in the northwestern part of the quadrangle, to 7,400 ft (2,250 m) on northeast-trending ridges in different parts of the quadrangle.

Black Butte Creek, the major drainage system of the area, is an intermittent stream which flows northwestward.

Industries in the quadrangle are sheep and cattle ranching, and gas and oil production from the Brady field in the southeast part of the quadrangle. The area is uninhabited.

Climate

The climate in the area is arid and windy. Mean annual precipitation, mostly in the form of snow, is about 7 in. (18 cm) (Root, Glass, and Lane, 1973). Temperature annually ranges between -30°F (-34°C) and 100°F (38°C) Strong westerly winds occur almost daily.

Land Status

The quadrangle is 8.6 mi (13.8 km) long, 6.5 mi (10.5 km) wide, and encompasses 55.9 mi^2 (145 km^2). It includes part of the Rock Springs Known Recoverable Coal Resource Area (KRCRA). Most lands in the area that contain minable coal--in beds more than 5 ft (1.5 m) thick, with overburden less than 1,000 ft (305 m) thick--are either privately owned or are Federal lands under Preference Right Lease Application (pl. 2). In some lands within the KRCRA the coal rights are federally owned, but are subject to Coal Prospecting Permits. Some federally owned lands underlain by minable coal inside this quadrangle are outside the boundaries of the KRCRA; none of these are under Federal coal lease, prospecting permit, or license.

GENERAL GEOLOGY

Previous Work

The southern part of the Rock Springs coal field, including the quadrangle area, was mapped in 1908, by A. R. Schultz of the U.S. Geological Survey. An uncolored geologic map, showing coal outcrops, at the scale of 1:250,000, on a planimetric base, was later published (Schultz, 1910, pl. 14). A detailed geologic map of the quadrangle, on a topographic base, was issued as an open-file report of the U.S. Geological Survey (Roehler, 1976); it is the principal basis of this compilation.

Stratigraphy

Rocks exposed in the quadrangle are of Quaternary, Tertiary and Cretaceous ages. They are assigned, in descending order, to surficial deposits of alluvium that occupy stream valleys, to the underlying Wasatch and Fort Union Formations of early Tertiary age, and to the Lance Formation, Fox Hills Sandstone, Lewis Shale, Almond Formation, Ericson Sandstone, and Rock Springs Formation of Late Cretaceous age.

Coal beds in the area are contained in the Fort Union, Lance, and Almond Formations. The Fort Union Formation is more than 1,200 ft (366 m) thick; it is composed of gray shale, siltstone, sandstone, carbonaceous shale, and coal (pl. 3). The underlying Lance Formation ranges in thickness from 0 in the southwest part to more than 200 ft (61 m) in the northeast part of the quadrangle. It consists predominantly of dark gray, carbonaceous shale that contains beds of calcareous sandstone and coal.

The Almond Formation is as much as 900 ft (274 m) thick; it consists of gray sandstone and interbedded gray shale, gray and brown carbonaceous shale, coal, and minor thin beds of gray dolomitic siltstone, and at least one bed of limestone.

Coal beds in the Almond Formation were deposited in coastal swamps and lagoons that developed west of north-trending barrier bars during westward transgression of the Lewis sea in late Cretaceous time (Roehler, Swanson, and Sanchez ,1977). During deposition of the Lance Formation the sea was retreating eastward and the coal beds were deposited along the shorelines of the sea, probably in swampy lagoons that formed along sand barrier bars. Coal beds in the Fort Union Formation were deposited in freshwater swamps in an extensive intermontane basin. These coal beds are more extensive and generally thicker than the coal beds in the Almond and Lance Formations.

Structure

The quadrangle is on the southeast flank of the Rock Springs uplift, a few miles east of the southward plunge of the major anticlinal axis of the uplift. The general strike of strata in the quadrangle is N. 30° E. except where strata bow along the flanks of a southeast-plunging anticline whose axis lies along Black Butte Creek. The rocks dip southeastward at angles rarely exceeding 6 degrees. The exposed rocks have not been faulted.

COAL GEOLOGY

Eleven coal beds having thicknesses of 5 ft (1.5 m) or more were mapped on the surface and named by Roehler (1976); many of these and some additional local beds, mostly less than 4 ft (1.2 m) thick, were identified on geophysical logs of oil-and-gas test holes (pl. 3).

There are no chemical analyses of coal from the Cooper Ridge NE quadrangle. However, analyses from other places in the Rock Springs coal field indicate that the coals are subbituminous C to subbituminous A in rank. They contain less than 1 percent sulfur and average about 50 percent fixed carbon and 4 percent ash. The heating values range from 8,800 to 10,850 Btu/lb (20,469 to 25,237 kJ/kg) on a moist, mineral-matter-free basis (Schultz, 1910, p. 243).

Coal Beds of the Fort Union Formation

The minable coal beds of the Fort Union Formation are the Big Burn and the Little Valley coal beds; they are the thickest and most extensive coal beds in the quadrangle.

The Big Burn, also known as the Nuttal coal bed in the proposed Black Butte mine area north of this area, persists throughout its outcrop extent within the quadrangle. It generally rests on carbonaceous shale and is overlain by 2 to 3 ft (0.6 to 0.9 m) of carbonaceous shale or siltstone and by as much as 30 ft (9 m) of gray, very fine grained, in part calcareous, in part soft, argillaceous sandstone that is moderately cemented. The upper third of the coal bed commonly contains a siltstone or carbonaceous shale parting as much as 6 in (15 cm) thick. At least one minor coal bed, generally less than 5 ft (1.5 m) thick, was found 15 to 40 ft (4.6 to 12 m) below the Big Burn bed in auger test holes that were drilled by the U. S. Geological Survey.

The coal bed called Little Valley in this quadrangle is equivalent to the Upper Little Valley of the Burley Draw quadrangle to the south (Roehler, 1974). It is the thickest coal bed in the quadrangle, but its thickness varies rapidly along the outcrop. It generally is overlain by sandstone and interbedded sandstone and shale that range in thickness to more than 50 ft (15 m). Partings, where present, are generally very thin. The Lower Little Valley coal bed is present in this area; it lies 5 to 25 ft (1.5 to 7.6 m) below the Upper Little Valley, but its net thickness is generally less than 4 ft (1.2 m).

Coal Beds of the Lance Formation

The minable coal beds of the Lance Formation include the French and Bluff coal beds. The French coal bed crops out only in the northeastern part of the quadrangle. It is generally a clean, bright coal free of partings, and it is generally overlain by a fine-grained, hard calcareous, ripple-marked sandstone, locally replaced by coarse-grained calcareous channel-filling sand.

The Bluff coal bed is also generally a clean, bright coal, free from partings, but it is generally overlain by carbonaceous shale and interbedded thin beds of gray shale and calcareous sandstone. Locally, the bed splits into a persistent lower split and a very localized upper split.

Coal Beds of the Almond Formation

The upper part of the Almond Formation contains as many as 10 beds of coal, most of which have been mapped and named by Roehler (1977). Only the Shrike, Buzzard, Magpie, Robin and Meadowlark have thicknesses exceeding 5 ft (1.5 m). All of the Almond coals comprise a coal zone that in outcrop ranges from 70 to 150 ft (21 to 46 m) in thickness; non-coal-bearing rocks of the zone consist largely of dark gray carbonaceous, fissile shale, gray limy siltstone and gray fissile shale, and lenticular, commonly calcareous, sandstone. Partings and splits are common in most of the coal beds. As shown on plate 1, most of the coals are local in extent except the Magpie, which is persistent and the most important of the Almond Formation coal beds.

COAL RESOURCES

Surface mapping information and coal thickness measurements from Roehler (1976), as well as data from oil-and-gas and coal test holes, were used to construct isopach and structure-contour maps of 11 coal beds in the quadrangle.

Coal resources were calculated using coal isopach maps (plates 4, 7, 10, 13, and 16). The coal-bed acreage, measured by planimeter, multiplied by the average isopached thickness of coal 5 ft (1.5 m) or more thick, times 1,770 (short tons per acre-foot of subbituminous coal — 13,018 metric tons per hectare-meter) yields the Reserve Base tonnage for each coal bed in each reporting category; measured, indicated, and inferred coal under 200 to 1,000 ft (61 to 305 m) of overburden. Reserve Base (RB) for less than 200 ft (61 m) of overburden and measured, indicated, and inferred for coal under 200 to 1,000 ft (61 to 305 m) of overburden. Reserve Base (RB) and Reserve values (R) for the coal beds are shown on plates 22 and 23. Reserve values are the Reserve Base times the recovery factor of 0.85 for coal under less than 200 ft (61 m) and 0.50 for coal under more than 200 ft (61 m) of overburden.

Total coal Reserve Base by cadastral section (for coal beds thicker than 5 ft (1.5 m) under less than 1,000 ft (305 m) of overburden) is shown on plate 2. Reserve Base from all sections totals approximately 99 million short tons. (89.8 million metric tons).

COAL DEVELOPMENT POTENTIAL

Development Potential for Surface Mining Methods

Areas where the coal beds are overlain by 200 ft (61 m) or less of overburden are considered to have potential for strip mining and were assigned a high, moderate, or low development potential, as shown on plate 24. The assignments are based on mining-ratio values -cubic yards of overburden per ton of recoverable coal (to convert to cubic meters per metric ton, multiply by 0.842). The formula used to calculate mining ratios is:

$$MR = \frac{t_o\ (0.911)}{t_c\ (rf)}$$

where MR = Mining ratio
t_o = Thickness of overburden
t_c = Thickness of coal
rf = Recovery factor
0.911 = Factor for subbituminous coal

Areas of high, moderate, and low development potential for surface mining in this quadrangle are underlain by coal beds having mining-ratio values of 0 to 10:1 for high, 10:1 to 15:1 for moderate, and greater than 15:1 to 200 ft (61 m) of overburden for low development potential. These mining-ratio values are shown on plates 6, 9, 12, 15, and 18. The areas of high, moderate, and low development potential are based on current economic and technological criteria and are applicable only to this quadrangle. They were derived in consultation with Paul Storrs, Area Mining Supervisor, U.S. Geological Survey.

Development Potential for Underground Mining

The coal development potential for underground mining of coal is shown on plate 25. In this quadrangle the Big Burn, Little Valley, Bluff, Magpie, Meadowlark, and Robin coal beds, where they are 5 ft (1.5 m) or more thick and are under 200 to 1,000 ft (61 to 305 m) of overburden, are considered to have a high potential for underground mining.

Table 1.--Strippable-coal Reserve Base data (in short tons) for Federal coal lands in the Cooper Ridge NE quadrangle, Sweetwater County, Wyoming

(Development potentials are based on mining ratios (cubic yards of overburden/ton of underlying recoverable coal). To convert short tons to metric tons, multiply by 0.9072; to convert mining ratios in yd^3/ton coal to m^3/t, multiply by 0.842)

Coal bed	High development potential (0 to 10:1 mining ratio)	Moderate development potential (10:1 to 15:1 mining ratio)	Low development potential (>15:1 mining ratio)	Total
Big Burn	1,930,000	980,000	2,725,000	5,635,000
Little Valley	2,310,000	1,580,000	2,256,000	6,146,000
Shrike	440,000	390,000	580,000	1,410,000
Robin	0	0	15,000	15,000
Meadowlark	0	0	12,000	12,000
Magpie	4,341,000	977,000	1,910,000	7,228,000
TOTAL	9,021,000	3,927,000	7,498,000	20,446,000

Table 2.--Coal Reserve Base data (in short tons) for underground mining methods for Federal coal lands in the Cooper Ridge NE quadrangle, Sweetwater County, Wyoming

(To convert short tons to metric tons, multiply by 0.9072)

Coal bed name	High development potential
Big Burn	20,340,000
Little Valley	28,383,000
Bluff	750,000
Mallard	2,110,000
Robin	11,590,000
Meadowlark	3,600,000
Magpie	11,980,000
TOTAL	78,753,000

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