UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

TEXT TO ACCOMPANY:

COAL RESOURCE OCCURRENCE

AND

COAL DEVELOPMENT POTENTIAL

MAPS

OF THE

COOLEY DRAW QUADRANGLE

NIOBRARA COUNTY, WYOMING

BY

INTRASEARCH INC.

DENVER, COLORADO

OPEN FILE REPORT 79-474

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This report is preliminary, and has not been edited or reviewed for conformity with United States Geological Survey standards or stratigraphic nomenclature.

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CONVERSION TABLE

TO CONVERT	MULTIPLY BY	TO OBTAIN
inches	2.54	centimeters (cm)
feet	0.3048	meters (m)
miles	1.609	kilometers (km)
acres	0.40469	hectares (ha)
tons (short)	0.9072	metric tons (t)
cubic yards/ton	0.8428	cubic meters per metric tons
acre feet	0.12335	hectare-meters
Btu/lb	2.326	kilojoules/kilogram (kJ/kg)
Btu/lb	0.55556	kilocalories/kilogram (kcal/kg)
Fahrenheit	5/9 (F-32)	Celsius

I. Introduction

This report and accompanying maps set forth the Coal Resource Occurrence (CRO) and Coal Development Potential (CDP) of coal beds within the Cooley Draw Quadrangle, Niobrara County, Wyoming. This CRO and CDP map series includes 3 plates (U. S. Geological Survey Open-File Report 79-474). The project is compiled by IntraSearch Inc., 1600 Ogden Street, Denver, Colorado, under KRCRA Northeastern Powder River Basin, Wyoming Contract Number 14-08-0001-17180. This contract is a part of a program to provide an inventory of unleased federal coal in Known Recoverable Coal Areas (KRCRA's) in the western United States.

The Cooley Draw Quadrangle is located in Niobrara County, in eastern Wyoming. It encompasses parts of Townships 34 and 35 North, Ranges 66 and 67 West, and covers the area; 42°52'30" to 43°00' north latitude; 104°45' to 104°52'30" west longitude.

Three maintained gravel roads provide access to the Cooley Draw Quadrangle from all quadrangle boundaries. The major maintained road extends northeast-southwest across the highest elevations within the study area. Numerous minor roads and trails that branch from these maintained roads provide additional access to the quadrangle. The closest railroad is the Chicago North Western trackage, approximately 7 miles (11 km) to the south at Keeline, Wyoming.

Little Lightning Creek flows northeastward through the eastern half of the quadrangle providing the major drainage for the area. Baby Springs Draw, Flat Top Draw, Dumbell Rock Draw, and the Spring Branch of Harney Creek Draw provide drainage for the southwestern portion of the quadrangle. All of the aforementioned creeks drain northeastward into the Cheyenne River. A maximum elevation of 5360 feet (1634 m) above sea level is located in Section 36, T.34 N., R. 67 W. Minimum elevations of

4560 feet (1390 m) above sea level occur in the valley floor of the Little Lightning Creek at the eastern quadrangle boundary.

The ten to twelve inches (25 to 30 cm) of annual precipitation that falls in this semi-arid region accrues principally in the springtime. Summer and fall precipitation usually originates from thunderstorms, and infrequent snowfalls of six inches (15 cm) or less generally characterize winter precipitation. Although temperatures ranging from less than -25°F (-32°C) to more than 100°F (38°C) have been recorded near Douglas, Wyoming, average wintertime minimums and summertime maximums approach +5° to +15°F (-15° and -9°C) and 75° to 90°F (24° to 32°C), respectively.

Surface ownership is divided among fee, state, and federal categories with the state and federal surface generally leased to ranchers for grazing purposes. Details of surface ownership are available at the Niobrara County Courthouse in Lusk, Wyoming. Details of mineral ownership on federal lands are available from the U. S. Bureau of Land Management in Cheyenne, Wyoming. Federal coal ownership is shown on Plate 2 of the Coal Resource Occurrence maps. The non-federal coal ownership comprises both fee and state coal resources.

The Coal Resource Occurrence and Coal Development Potential program pertains to unleased federal coal and focuses upon: 1) the delineation of lignite, subbituminous coal, bituminous coal, and anthracite at the surface and in the subsurface on federal land; 2) the identification of total tons in place as well as recoverable tons; 3) categorization of these tonnages into measured, indicated, and inferred reserves and resources, and hypothetical resources; and 4) recommendations regarding the potential for surface mining, underground mining, and in-situ gasification of the coal beds. This report evaluates the

coal resources of all unleased federal coal beds in the quadrangle which are 5 feet (1.5 m) or greater in thickness and occur at depths down to 3000 feet (914 m). No resources or reserves are computed for leased federal coal, state coal, fee coal, or lands encompassed by coal prospecting permits and preference right lease applications.

II. Geology

Regional. The thick, economic coal deposits of the Powder River Basin in northeastern Wyoming occur mostly in the Tongue River Member of the Fort Union Formation, and in the lower part of the Wasatch Formation. Approximately 3000 feet (914 m) of the Fort Union Formation, that includes the Tongue River, Lebo, and Tullock Members of Paleocene age, are unconformably overlain by approximately 700 feet (213 m) of the Wasatch Formation of Eocene age. These Tertiary formations lie in a structural basin flanked on the east by the Black Hills uplift, on the south by the Hartville and Casper Mountain uplifts, and on the west by the Casper Arch and the Big Horn Mountain uplift. The structural configuration of the Powder River Basin originated in Late Cretaceous time, with episodic uplift thereafter. The Cretaceous Cordillera was the dominant positive land form throughout the Rocky Mountain area at the close of Mesozoic time.

Outcrops of the Wasatch Formation and the Tongue River Member of the Fort Union Formation cover most of the areas of major coal resource occurrence in the Powder River Basin. The Lebo Shale Member of the Fort Union Formation is mapped at the surface northeast of Recluse, Wyoming, east of the principal coal outcrops and associated clinkers (McKay, 1974), and presumably projects into the subsurface beneath much of the basin. One of the principal characteristics for separating the

Lebo and Tullock Members (collectively referred to as the Ludlow Member east of Miles City, Montana) from the overlying Tongue River Member is the color differential between the lighter-colored upper portion and the somewhat darker lower portion (Brown, 1958). Although geologists working with subsurface data, principally geophysical logs, in the basin are trying to develop criteria for subsurface recognition of the Lebo-Tullock and Tongue River-Lebo contacts, no definitive guidelines are known to have been published. Hence, for subsurface mapping purposes, the Fort Union Formation is not divided into its members for this study.

During the Paleocene epoch, the Powder River Basin tropic to subtropic depositional environment included broad, inland flood basins with extensive swamps, marshes, freshwater lakes, and a sluggish but active northeastward discharging drainage system, superimposed on a near base level, emerging sea floor. Much of the vast areas where organic debris collected was within a reducing depositional environment. Localized uplifts began to disturb the near sea level terrain of northeastern Wyoming following retreat of the Cretaceous seas. However, the extremely fine-grained characteristics of the Tongue River Member clastics suggest that areas of recurring uplift peripheral to the Powder River Basin were subdued during major coal deposit formation.

The uplift of areas surrounding the Powder River Basin created a structural basin of asymmetric characteristic, with the steep west flank located on the eastern edge of the Big Horn Mountains. The axis of the Powder River Basin is difficult to specifically define, but is thought to be located in the western part of the Basin, and to display a north-south configuration some 15 to 20 miles (24 to 32 km) east of Sheridan, Wyoming. Thus, the sedimentary section described in this report lies on the east flank of the Powder River Basin, with gentle

dips of two degrees or less disrupted by structural configurations thought to relate to tectonic adjustment and differential compaction.

Some coal beds in the Powder River Basin exceed 200 feet (61 m) in thickness. Deposition of these thick, in-situ coal beds requires a discrete balance between subsidence of the earth's crust and in-filling by trememdous volumes of organic debris. These conditions in concert with a favorable ground water table, non-oxidizing clear water, and a climate amenable to the luxuriant growth of vegetation produce a stabilized swamp critical to the deposition of coal beds.

Deposition of the unusually thick coal beds of the Powder River Basin may be partially attributable to short distance water transportation of organic detritus into areas of crustal subsidence. Variations in coal bed thickness throughout the basin relate to changes in the depositional environment. Drill hole data that indicate either the complete absence or extreme attenuation of a thick coal bed probably relate to location of the drill holes within the ancient stream channel system draining this low land area in Early Cenozoic time. Where thick coal beds thin rapidly from the depocenter of a favorable depositional environment, it is not unusual to encounter a synclinal structure over the maximum coal thickness due to the differential compaction between organic debris in the coal depocenter and fine-grained clastics in the adjacent areas.

Local. The Cooley Draw Quadrangle is located in an area where surface rocks are classified into the Fort Union, White River, and Arikaree Formations of Tertiary age. Also present at the surface are the Cretaceous age Lance Formation, Fox Hills Sandstone and Pierre (Love and others, 1955).
Shale ∧ The Fort Union outcrops cover approximately forty percent of the quadrangle and include fine to very fine-grained sandstones,

siltstones, mudstones, carbonaceous shales, and thin coal beds. The White River Formation covers approximately thirty percent of the quadrangle and consists of tuffaceous siltstones, conglomerates, freshwater limestones, and altered ash beds. The Arikaree Formation includes very fine-grained sandstones, conglomerates, siltstones, limestones, and altered ash beds, and it crops out over approximately fifteen percent of the quadrangle. The Lance Formation, covering about thirteen percent of the area, consists of fine to very fine-grained sandstones, siltstones, carbonaceous shales, lenticular coal beds, and bentonite zones. The Fox Hills Sandstone and the Pierre Shale crop out in a small inlier surrounded by the White River Formation. Each of these units covers approximately one percent of the quadrangle. The Fox Hills sandstone is fine to medium-grained, angular to sub-rounded, argillaceous and very slightly to non-calcarcous. The Pierre Shale is a gray marine shale with carbonaceous zones, bentonite beds and fine to very fine-grained sandstones.

The Cretaceous sediments dip eight to twenty-four degrees to the northwest. The Tertiary strata are unconformable with the underlying Cretaceous rocks and dip to the northwest at one to three degrees. Denson and Horn (1975) define a concealed fault, downthrown on the west side, trending northeast from the southwest part of the quadrangle to the northeast corner. A northeast trending syncline in the extreme southeast corner is also shown by Denson & Horn (1975).

III. Data Sources

Areal geology of the coal outcrops and associated clinker is derived from the Lost Spring coal field report (Winchester, 1912). Two coal bed outcrops less than five feet (1.5 m) thick are present in the southwestern portion of the Cooley Draw Quadrangle.

The major source of subsurface control, particularly on deep coal beds, is the geophysical logs from oil and gas test bores and producing wells. Some geophysical logs are not applicable to this study, for the logs relate only to the deep potentially productive oil and gas zones. More than eighty percent of the logs include resistivity, conductivity, and self-potential curves. Occasionally the logs include gamma, density, and sonic curves. These logs are available from several commercial sources.

All geophysical logs available in the quadrangle are scanned to select those with data applicable to Coal Resource Occurrence mapping. Paper copies of the logs are obtained, interpreted, and coal intervals identified where they exist.

The topographic map of the Cooley Draw Quadrangle is published by the U. S. Geological Survey, compilation date, 1970. Land network and mineral ownership data are compiled from land plats available from the U. S. Bureau of Land Management in Cheyenne, Wyoming. This information is current to October 13, 1977.

IV. Coal Bed Occurrence

The Cooley Draw Quadrangle is located south of the principal coal deposits of the Powder River Basin. Two coal bed outcrops less than 5 feet (1.5 m) thick are present in this area, and are considered too thin to be evaluated. No coal beds are identified in the subsurface from evaluation of geophysical logs.

A published analysis for a 59 in. (150 cm) coal bed at the Harney Creek mine located in Section 13, T. 34 N., R. 67 W. is as follows:

COAL BED NAME	ASH	FIXED CARBON	MOISTURE	VOLATILES	SULFUR	BTU/LB
Local (1)	7.3	34.7	29.9	28.1	0.79	7660

(1) - Winchester, D. E., 1912, The Lost Spring coal field, Converse County, Wyoming: U. S. Geol. Survey Bull. 471-F, p. 485.
All analyses except BTU/LB are express as a percentage.

The Coal Data Sheet, Plate 3, shows by columnar sections the interpretations of geophysical logs.

V. Coal Development Potential

The current data base indicates that, within the parameters of this CRO/CDP map program, there are no significant coal resources within the Cooley Draw Quadrangle of importance to surface and underground mining or in-situ gasification. The entire quadrangle is considered to have no coal development potential. Therefore, no coal development potential map was compiled.

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