



# PATHFINDER

May 25, 2006

Mr. Gary Janosko, Chief  
Fuel Cycle Facilities Branch  
Division of Fuel Cycle Safety and Safeguards  
Office of Nuclear Material Safety and Safeguards  
U. S. Nuclear Regulatory Commission  
Washington, D. C. 20555

Ref: Docket No. 40-6622, Source Material License No. SUA-442

Dear Mr. Janosko:

Enclosed please find two copies of an annual radiation safety ALARA audit report covering year 2005 for the Shirley Basin mill and tailings site as required by condition 36 of Source Material License No. SUA-442.

Sincerely,

T. W. Hardgrove  
Manager, Reclamation Operations

Enclosure

Cc: J. Whitten, USNRC, Region IV  
D. L. Wichers

**Annual ALARA Audit**

**For 2005**

**PATHFINDER MINES CORP.**

**Shirley Basin Mine**

**Source Material License SUA-442**

**Prepared By**

**L. Arbogast**

**April 26, 2006**

A. Introduction

An annual ALARA audit of the radiation safety program at the Shirley Basin Mine was conducted during the fourth week of April, 2006. The audit was conducted in fulfillment of condition 36 of the license. The audit entailed a review of 2005 radiation safety records and an evaluation of conformance with requirements of the license.

B. Personnel Dose Records

Attachment 1 is a summary of the annual Pathfinder (PMC) and selected contractor employee radiation doses for 2005. TEDEs were assigned to the two PMC hourly employees and to the contractor heavy equipment operators who were subject to the highest doses. Those contractor employees were the four individuals who operated scrapers for a significant amount of time directly on the tailings. The highest PMC annual TEDE was 170 mrem or 3% of the annual limit of five rem. All hourly employees are issued TLD badges. No badges recorded any doses for the year. Therefore, all doses were due to internal committed effective dose. The highest dose for a contractor scraper operator was 297 mrem or 6% of the annual limit. Like PMC employees there was no penetrating radiation dose recorded for any contractor employees as indicated by TLD badges issued to representative scraper operators. The annual doses have been in a downward trend for a number of years (see Attachment 2). This trend is most likely due to the progressive covering of tailings and declines in PMC personnel hours actually spent directly on the tailings.

As noted above, external radiation doses as measured by dosimeters were zero for 2005. Little or no external dose has been the case at the site for some time now, reflecting the status of the facility (no mill plant and interim cover on much of the tailings even during grading operations).

C. Bioassays

Only two urine samples were analyzed during 2005. Since bioassay samples have not indicated any uranium uptake at this site for a number of years, a single quarterly sample is typically obtained in conjunction with a radiation work permit issued for the receipt of a shipment of ISL waste. This limited program acts as a confirmatory exercise to demonstrate no uptake. The ISL waste receipt is the only activity that remotely presents an opportunity for uranium uptake. Samples were taken for the first and the fourth quarters of the year. Bioassays are not required by the approved radiation safety program at Shirley Basin. Both bioassay samples were less than the detection level. Spiked samples of water were analyzed for QA/QC purposes with each urine sample, and results for all spikes were acceptable.

D. Inspections

No inspections by the NRC were done in 2005.

#### E. Training

The required annual refresher radiation safety training was given to two PMC hourly employees on December 28, 2005. A written test was administered at the conclusion of the training session. One employee hired by PMC worked the first two months of the year. This individual was hired as a scale operator to weigh incoming shipments of rip rap to be used in tailings reclamation. His position does not bring him in contact with tailings or other contaminated materials. Consequently, no radiation safety training was deemed necessary for that individual. Contractor employees were given an introductory presentation on radiation hazards and appropriate conduct to minimize exposure, including personal cleanliness and avoidance of food consumption while working directly on tailings. The training program is adequate for the level and type of activities at this site.

#### F. Safety Meetings

Documented routine safety meetings were held with Pathfinder employees on a bimonthly basis. Safety meetings are often utilized as a means of re-enforcing the radiation safety refresher training. Such meetings were documented, including topics discussed.

#### G. Radiological Surveys and Sampling Data

See Attachment 3 for a 2005 summary of values resulting from routine area surveys for airborne particulates. The overall alpha particulate levels remained generally low. Attachment 3 provides the overall annual average airborne concentrations for U, Ra226, and Th230, and the corresponding percentages of the applicable DAC's. Th230 remains the radionuclide of greatest concern with the average annual concentration at 5.8 % of the DAC.

Radon with daughters monitoring was done quarterly (see Attachment 3). Measured working levels (WL) remained low, averaging less than one percent of the DAC. The highest measured WL was two percent of the DAC. Overall, radon with daughters was lower than in 2004.

Area gamma levels were consistently low with the highest reading of 0.08 mR/hr at the ISL burial trench. Other sites were 0.04 or less mR/hr, and the mill shop sample sites were 0.02 to 0.03 mR/hr. Background gamma levels adjacent to the office are around 0.02 mR/hr.

Surface alpha contamination levels were consistently low and well below the action level. Checks were made quarterly, appropriate for the low alpha levels observed. The highest reading was 8.7 dpm/100 cm<sup>2</sup> in the lunchroom during the second quarter. Personnel alpha contamination survey records were examined; there were no cases of contamination

necessitating decontamination and re-monitoring. Site workers monitor out if they have been working on ISL waste shipment receipts. ISL waste shipment truck drivers were also checked routinely for alpha contamination, and no problems were evident. The drivers do not come in contact with the byproduct waste, making it highly unlikely they would incur any contamination. Note that exit contamination personnel surveys are not specifically required by the license and approved radiation safety program at this site.

Surveys of equipment (primarily ISL waste delivery trucks) prior to release from the restricted area are well documented with no problems apparent. Some heavy equipment used by the contractor on tailings was also surveyed for release with no contamination problems evident. Spot checks of small vehicles used within the restricted area indicated no problems with surface contamination. Typical surface alpha and gamma levels were at or near background levels.

#### H. Equipment Used for Exposure Control

Radiation detection instrument calibration records were examined and found to be in order. Acceptable documentation of instrument function checks was noted. Breathing zone air pump samplers were found to be calibrated and so documented in a timely manner.

#### I. Reports on Overexposures

There were no overexposures during 2005.

#### J. Standard Operating Procedures Review

The records with the SOPs documented the required annual review of all SOPs by the RSO.

#### K. Radiation Work Permits

There were two radiation work permits (RWPs) during 2005, both related to the receipt of ISL byproduct shipments. Measured doses from RWPs have been trivial for a number of years. No doses were assigned as a result of any of the RWPs in 2005.

#### L. Recommendations on Ways to Further Reduce Personnel Exposures

- Continue to emphasize good housekeeping and personal hygiene practices as a means to avoid contamination problems, particularly in conjunction with ISL waste shipments delivery.
- The continuation of contractor monitoring until all exposed tailings are covered with clay will help assure that exposures are kept as low as reasonably achievable.

However, the nearly complete re-grading and covering of the tailings by the ongoing reclamation program has nearly eliminated tailings as an area of concern relative to personnel exposures.

M. Concluding Comment

During 2005 radiation doses continued the pattern of decline that has been evident during recent years. The radiation safety program at Shirley Basin conforms with the requirements of the license and is appropriate for the kind and level of activity at the site. There are no upward trends in doses to the limited number of PMC site personnel, and doses to contractor personnel appear to be acceptably low. It is anticipated that the already low doses will continue to decline as the mill and tailings site is capped and reclaimed.



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Attachment 1

**Summary of PMC Hourly Employee Doses for the Period January, 2005 - December, 2005.**

<u>Site</u>	<u>Name</u>	<u>Occupation</u>	<u>External</u>	<u>CEDE (mrems)</u>
Shirley Basin Mine				
	Lee, D.	mill tailings worker	0	158
	Sears, D.	mill tailings worker	0	170

**Summary of Contractor Doses for the Period January, 2005 - December, 2005.**

(Highest exposed contractor employees - scraper operators on tailings)

<u>Site</u>	<u>Name</u>	<u>Occupation</u>	<u>External</u>	<u>CEDE (mrems)</u>
Shirley Basin Mine				
	Cummins, D.	scraper operator	0	115
	Hermisillo, M.	scraper operator	0	297
	Kendall, C.	scraper operator	0	122
	Somers, J.	scraper operator	0	120

**Attachment 2 - Exposure (CEDE) Trend at Shirley Basin Uranium Mill & Tailings Site**

<b>PMC Employee CEDE (mrems/year)</b>		
<b>Year</b>	<b>High</b>	<b>Average</b>
2000	789	590
2001	675	480
2002	530	378
2003	302	224
2004	270	184
2005	170	164

**Note: Total dose (TEDE) comprised solely of CEDE. TLD badges recorded no external dose for years 2000-2005.**



Attachment 3

Area Airbornes - 2005-CRE Scraper Operators

Date	Th230 uCi/ml	U-Nat uCi/ml	Ra226 uCi/ml
01/03/05	1.59E-13	3.12E-13	7.66E-14
01/18/05	2.37E-13	4.66E-13	1.14E-13
01/25/05	1.93E-13	3.80E-13	9.33E-14
02/08/05	9.04E-14	1.78E-13	4.37E-14
02/16/05	8.00E-14	1.57E-13	3.86E-14
03/01/05	1.93E-13	3.79E-13	9.30E-14
03/09/05	1.77E-13	3.48E-13	8.55E-14
03/16/05	1.78E-13	3.49E-13	8.58E-14
03/22/05	3.16E-13	6.21E-13	1.52E-13
03/28/05	6.25E-13	1.23E-12	3.02E-13
04/07/05	5.00E-13	9.83E-13	2.42E-13
04/11/05	2.94E-13	5.79E-13	1.42E-13
04/26/05	3.98E-13	7.83E-13	1.92E-13
05/04/05	3.25E-13	6.38E-13	1.57E-13
05/18/05	1.10E-13	2.16E-13	5.31E-14
05/25/05	1.57E-13	3.09E-13	7.59E-14
06/08/05	7.91E-14	1.55E-13	3.82E-14
06/14/05	5.98E-13	1.18E-12	2.89E-13
07/06/05	1.70E-13	3.34E-13	8.21E-14
07/13/05	1.03E-12	2.03E-12	4.99E-13
07/19/05	2.34E-12	4.59E-12	1.13E-12
07/28/05	4.99E-13	9.81E-13	2.41E-13
08/02/05	3.02E-13	5.94E-13	1.46E-13
08/10/05	4.42E-13	8.69E-13	2.13E-13
08/17/05	2.35E-13	4.62E-13	1.14E-13
08/24/05	8.48E-13	1.67E-12	4.09E-13
09/01/05	1.23E-13	2.42E-13	5.95E-14
09/29/05	-1.07E-13	-2.10E-13	-5.17E-14
10/17/05	1.35E-13	2.66E-13	6.52E-14
10/24/05	5.27E-13	1.04E-12	2.55E-13
11/01/05	2.24E-13	4.39E-13	1.08E-13
12/29/05	-3.44E-14	-6.76E-14	-1.66E-14
12/29/05	5.85E-15	1.15E-14	2.82E-15
2005 AVG.	3.47E-13	6.82E-13	1.68E-13
% DAC	5.78	0.14	0.06

Area Airbornes - 2005 - PMC Hourly Workers

Date	Th230 uCi/ml	U-Nat uCi/ml	Ra-226 uCi/ml
01/18/05	2.11E-13	4.15E-13	1.02E-13
01/18/05	3.24E-13	6.36E-13	1.56E-13
01/18/05	1.88E-13	3.70E-13	9.09E-14
01/18/05	8.09E-14	1.59E-13	3.91E-14
01/18/05	2.15E-13	4.22E-13	1.04E-13
02/08/05	3.04E-13	5.97E-13	1.47E-13
02/08/05	2.09E-13	4.12E-13	1.01E-13
02/08/05	1.82E-13	3.58E-13	8.78E-14
02/08/05	2.95E-13	5.81E-13	1.43E-13
02/08/05	1.68E-13	3.30E-13	8.11E-14
03/01/05	3.43E-13	6.74E-13	1.66E-13
03/01/05	6.15E-13	1.21E-12	2.97E-13
03/01/05	3.25E-13	6.38E-13	1.57E-13
03/01/05	1.51E-13	2.97E-13	7.30E-14
03/01/05	-1.16E-14	-2.28E-14	-5.60E-15
04/11/05	2.71E-13	5.32E-13	1.31E-13
04/11/05	5.93E-13	1.66E-12	2.86E-13
04/11/05	9.39E-14	1.84E-13	4.53E-14
04/11/05	1.01E-13	1.88E-13	4.87E-14
05/04/05	1.10E-13	2.17E-13	5.33E-14
05/04/05	4.11E-13	8.07E-13	1.98E-13
05/04/05	5.94E-13	1.17E-12	2.87E-13
05/04/05	2.91E-13	5.72E-13	1.40E-13
06/08/05	3.32E-14	6.52E-14	1.60E-14
06/08/05	1.96E-13	3.85E-13	9.46E-14
06/08/05	1.99E-13	3.91E-13	9.60E-14
07/06/05	3.67E-13	7.22E-13	1.77E-13
07/06/05	7.88E-13	1.55E-12	3.80E-13
07/06/05	3.70E-13	7.27E-13	1.79E-13
08/10/05	6.88E-13	1.35E-12	3.31E-13
08/24/05	1.51E-13	2.96E-13	7.28E-14
08/24/05	4.66E-13	9.17E-13	2.25E-13
08/24/05	3.40E-13	6.69E-13	1.64E-13
09/28/05	2.79E-13	5.48E-13	1.35E-13
09/28/05	3.08E-13	6.05E-13	1.49E-13
09/28/05	1.27E-13	2.50E-13	6.14E-14
10/17/05	5.82E-13	1.14E-12	2.81E-13
10/17/05	4.80E-13	9.43E-13	2.32E-13
10/24/05	9.65E-13	1.90E-12	4.66E-13
10/24/05	1.23E-12	2.41E-12	5.92E-13
2005 AVG.	3.41E-13	6.82E-13	1.64E-13
% DAC	5.68	0.14	0.05

Radon Daughters - SEM - 2005

Date	Working Levels
03/14/05	-0.001
03/14/05	0.001
03/14/05	0.000
03/14/05	0.002
03/14/05	0.003
06/14/05	0.002
06/14/05	0.005
06/14/05	0.001
06/14/05	0.006
06/14/05	0.001
09/29/05	0.000
09/29/05	0.001
09/29/05	0.001
09/29/05	0.001
09/29/05	0.001
12/28/05	0.000
12/28/05	0.002
12/28/05	0.000
12/28/05	-0.001
12/28/05	0.001
AVG	0.001
% DAC	0.39