CROW BUTTE RESOURCES, INC.

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December 6, 1996

Mr. Joseph J. Holonich, Chief
Uranium Recovery Branch
Division of Waste Management, NMSS (T-7-J9)
Office of Nuclear Material Safety & Safeguards
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20850

RE: Docket No. 40-8943
License No. SUA-1534
Notification of Process Modification

Dear Mr. Holonich:

Crow Butte Resources (CBR) has revised its previous submittal dated October 21, 1996 regarding the use of upflow ion exchange columns to include the results of the MILDOS - Area calculation. CBR is presently authorized to operate at a flow rate of 5,000 gallons per minute (gpm). The present flow rate was authorized by Amendment No. 34, issued March 14, 1996. As part of the Amendment process, the USNRC prepared an Environmental Assessment (EA) to evaluate the impact of the increased flowrate. The EA evaluated the impact from a 5,000 gpm production flowrate and 1,000 gpm of restoration flow. The production flow rate estimate included 3,500 gpm of upflow ion exchange processing and 1,500 gpm of processing in pressurized downflow ion exchange columns. Under the conditions evaluated, the annual Radon emissions were 4,904 curies and the potential total effective dose equivalent (TEDE) to the most affected residence was 20.3 mRem per year or 20.3% of the public dose limit of 100 mRem/year found in 10CFR20.1301.

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NMSS

By this notification, CBR is requesting authorization to operate at a flow of 5,000 gpm using the existing upflow ion exchange columns and 1,000 gpm of restoration flow. This process change will result in an increase in the Radon emissions from 4904 curies per year to 5937 curies per year. The increase in the amount of Radon released is due to the higher Radon release rate (100%) when using upflow ion exchange columns as compared to the release rate (approximately 10%) when using pressurized downflow ion exchange columns. The calculations used to derive the Radon Source Term are found in Appendix A.

The impacts of this process change have been evaluated and follow.

1. The in-plant radiological impact from the proposed process change will be insignificant since all of the Radon is vented to the atmosphere by a Radon exhaust system which vents through a single point source 15.9 meters above the plant foundation.

2. Radiological impacts to the public will be below the NRC regulatory limit. The proposed process change will result in a 21.1% increase in Radon emissions. The maximum potential dose to the receptor located one kilometer from the discharge point based on the previous MILDOS run was 20.3 mRem/year. CBR evaluated the impact of the proposed change using the computer simulation, MILDOS-Area. The results of the MILDOS-Area evaluation are shown in Table 1 and Table 2, along with the results obtained on the previous MILDOS-Area simulation. The data in Table 1 shows that the maximum potential dose to the most affected resident (Receptor #19) increased from 20.3 mRem/yr to 23.2 mRem/yr. The increase is less than 3% of the public dose limit found in 10CFR20.1301.

   Table 2 shows that the proposed activity has no significant impact on the dose received by persons within 80 kilometers (km) when compared to the natural background. The data also shows no significant impact on the population beyond 80 km of the facility or on the total continental dose.

3. The process change will have no impact on liquid effluents.

CBR would appreciate a timely review of this minor process modification, and if you need any further information please contact the undersigned

Sincerely,

CROW BUTTE RESOURCES, INC.

Steve Collings

Steve Collings
SC/dfm
enc.
cc: Ross Scarano

TABLE 1
Total Effective Dose Equivalent to Nearby Residents[1]

Receptor	3500 gpm upflow/1500 gpm downflow 1000 gpm restoration TEDE (mRem/yr)[1]
#6 (Town of Crawford)	0.43
#18 (Ehlers)	8.9
#19 (Gibbons)	20.3
#20 (Stetson)	13.1
#21 (Knode)	2.6
#22 (Brott)	10.5
#26 (McDowell)	1.8
#27 (Taggert)	2.1
#28 (Franey)	2.9
#29 (Bunch)	3.7
#30 (Dyer)	1.2

Receptor	5000 gpm upflow 1000 gpm restoration TEDE (mRem/yr)[1]
#6 (Town of Crawford)	0.49
#18 (Ehlers)	9.8
#19 (Gibbons)	23.2
#20 (Stetson)	14.4
#21 (Knode)	2.9
#22 (Brott)	10.6
#26 (McDowell)	2.0
#27 (Taggert)	2.3
#28 (Franey)	3.3
#29 (Bunch)	4.2
#30 (Dyer)	1.2

[1] TEDE was identical for infant, child, teenager and adult.

TABLE 2

Dose to the Population Bronchial Epithelium From One Year's Operation at 5000 gpm

Criteria	3500 gpm upflow 1500 gpm downflow 1000 gpm restoration (person rem/yr)
Dose received by population within 80 km of the facility	39
Natural background by population within 80 km of the facility	24025
Dose received by population beyond 80 km of the facility	275
Total continental dose	314
Natural background for the continental population	1.73×10^{8}
Fraction increase in continental dose	1.82×10^{-6}

Criteria	5000 gpm upflow 1000 gpm restoration (person rem/yr)
Dose received by population within 80 km of the facility	44.6
Natural background by population within 80 km of the facility	24025
Dose received by population beyond 80 km of the facility	355
Total continental dose	400
Natural background for the continental population	1.73×10^{8}
Fraction increase in continental dose	2.31×10^{-6}

APPENDIX A

RADON EMISSIONS FROM

THE CROW BUTTE PROJECT

Calculation of Annual Radon Emissions
Crow Butte Project
5,000 gpm Upflow with 1,000 gpm Restoration

1) To calculate Radon release from leaching assuming that U-238 is in equilibrium with all its decay products:

$Ci/M^3 = 761\ pCi/g\ ore \times 1.89\ g/cm^3 \times 0.2 \times 0.71/0.29 \times 10^{-6} = 7.04 \times 10^{-4}\ Ci/m^3$

Where:
- 0.2 = Emanating Power
- 0.71 = 1 - Porosity
- 0.29 = Porosity

The yearly release is then:

$7.04 \times 10^{-4}\ Ci/m^3 \times 18925\ lpm \times (0.72) \times 365\ d/yr \times 1.44 = 5042\ Ci/yr$

Where:
- 18925 = liters per minute
- 0.72 = $1\text{-}e^{-(\lambda t)}$
- = $1\text{-}e^{-(0.1812)(7d)}$
- = $1\text{-}e^{-(1.27)} = 1\text{-}0.28$
- 1.44 = constant

2) The Radon release from start-up is given by:

$7.04 \times 10^{-4}\ Ci/m^3 \times 34\ acres \times 4074\ m^2/acre \times 1.52\ m \times 0.29 = 43\ Ci/yr$

Where:
- 4074 = m^2/acre
- 1.52 = Thickness of orebody in meters
- 0.29 = Porosity

The total release of Radon from the start-up solution and production lixiviant solution is:

Start-up solution	43 Ci/yr
Production	5042 Ci/yr
	5085 Ci/yr

3) The Radon release from restoration is given by:

7.04×10^{-4} Ci/m3 x 3785 lpm x 365 d/yr x (0.99) x 1.44
= 1387 Ci/yr + 43 (start-up) = 1430 Ci/yr

Where: 3785 = Restoration flow in liters per minute
0.99 = $1-e^{-(\lambda t)}$
= $1-e^{-(0.181)(35)}$
= 0.99
1.44 = constant

The total release from this 34 acre in situ mining operation is then:

Production	-5042
Start-up	- 43
Restoration (Includes Start-up)	-1430
	6515 Ci/yr

4) Actual Radon Release to the Environment

With 5,000 gpm being processed by upflow ion exchange columns it is expected that all of the Radon will be released to the environment and that 25% of the Radon (1260 Ci) will be released in the wellfield and 75% (3782 Ci) will be released in the plant vent.

During restoration 1,000 gpm of recovered water will be processed by pressurized downflow ion exchange (IX) columns. After IX treatment, 400 gpm will be treated by reverse osmosis (RO). Only a small fraction of the contained Radon will be released during ion exchange and virtually all of the contained Radon will be released during RO treatment. The actual release of the source term of 1,430 Ci of Radon/yr (including start-up) will be as follows:

- 25% of the 1,430 Ci will be released in the wellfield which is 358 Ci/yr
- 10% of the Radon in the 600 gpm to be treated by pressurized IX (NOTE: All of the Radon in the 400 gpm treated by IX-RO will be released).

The calculation for the Radon release from the 600 gpm treated by pressurized IX follows:

1430 Ci/yr - 358 Ci/yr (Wellfield loss) x $\frac{600\ gpm}{1000\ gpm}$ x 0.10 (fraction of Radon released) = 64 Ci/yr

The calculation for the release of 100% of the Radon in the 400 gpm to be treated by RO follows:

1430 Ci/yr - 358 Ci/yr (Wellfield loss) x $\frac{400\ gpm}{1000\ gpm}$ = 429 Ci/yr

A summary of the actual Radon releases to the environment follow:

	Ci/yr Released
• 5,000 gpm upflow	
Plant Vent	3782
Wellfield	1260
• Start-up	43
• 1,000 gpm	
Restoration	852
TOTAL RADON RELEASE TO THE ENVIRONMENT	5937 Ci/yr