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February 26, 2013

Attn: Document Control Desk
Deputy Director, Decommissioning and Uranium Recovery Licensing Directorate
Division of Waste Management and Environmental Protection
Office of Federal and State Materials and Environmental Management Programs
Mailstop T8-F5
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Semiannual Radiological Effluent and Environmental Monitoring Report
Source Materials License # SUA-1534, Docket No. 40-8943

Dear Document Control:

Enclosed please find one copy of the Semiannual Radiological Effluent and Environmental Monitoring Report for the Crow Butte Uranium Project. The report is provided in accordance with License Condition 12.1 of Source Materials License SUA-1534 and 10 CFR Part 40. This report covers the third and fourth quarters of 2012.

If you have any questions concerning the report, please feel free to call me at (307) 316-7568.

Sincerely,
CAMECO RESOURCES

Josh Leftwich
Director of Radiation Safety and Licensing

cc: Ron Burrows - NRC
Nancy Harris – NDEQ, Lincoln Office
CBO File
CR: Cheyenne Office

FSME20

# CROW BUTTE URANIUM PROJECT

# RADIOLOGICAL EFFLUENT AND ENVIRONMENTAL MONITORING REPORT

**For**

## THIRD AND FOURTH QUARTERS, 2012

**USNRC Source Materials License SUA 1534**

## Table of Contents

# 1 WATER QUALITY MONITORING DATA

## 1.1 Excursion Monitoring

Biweekly excursion monitoring in the shallow aquifer and perimeter monitor wells was continued in Mine Units 2 through 11 during the third and fourth quarters of 2012.

There were no monitor wells on excursion status during the reporting period.

## 1.2 Water Supply Wells and Surface Water

Summary sheets of quarterly radiological analytical data for the reporting period from all surface waters and water supply wells within one kilometer of the active wellfield boundary are included in Appendix A.

The reported radiological data are within the expected ranges for each well and surface water sampling points. Samples were obtained from all sample locations with the exceptions noted in Appendix A.

# 2 OPERATIONAL

## 2.1 Production Data Summary

Mining operations continued through the third and fourth quarters of 2012. The average operating production flow rate was 6,244 gpm for the third quarter and 6,711 gpm for the fourth quarter. Injection and production totals from the totalizers and the calculated bleed totals for the reporting period are included in Appendix B.

## 2.2 Wastewater Summary

The total volume of wastewater discharged to the ponds was 4,127,622 gallons during the third quarter and 2,357,470 gallons during the fourth quarter. Currently, all five evaporation ponds contain wastewater.

Wastewater that is not disposed of in the evaporation ponds is injected down two Deep Disposal Wells. Currently, the wells are operated on a nearly continuous basis and 46,676,907 gallons of

wastewater was injected into the wells during the second half of 2012. A summary of the total volume of wastewater injected and the average radionuclide content is contained in Appendix D.

## 2.3 Effluent Release

10 CFR §40.65 requires licensees to report quantities of radionuclides in liquid and gaseous effluent releases to the environment. In the Application for Renewal of Source Materials License SUA-1534, submitted December 1995, Table 7.3(A) presented calculations of the annual radon emissions for the Crow Butte Plant. These calculations assumed a $7.04 \times 10^{-4}$ Curies/$m^3$ radon release from leaching operations and the radon release calculations for the second half of 2012 use this release rate estimate.

During the third quarter, production occurred at an average flow rate of 6,244 gpm (23,636 lpm). Production was maintained nearly continuously for 92 days during the third quarter with an operating factor of 98.1 %. The production flow for the third quarter results in a calculated radon release of 1,557 Curies. During the fourth quarter, production occurred at an average flow rate of 6,711 gpm (25,404 lpm). Production was maintained nearly continuously for 92 days during the fourth quarter with an operating factor of 100.0%. The production flow for the fourth quarter results in a calculated radon release of 1,706 Curies. Calculations for radon release from production operations are shown in Appendix E.

Additional wells were brought on line during the second half of 2012. Calculations for the start-up of 10.0 acres of a new wellfield are shown in Appendix E. The calculated radon released from start-up of 10.0 acres is 13 Curies.

The total radon emission due to leaching operations from the Crow Butte plant for the second half of 2012 was 3,276 Curies. This calculated release rate is comparable with the releases estimated in CBR's License Renewal Application.

Radon gas is also released from restoration activities. For restoration water that is treated by ion exchange only, the radon concentration is 0.697 µCi/l. Of the total restoration production flow it is assumed that 25% of the radon is released through wellfield loss and 10% of the remaining radon is released during pressurized ion exchange treatment. For water that is treated by reverse osmosis, it is assumed that 100% of the remaining radon is released. For water treated by reverse osmosis the radon concentration is 0.470 µCi/l after adjusting for wellfield loss and ion exchange loss.

During the second half of 2012, a total of 140,133,024 gallons (530,459,550 l) of restoration water was produced from Mine Units 2, 3, 4, 5, and 6. Based upon an estimated radon concentration of 0.697 µCi/l, the total amount of radon in the restoration solution was calculated to be 370 Curies as shown in Appendix E. The estimated release of radon through wellfield loss at 25% of this total was 92 Curies. The plant loss for ion exchange treatment of the restoration water is estimated at

10% of the remaining radon, or 28 Curies. For water that is treated by reverse osmosis, it is assumed that 100% of the remaining radon is released. For water treated by reverse osmosis the radon concentration is 0.470 µCi/l after adjusting for wellfield loss and ion exchange loss.

Of the total amount of restoration water produced in the second half of 2012, 84,641,544 gallons (320,402,100 l) of the water was treated by reverse osmosis. The total estimated radon release from reverse osmosis treatment was 151 Curies. An additional 1.0 acres of wellfields were placed into restoration during the second half of 2012. The calculated radon released from start-up of 1.0 acres is 1 Curie. Calculations for the start-up of 1.0 acres of a wellfield placed in restoration are shown in Appendix E.

Based upon the calculations shown in Appendix E, the total estimated semiannual radon emission for the second half of 2012 from restoration activities was 272 Curies. This resulted in a total estimated radon release from the Crow Butte project during the second half of 2012 of 3,548 Curies.

### 2.4 Restoration

Restoration activities continued in Mine Units 2, 3, 4, 5, and 6 during the second half of 2012. Permeate continued to be injected into Mine Units 2, 3, 4, and 5. An additional RO capacity of 500 GPM was put into service by SERP 12-09, dated October 17, 2012. IX treatment was started in Mine Unit 6 during the second half of 2012. Restoration injection and production totals are included in Appendix B. Restoration injection pressures are included in Appendix C.

## 3 ENVIRONMENTAL MONITORING

### 3.1 Air Monitor Stations

Seven air monitoring stations are used to monitor the Crow Butte Plant. Ambient radon-222 concentrations and radionuclide concentrations in air for each monitoring site are listed in Appendix F. All air monitoring results were within expected historical ranges.

### 3.2 OSL Monitors

Environmental OSL monitors are located at each air monitoring station. The results of the area OSL monitors fall within the expected ranges and are listed in Appendix G.

### 3.3 Annual Dose to the Public (2012)

10 CFR 20.1301 requires that each NRC licensee conduct their operations in such a manner that the total effective dose equivalent (TEDE) to members of the public does not exceed 0.1 rem (100 mrem) in a year, and that the dose from external sources in any unrestricted area does not exceed 0.002 rem (2 mrem) in any one hour.

Additionally, 10 CFR 20.1302 requires that each NRC licensee annually show compliance with the above described dose limits by demonstrating one of the following:

1) Show by actual measurement or calculation that the TEDE to the public does not exceed 100 mrem; or

2) Show that the annual average concentrations of radioactive effluents released at the restricted area boundary do not exceed the values in Table 2 of Appendix B to 10 CFR 20 and that the external dose to an individual continuously present in an unrestricted area would not exceed 2 mrem in an hour and 50 mrem in a year.

The Dose to the Public table in Appendix F compares the 2012 annual average concentrations of radioactive effluents from the Crow Butte Project to the 10 CFR 20, Table 2 limits of Appendix B. The table also shows the calculated TEDE at unrestricted area sampling locations (AM-2 – Nearest Downwind Residence) and the Site Area location (AM – 8) assuming a person was continuously in the area for the entire year. As shown in the table, all measured concentrations of radioactive effluents are less than the Table 2 limits of Appendix B, confirming compliance with 10 CFR 20.1302(b)(2)(i) and (ii). Additionally, the calculated TEDE for the two locations confirms compliance with 10 CFR 20.11302(b)(1).

### 3.4 Stream Sediments

Sediment samples are collected from three locations on Squaw Creek (S-1, S-2, and S-5), two locations on English Creek (E-1, and E-5), and from three impoundments on English Creek (I-3, I-4, and I-5) on an annual basis during the fourth quarter. The results of sediment sampling for 2012 are included in Appendix H.

The concentration of natural uranium at the upper end of English Creek was above the regional background levels. CBR has noted these elevated concentrations in the English Creek drainage during preoperational monitoring, which indicates that these levels are anomalous natural background concentrations. Composite samples obtained from E-1 and E-2 as part of the preoperational sampling program from 1982 through 1986 had average results with elevated natural uranium (3.4 pCi/g) and lead-210 (1.4 pCi/g) when compared with the other surface water sample

locations. Samples obtained in 1998 before mining operations began in this area showed similar elevated uranium concentrations.

This sample location is in a wetland area in the upper course of English Creek that was dry most of the year due to drought conditions. The area has a large amount of organic matter and low water flows as compared with the other surface water sampling locations for the project. CBR believes that the upper courses of English Creek are an area with reducing conditions that favor deposition of radionuclides. Appendix H contains a trend graph for English Creek sediment sample points since 1998 that shows the elevated uranium concentrations noted in past sediment samples along with a trend graph for Squaw Creek showing the elevated uranium concentrations upstream from the current operation.

# Appendix A

## Private Well and Surface Water Radiological Monitoring Results

## Third and Fourth Quarter, 2012

**CROW BUTTE RESOURCES, INC.**

**PRIVATE WELL AND SURFACE WATER RADIOLOGICAL MONITORING RESULTS**

**Third Quarter, 2012**

| SAMPLE ID | DATE SAMPLED | URANIUM mg/l | URANIUM µCi/ml | RADIUM-226 pCi/l | RADIUM-226 precision ± |
|---|---|---|---|---|---|
| Well #8 | 09/11/12 | 0.0161 | 1.10E-08 | ND | 0.14 |
| Well #11 | Well Off-Sample Not Available | | | | |
| Well #12 | 09/11/12 | 0.0038 | 2.60E-09 | ND | 0.09 |
| Well #26 | 08/10/12 | 0.0084 | 5.70E-09 | ND | 0.09 |
| Well #28 | 09/11/12 | 0.0062 | 4.20E-09 | ND | 0.07 |
| Well #41 | 08/10/12 | 0.0064 | 4.40E-09 | ND | 0.06 |
| Well #61 | 07/27/12 | ND | ND | 3.1 | 0.35 |
| Well #63 | 08/10/12 | 0.0139 | 9.40E-09 | ND | 0.09 |
| Well #66 | 07/27/12 | 0.0211 | 1.40E-08 | ND | 0.11 |
| Well #125 | 08/10/12 | 0.0061 | 4.10E-09 | ND | 0.08 |
| Well #129 | 08/31/12 | 0.0066 | 4.50E-09 | ND | 0.07 |
| Well #131 | 08/10/12 | 0.0047 | 3.20E-09 | ND | 0.09 |
| Well #133 | 08/10/12 | 0.0092 | 6.20E-09 | 0.21 | 0.12 |
| Well #134 | 08/31/12 | 0.0090 | 6.10E-09 | ND | 0.12 |
| Well #135 | 08/31/12 | 0.0180 | 1.20E-08 | ND | 0.11 |
| Well #138 | 08/10/12 | 0.0207 | 1.40E-08 | 0.28 | 0.13 |
| Well #140 | 09/11/12 | 0.0112 | 7.60E-09 | ND | 0.09 |
| Well #435 | 08/10/12 | 0.0069 | 4.70E-09 | ND | 0.12 |
| Drinking Water Well | 08/10/12 | 0.0059 | 4.00E-09 | ND | 0.12 |
| Well #38 | 08/10/12 | 0.0031 | 2.10E-09 | ND | 0.09 |
| Well #445 | 08/31/12 | 0.0128 | 8.70E-09 | ND | 0.09 |
| Stream S-1 | 09/25/12 | 0.0076 | 5.10E-09 | 0.32 | 0.14 |
| Stream S-2 | 09/25/12 | 0.0051 | 3.50E-09 | ND | 0.12 |
| Stream S-5 | Dry | | | | |
| Stream E-1 | 09/25/12 | 0.0361 | 2.50E-08 | 0.4 | 0.2 |
| Stream E-5 | 09/25/12 | 0.0044 | 3.00E-09 | ND | 0.1 |
| | | | | | |
| Impoundment I-3 | Dry | | | | |
| Impoundment I-4 | Dry | | | | |
| Impoundment I-5 | 09/25/12 | 0.0125 | 8.40E-09 | ND | 0.1 |
| **Reporting Limit** | | **0.0003** | **2.00E-10** | **0.2** | - |

ND-Not detected at the reporting limit

**CROW BUTTE RESOURCES, INC.**

**PRIVATE WELL AND SURFACE WATER RADIOLOGICAL MONITORING RESULTS**

**Fourth Quarter, 2012**

| SAMPLE ID | DATE SAMPLED | URANIUM mg/l | URANIUM µCi/ml | RADIUM-226 pCi/l | RADIUM-226 precision ± |
|---|---|---|---|---|---|
| Well #8 | 11/07/12 | 0.0160 | 1.10E-08 | 0.4 | 0.2 |
| Well #11 | 11/02/12 | 0.0090 | 6.10E-09 | ND | 0.2 |
| Well #12 | 11/07/12 | 0.0042 | 2.90E-09 | ND | 0.1 |
| Well #26 | 10/12/12 | 0.0085 | 5.70E-09 | ND | 0.1 |
| Well #28 | 11/07/12 | 0.0064 | 4.40E-09 | 0.4 | 0.2 |
| Well #41 | 11/02/12 | 0.0064 | 4.40E-09 | ND | 0.1 |
| Well #61 | 10/12/12 | ND | ND | 4.0 | 0.3 |
| Well #63 | 11/01/12 | 0.0181 | 1.20E-08 | 0.2 | 0.08 |
| Well #66 | 10/12/12 | 0.0240 | 1.60E-08 | 0.5 | 0.1 |
| Well #125 | 11/02/12 | 0.0058 | 3.90E-09 | 0.3 | 0.2 |
| Well #129 | 11/07/12 | 0.0067 | 4.50E-09 | ND | 0.1 |
| Well #131 | 10/12/12 | 0.0047 | 3.20E-09 | ND | 0.1 |
| Well #133 | 11/02/12 | 0.0092 | 6.20E-09 | ND | 0.2 |
| Well #134 | 11/01/12 | 0.0096 | 6.50E-09 | 0.4 | 0.1 |
| Well #135 | 11/01/12 | 0.0183 | 1.20E-08 | ND | 0.08 |
| Well #138 | 11/02/12 | 0.0183 | 1.20E-08 | 0.5 | 0.2 |
| Well #140 | 11/07/12 | 0.0115 | 7.80E-09 | 0.3 | 0.2 |
| Well #435 | 11/02/12 | 0.0054 | 3.60E-09 | ND | 0.08 |
| Drinking Water Well | 11/02/12 | 0.0061 | 4.20E-09 | ND | 0.1 |
| Well #38 | 11/01/12 | 0.0042 | 2.90E-09 | ND | 0.1 |
| Well #445 | 10/12/12 | 0.0137 | 9.30E-09 | ND | 0.1 |
| Stream S-1 | 11/01/12 | 0.0040 | 2.70E-09 | 0.2 | 0.1 |
| Stream S-2 | 11/01/12 | 0.0042 | 2.80E-09 | 0.2 | 0.1 |
| Stream S-5 | Dry | | | | |
| Stream E-1 | 11/01/12 | 0.2070 | 1.40E-07 | 0.5 | 0.1 |
| Stream E-5 | 11/01/12 | 0.0072 | 4.80E-09 | 0.2 | 0.09 |
| | | | | | |
| Impoundment I-3 | Dry | | | | |
| Impoundment I-4 | Dry | | | | |
| Impoundment I-5 | 11/01/12 | 0.0196 | 1.30E-08 | 0.3 | 0.1 |
| **Reporting Limit** | | **0.0003** | **2.00E-10** | **0.2** | - |

ND-Not detected at the reporting limit

# Appendix B

## Plant Production and Waste Totals

## Third and Fourth Quarter, 2012

**WASTE VOLUME**
**Third Quarter 2012**

| TOTALIZER | PLANT TO PONDS | PLANT TO DDW 1 & 2 | RESTORATION TO DDW | CLEAN WATER INTO PLANT | DDW TOTAL INJECTED | TRUCKS TO POND |
|---|---|---|---|---|---|---|
| July | 1,345,210 | 4,395,881 | 3,092,627 | 668,128 | 7,488,508 | 6,150 |
| August | 1,406,770 | 4,216,570 | 2,933,608 | 641,058 | 7,150,178 | 44,902 |
| September | 1,269,490 | 3,806,225 | 2,571,353 | 523,747 | 6,377,578 | 55,100 |
| TOTAL GAL. EOQ | 4,021,470 | 12,418,676 | 8,597,588 | 1,832,933 | 21,016,264 | 106,152 |

| | |
|---|---|
| TOTAL 3rd QTR VOLUME DISCHARGED TO WASTE PONDS = | 4,127,622 GALLONS |
| TOTAL 3rd QTR VOLUME DISCHARGED TO DEEP WELL= | 21,016,264 GALLONS |
| TOTAL 3rd QTR VOLUME DISCHARGED TO WASTE PONDS + DPWELL = | 25,143,886 GALLONS |
| TOTAL 3rd QTR VOLUME WF BLEED FROM WELLFIELDS= | 23,204,801 GALLONS |

**WELLFIELD BLEED**
**Third Quarter 2012**

| MONTH | July | August | September |
|---|---|---|---|
| BLEED | 1.7% | 1.9% | 1.7% |

**PLANT FLOW**
**Third Quarter 2012**

| | |
|---|---|
| AVERAGE OPERATING FLOW RATE= | 6,244 GPM EOQ |
| TOTAL GALLONS PRODUCED= | 827,265,270 GALLONS EOQ |
| TOTAL GALLONS INJECTED= | 810,825,124 GALLONS EOQ |

| | TOTAL GALS. PRODUCED | TOTAL GALS. INJECTED | HOURS IN MONTH | HOURS IN PRODUCTION | AVERAGE PROD. GPM | AVERAGE COM INJ GPM | AVERAGE REST INJ GPM | HRS. DOWN TIME |
|---|---|---|---|---|---|---|---|---|
| Prev. YTD | 1,723,016,390 | 1,688,718,855 | 4,368 | 4,363 | 6,574 | 6,444 | 499 | 5 |
| July | 299,463,223 | 293,722,132 | 744 | 744 | 6,708 | 6,580 | 365 | 0 |
| August | 261,438,284 | 255,814,944 | 744 | 736 | 5,857 | 5,731 | 350 | 8 |
| September | 266,363,763 | 261,288,048 | 720 | 687 | 6,166 | 6,048 | 367 | 33 |
| EOQ TOTAL | 827,265,270 | 810,825,124 | 2,208 | 2,167 | 6,244 | 6,120 | 360 | 41 |
| YTD TOTAL | 2,550,281,660 | 2,499,543,979 | 6,576 | 6,530 | 6,464 | 6,335 | 453 | 46 |

| | TOTAL MUII GALS PRODUCED | TOTAL MUIII GALS PRODUCED | TOTAL MUIV GALS PRODUCED | TOTAL MUV GALS PRODUCED | TOTAL MUVI GALS PRODUCED | MUII BLEED TO WASTE | MUIII BLEED TO WASTE | MUIV BLEED TO WASTE | MUV BLEED TO WASTE | MUVI BLEED TO WASTE |
|---|---|---|---|---|---|---|---|---|---|---|
| Prev. YTD | 19,482,532 | 32,358,186 | 32,874,855 | 17,463,399 | 49,280,222 | 565,180 | -5,806,482 | 11,367,540 | 10,415,348 | 4,356,420 |
| July | 3,559,204 | 3,695,239 | 3,469,074 | 1,512,098 | 7,722,315 | 1,543,851 | -1,819,436 | 2,138,289 | 1,026,909 | 792,350 |
| August | 3,402,941 | 2,615,282 | 3,586,568 | 1,574,553 | 7,789,311 | 1,507,178 | -1,741,071 | 2,396,771 | 790,362 | 574,622 |
| September | 3,286,107 | 2,635,561 | 3,618,164 | 1,422,595 | 7,348,073 | 966,326 | -1,034,835 | 1,711,365 | 854,089 | 677,749 |
| EOQ TOTAL | 10,248,252 | 8,946,082 | 10,673,806 | 4,509,246 | 22,859,699 | 4,017,355 | -4,595,342 | 6,246,425 | 2,671,360 | 2,044,721 |
| YTD TOTAL | 29,730,784 | 41,304,268 | 43,548,661 | 21,972,645 | 72,139,921 | 4,582,535 | -10,401,824 | 17,613,965 | 13,086,708 | 6,401,141 |

| | TOTAL BRINE GALS PRODUCED | TOTAL PERM GALS PRODUCED | COMM BLEED TO RO FEED |
|---|---|---|---|
| Prev. YTD | 19,620,429 | 67,374,983 | 0 |
| July | 3,068,260 | 9,136,130 | 0 |
| August | 2,909,241 | 7,553,231 | 0 |
| September | 2,546,986 | 6,346,612 | 0 |
| EOQ TOTAL | 8,524,487 | 23,035,973 | 0 |
| YTD TOTAL | 28,144,916 | 90,410,956 | 0 |

WASTE VOLUME
Fourth Quarter 2012

| TOTALIZER | PLANT TO PONDS | PLANT TO DDW 1 & 2 | RESTORATION TO DDW | CLEAN WATER INTO PLANT | DDW TOTAL INJECTED | TRUCKS TO POND |
|---|---|---|---|---|---|---|
| October | 638,670 | 4,833,950 | 2,678,330 | 404,326 | 7,512,280 | 57,000 |
| November | 709,160 | 4,699,531 | 3,518,054 | 440,904 | 8,217,585 | 51,000 |
| December | 888,440 | 4,514,810 | 5,415,968 | 583,793 | 9,930,778 | 13,200 |
| TOTAL GAL. EOQ | 2,236,270 | 14,048,291 | 11,612,352 | 1,429,023 | 25,660,643 | 121,200 |

| | |
|---|---|
| TOTAL 4th QTR VOLUME DISCHARGED TO WASTE PONDS = | 2,357,470 GALLONS |
| TOTAL 4th QTR VOLUME DISCHARGED TO DEEP WELL= | 25,660,643 GALLONS |
| TOTAL 4th QTR VOLUME DISCHARGED TO WASTE PONDS + DPWELL = | 28,018,113 GALLONS |
| TOTAL 4th QTR VOLUME WF BLEED FROM WELLFIELDS= | 26,467,890 GALLONS |

WELLFIELD BLEED
Fourth Quarter 2012

| MONTH | October | November | December |
|---|---|---|---|
| BLEED | 1.7% | 2.1% | 2.4% |

PLANT FLOW
Fourth Quarter 2012

| | |
|---|---|
| AVERAGE OPERATING FLOW RATE= | 6,711 GPM EOQ |
| TOTAL GALLONS PRODUCED= | 889,025,957 GALLONS EOQ |
| TOTAL GALLONS INJECTED= | 872,741,396 GALLONS EOQ |

| | TOTAL GALS. PRODUCED | TOTAL GALS. INJECTED | HOURS IN MONTH | HOURS IN PRODUCTION | AVERAGE PROD. GPM | AVERAGE COM INJ GPM | AVERAGE REST INJ GPM | HRS. DOWN TIME |
|---|---|---|---|---|---|---|---|---|
| Prev. YTD | 2,550,281,660 | 1,688,718,855 | 6,576 | 6,530 | 6,464 | 6,444 | 499 | 46 |
| October | 293,983,905 | 288,511,285 | 744 | 744 | 6,586 | 6,463 | 365 | 0 |
| November | 289,594,031 | 284,185,340 | 720 | 720 | 6,704 | 6,578 | 555 | 0 |
| December | 305,448,022 | 300,044,772 | 744 | 744 | 6,842 | 6,721 | 694 | 0 |
| EOQ TOTAL | 889,025,957 | 872,741,396 | 2,208 | 2,208 | 6,711 | 6,588 | 538 | 0 |
| YTD TOTAL | 3,439,307,617 | 2,561,460,251 | 8,784 | 8,738 | 6,526 | 4,860 | 474 | 46 |

| | TOTAL MUII GALS PRODUCED | TOTAL MUIII GALS PRODUCED | TOTAL MUIV GALS PRODUCED | TOTAL MUV GALS PRODUCED | TOTAL MUVI GALS PRODUCED | MUII BLEED TO WASTE | MUIII BLEED TO WASTE | MUIV BLEED TO WASTE | MUV BLEED TO WASTE | MUVI BLEED TO WASTE |
|---|---|---|---|---|---|---|---|---|---|---|
| Prev. YTD | 29,730,784 | 41,304,268 | 43,548,661 | 21,972,645 | 72,139,921 | 565,180 | -5,806,482 | 11,367,540 | 10,415,348 | 4,356,420 |
| October | 3,576,726 | 2,972,541 | 3,748,135 | 1,437,709 | 7,788,489 | 1,088,478 | -901,470 | 1,422,240 | 850,993 | 778,619 |
| November | 3,457,886 | 3,233,839 | 7,880,816 | 4,583,194 | 8,153,345 | 736,099 | -1,141,192 | 1,323,638 | 1,727,876 | 666,380 |
| December | 3,456,478 | 4,003,824 | 11,928,670 | 8,212,901 | 8,461,386 | 979,567 | -1,656,649 | 2,467,427 | 2,646,050 | 645,079 |
| EOQ TOTAL | 10,491,090 | 10,210,204 | 23,557,621 | 14,233,804 | 24,403,220 | 2,804,144 | -3,699,311 | 5,213,305 | 5,224,919 | 2,090,078 |
| YTD TOTAL | 40,221,874 | 51,514,472 | 67,106,282 | 36,206,449 | 96,543,141 | 3,369,324 | -9,505,793 | 16,580,845 | 15,640,267 | 6,446,498 |

| | TOTAL BRINE GALS PRODUCED | TOTAL PERM GALS PRODUCED | COMM BLEED TO RO FEED |
|---|---|---|---|
| Prev. YTD | 28,144,916 | 90,410,956 | 0 |
| October | 2,678,330 | 5,867,882 | 0 |
| November | 3,518,054 | 13,351,145 | 0 |
| December | 5,415,968 | 22,249,705 | 0 |
| EOQ TOTAL | 11,612,352 | 41,468,732 | 0 |
| YTD TOTAL | 39,757,268 | 131,879,688 | 0 |

# Appendix C

## Wellfield Injection Pressures

## Third and Fourth Quarter, 2012

## WELLFIELD INJECTION PRESSURE - PSI
### Third Quarter 2012

| | WF HOUSE #3 | | WF HOUSE #4 | | WF HOUSE #5 | | WF HOUSE #6 | | WF HOUSE #7 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| July | 45 | 53 | 51 | 58 | 41 | 91 | 45 | 52 | 29 | 37 |
| August | 44 | 54 | 49 | 59 | 37 | 46 | 45 | 55 | 28 | 38 |
| September | 55 | 65 | 59 | 68 | 48 | 55 | 55 | 61 | 39 | 44 |
| AVERAGE | 48 | 65 | 53 | 68 | 42 | 91 | 48 | 61 | 32 | 44 |
| | WF HOUSE #8 | | WF HOUSE #9 | | WF HOUSE #10 | | WF HOUSE #11 | | WF HOUSE #12 | |
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| July | 38 | 44 | 37 | 44 | 30 | 36 | 0 | 0 | 4 | 6 |
| August | 38 | 60 | 35 | 44 | 29 | 38 | 0 | 8 | 4 | 5 |
| September | 49 | 56 | 46 | 51 | 39 | 48 | 25 | 40 | 3 | 10 |
| AVERAGE | 42 | 60 | 39 | 51 | 32 | 48 | 8 | 40 | 4 | 10 |
| | WF HOUSE #13 | | WF HOUSE #14 | | WF HOUSE #15 | | WF HOUSE #16 | | WF HOUSE #17 | |
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| July | 0 | 0 | 47 | 59 | 0 | 0 | 0 | 2 | 4 | 5 |
| August | 0 | 2 | 46 | 57 | 0 | 0 | 0 | 2 | 4 | 5 |
| September | 0 | 2 | 56 | 64 | 0 | 2 | 1 | 2 | 4 | 7 |
| AVERAGE | 0 | 2 | 49 | 64 | 0 | 2 | 0 | 2 | 4 | 7 |
| | WF HOUSE #18 | | WF HOUSE #19 | | WF HOUSE #20 | | WF HOUSE #21 | | WF HOUSE #22 | |
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| July | 39 | 46 | 0 | 0 | 13 | 24 | 77 | 84 | 73 | 74 |
| August | 50 | 57 | 0 | 0 | 5 | 20 | 74 | 86 | 73 | 74 |
| September | 35 | 48 | 1 | 28 | 23 | 69 | 74 | 80 | 87 | 92 |
| AVERAGE | 41 | 57 | 0 | 28 | 14 | 69 | 75 | 86 | 77 | 92 |
| | WF HOUSE #23 | | WF HOUSE #24 | | WF HOUSE #25 | | WF HOUSE #26 | | WF HOUSE #27 | |
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| July | 84 | 92 | 81 | 82 | 93 | 95 | 80 | 80 | 94 | 96 |
| August | 81 | 92 | 81 | 82 | 93 | 97 | 81 | 93 | 93 | 94 |
| September | 85 | 92 | 91 | 95 | 91 | 95 | 91 | 96 | 91 | 96 |
| AVERAGE | 83 | 92 | 84 | 95 | 92 | 97 | 84 | 96 | 93 | 96 |
| | WF HOUSE #28 | | WF HOUSE #29 | | WF HOUSE #30 | | WF HOUSE #31 | | WF HOUSE #32 | |
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| July | 75 | 81 | 83 | 89 | 78 | 86 | 53 | 59 | 58 | 66 |
| August | 78 | 87 | 69 | 94 | 72 | 86 | 51 | 67 | 49 | 69 |
| September | 71 | 92 | 66 | 89 | 67 | 82 | 43 | 58 | 45 | 64 |
| AVERAGE | 74 | 92 | 73 | 94 | 72 | 86 | 49 | 67 | 51 | 69 |
| | WF HOUSE #33 | | WF HOUSE #34 | | WF HOUSE #35 | | WF HOUSE #36 | | WF HOUSE #37 | |
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| July | 62 | 69 | 91 | 92 | 92 | 94 | 90 | 93 | 90 | 92 |
| August | 61 | 86 | 91 | 93 | 92 | 95 | 90 | 92 | 91 | 93 |
| September | 55 | 68 | 88 | 94 | 86 | 94 | 87 | 92 | 89 | 95 |
| AVERAGE | 59 | 86 | 90 | 94 | 90 | 95 | 89 | 93 | 90 | 95 |
| | WF HOUSE #38 | | WF HOUSE #39 | | WF HOUSE #40 | | WF HOUSE #41 | | WF HOUSE #42 | |
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| July | 89 | 96 | 83 | 90 | 89 | 92 | 92 | 94 | 93 | 96 |
| August | 89 | 92 | 83 | 86 | 90 | 92 | 87 | 95 | 89 | 96 |
| September | 86 | 92 | 80 | 84 | 87 | 92 | 88 | 93 | 91 | 96 |
| AVERAGE | 88 | 96 | 82 | 90 | 89 | 92 | 89 | 95 | 91 | 96 |
| | WF HOUSE #43 | | WF HOUSE #44 | | WF HOUSE #45 | | WF HOUSE #46 | | WF HOUSE #46A | |
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| July | 95 | 98 | 94 | 96 | 94 | 98 | 88 | 89 | 93 | 94 |
| August | 89 | 95 | 90 | 96 | 90 | 96 | 88 | 89 | 94 | 95 |
| September | 90 | 96 | 90 | 96 | 90 | 96 | 85 | 90 | 91 | 96 |
| AVERAGE | 91 | 98 | 91 | 96 | 91 | 98 | 87 | 90 | 93 | 96 |
| | WF HOUSE #47 | | WF HOUSE #47A | | WF HOUSE #48 | | WF HOUSE #49 | | WF HOUSE #50 | |
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| July | 94 | 96 | 55 | 59 | 91 | 92 | 91 | 95 | 91 | 92 |
| August | 89 | 96 | 54 | 58 | 91 | 93 | 92 | 95 | 91 | 94 |
| September | 90 | 95 | 53 | 57 | 86 | 92 | 89 | 93 | 89 | 94 |
| AVERAGE | 91 | 96 | 54 | 59 | 89 | 93 | 91 | 95 | 90 | 94 |
| | WF HOUSE #51 | | WF HOUSE #52 | | WF HOUSE #53 | | WF HOUSE #54 | | WF HOUSE #55 | |
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| July | 91 | 93 | 92 | 93 | 92 | 94 | 69 | 71 | 70 | 79 |
| August | 92 | 94 | 92 | 94 | 92 | 95 | 72 | 92 | 68 | 81 |
| September | 88 | 92 | 88 | 92 | 88 | 95 | 70 | 75 | 61 | 64 |
| AVERAGE | 90 | 94 | 90 | 94 | 90 | 95 | 71 | 92 | 64 | 81 |

| | WF HOUSE #55 | |
|---|---|---|
| | AVERAGE | MAXIMUM |
| July | 70 | 82 |
| August | 74 | 77 |
| September | 72 | 84 |
| AVERAGE | 73 | 84 |

| | WF HOUSE #60 | | WF HOUSE #61 | | WF HOUSE #62 | | | |
|---|---|---|---|---|---|---|---|---|
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | | |
| July | 91 | 95 | 90 | 95 | 72 | 94 | | |
| August | 88 | 94 | 89 | 95 | 86 | 90 | | |
| September | 88 | 93 | 87 | 93 | 80 | 90 | | |
| AVERAGE | 88 | 95 | 88 | 95 | 83 | 94 | | |

## WELLFIELD INJECTION PRESSURE - PSI
### Fourth Quarter 2012

| | WF HOUSE #3 | | WF HOUSE #4 | | WF HOUSE #5 | | WF HOUSE #6 | | WF HOUSE #7 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| October | 47 | 66 | 53 | 70 | 43 | 70 | 49 | 66 | 34 | 63 |
| November | 54 | 77 | 62 | 86 | 51 | 76 | 56 | 76 | 41 | 64 |
| December | 70 | 78 | 79 | 85 | 67 | 75 | 70 | 79 | 58 | 64 |
| AVERAGE | 57 | 78 | 65 | 86 | 54 | 76 | 58 | 79 | 44 | 64 |
| | WF HOUSE #8 | | WF HOUSE #9 | | WF HOUSE #10 | | WF HOUSE #11 | | WF HOUSE #12 | |
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| October | 44 | 58 | 38 | 49 | 31 | 50 | 26 | 38 | 42 | 48 |
| November | 51 | 74 | 44 | 77 | 35 | 65 | 31 | 60 | 44 | 45 |
| December | 68 | 73 | 59 | 69 | 49 | 65 | 43 | 51 | 42 | 44 |
| AVERAGE | 54 | 74 | 47 | 77 | 39 | 65 | 33 | 60 | 43 | 48 |
| | WF HOUSE #13 | | WF HOUSE #14 | | WF HOUSE #15 | | WF HOUSE #16 | | WF HOUSE #17 | |
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| October | 0 | 2 | 49 | 66 | 0 | 2 | 0 | 2 | 4 | 6 |
| November | 2 | 39 | 57 | 80 | 0 | 2 | 1 | 7 | 35 | 66 |
| December | 2 | 44 | 72 | 80 | 1 | 2 | 2 | 64 | 61 | 69 |
| AVERAGE | 1 | 44 | 60 | 80 | 0 | 2 | 1 | 64 | 33 | 69 |
| | WF HOUSE #18 | | WF HOUSE #19 | | WF HOUSE #20 | | WF HOUSE #21 | | WF HOUSE #22 | |
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| October | 32 | 52 | 0 | 0 | 40 | 64 | 77 | 85 | 86 | 92 |
| November | 55 | 82 | 34 | 85 | 47 | 71 | 73 | 78 | 81 | 93 |
| December | 74 | 81 | 78 | 85 | 67 | 76 | 68 | 72 | 75 | 80 |
| AVERAGE | 54 | 82 | 38 | 85 | 51 | 76 | 73 | 85 | 81 | 93 |
| | WF HOUSE #23 | | WF HOUSE #24 | | WF HOUSE #25 | | WF HOUSE #26 | | WF HOUSE #27 | |
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| October | 82 | 87 | 90 | 95 | 94 | 95 | 94 | 95 | 93 | 95 |
| November | 74 | 90 | 92 | 94 | 91 | 95 | 89 | 94 | 92 | 92 |
| December | 68 | 72 | 89 | 92 | 89 | 94 | 84 | 93 | 91 | 92 |
| AVERAGE | 75 | 90 | 90 | 95 | 91 | 95 | 89 | 95 | 92 | 95 |
| | WF HOUSE #28 | | WF HOUSE #29 | | WF HOUSE #30 | | WF HOUSE #31 | | WF HOUSE #32 | |
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| October | 70 | 80 | 71 | 80 | 70 | 80 | 45 | 56 | 51 | 61 |
| November | 62 | 73 | 63 | 74 | 61 | 74 | 38 | 68 | 42 | 54 |
| December | 60 | 70 | 62 | 70 | 60 | 68 | 35 | 44 | 41 | 49 |
| AVERAGE | 64 | 80 | 65 | 80 | 64 | 80 | 39 | 68 | 45 | 61 |
| | WF HOUSE #33 | | WF HOUSE #34 | | WF HOUSE #35 | | WF HOUSE #36 | | WF HOUSE #37 | |
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| October | 55 | 66 | 90 | 92 | 90 | 92 | 91 | 93 | 90 | 95 |
| November | 47 | 60 | 91 | 94 | 90 | 93 | 91 | 92 | 89 | 92 |
| December | 46 | 56 | 92 | 94 | 93 | 98 | 91 | 95 | 90 | 92 |
| AVERAGE | 49 | 66 | 91 | 94 | 91 | 98 | 91 | 95 | 90 | 95 |
| | WF HOUSE #38 | | WF HOUSE #39 | | WF HOUSE #40 | | WF HOUSE #41 | | WF HOUSE #42 | |
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| October | 90 | 92 | 83 | 84 | 86 | 90 | 86 | 90 | 94 | 98 |
| November | 89 | 92 | 84 | 86 | 87 | 88 | 83 | 87 | 92 | 96 |
| December | 89 | 91 | 83 | 84 | 86 | 88 | 81 | 86 | 88 | 94 |
| AVERAGE | 89 | 92 | 83 | 86 | 86 | 90 | 83 | 90 | 92 | 98 |
| | WF HOUSE #43 | | WF HOUSE #44 | | WF HOUSE #45 | | WF HOUSE #46 | | WF HOUSE #46A | |
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| October | 94 | 96 | 94 | 98 | 94 | 96 | 87 | 88 | 95 | 95 |
| November | 91 | 96 | 90 | 94 | 91 | 95 | 88 | 88 | 95 | 97 |
| December | 90 | 95 | 87 | 93 | 88 | 95 | 87 | 88 | 95 | 96 |
| AVERAGE | 92 | 96 | 90 | 98 | 91 | 96 | 87 | 88 | 95 | 97 |
| | WF HOUSE #47 | | WF HOUSE #47A | | WF HOUSE #48 | | WF HOUSE #49 | | WF HOUSE #50 | |
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| October | 94 | 96 | 51 | 60 | 91 | 93 | 90 | 93 | 91 | 92 |
| November | 90 | 94 | 48 | 94 | 91 | 93 | 91 | 92 | 92 | 94 |
| December | 86 | 95 | 43 | 52 | 92 | 95 | 90 | 92 | 92 | 94 |
| AVERAGE | 90 | 96 | 47 | 94 | 91 | 95 | 90 | 93 | 91 | 94 |
| | WF HOUSE #51 | | WF HOUSE #52 | | WF HOUSE #53 | | WF HOUSE #54 | | WF HOUSE #55 | |
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| October | 91 | 95 | 92 | 93 | 92 | 94 | 74 | 92 | 75 | 78 |
| November | 92 | 96 | 92 | 94 | 92 | 93 | 72 | 74 | 74 | 76 |
| December | 91 | 93 | 92 | 94 | 91 | 92 | 71 | 88 | 76 | 96 |
| AVERAGE | 91 | 96 | 92 | 94 | 91 | 94 | 72 | 92 | 75 | 96 |

| | WF HOUSE #56 | |
|---|---|---|
| | AVERAGE | MAXIMUM |
| October | 70 | 79 |
| November | 69 | 78 |
| December | 69 | 73 |
| AVERAGE | 69 | 79 |

| | WF HOUSE #60 | | WF HOUSE #61 | | WF HOUSE #62 | | WF HOUSE #63 | |
|---|---|---|---|---|---|---|---|---|
| | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM | AVERAGE | MAXIMUM |
| October | 70 | 79 | 89 | 91 | 91 | 93 | #DIV/0! | 0 |
| November | 86 | 90 | 89 | 92 | 74 | 91 | 24 | 76 |
| December | 84 | 88 | 87 | 92 | 75 | 78 | 31 | 37 |
| AVERAGE | 80 | 90 | 88 | 92 | 80 | 93 | 27 | 76 |

# Appendix D

## Deep Disposal Well Injection Radiological Data

## Third and Fourth Quarter, 2012

## Crow Butte Uranium Mine

## Deep Disposal Well #1 Injection Radiological Data

| Month | Total Gallons Injected | Average Natural Uranium (mg/l) | Total Natural Uranium Injected (mg) | Total Natural Uranium Injected (µCi) | Average Radium-226 (pCi/l) | Total Radium-226 Injected (µCi) |
|---|---|---|---|---|---|---|
| July-12 | 5,615,358 | 2 | 4.25E+07 | 2.88E+04 | 593 | 1.26E+04 |
| August-12 | 5,290,499 | 4 | 8.01E+07 | 5.42E+04 | 568 | 1.14E+04 |
| September-12 | 4,598,394 | 4 | 6.96E+07 | 4.71E+04 | 712 | 1.24E+04 |
| October-12 | 5,688,878 | 3 | 6.46E+07 | 4.37E+04 | 794 | 1.71E+04 |
| November-12 | 6,458,651 | 5 | 1.22E+08 | 8.28E+04 | 1,110 | 2.71E+04 |
| December-12 | 8,157,401 | 4 | 1.24E+08 | 8.36E+04 | 828 | 2.56E+04 |
| Totals | 35,809,181 | | 5.03E+08 | 3.40E+05 | | 1.06E+05 |

## Crow Butte Uranium Mine

## Deep Disposal Well #2 Injection Radiological Data

| Month | Total Gallons Injected | Average Natural Uranium (mg/l) | Total Natural Uranium Injected (mg) | Total Natural Uranium Injected (µCi) | Average Radium-226 (pCi/l) | Total Radium-226 Injected (µCi) |
|---|---|---|---|---|---|---|
| July-12 | 1,873,150 | 1 | 7.09E+06 | 4.80E+03 | 895 | 6.35E+03 |
| August-12 | 1,859,679 | 1 | 7.04E+06 | 4.77E+03 | 836 | 5.88E+03 |
| September-12 | 1,779,184 | 1 | 6.73E+06 | 4.56E+03 | 896 | 6.03E+03 |
| October-12 | 1,823,402 | 1 | 6.90E+06 | 4.67E+03 | 894 | 6.17E+03 |
| November-12 | 1,758,934 | 2 | 1.33E+07 | 9.02E+03 | 824 | 5.49E+03 |
| December-12 | 1,773,377 | 2 | 1.34E+07 | 9.09E+03 | 1,370 | 9.20E+03 |
| Totals | 10,867,726 | | 5.45E+07 | 3.69E+04 | | 3.91E+04 |

# Appendix E

# Radon Release Calculations

# Third and Fourth Quarter, 2012

## Radon Effluent Release Calculation (Production and Startup)

Third Quarter 2012 Radon Release from Leaching Operations:

| *Curies/M3* | *Production Flow (liters)* | *Radon-222 Decay Constant* | *Operating Days* | *Operating Factor* | *M3/liter conversion* | *Hours/Day Conversion* | *Minutes/Hour Conversion* | *Total Radon Release from Leaching* |
|---|---|---|---|---|---|---|---|---|
| 7.04E-04 | 23,636 | 0.72 | 92 | 98.1% | 0.001 | 24 | 60 | 1,557 |

Fourth Quarter 2012 Radon Release from Leaching Operations:

| *Curies/M3* | *Production Flow (liters)* | *Radon-222 Decay Constant* | *Operating Days* | *Operating Factor* | *M3/liter conversion* | *Hours/Day Conversion* | *Minutes/Hour Conversion* | *Total Radon Release from Leaching* |
|---|---|---|---|---|---|---|---|---|
| 7.04E-04 | 25,404 | 0.72 | 92 | 100.0% | 0.001 | 24 | 60 | 1,706 |

Second Half 2012 Radon Release From Startup:

| *Curies/M3* | *Total Acres of New Wellfield* | *Meter3/Acre Conversion* | *Orebody Thickness (meters)* | *Porosity* | *Total Radon Release from Startup* |
|---|---|---|---|---|---|
| 7.04E-04 | 10.0 | 4,074 | 1.52 | 0.29 | 13 |

**Total Estimated Radon Release from Production:** **3,276**

## Radon Effluent Release Calculation (Restoration)

Second Half 2012 Radon Release From Restoration:

| *Total Restoration Flow (liters)* | *Microcuries/liter* | *Curies/Microcurie* | *Production Potential* |
|---|---|---|---|
| 530,459,550 | 0.697 | 1.00E-06 | 370 |

| | |
|---|---|
| Wellfield Loss (25% of Production Potential): | 92 |
| Ion Exchange Loss (10% of Production Potential minus Wellfield Loss): | 28 |
| Reverse Osmosis Loss (100% of remaining activity at 0.470 microcuries/liter) | 151 |

| *Total Reverse Osmosis Flow (liters)* | *Microcuries/liter* | *Curies/Microcurie* |
|---|---|---|
| 320,402,100 | 0.470 | 1.00E-06 |

Second Half 2012 Radon Release From Startup of New Restoration:

| *Curies/M3* | *Total Acres of New Wellfield* | *Meter3/Acre Conversion* | *Orebody Thickness (meters)* | *Porosity* | *Total Radon Release from Startup* |
|---|---|---|---|---|---|
| 7.04E-04 | 1.0 | 4074 | 1.52 | 0.29 | 1 |

**Total Estimated Radon Release from Restoration:** **272**

**Total Estimated Radon Release, Second Half 2012:** **3,548**

# Appendix F

# Environmental Air Monitoring Results

# Third and Fourth Quarter, 2012

**Crow Butte Resources, Inc.**
Crow Butte Uranium Project

**Track Etch Cup Ambient Radon Concentrations**

***Air Monitoring Station No.***

***Period: June 29, 2012 to January 2, 2013***

| | Gross Count | Average Radon Concentration (x $10^{-9}$ µCi/ml) | Accuracy (x $10^{-9}$ µCi/ml) | Percent Effluent Concentration |
|---|---|---|---|---|
| AM-1 | 175.0 | 0.4 | 0.03 | 4.0% |
| AM-2 | 267.0 | 0.9 | 0.06 | 9.0% |
| AM-3 | 198.0 | 0.5 | 0.04 | 5.0% |
| AM-4 | 152.0 | 0.4 | 0.03 | 4.0% |
| AM-5 | 300.0 | 1.0 | 0.06 | 10.0% |
| AM-6 | 331.0 | 1.3 | 0.07 | 13.0% |
| AM-8 | 165.0 | 0.5 | 0.04 | 5.0% |
| AB-1 (AM-1 Duplicate) | 212.0 | 0.6 | 0.04 | 6.0% |
| AB-2 (AM-2 Duplicate) | 255.0 | 0.8 | 0.05 | 8.0% |
| AB-6 (AM-6 Duplicate) | 300.0 | 1.1 | 0.06 | 11.0% |
| LLD (x $10^{-9}$ µCi/ml) | | | | 0.2 |
| Effluent Concentration Limit, 10 CFR 20 App B Column 2: | | | | 10 |

**Crow Butte Resources**
**Crow Butte Uranium Project**

**Perimeter Air Monitoring Stations**

| Analyte | Result | Precision ± | Result | Precision ± | RL | 10 CFR Pt 20 Effluent Limit | Effluent Class | % Effluent Concentration |
|---|---|---|---|---|---|---|---|---|
| | pCi/filter | pCi/filter | uCi/ml | uCi/ml | uCi/ml | | | |
| **Third Quarter 2012** | | | | | | | | |
| **AM-1 [Sample Air Volume 6,190,139 liters]** | | | | | | | | |
| Lead 210 | 134.0 | 7.3 | 2.E-14 | 1.E-15 | 2.E-15 | 6.E-13 | Day | 3.33 |
| Radium 226 | 0.3 | 0.1 | <1E-16 | -- | 1.E-16 | 9.E-13 | Week | 0.00 |
| Uranium | <0.3 | -- | <1E-16 | -- | 1.E-16 | 9.E-14 | Year | 0.00 |
| **AM-2 [Sample Air Volume 6,482,331 liters]** | | | | | | | | |
| Lead 210 | 17.8 | 3.4 | 3.E-15 | 5.E-16 | 2.E-15 | 6.E-13 | Day | 0.50 |
| Radium 226 | <0.3 | -- | <1E-16 | -- | 1.E-16 | 9.E-13 | Week | 0.00 |
| Uranium | 0.4 | -- | <1E-16 | -- | 1.E-16 | 9.E-14 | Year | 0.00 |
| **AM-3 [Sample Air Volume 5,907,150 liters]** | | | | | | | | |
| Lead 210 | 369.0 | 23.0 | 6.E-14 | 4.E-15 | 2.E-15 | 6.E-13 | Day | 10.00 |
| Radium 226 | 0.4 | 0.1 | <1E-16 | -- | 1.E-16 | 9.E-13 | Week | 0.00 |
| Uranium | 0.4 | -- | <1E-16 | -- | 1.E-16 | 9.E-14 | Year | 0.00 |
| **AM-4 [Sample Air Volume 6,490,229 liters]** | | | | | | | | |
| Lead 210 | 139.0 | 7.6 | 2.E-14 | 1.E-15 | 2.E-15 | 6.E-13 | Day | 3.33 |
| Radium 226 | 0.3 | 0.1 | <1E-16 | -- | 1.E-16 | 9.E-13 | Week | 0.00 |
| Uranium | 0.3 | -- | <1E-16 | -- | 1.E-16 | 9.E-14 | Year | 0.00 |
| **AM-5 [Sample Air Volume 6,256,253 liters]** | | | | | | | | |
| Lead 210 | 133.0 | 7.6 | 2.E-14 | 1.E-15 | 2.E-15 | 6.E-13 | Day | 3.33 |
| Radium 226 | 0.6 | 0.2 | <1E-16 | -- | 1.E-16 | 9.E-13 | Week | 0.00 |
| Uranium | 0.5 | -- | <1E-16 | -- | 1.E-16 | 9.E-14 | Year | 0.00 |
| **AM-6 [Sample Air Volume 5,789,301 liters]** | | | | | | | | |
| Lead 210 | 128.0 | 7.2 | 2.E-14 | 1.E-15 | 2.E-15 | 6.E-13 | Day | 3.33 |
| Radium 226 | 0.3 | 0.1 | <1E-16 | -- | 1.E-16 | 9.E-13 | Week | 0.00 |
| Uranium | <0.3 | -- | <1E-16 | -- | 1.E-16 | 9.E-14 | Year | 0.00 |
| **AM-8 (Sample Air Volume 6,122,114 liters]** | | | | | | | | |
| Lead 210 | 69.6 | 6.3 | 1.E-14 | 1.E-15 | 2.E-15 | 6.E-13 | Day | 1.67 |
| Radium 226 | 0.5 | 0.8 | <1E-16 | -- | 1.E-16 | 9.E-13 | Week | 0.00 |
| Uranium | 0.4 | -- | <1E-16 | -- | 1.E-16 | 9.E-14 | Year | 0.00 |

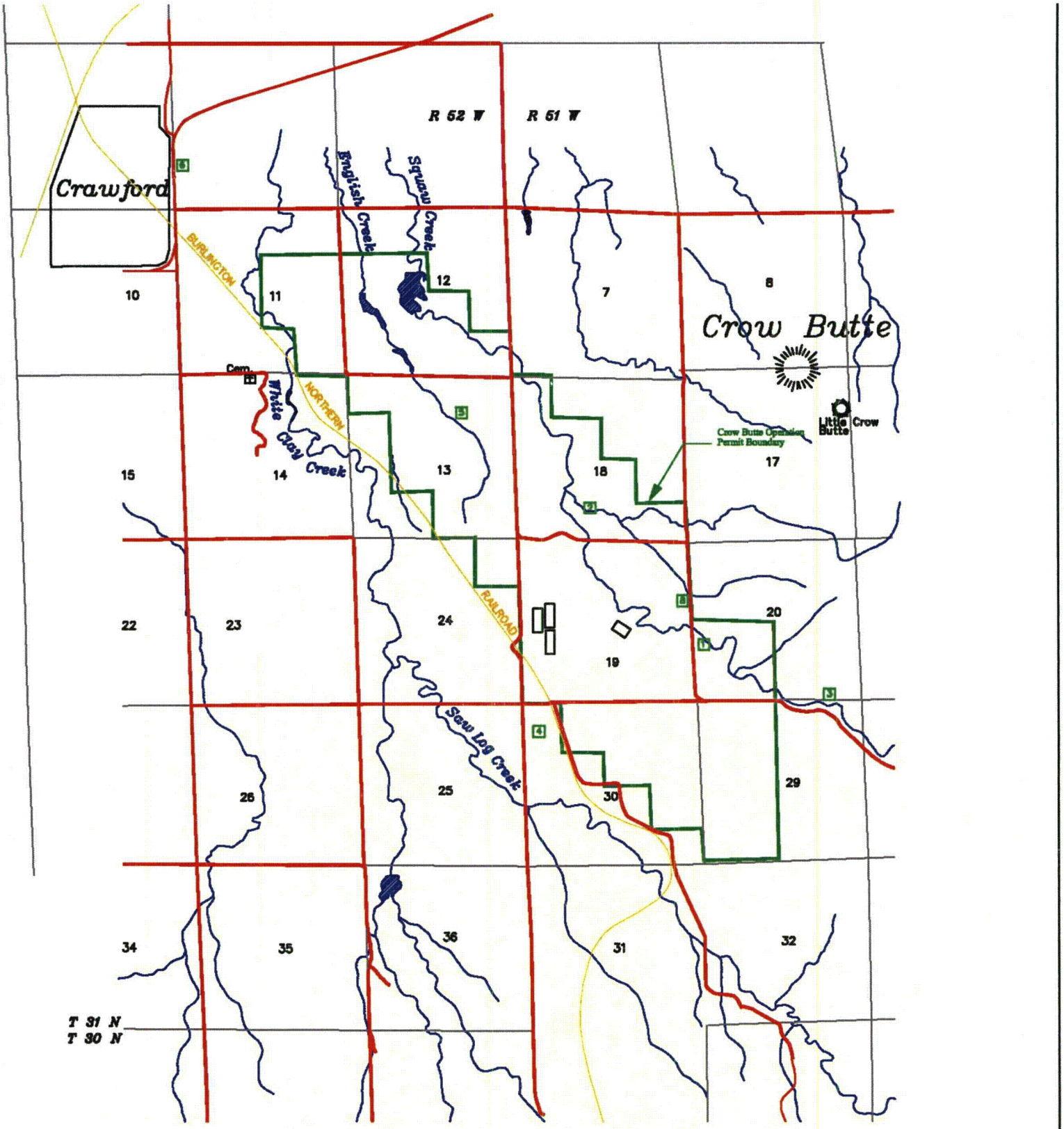
**RL – Reporting Limit**
**uCi/ml – microuries per milliliter**
**pCi/filter – picocuries per filter**

**Crow Butte Resources**
**Crow Butte Uranium Project**

**Perimeter Air Monitoring Stations**

| Analyte | Result | Precision ± | Result | Precision ± | RL | 10 CFR Pt 20 Effluent Limit | Effluent Class | % Effluent Concentration |
|---|---|---|---|---|---|---|---|---|
| | pCi/filter | pCi/filter | uCi/ml | uCi/ml | uCi/ml | | | |
| **Fourth Quarter 2012** | | | | | | | | |
| **AM-1 [Sample Air Volume 6,584,909 liters]** | | | | | | | | |
| Lead 210 | 120.0 | 5.7 | 2.E-14 | 9.E-16 | 2.E-15 | 6.E-13 | Day | 3.33 |
| Radium 226 | 0.3 | 0.1 | <1E-16 | -- | 1.E-16 | 9.E-13 | Week | 0.00 |
| Uranium | <0.3 | -- | <1E-16 | -- | 1.E-16 | 9.E-14 | Year | 0.00 |
| **AM-2 [Sample Air Volume 6,591,462 liters]** | | | | | | | | |
| Lead 210 | 139.0 | 6.4 | 2.E-14 | 5.E-16 | 2.E-15 | 6.E-13 | Day | 3.33 |
| Radium 226 | <0.3 | -- | <1E-16 | -- | 1.E-16 | 9.E-13 | Week | 0.00 |
| Uranium | 0.4 | -- | <1E-16 | -- | 1.E-16 | 9.E-14 | Year | 0.00 |
| **AM-3 [Sample Air Volume 6,359,539 liters]** | | | | | | | | |
| Lead 210 | 115.0 | 5.5 | 2.E-14 | 9.E-16 | 2.E-15 | 6.E-13 | Day | 3.33 |
| Radium 226 | <0.3 | -- | <1E-16 | -- | 1.E-16 | 9.E-13 | Week | 0.00 |
| Uranium | <0.3 | -- | <1E-16 | -- | 1.E-16 | 9.E-14 | Year | 0.00 |
| **AM-4 [Sample Air Volume 6,504,532 liters]** | | | | | | | | |
| Lead 210 | 129.0 | 5.9 | 2.E-14 | 9.E-16 | 2.E-15 | 6.E-13 | Day | 3.33 |
| Radium 226 | 0.4 | 0.1 | <1E-16 | -- | 1.E-16 | 9.E-13 | Week | 0.00 |
| Uranium | 0.4 | -- | <1E-16 | -- | 1.E-16 | 9.E-14 | Year | 0.00 |
| **AM-5 [Sample Air Volume 6,595,507 liters]** | | | | | | | | |
| Lead 210 | 129.0 | 5.8 | 2.E-14 | 9.E-16 | 2.E-15 | 6.E-13 | Day | 3.33 |
| Radium 226 | 0.3 | 0.1 | <1E-16 | -- | 1.E-16 | 9.E-13 | Week | 0.00 |
| Uranium | 0.3 | -- | <1E-16 | -- | 1.E-16 | 9.E-14 | Year | 0.00 |
| **AM-6 [Sample Air Volume 6,655,020 liters]** | | | | | | | | |
| Lead 210 | 131.0 | 5.9 | 2.E-14 | 9.E-16 | 2.E-15 | 6.E-13 | Day | 3.33 |
| Radium 226 | <0.3 | -- | <1E-16 | -- | 1.E-16 | 9.E-13 | Week | 0.00 |
| Uranium | <0.3 | -- | <1E-16 | -- | 1.E-16 | 9.E-14 | Year | 0.00 |
| **AM-8 (Sample Air Volume 7,070,811 liters]** | | | | | | | | |
| Lead 210 | 79.1 | 4.7 | 1.E-14 | 7.E-16 | 2.E-15 | 6.E-13 | Day | 1.67 |
| Radium 226 | <0.3 | -- | <1E-16 | -- | 1.E-16 | 9.E-13 | Week | 0.00 |
| Uranium | <0.3 | -- | <1E-16 | -- | 1.E-16 | 9.E-14 | Year | 0.00 |

**RL – Reporting Limit**
**uCi/ml – microuries per milliliter**
**pCi/filter – picocuries per filter**




Air Monitoring Station, Radon, Vegetation Soil, Direct Radiation

– PERMIT AREA

N

1/4 MILE 1/2 MILE

5280' (ONE MILE)

# CROW BUTTE RESOURCES, INC.

**Environmental Sample Locations**

*Date: 8–21–2012*

*Fig.* 1

## 2012 DOSE TO PUBLIC CALCULATIONS

| Monitoring Location/Parameter | | Average Concentration/Annual Gamma Dose | Average Concentration/Annual Gamma Dose Above Background | 10 CFR 20 App. B, Table 2 Values | Dose to the Public mrem/yr[1] |
|---|---|---|---|---|---|
| **AM-6** | Uranium (μCi/ml) | 2.E-16 | | 9.E-14 | |
| **Background** | Radium-226 (μCi/ml) | 1.E-16 | | 9.E-13 | |
| | Lead-210 (μCi/ml) | 2.E-14 | | 6.E-13 | |
| | Radon-222 (μCi/ml) | 6.E-10 | | 1.E-08 | |
| | Gamma (mrem/yr) | 36.0 | | -- | |
| | **TEDE (mrem/yr)** | | | | **Background** |
| **AM-1** | Uranium (μCi/ml) | 2.E-16 | 0 | 9.E-14 | 0.00 |
| **Residence** | Radium-226 (μCi/ml) | 1.E-16 | 0 | 9.E-13 | 0.00 |
| | Lead-210 (μCi/ml) | 2.E-14 | 0 | 6.E-13 | 0.00 |
| | Radon-222 (μCi/ml) | 3.E-10 | 0 | 1.E-08 | 0.00 |
| | Gamma (mrem/yr) | 30 | 0 | -- | 0 |
| | **TEDE (mrem/yr)** | | | | **0.00** |
| **AM-2** | Uranium (μCi/ml) | 3.E-16 | 1.E-16 | 9.E-14 | 0.06 |
| **Nearest Downwind Residence** | Radium-226 (μCi/ml) | 1.E-16 | 0 | 9.E-13 | 0.00 |
| | Lead-210 (μCi/ml) | 2.E-14 | 0 | 6.E-13 | 0.00 |
| | Radon-222 (μCi/ml) | 6.E-10 | 0 | 1.E-08 | 0.00 |
| | Gamma (mrem/yr) | 37 | 1.0 | -- | 1.00 |
| | **TEDE (mrem/yr)** | | | | **1.06** |
| **AM-3** | Uranium (μCi/ml) | 2.E-16 | 0 | 9.E-14 | 0.00 |
| **Permit Area Boundary** | Radium-226 (μCi/ml) | 1.E-16 | 0 | 9.E-13 | 0.00 |
| | Lead-210 (μCi/ml) | 3.E-14 | 1.E-14 | 6.E-13 | 0.83 |
| | Radon-222 (μCi/ml) | 4.E-10 | 0 | 1.E-08 | 0.00 |
| | Gamma (mrem/yr) | 34 | 0 | -- | 0 |
| | **TEDE (mrem/yr)** | | | | **0.83** |
| **AM-4** | Uranium (μCi/ml) | 2.E-16 | 0 | 9.E-14 | 0.00 |
| **Permit Area Boundary** | Radium-226 (μCi/ml) | 1.E-16 | 0 | 9.E-13 | 0.00 |
| | Lead-210 (μCi/ml) | 2.E-14 | 0 | 6.E-13 | 0.00 |
| | Radon-222 (μCi/ml) | 4.E-10 | 0 | 1.E-08 | 0.00 |
| | Gamma (mrem/yr) | 25.0 | 0 | -- | 0 |
| | **TEDE (mrem/yr)** | | | | **0.00** |
| **AM-5** | Uranium (μCi/ml) | 2.E-16 | 0 | 9.E-14 | 0.00 |
| **Residence** | Radium-226 (μCi/ml) | 1.E-16 | 0 | 9.E-13 | 0.00 |
| | Lead-210 (μCi/ml) | 2.E-14 | 0 | 6.E-13 | 0.00 |
| | Radon-222 (μCi/ml) | 8.E-10 | 2.E-10 | 1.E-08 | 1.00 |
| | Gamma (mrem/yr) | 36 | 0 | -- | 0 |
| | **TEDE (mrem/yr)** | | | | **1.00** |
| **AM-8** | Uranium (μCi/ml) | 2.E-16 | 0 | 9.E-14 | 0.00 |
| **Site Boundary** | Radium-226 (μCi/ml) | 1.E-16 | 0 | 9.E-13 | 0.00 |
| | Lead-210 (μCi/ml) | 2.E-14 | 0 | 6.E-13 | 0.00 |
| | Radon-222 (μCi/ml) | 4.E-10 | 0 | 1.E-08 | 0.00 |
| | Gamma (mrem/yr) | 45 | 9.0 | -- | 9.00 |
| | **TEDE (mrem/yr)** | | | | **9.00** |

Notes:

TEDE — Total Effective Dose Equivalent (mrem/yr)

< — One or more of the Lower Limits of Detection (LLD) used to determine average concentration.

[1] Dose from radionuclides (i) = $\frac{\text{Avg concentration above background in } \mu\text{Ci/ml}}{\text{10 CFR 20 AppB, Table 2 value in } \mu\text{Ci/ml}} * 50 \text{ mrem}$

# Appendix G

## Environmental OSL Monitoring Results

## Third and Fourth Quarter, 2012

# Crow Butte Resources
## Crow Butte Uranium Project
## Perimeter Air Monitoring Stations

### Gamma Exposure Results

| Location | Exposure of Dosimeter (mrems ambient dose equivalent) | | Net Cumulative Totals | | |
|---|---|---|---|---|---|
| | Gross | Net | Calendar Quarter | Year to Date | Permanent |
| **07/01/2012 - 09/30/2012** | | | | | |
| Transient Control | -- | 0.0 | Q3 | 2012 | -- |
| Deploy Control | 30.6 | 0.0 | -- | -- | -- |
| AM-1 | 35.1 | 4.6 | 4.6 | 21.8 | 151.5 |
| AM-2 | 38.4 | 7.9 | 7.9 | 27.4 | 155.9 |
| AM-3 | 38.4 | 7.9 | 7.9 | 24.0 | 167.9 |
| AM-4 | 37.0 | 6.4 | 6.4 | 18.8 | 125.1 |
| AM-5 | 35.9 | 5.3 | 5.3 | 28.0 | 167.2 |
| AM-6 | 39.2 | 8.7 | 8.7 | 27.4 | 155.6 |
| AM-8 | 40.2 | 9.6 | 9.6 | 31.7 | 203.8 |

mrem – millirems

AM-1 air sampling locations

Minimum Detectable Dose = 0.1 mrems ambient dose equivalent

# Crow Butte Resources
## Crow Butte Uranium Project
## Perimeter Air Monitoring Stations

### Gamma Exposure Results

| Location | Exposure of Dosimeter (mrems ambient dose equivalent) | | Net Cumulative Totals | | |
|---|---|---|---|---|---|
| | Gross | Net | Calendar Quarter | Year to Date | Permanent |
| **10/01/2012 - 12/31/2012** | | | | | |
| Transient Control | -- | 0.0 | Q4 | 2012 | -- |
| Deploy Control | 27.5 | 0.0 | -- | -- | -- |
| AM-1 | 35.2 | 7.8 | 7.8 | 29.6 | 159.3 |
| AM-2 | 36.9 | 9.5 | 9.5 | 48.1 | 176.6 |
| AM-3 | 37.8 | 10.3 | 10.3 | 34.3 | 178.2 |
| AM-4 | 33.6 | 6.2 | 6.2 | 25.0 | 131.3 |
| AM-5 | 35.9 | 8.4 | 8.4 | 36.4 | 175.6 |
| AM-6 | 36.5 | 9.0 | 9.0 | 36.4 | 164.6 |
| AM-8 | 40.6 | 13.1 | 13.1 | 44.8 | 216.9 |

mrem – millirems

AM-1 air sampling locations

Minimum Detectable Dose = 0.1 mrems ambient dose equivalent

# Appendix H

## Sediment Monitoring Results

## Third and Fourth Quarter, 2012

# LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Crow Butte Resources
**Project:** Annual Sediment Samples 2012
**Lab ID:** C12110476-001
**Client Sample ID:** Stream E-5

**Revised Date:** 02/20/13
**Report Date:** 12/18/12
**Collection Date:** 11/01/12
**DateReceived:** 11/09/12
**Matrix:** Sediment

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **METALS - TOTAL** | | | | | | | |
| Uranium | 0.7 | mg/kg-dry | | 0.3 | | SW6020 | 11/27/12 23:22 / cp |
| Uranium, Activity | 0.5 | pCi/g-dry | | 0.2 | | SW6020 | 11/27/12 23:22 / cp |
| **RADIONUCLIDES** | | | | | | | |
| Lead 210 | 0.5 | pCi/g-dry | | 0.2 | | E909.0 | 12/15/12 01:09 / eli-cs |
| Lead 210 precision (±) | 0.1 | pCi/g-dry | | | | E909.0 | 12/15/12 01:09 / eli-cs |
| Lead 210 MDC | 0.2 | pCi/g-dry | | | | E909.0 | 12/15/12 01:09 / eli-cs |
| Radium 226 | 0.7 | pCi/g-dry | | 0.04 | | E903.0 | 12/04/12 10:26 / trs |
| Radium 226 precision (±) | 0.08 | pCi/g-dry | | | | E903.0 | 12/04/12 10:26 / trs |
| Radium 226 MDC | 0.04 | pCi/g-dry | | | | E903.0 | 12/04/12 10:26 / trs |
| Thorium 230 | 0.5 | pCi/g-dry | | 0.3 | | E908.0 | 11/28/12 10:17 / dmf |
| Thorium 230 precision (±) | 0.2 | pCi/g-dry | | | | E908.0 | 11/28/12 10:17 / dmf |
| Thorium 230 MDC | 0.3 | pCi/g-dry | | | | E908.0 | 11/28/12 10:17 / dmf |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

# LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Crow Butte Resources
**Project:** Annual Sediment Samples 2012
**Lab ID:** C12110476-002
**Client Sample ID:** Impoundent I5

**Revised Date:** 02/20/13
**Report Date:** 12/18/12
**Collection Date:** 11/01/12
**DateReceived:** 11/09/12
**Matrix:** Sediment

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **METALS - TOTAL** | | | | | | | |
| Uranium | 10.0 | mg/kg-dry | | 0.3 | | SW6020 | 11/27/12 23:25 / cp |
| Uranium, Activity | 6.8 | pCi/g-dry | | 0.2 | | SW6020 | 11/27/12 23:25 / cp |
| **RADIONUCLIDES** | | | | | | | |
| Lead 210 | 0.7 | pCi/g-dry | | 0.2 | | E909.0 | 12/15/12 03:14 / eli-cs |
| Lead 210 precision (±) | 0.1 | pCi/g-dry | | | | E909.0 | 12/15/12 03:14 / eli-cs |
| Lead 210 MDC | 0.2 | pCi/g-dry | | | | E909.0 | 12/15/12 03:14 / eli-cs |
| Radium 226 | 0.4 | pCi/g-dry | | 0.03 | | E903.0 | 12/04/12 10:26 / trs |
| Radium 226 precision (±) | 0.06 | pCi/g-dry | | | | E903.0 | 12/04/12 10:26 / trs |
| Radium 226 MDC | 0.03 | pCi/g-dry | | | | E903.0 | 12/04/12 10:26 / trs |
| Thorium 230 | 0.3 | pCi/g-dry | | 0.3 | | E908.0 | 11/28/12 10:17 / dmf |
| Thorium 230 precision (±) | 0.2 | pCi/g-dry | | | | E908.0 | 11/28/12 10:17 / dmf |
| Thorium 230 MDC | 0.3 | pCi/g-dry | | | | E908.0 | 11/28/12 10:17 / dmf |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

# LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Crow Butte Resources
**Project:** Annual Sediment Samples 2012
**Lab ID:** C12110476-003
**Client Sample ID:** Stream S2

**Revised Date:** 02/20/13
**Report Date:** 12/18/12
**Collection Date:** 11/01/12
**DateReceived:** 11/09/12
**Matrix:** Sediment

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **METALS - TOTAL** | | | | | | | |
| Uranium | 0.7 | mg/kg-dry | | 0.3 | | SW6020 | 11/27/12 23:38 / cp |
| Uranium, Activity | 0.5 | pCi/g-dry | | 0.2 | | SW6020 | 11/27/12 23:38 / cp |
| **RADIONUCLIDES** | | | | | | | |
| Lead 210 | 0.6 | pCi/g-dry | | 0.2 | | E909.0 | 12/15/12 05:19 / eli-cs |
| Lead 210 precision (±) | 0.1 | pCi/g-dry | | | | E909.0 | 12/15/12 05:19 / eli-cs |
| Lead 210 MDC | 0.2 | pCi/g-dry | | | | E909.0 | 12/15/12 05:19 / eli-cs |
| Radium 226 | 0.3 | pCi/g-dry | | 0.04 | | E903.0 | 12/04/12 10:26 / trs |
| Radium 226 precision (±) | 0.06 | pCi/g-dry | | | | E903.0 | 12/04/12 10:26 / trs |
| Radium 226 MDC | 0.04 | pCi/g-dry | | | | E903.0 | 12/04/12 10:26 / trs |
| Thorium 230 | <0.2 | pCi/g-dry | U | 0.2 | | E908.0 | 11/28/12 10:17 / dmf |
| Thorium 230 precision (±) | 0.1 | pCi/g-dry | | | | E908.0 | 11/28/12 10:17 / dmf |
| Thorium 230 MDC | 0.2 | pCi/g-dry | | | | E908.0 | 11/28/12 10:17 / dmf |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

## LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Crow Butte Resources
**Project:** Annual Sediment Samples 2012
**Lab ID:** C12110476-004
**Client Sample ID:** Stream S1

**Revised Date:** 02/20/13
**Report Date:** 12/18/12
**Collection Date:** 11/01/12
**DateReceived:** 11/09/12
**Matrix:** Sediment

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **METALS - TOTAL** | | | | | | | |
| Uranium | 1.1 | mg/kg-dry | | 0.3 | | SW6020 | 11/27/12 23:41 / cp |
| Uranium, Activity | 0.7 | pCi/g-dry | | 0.2 | | SW6020 | 11/27/12 23:41 / cp |
| **RADIONUCLIDES** | | | | | | | |
| Lead 210 | 0.5 | pCi/g-dry | | 0.2 | | E909.0 | 12/15/12 07:24 / eli-cs |
| Lead 210 precision (±) | 0.1 | pCi/g-dry | | | | E909.0 | 12/15/12 07:24 / eli-cs |
| Lead 210 MDC | 0.2 | pCi/g-dry | | | | E909.0 | 12/15/12 07:24 / eli-cs |
| Radium 226 | 0.3 | pCi/g-dry | | 0.03 | | E903.0 | 12/04/12 10:26 / trs |
| Radium 226 precision (±) | 0.05 | pCi/g-dry | | | | E903.0 | 12/04/12 10:26 / trs |
| Radium 226 MDC | 0.03 | pCi/g-dry | | | | E903.0 | 12/04/12 10:26 / trs |
| Thorium 230 | 0.3 | pCi/g-dry | | 0.2 | | E908.0 | 11/28/12 10:17 / dmf |
| Thorium 230 precision (±) | 0.2 | pCi/g-dry | | | | E908.0 | 11/28/12 10:17 / dmf |
| Thorium 230 MDC | 0.2 | pCi/g-dry | | | | E908.0 | 11/28/12 10:17 / dmf |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

# LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Crow Butte Resources
**Project:** Annual Sediment Samples 2012
**Lab ID:** C12110476-005
**Client Sample ID:** E1 & E2 Composite

**Revised Date:** 02/20/13
**Report Date:** 12/18/12
**Collection Date:** 11/01/12
**DateReceived:** 11/09/12
**Matrix:** Sediment

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **METALS - TOTAL** | | | | | | | |
| Uranium | 36.1 | mg/kg-dry | | 0.3 | | SW6020 | 11/27/12 23:44 / cp |
| Uranium, Activity | 24.5 | pCi/g-dry | | 0.2 | | SW6020 | 11/27/12 23:44 / cp |
| **RADIONUCLIDES** | | | | | | | |
| Lead 210 | 1 | pCi/g-dry | | 0.2 | | E909.0 | 12/15/12 09:29 / eli-cs |
| Lead 210 precision (±) | 0.1 | pCi/g-dry | | | | E909.0 | 12/15/12 09:29 / eli-cs |
| Lead 210 MDC | 0.2 | pCi/g-dry | | | | E909.0 | 12/15/12 09:29 / eli-cs |
| Radium 226 | 0.6 | pCi/g-dry | | 0.03 | | E903.0 | 12/04/12 12:07 / trs |
| Radium 226 precision (±) | 0.07 | pCi/g-dry | | | | E903.0 | 12/04/12 12:07 / trs |
| Radium 226 MDC | 0.03 | pCi/g-dry | | | | E903.0 | 12/04/12 12:07 / trs |
| Thorium 230 | <0.2 | pCi/g-dry | U | 0.2 | | E908.0 | 11/28/12 10:17 / dmf |
| Thorium 230 precision (±) | 0.1 | pCi/g-dry | | | | E908.0 | 11/28/12 10:17 / dmf |
| Thorium 230 MDC | 0.2 | pCi/g-dry | | | | E908.0 | 11/28/12 10:17 / dmf |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

# LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Crow Butte Resources
**Project:** Annual Sediment Samples 2012
**Lab ID:** C12110476-006
**Client Sample ID:** Impoundment I4

**Revised Date:** 02/20/13
**Report Date:** 12/18/12
**Collection Date:** 11/01/12
**DateReceived:** 11/09/12
**Matrix:** Sediment

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **METALS - TOTAL** | | | | | | | |
| Uranium | 16.1 | mg/kg-dry | | 0.3 | | SW6020 | 11/27/12 23:46 / cp |
| Uranium, Activity | 10.9 | pCi/g-dry | | 0.2 | | SW6020 | 11/27/12 23:46 / cp |
| **RADIONUCLIDES** | | | | | | | |
| Lead 210 | 1.6 | pCi/g-dry | | 0.2 | | E909.0 | 12/15/12 11:34 / eli-cs |
| Lead 210 precision (±) | 0.1 | pCi/g-dry | | | | E909.0 | 12/15/12 11:34 / eli-cs |
| Lead 210 MDC | 0.2 | pCi/g-dry | | | | E909.0 | 12/15/12 11:34 / eli-cs |
| Radium 226 | 0.1 | pCi/g-dry | | 0.03 | | E903.0 | 12/04/12 12:07 / trs |
| Radium 226 precision (±) | 0.04 | pCi/g-dry | | | | E903.0 | 12/04/12 12:07 / trs |
| Radium 226 MDC | 0.03 | pCi/g-dry | | | | E903.0 | 12/04/12 12:07 / trs |
| Thorium 230 | <0.2 | pCi/g-dry | U | 0.2 | | E908.0 | 11/28/12 10:17 / dmf |
| Thorium 230 precision (±) | 0.2 | pCi/g-dry | | | | E908.0 | 11/28/12 10:17 / dmf |
| Thorium 230 MDC | 0.2 | pCi/g-dry | | | | E908.0 | 11/28/12 10:17 / dmf |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

# LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Crow Butte Resources
**Project:** Annual Sediment Samples 2012
**Lab ID:** C12110476-007
**Client Sample ID:** Impoundment I3

**Revised Date:** 02/20/13
**Report Date:** 12/18/12
**Collection Date:** 11/01/12
**DateReceived:** 11/09/12
**Matrix:** Sediment

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **METALS - TOTAL** | | | | | | | |
| Uranium | 19.1 | mg/kg-dry | | 0.3 | | SW6020 | 11/27/12 23:49 / cp |
| Uranium, Activity | 12.9 | pCi/g-dry | | 0.2 | | SW6020 | 11/27/12 23:49 / cp |
| **RADIONUCLIDES** | | | | | | | |
| Lead 210 | 2.2 | pCi/g-dry | | 0.2 | | E909.0 | 12/15/12 13:39 / eli-cs |
| Lead 210 precision (±) | 0.1 | pCi/g-dry | | | | E909.0 | 12/15/12 13:39 / eli-cs |
| Lead 210 MDC | 0.2 | pCi/g-dry | | | | E909.0 | 12/15/12 13:39 / eli-cs |
| Radium 226 | 0.6 | pCi/g-dry | | 0.03 | | E903.0 | 12/04/12 12:07 / trs |
| Radium 226 precision (±) | 0.07 | pCi/g-dry | | | | E903.0 | 12/04/12 12:07 / trs |
| Radium 226 MDC | 0.03 | pCi/g-dry | | | | E903.0 | 12/04/12 12:07 / trs |
| Thorium 230 | 0.4 | pCi/g-dry | | 0.2 | | E908.0 | 11/28/12 10:17 / dmf |
| Thorium 230 precision (±) | 0.2 | pCi/g-dry | | | | E908.0 | 11/28/12 10:17 / dmf |
| Thorium 230 MDC | 0.2 | pCi/g-dry | | | | E908.0 | 11/28/12 10:17 / dmf |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

# LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Crow Butte Resources
**Project:** Annual Sediment Samples 2012
**Lab ID:** C12110476-008
**Client Sample ID:** Stream S5

**Revised Date:** 02/20/13
**Report Date:** 12/18/12
**Collection Date:** 11/01/12
**DateReceived:** 11/09/12
**Matrix:** Sediment

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **METALS - TOTAL** | | | | | | | |
| Uranium | 0.7 | mg/kg-dry | | 0.3 | | SW6020 | 11/27/12 23:51 / cp |
| Uranium, Activity | 0.5 | pCi/g-dry | | 0.2 | | SW6020 | 11/27/12 23:51 / cp |
| **RADIONUCLIDES** | | | | | | | |
| Lead 210 | 0.4 | pCi/g-dry | | 0.2 | | E909.0 | 12/15/12 15:44 / eli-cs |
| Lead 210 precision (±) | 0.1 | pCi/g-dry | | | | E909.0 | 12/15/12 15:44 / eli-cs |
| Lead 210 MDC | 0.2 | pCi/g-dry | | | | E909.0 | 12/15/12 15:44 / eli-cs |
| Radium 226 | 0.4 | pCi/g-dry | | 0.03 | | E903.0 | 12/04/12 12:07 / trs |
| Radium 226 precision (±) | 0.06 | pCi/g-dry | | | | E903.0 | 12/04/12 12:07 / trs |
| Radium 226 MDC | 0.03 | pCi/g-dry | | | | E903.0 | 12/04/12 12:07 / trs |
| Thorium 230 | 0.2 | pCi/g-dry | | 0.2 | | E908.0 | 11/28/12 10:17 / dmf |
| Thorium 230 precision (±) | 0.1 | pCi/g-dry | | | | E908.0 | 11/28/12 10:17 / dmf |
| Thorium 230 MDC | 0.2 | pCi/g-dry | | | | E908.0 | 11/28/12 10:17 / dmf |

**Report Definitions:**
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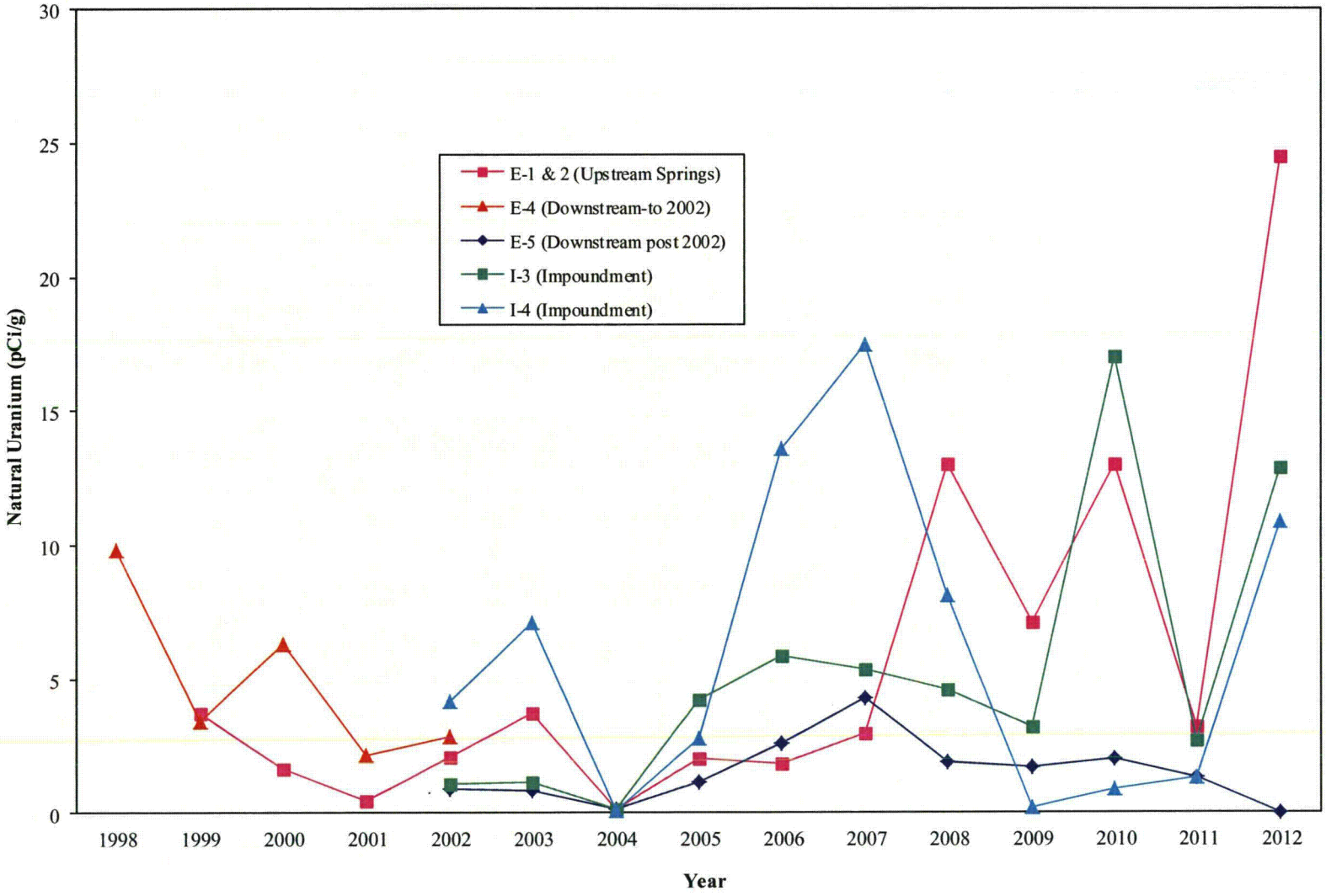
## English Creek Sediment Uranium Concentration



## Squaw Creek Sediment Uranium Concentration