

**TECHNICAL REVIEW  
OF GROUND-WATER MONITORING DATA  
AT PATHFINDER MINES CORPORATION-LUCKY MC MINE**

Performed by: Lifeng Guo, Hydrogeologist  
Date: September 4, 2012

The Semi-Annual Ground-Water Monitoring Reports for Lucky Mc Mine, dated August 2011 and January 2012 by Hydro-Engineering, LLC presents the ground-water monitoring data collected at the Lucky Mc tailing site in the 1<sup>st</sup> and 2<sup>nd</sup> Quarters, and 3<sup>rd</sup> and 4<sup>th</sup> Quarters of 2011, respectively. Ground-water monitoring was conducted based on condition 60B of Source Material License No. SUA-672. License Condition 60B requires monitoring of groundwater from Well T1-12 (POC well), Well AL-6 (POE well), and other selected wells, AL-1 and AL-7.

The table below lists the measured concentrations for POC well T1-12:

**Groundwater Monitoring Data at POC well T1-12, with Established Protection Standard**

| Chemical Constituents Protection Standard | Arsenic | Beryllium | Cadmium | Chromium | Nickel | Ra226+228 | Selenium | Thorium-230 | Uranium |
|---|---------|-----------|---------|----------|--------|-----------|----------|-------------|---------|
| 3/24/2011                                 | 0.05    | 0.07      | 0.02    | 0.05     | 0.85   | 7.5       | 1.1      | 13.2        | 1.7     |
| 6/8/2011                                  | 0.001   | <0.01     | <0.010  | <0.05    | 0.28   | 3.5       | 0.265    | 0.07        | 0.378   |
| 8/18/2011                                 | -       | -         | -       | -        | -      | -         | -        | -           | -       |
| 11/17/2011                                | 0.002   | <0.01     | <0.010  | <0.05    | 0.26   | 3.7       | 0.26     | 0.2         | 0.364   |
|   | <0.001  | <0.01     | <0.005  | <0.05    | 0.19   | 4         | 0.24     | 0.1         | 0.362   |

**Note: All concentrations in mg/l except for radium and thorium in pCi/l.**

The uranium concentrations observed during 2011 at POC well T1-12 are consistent with the previous 11 years of sampling results (i.e., since approximately 2000), with concentration values fluctuating just below 0.4 mg/l. The uranium concentrations at downgradient POE well AL-6 varied from 0.671 mg/l to 0.733 mg/l in 2011, similar to the concentrations observed in previous years. The uranium concentrations at AL-6 have always been above the concentrations observed at the POC well T1-12 from 1988 to the present. The highest uranium concentrations at AL-6 reached approximately 1.6 mg/l between 2000 and 2002. However, the uranium concentrations at well AL-1, located upgradient of POE well AL-6 have increased from 0.939 mg/l in March 2011 to 2.42 mg/l in November 2011. These elevated uranium concentrations at well AL-1 also occurred between 1995 and 2003. There appears

to be no indication of leakage of impacted groundwater from the tailings impoundment that may result in these recent spikes of uranium concentrations at downgradient well AL-1.

The selenium concentrations at both POC well T1-12 and POE well AL-6 are significantly below the established protective level of 1.1 mg/l. The selenium concentrations at T1-12 have continued to decrease since late 1990s. The activities of radium-226 and radium-228 measured at both POC well T1-12 and POE well AL-6 during 2011 are well below the site protection level of 7.5 pCi/l.

Other measured chemical constituents include chloride, sulfate, and TDS. The chloride concentrations in the POC well T1-12 have been decreasing since the late 1980's, with a current concentration of 200 mg/l. The chloride concentration at well AL-6 (POE) fluctuates between 50 and 250 mg/l, with the background level at about 50 mg/l in well T1-6. The sulfate concentrations at the POC well T1-12 have been steady overall for the last five years at approximately 2500 mg/l. The TDS at the POC well T1-12 has been steady at about 6200 mg/l since 2005.

No monitoring data were reported for the 2<sup>nd</sup> quarter of 2011.

#### Conclusion:

The NRC staff concur with the conclusion that the present concentrations of chemical constituents monitored at the POC well T1-12 are significantly below the levels established to be protective for the site. However, the uranium concentrations at well AL-1, located upgradient of POE well AL-6 has increased from 0.939 mg/l in March 2011 to 2.42 mg/l in November 2011, which is above the site protection level of 1.7 mg/l. Since the uranium concentrations at upgradient POC well T1-12 have been consistently below 0.4 mg/l, it is not likely that leakage of impacted groundwater from the tailings impoundment is the source of these elevated levels. Further evaluation and/or monitoring of the increase of uranium concentrations at well AL-1 is needed before the site transfer to DOE-Legacy Management for long-term stewardship.