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CHEMICAL AND RADIOLOGICAL COMPOSITION OF AIR AND GROUND WATER NEAR THE MINERALIZED URANIUM ORE DEPOSIT AT CRAWFORD, NEBRASKA

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Data on chemical composition of ground water collected from the "post-Middle Chadron" Oligocene strata are compared with those from water of the basal Chadron hydrological unit in an area near Crawford, Nebraska, where uranium mineralization is known to occur. Uncorrected Eh values, using a calomel reference electrode, indicated water from the "post-Middle Chadron" Oligocene unit was positive, whereas water from the basal Chadron was negative. The basal Chadron waters contained lower levels of calcium and uranium and higher concentrations of sodium, chloride, sulfate, and total dissolved solids, than did waters from the "post-Middle Chadron" Oligocene zone. Radon and radium concentrations in the water samples from the basal Chadron unit fluctuated widely. Radium levels in the oxidizing waters were consistently low (<2 pCi/l), while radium in several water samples from the reduced unit exceeded the maximum recommended level of 5 pCi/l for drinking purposes. These samples, however, are not used domestically.

Radon and radon daughter products in air were also evaluated on a limited basis. Their concentrations appeared similar to reported background levels in other midwestern regions.

† † †

INTRODUCTION

An announcement was made in 1981 of the discovery of a "significant" uranium deposit near Crawford (population 1,300) in northwestern Nebraska (Gigot, 1981). This ore deposit is sometimes called the Crow Butte deposit due to its proximity to neighboring Crow Butte, a landmark located a few kilometers southeast of Crawford. Wyoming Fuel Company, the discoverer of the ore deposit, has estimated a probable reserve in excess of 11,000 metric tons of U_3O_8. Extraction from the ore reserve is currently under study by the *in situ* (solution) technique. Because previous work indicated anomalous concentrations of radium in several flowing wells used for lawn and garden irrigation in Crawford, this study was undertaken to evaluate various water parameters from all known wells in Crawford serving drinking or lawn-garden purposes. Water from known flowing wells in and surrounding the mineralized zone was likewise analyzed. A further extension of the study evaluated radon and radon daughter concentrations in the atmosphere on a monthly basis at three selected sites for a one-year period. The data provide baseline information of water and air parameters in relationship to the underlying mineralized ore zone.

Geological Setting

The Crow Butte ore deposit lies immediately southeast of Crawford in a narrow band up to about 915 m wide and about 9.7 km long (Fig. 1). The ore deposit is contained exclusively in the basal Chadron Sands of Early Oligocene age at depths from 90 m to 250 m (Schultz and Stout, 1955; Collings and Knode, 1983). The confining bed below the basal Chadron Sandstone is the Pierre Shale. The Pierre is a Late Cretaceous marine deposit with relatively uniform composition throughout. It crops out north of Crawford but is not considered an aquifer as demonstrated by the need to pipe in water from other formations for drinking and livestock uses. However, water may be occasionally obtained from wells penetrating the Quaternary sediments lying on top of the Pierre.

The White River Group of Oligocene age consists of the Chadron and the Brule formations (Schultz and Stout, 1955). The Chadron is sometimes separated into three members, but for interpretation of data for this study, the White River Group is separated into the basal Chadron Sandstone and the "post-Middle Chadron Unit."

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