UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
CROW BUTTE RESOURCES, INC.	)	Docket No. 40-8943
	)	ASLBP No. 08-867-02-OLA-BD01
(License Renewal for the	)	
In Situ Leach Facility, Crawford, Nebraska)	)	September 16, 2015

SUPPLEMENTAL TESTIMONY OF MICKEL WIREMAN

The following is my supplemental testimony in this matter. This testimony specifically addresses:

(a) the potential for declines in Brule water levels as a result of large groundwater withdrawals from the underlying basal Chadron / Chamberlain Pass Formation and;
(b) the hydrology of the Basal Chadron as it relates to mining operations

Ground water levels in the Brule aquifer have not been adequately monitored over the life of the in-situ uranium mining to determine if water levels have declined as a result of lowering the potentiometric surface of the underlying Basal Chadron / Chamberlin Pass Fm to facilitate uranium recovery. Mining operations and water treatment require withdrawal of large volumes of groundwater from the underlying Basal Chadron / Chamberlin Pass Fm. which has lowered the potentiometric head above the aquifer. A significant volume (up to 160 gpm) of this groundwater is consumptively used. There are far too few Brule monitoring wells to adequately monitor for long term water level trends in the Brule aquifer. Three of the four aquifer tests that were reported in the 2007 License Renewal Application (LRA) included only one monitoring well in the Brule aquifer and the fourth test included only two Brule aquifer monitoring wells. Limited Brule water level data are included in the LRA. Table 2.7-3 (LRA –page 2-145) presents 1982 (pre-mining) and 1993 Brule water level data for 8 domestic wells and four Brule monitoring wells

(constructed by Wyoming Fuel Co.) located in the R&D wellfield. However the data from the domestic wells is highly suspect (as indicated in the footnotes to the Table) because the pumping history of the wells before measuring the water level is unknown. Figure 2.7-3 in the LRA depicts 1982-1983 water level elevations for approximately 20 domestic /stock Brule wells; however all but 4 of these wells are located outside the Class III permit area. Crow Butte Resources has supplemented this data with: Exhibits BRD -008a-00-BD01 (Figure 2.7-3a) which depicts 1982-83 water level contours based on Figure 2.7-3 of the LRA and BRD-008b -00 – BD01 (figure 2.7-3b) which depicts 2008 Brule water level elevation contours for the Class III permit area. The LRA did not include data on how many and which wells were used to construct the 2008 water level contour map. CBR has also submitted hydrographs for two Brule wells (Exhibits CBR-063 and CBR-064). The hydrographs depict water level elevations for wells SM 7-22 and SM 7-17 for the time period August 1999 to August 2015. No water level elevation data has been presented for the periods from 1983 until 1993 and from 1994-1999. It is apparent that a there has been no methodical effort to monitor water levels in the Brule aquifer at key locations.

The limited data available to evaluate water level trends in the Brule aquifer over the life of the mine do indicate some changes:

(a) The elevation of the Brule water level at well # 11 on Figure 2.7-3a (BRD-008a) was approximately 3883 ft-amsl in 1982. In 2008 the Brule water level elevation in the same area was approximately 3840 ft-amsl. (Figure 2.7-3b, Ex. BRD-008b) While water level data from different wells was used to construct the contour maps, it appears that the Brule water level elevation in the vicinity of well # 11 declined by about 40 feet from 1982 to 2008. The hydrographs for Brule monitoring wells SM 7-22 and SM 7-17, which are located about ½ mile NE of well # 11, indicate water level elevations ranging between 3842 and 3845 ft amsl for well SM 7- 22 and between 3848 and 3852 ft amsl.for well SM 7-17 over the period from August 1999 to August 2015. These data also indicate a 40 foot decline from 1982. Detailed

comparison of Figures 2.7 -3a (BRD -008a) and 2.7 -3b (BRD -008b) indicates that the Brule water level elevation has decreased between 40 feet (Well 11) and 5 feet in the northwest part of the Class III permit area. Importantly there is no water level data for wells for the period from1991, when mining began to 1999. It is possible that the declines in the Brule water levels occurred within a few years after mining started (which is compatible with a large decline in the potentiometric surface of the Basal Chadron / Chamberlain Pass Fm.) and reached a maximum decline of about 40 feet. Without data from this period it cannot be determined if the 40 foot decline occurred relatively soon after mining began and is the "new" equilibrium.

(b) The water level in wells SM 7-22 and SM 7-17 appear to increase from 2008 to 2012 ((Exhibits CBR-063 and CBR-064). This could be a result of a stopping or reducing mining operations in the vicinity of these two wells, which is another indication that pumping the Basal Chadron / Chamberlain Pass Fm. affects the water level in the Brule aquifer.

(c) The hydraulic gradient on the Brule water table surface also increased significantly from 0.012 in 1982 to 0.25 /0.43 in 2008. This steeping could result from increased discharge from the Brule aquifer via induced downward leakage caused by pumping the underlying Basal Chadron / Chamberlain Pass Fm.

(d) There is uncertainty regarding direction of groundwater flow – the LRA (page 2-140) reports a N-NW flow direction; the LRA (page 2-153) reports an E-NE flow direction; the SER (p22) reports a NW flow direction; Souder (2004) reports a N-NE flow direction. While local variation in flow direction is common, there is no trend data at key locations that would allow determination if the variations are seasonal, climate related or related to mining operations.

(e) Numerous groundwater/geology reports indicate that that the White River and some of its tributaries are hydrologically connected to ground water in their upper reaches. Groundwater in the Brule likely discharges to Squaw Creek, English Creek and the White River. No long trend data from dedicated

monitoring locations on these creeks has been presented by CBR. without this type of data it is not possible to determine if there has been a reduction in groundwater discharge to streams and, if so, is it related to lowering of the Brule water table from pumping the underlying Basal Chadron / Chamberlain Pass Fm. Numerous antidotal accounts of reduced stream flow and spring discharge have been reported.

(f) Data presented on Exhibit CBR-62 (Figure 2.7 -4d - Potentiometric surface -Basal Chadron Sandstone, 2009) and Exhibit BRD-008b (Figure 2.7 -3b –water level map –Brule Fm. 2008) indicate that in the NW part of the Class III permit area the potentiometric surface elevation in the Basal Chadron (3645 ft amsl) in the vicinity of well CM10-15 is lower than the water table elevation in the Brule aquifer (3715 ft amsl . This indicates a downward vertical gradient that would facilitate flow from the Brule downward.

Basal Chadron / Chamberlain Pass Fm. hydrology - The pre-mining potentiometric surface of the Basal Chadron / Chamberlain Pass Fm was above or a few feet below the land surface over most of the mining area, which results in an upward vertical gradient and precludes downward leakage from the overlying Brule aquifer. Estimates by CBR, reported in the NRC EA (page 75), indicate that the potentiometric surface has been lowered by 40-60 feet since 1982 beneath the mine units and predicts a decline of 30-50 ft at Crawford. However there is no Basal Chadron / Chamberlain Pass Fm monitoring well located near Crawford to monitor the decline as mining activities move to the northwest. This is a concern because, as indicated on CBR Figure 2.74d (Ex CBR -062?) the available head above the top of the Basal Chadron / Chamberlain Pass Fm in 2009 was less than 150 ft in the northwest part of the Class III permit area. This is significantly less than the available head in the central and southeastern parts of the mine (250-300 ft.) This could be due to: (a) the fact that mining was more active in the northwest part of the Permit area in 2009; (b) a change in the thickness of the Basal Chadron / Chamberlain Pass Fm; (c) or the effects of a geologic structure (white River fold /fault) on the flow system. Reducing the available head will affect the uranium recovery operations, potentially induce or increase downward leakage from the overlying Brule aquifer, and

decrease well yields and discharge from Basal Chadron / Chamberlain Pass Fm downgradient of the mine. Potentiometric pressure (head) declines occur must faster (and at lower pumping rates) than declines in a water table since no water is coming from storage. There is no discussion of recharge / discharge locations / conditions for the Basal Chadron / Chamberlain Pass Fm. CBR needs to improve the rigor of the monitoring program for the Basal Chadron / Chamberlain Pass Fm. It is very important to collect long term potentiometric surface elevation data downgradient of the mining units and in the vicinity of the White River fold /fault structure.

Pursuant to 10 C.F.R. § 22.304(d) and 28 U.S.C. § 1746, I declare, under penalty of perjury, that the foregoing is true and correct to the best of my knowledge and belief.

Dated this 15th day of September, 2015.

Respectfully submitted,

/s/

Mickel Wireman