United States Nuclear Regulatory Commission Official Hearing Exhibit			
In the Matter of:	CROW BUTTE RESOURCES, INC. (Marsland Expansion Area)		
	ASLBP #: 13-926-01-MLA-BD01		
	Docket #: 04008943		
	Exhibit #: NRC013-00-BD01	**Identified:**	10/30/2018
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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

In the Matter of CROW BUTTE RESOURCES, INC. (Marsland Expansion Area)	Docket No. 40-8943-MLA-2 ASLBP No. 13-926-01-MLA-BD01

Hearing Exhibit

Exhibit Number: NRC013

Exhibit Title: Excerpt from Diffendal, "Geomorphic and structural features of the Alliance [ ] Quadrangle, western Nebraska..." (1994)

Geomorphic and structural features of the Alliance 1° × 2° Quadrangle, western Nebraska, discernible from synthetic-aperture radar imagery and digital shaded-relief maps

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ABSTRACT

The digital shaded-relief map of the United States and the synthetic-aperture radar map of the Alliance Nebraska 1° × 2° area prepared by the U.S. Geological Survey (USGS) in the former case and for the USGS in the latter show oriented landforms and lineaments in northwest Nebraska. Parallel and subparallel hills and valleys developed on different geologic materials ranging from shales through sandstones to loess and eolian sand appear to be wind erosional features subsequently modified by running water. The long axes of these hills and valleys generally trend between N40°W and N50°W. Similar features also occur across major areas of the Great Plains from Montana southeast at least to Kansas. Most of the lineaments are in two sets, one trending northeast, the other northwest. There are some east-west and north-south trending lineaments in the western part of the quadrangle, some circular features in the northwest, and some chevronlike lineaments in the north-central part. Some lineaments appear to coincide wholly or in part with known faults in western Nebraska or with extensions of faults in east-central Wyoming into northwest Nebraska. All other lineaments are probably reflections of either jointing or, more likely, of faulting. Additional field work will be needed to verify which of these two, if either, is responsible for any particular lineament.

INTRODUCTION

In 1988 the U.S. Geological Survey (USGS) published a radar image mosaic of the area covered on the Alliance, Nebraska, 1° × 2° topographic map at the scale of 1:250,000. Then in 1991 the USGS published a digital shaded-relief map of the 48 contiguous states at a scale of 1:1,000,000. Both of these maps depict numerous linear features in northwest Nebraska and the shaded relief map seems to indicate that some continue into adjacent states. The features seem to fall into two groups, those that are formed to a greater extent by eolian and/or fluvial processes and those that are structurally formed. The purposes of this paper are to review reports and data about geomorphology and structural geology in northwestern Nebraska and adjacent areas, to compare these data to data on the groups of features discernible on the two maps, and to suggest which groups are probably largely due to geomorphic processes and which are formed primarily by structural processes.

STUDY AREA

The study area is in northwestern Nebraska (Fig. 1) and lies between 42° and 43° North Latitude and between 102° and 104° West Longitude. Parts of five physiographic regions and two principal rivers occur in the study area. The physiographic regions are the Pierre Hills, Pine Ridge, Box Butte Tableland, Sand Hills, and the North Platte Valley (Fig. 2). The Niobrara River, the White River, and their tributaries drain much of the northern part of the study area, while tributaries to the North Platte River (itself not in the study area) drain the southwest. Drainages on much of the Box Butte Tableland stop abruptly in the east at the boundary with the Sand Hills.

The Pierre Hills occupy the northwestern part of the map area and are generally underlain by the Pierre Shale of Cretaceous age. Some areas of so-called "badlands" Tertiary beds of the Brule and Chadron formations, White River Group, overlie the Pierre in places, while some Cretaceous strata older than the Pierre crop out in the Chadron Dome area northeast of Chadron, Nebraska (Moore, 1954; Swinehart et al., 1985; Burchett, 1986). Fill terraces composed of Quaternary deposits occur adjacent to floodplains of the White River and its tributaries, and on some hilltops where inverted topography marks the position of the deepest parts of old valley fills.

The Pine Ridge forms a prominent north-facing escarpment up to about 1000 ft (305 m) higher than the Pierre Hills and is underlain directly by Tertiary strata of the Ogallala, Arikaree, and White River groups and beneath these by the Cretaceous units exposed in the Pierre Hills. The Arikaree and older rocks on the north slope of the Pine Ridge are faulted and generally dip southward, both indications that the Pine Ridge is part of the area of deformation of the Black Hills (Swinehart, et al., 1985). The divide between the north and south slopes of the Pine Ridge (dashed line in Fig. 2) separates the generally narrower and more steeply sloping north part which is drained by tributaries of the White River from the more gently sloping south part drained by Niobrara River tributaries.

The Box Butte Tableland (Fig. 2) is underlain by Ogallala and older strata (Yatkola, 1978; Swinehart, et al., 1985). Its surface, an extension of the High Plains of Wyoming into Nebraska, is much flatter than the Pine Ridge and is up to 200 ft (61 m) lower than the highest parts of the Pine Ridge to the north. The Tertiary formations beneath the tableland occur as valley fills cut in places by faults, particularly near the Niobrara Valley.

The Sand Hills is part of the large Nebraska Sand Hills Physiographic Province which covers some 20,000 square miles (51,800 square kilometers) of west-central Nebraska (Swinehart, 1990). The surface of this region, mostly in the eastern part of the study area, is underlain by eolian sand which was formed into various types of dunes in the Holocene (Swinehart, 1990). Swinehart (1990) subdivided the dune field on the basis of differences in dune morphology which can be seen without difficulty on radar images (Figs. 1 and 2). The eolian sand, up to 300 ft (91 m) thick, covers parts of the Box Butte Tableland on the east, south, and west, as well as small parts of the eastern Pine Ridge (Fig. 2).