May 2, 2002

Mr. Tom McLaughlin U.S. Nuclear Regulatory Commission Division of Waste Management 11555 Rockville Pike Mail Stop: T-7F27 Rockville, MD 20852

SUBJECT: ANALYTICAL RESULTS FOR WATER SAMPLES COLLECTED MARCH 12, 2002 FROM MOLYCORP, INC., WASHINGTON, PENNSYLVANIA (TAC# L52054; DOCKET #040-08778) [RFTA NO. 02-005]

OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

Dear Mr. McLaughlin:

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) received four water samples on March 14, 2002, that were collected on March 12, 2002 by Molycorp, Inc staff. The samples were analyzed by gamma spectroscopy, gross alpha and beta, isotopic uranium, isotopic thorium, radium-226, and radium-228. The data are presented in Tables 1, 2, 3, 4, 5, and 6, respectively. The radium-228 data in Table 6 have been qualified and a separate case narrative for these results is attached to the letter report. The case narrative also includes discussion of the gamma spectroscopy results.

ESSAP's Quality Control (QC) procedures were followed for these analyses. The daily QC and detector background for the counting instrumentation used in the analyses were within acceptable limits. The QC files are available for your review upon request. Gamma spectroscopy was performed by procedure CP1, Revision 11. Gross alpha and beta were analyzed by procedure AP1, Revision 13. Isotopic thorium & uranium analyses were performed using AP3, Revision 16. Radium-226 was analyzed using non-routine procedure AP7, Revision 11. Radium-228 was analyzed using a modified version of non-routine procedure AP8, Revision 0.

Please contact me at (865) 241-3242 or Wade Ivey at (865) 576-9184 with any questions or comments.

Sincerely,

ale Condra

Dale Condra Laboratory Manager Environmental Survey and Site Assessment Program

RDC/WPI/kp

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Ra-228 and Gamma Spectroscopy Case Narrative

ESSAP received four-2 L water samples to be analyzed for gross alpha and beta, gamma spectroscopy, isotopic thorium and uranium, Ra-226, and Ra-228. The Ra-226 and Ra-228 data for the QC samples were acceptable for the non-routine procedures; however, the Ra-228 data for the four water samples are presented as qualified for the following reason:

Due to infrequent requests for radium analysis, the determination was made that the maintenance of formal procedures and continued proficiency testing for these analyses types were not cost effective. Therefore, the procedures were removed from the ESSAP Laboratory Manual as formal procedures.

When radium analyses were requested for this set of samples, the ESSAP laboratory staff determined that the existing Ra-228 non-routine procedure was not sufficient and an updated procedure was sought. Literature was obtained and the procedure referenced in the paper entitled Determination of Radium-228 in Natural Waters Using Extraction Chromatography Resins by W.C. Burnett, et al, from Florida State University, published in Radioactivity & Radiochemistry, Vol. 6, No. 3, 1995 was selected for evaluation. This procedure uses extraction chromatography to separate the Ra-228 daughter, Ac-228, from possible interfering beta emitters, including but not limited to, Ba-133, Pb-212, Pb-214, Bi-210, Bi-214, Sr-90, Y-90, and Y-88, and counting using a low background proportional counter. Two separate analyses were performed to determine if the procedure could meet ESSAP's QC requirements. In order to meet the NRC requested report deadlines, full evaluation of the procedure was not possible. The generated results were within the criteria specified in our Quality Assurance Manual for non-routine The QC data showed excellent agreement for the laboratory control samples. procedures. ESSAP does not have independent Performance Evaluation results relating to Ra-228. Results from the gross alpha and beta, isotopic thorium, Ra-226, and gamma spectroscopy indicated that activity levels were essentially indistinguishable from background. Therefore, the Ra-228 data are further substantiated by these results.

During the gamma spectroscopy review process, a comparison was made between Ra-226 concentrations and the concentrations of the daughters. While the concentrations of Ra-226 were statistically at the minimum detectable concentration (MDC), the concentrations of the daughters ranged from a low of 58 pCi/L for sample W004 to a high of 222 pCi/L for sample W002. The only theory for this discrepancy is the trapping of radon by the ground water.

When returning the samples to the storage area, there appeared to be a gas buildup in the Marinelli beakers in which the samples were counted. The samples were placed in a fume hood. Using a needle, a small hole was introduced into each Marinelli to allow for the gas to escape.

It was decided that one sample should be recounted after permitting any radon to decay. Sample W001 was selected and recounted approximately seven days later. The concentrations of the daughters of Ra-226 were found to be statistically around the MDC. This supports the theory that radon was being trapped by the groundwater. The Ra-226 analytical data also supports this theory since the highest concentrations found in the four samples was 0.87 pCi/L.

RADIUM AND THORIUM CONCENTRATIONS BY GAMMA SPECTROSCOPY IN WATER SAMPLES MOLYCORP INC. WASHINGTON, PENNSYLVANIA

	NPC	Radionuclide Concentrations (pCi/L)				
ESSAP ID	Region-I ID	Ra-226	Ra-226 by Pb-214	Ra-226 by Bi-214	Th-228 by Pb-212	Th-232 by Ac-228
812W001	M2	-33 ± 51^{a}	113 ± 12	103 ± 18	8 .0 ± 7.0	1 ± 10
812W001RC ^b	M2	11 ± 54	9.7 ± 8.2	5.7 ± 8.3	5.4 ± 6.0	10 ± 25
812W002	M18	24 ± 62	222 ± 14	230 ± 20	2.0 ± 6.2	10.6 ± 8.9
812W003	MW25	15 ± 2 1	132.7 ± 8.7	136 ± 13	2.1 ± 4.0	7.3 ± 6.6
812W004	BR1	44 ± 27	58.3 ± 7.2	71 ± 11	12.7 ± 4.1	2.9 ± 6.4

^aUncertainties represent the 95% confidence level, based on total propagated uncertainties.

^bSample was recounted to confirm the presence of the radionuclide concentrations in the first count. All radon daughter products decayed to less than minimum detectable concentration. This indicates that there is no Ra-226 present in the water to produce radon and other daughters (Pb-214 and Bi-214).

CONCENTRATIONS OF GROSS ALPHA AND BETA IN WATER SAMPLES MOLYCORP INC. WASHINGTON, PENNSYLVANIA

	NRC	Concentrations (pCi/L)		
ESSAP ID	Region-I ID	Gross Alpha ^a	Gross Beta ^b	
812W001	M2	$5.1 \pm 2.7^{\circ}$	13.3 ± 3.1	
812W002	M18	4.8 ± 6.7	25.8 ± 6.9	
812W003	MW25	8.1 ± 5.6	16.8 ± 5.3	
812W004	BR1	8.9 ± 8.6	18.1 ± 9.0	

^aTypcial MDC for gross alpha for a 0.1L sample is 3.7 pCi/L.

^bTypcial MDC for gross beta for a 0.1L sample is 4.1 pCi/L

°Uncertainties represent the 95% confidence level, based on total propagated uncertainties.

CONCENTRATIONS OF ISOTOPIC URANIUM IN WATER SAMPLES MOLYCORP INC. WASHINGTON, PENNSYLVANIA

NRC		Radionuclide Concentrations ^a (pCi/L)				
ESSAP ID	Region-I ID	U-234	U-235	U-238	Total U ^c	
812W001	M2	1.07 ± 0.24^{b}	0.08± 0.06	0.84 ± 0.21	1.99 ± 0.33	
812W002	M18	1.23 ± 0.26	0.07 ± 0.06	0.61 ± 0.17	1.91 ± 0.32	
812W003	MW25	1.46 ± 0.30	0.06 ± 0.14	1.45 ± 0.30	2.97 ± 0.45	
812W004	BR1	0.15 ± 0.08	0.01 ± 0.04	0.05 ± 0.05	0.21 ± 0.10	

^aTypcial MDC for the U isotopic procedure for a 0.1L sample is 0.3 pCi/L.

^bUncertainties represent the 95% confidence level, based on total propagated uncertainties.

^cTotal U is determined to be the sum of isotopic values with total propagated uncertainties.

CONCENTRATIONS OF ISOTOPIC THORIUM IN WATER SAMPLES MOLYCORP INC. WASHINGTON, PENNSYLVANIA

ESSAP ID	NDC	Radionuclide Concentrations ^a (pCi/L)			
	Region-I ID	Th-228	Th-230	Th-232	Total Th ^c
812W001	M2	0.12 ± 0.10^{b}	0.04 ± 0.04	0.01 ± 0.02	0.13 ± 0.10
812W002	M18	0.16 ± 0.10	0.01 ± 0.03	-0.02 ± 0.03	0.14 ± 0.11
812W003	MW25	0.08 ± 0.10	0.05 ± 0.06	0.03 ± 0.03	0.11 ± 0.11
812W004	BR1	0.15 ± 0.08	0.02 ± 0.04	-0.01 ± 0.03	0.14 ± 0.09

 $^{\rm a}\text{Typcial MDC}$ for the Th isotopic procedure for a 0.1L sample is 0.3 pCi/L.

^bUncertainties represent the 95% confidence level, based on total propagated uncertainties.

^cTotal Th is determined to be the sum of Th-228 and Th-232 isotopic values with total propagated uncertainties.

CONCENTRATION OF RADIUM-226 IN WATER SAMPLES MOLYCORP INC. WASHINGTON, PENNSYLVANIA

FSSAPID	NRC	Ra-226 ^a
ESSAID	Region-I ID	Concentrations (pCi/L)
812W001	M2	0.14 ± 0.16^{b}
812W002	M18	0.87 ± 0.35
812W003	MW25	0.25 ± 0.20
812W004	BR1	0.30 ± 0.23

^aTypcial MDC for this procedure for a 0.1L sample is 0.33 pCi/L.

^bUncertainties represent the 95% confidence level, based on total propagated uncertainties.

CONCENTRATION OF RADIUM-228 IN WATER SAMPLES MOLYCORP INC. WASHINGTON, PENNSYLVANIA

ESSAP ID	NRC	Ra-228 ^{a,b}
	Region-I ID	Concentrations (pCi/L)
812W001	M2	$-1.46 \pm 0.76^{\circ}$
812W002	M18	-0.94 ± 0.72
812W003	MW25	0.75 ± 0.78
812W004	BR1	0.18 ± 0.88

^aData is qualified per the associated case narrative.

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^bTypcial MDC for this procedure for a 1.0 L sample is 1.5 pCi/L.

°Uncertainties represent the 95% confidence level, based on counting uncertainties. TPU has not been evaluated for this procedure.