March 24, 2006

Mr. Thomas E. Gieck
Remediation Leader
Umetco Minerals Corporation
P.O. Box 1029
Grand Junction, CO 81502

SUBJECT: UMETCO - GAS HILLS - MATERIALS LICENSE NO. SUA-648 - ENVIRONMENTAL ASSESSMENT OF ALTERNATE CONCENTRATION LIMIT (TAC LU0100)

Dear Mr. Gieck:

The U.S. Nuclear Regulatory Commission (NRC) staff has completed its review of your request to approve the proposed alternate concentration limit (ACL) of 189 pCi/L for Lead-210 (Pb-210) in ground water. The ACL application was submitted by letter dated June 17, 2005, with supplemental analysis supplied by e-mail on January 6, 10, and 24; and March 9 and 20, 2006. The staff has determined that your request to revise License Condition (LC) 35, to authorize the use of the ACL at the Umetco Gas Hills, Wyoming, uranium mill site is acceptable.

The staff determined that Umetco has demonstrated that Pb-210 in ground water will not pose a substantial present or potential hazard to human health or the environment as long as the ACL is not exceeded at the Point of Compliance wells. Umetco's proposal is acceptable and is in accordance with 10 CFR Part 40, Appendix A, Criterion 5B(5)(c). The staff's technical evaluation is provided in Enclosure 1.

Based on the conclusions of this review, the Umetco license has been modified to change wording in LC 35 to reflect the revised Pb-210 ACL. The amended license is provided as Enclosure 2.

The NRC staff evaluated the potential impact of implementation of the proposed ACL and prepared an Environmental Assessment (EA). A copy of the final EA was sent to you on January 20, 2006. The EA indicates that the staff concluded that there would be no significant environmental impact from the requested licensing action. A notice to this effect has been published in the *Federal Register* (January 27, 2006) and the notice includes an opportunity for a hearing.

If you have any questions regarding this letter or the enclosures, please contact the NRC Project Manager for your facility, Paul Michalak, at (301) 415-7612 or at pxm2@nrc.gov.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html.

Sincerely,

/RA/

Gary S. Janosko, Chief
Fuel Cycle Facilities Branch
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

Docket No.: 40-0299
License No.: SUA-648

Enclosure:
1. Environmental Assessment
2. Amended License No. 56

cc: Richard Chancellor, WDEQ
Kevin Frederick, WDEQ
Roberta Hoy, WDEQ

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TECHNICAL EVALUATION REPORT
UMETCO MINERALS CORPORATION
REQUEST TO AMEND LICENSE SUA-648
LICENSE CONDITION 35

DATE:	**March 20, 2006**
DOCKET NO.	**40-0299**
LICENSE:	**SUA-648**
LICENSEE:	**Umetco Minerals Corporation** **P.O. Box 1029** **Grand Junction, CO 81502**
FACILITY:	**East Gas Hills, Wyoming**
PROJECT MANAGER:	**Paul Michalak**
TECHNICAL REVIEWER:	**Paul Michalak**

SUMMARY AND CONCLUSIONS:

Umetco Minerals Corporation (Umetco) submitted, by letter dated June 17, 2005 (Umetco 2005a), an application for an alternative concentration limit (ACL) for the Pb-210 ground water standard in License Condition 35 for its uranium mill site in East Gas Hills region of Wyoming (the site). Supplemental geochemical modeling results requested by the U.S. Nuclear Regulatory Commission (NRC) were submitted via e-mail on January 6, 10, and 24, and March 9 and 20, 2006 (Umetco 2006a, through 2006e, respectively). Based on these submittals, Umetco has demonstrated that Pb-210 concentrations in the ground water will not pose a substantial present or potential hazard to human health or the environment as long as the ACL is not exceeded.

In addition, the staff is in agreement with the Wyoming Department of Environmental Quality (WDEQ) (2006) comment concerning the graphical presentation of data in Umetco's annual reports. The staff suggests that at a minimum, for both the POC and non-POC wells included in the Southwestern Flow Regime sampling program, the last 10 years of data should be include in the graphs.

BACKGROUND:

The Umetco uranium mill site is located in western Natrona and eastern Freemont Counties, in the East Gas Hills area of central Wyoming. The Umetco site is licensed by the NRC under Materials License SUA-648 to possess byproduct material in the form of uranium tailings and other wastes generated by past milling operations. The mill operated from 1960 to 1984. Mill decommissioning was initiated in 1987 and completed in 1993. A key feature of the milling operation was the A-9 Repository, a former surface uranium mine pit that was used for tailings

disposal (see attached Monitoring Locations Map). Umetco's Final Status Survey Report, which documented the site's final radiological status, was approved on September 27, 2004 (NRC 2004). Addendum 2 to the Final Status Survey report (Umetco 2005c), which documented the A-9 repository exposure survey was recently approved by the NRC (NRC 2005).

Umetco's ground water corrective action activities began in 1983. Ground water remediation involved extracting ground water in the vicinity of the Impoundment and the A-9 Repository and evaporating the water extracted in evaporation ponds. In 2002, Umetco proposed ACLs for nine constituents (arsenic, beryllium, gross alpha, Pb-210, nickel, radium-226 and -228, selenium, thorium-230, and natural uranium). Upon NRC approval of the ACL application (March 29, 2002), the corrective action program was terminated (NRC 2002a). Ground water monitoring in accordance with Umetco's Groundwater Monitoring Plan, Appendix M, is ongoing (Umetco 2002a, 2002b, and 2004a).

Hydrogeology

The Umetco site is within the Wind River Basin of central Wyoming and is situated on the Wind River Formation. The Wind River Formation is characterized as a sequence of alternating discontinuous layers of sandstone, siltstone, claystone, and conglomerate. The uppermost occurrence of ground water beneath the site is within the Wind River aquifer.

Two flow regimes, or hydrostratigraphic units, are present at the Gas Hills site: the Southwest Flow Regime (SWFR) which includes the upper portion of the Wind River Formation and is present beneath the A-9 Repository, and the Western Flow Regime which includes the lower portion of the Wind River Formation. Of particular interest in this proposed license amendment is the SWFR. The SWFR is characterized as a shallow unconfined system with a southwesterly flow direction and a saturated thickness of typically less than 6 m (20 feet) (see attached Monitoring Locations Map).

This shallow unit generally occurs within 30.5 to 46 m (100 to 150 feet) of the ground surface. The SWFR is absent beneath the Above-Grade Tailings Impoundment (AGTI) and west of the site. The SWFR, where present, is separated from the Western Flow Regime by a low-permeable mudstone unit.

Current Ground Water Usage

There are no perennial surface water sources and ground water use in the vicinity of the site is limited. No residential ground water use occurs within a 8-km (5-mile) radius of the site and no current irrigation use has been identified down gradient of the site as discussed below (NRC 2002a). The nearest down gradient year-round residence is approximately 32 km (20 miles) from the site. The water rights search by Umetco yielded 178 distinct water uses, the majority of which (59 percent) are permitted for monitoring purposes, within 5 km (3 miles) of the site (Umetco 2001a). The remaining uses are classified as miscellaneous (14 percent), industrial (13 percent), stock watering (12 percent), and irrigation (3 percent).

Of particular relevance to this assessment is the fact that all irrigation and stock water uses correspond to surface water sources, not ground water via wells. The five irrigation uses are located up gradient to the north/northeast of the Gas Hills site. Livestock and wildlife do use

the Rattlesnake springs/ditches located east (up gradient) of the site and several springs located west of the site that are derived from the Wind River aquifer. These springs have not been impacted by site activities, nor are any site related water quality impacts expected in the future (NRC 2002a, Umetco 2001a). The WDEQ Water Quality Division classification of ground water compared to ambient quality is provided in Umetco (2001b, Table 2.12). The Wyoming classification is first done by use of the water on a well by well basis and secondly, on constituent concentration. Umetco stated that comparison of ambient levels of constituents with WDEQ ground water quality standards could yield a Class IV (industrial) designation, based on concentration. However, based on use, the springs west of the site that are fed by ground water, should represent Class III (livestock watering).

Future Ground Water Usage

The sparse population that characterizes the Gas Hills area is expected to remain stable. This prediction is based on 1997 census projections as well as other factors, including the harsh climate, lack of arable land, and the lack of a foreseeable economic base (Umetco 2001a). Therefore, ground water uses in the area (within 5 miles) of the Umetco site are not expected to change in the future, but to remain for mining and livestock and wildlife watering (NRC 2002a).

Based on ground water fate and transport modeling conducted by Umetco, mill related ground water contamination is not expected to degrade ground water use. This is due to the attenuation (absorption and precipitation) of chemical constituents in the ground water plume as the plume migrates through the aquifer over time and distance. Geochemical processes account for the majority of the reduction in chemical concentrations. The concentration of each licensed constituent including Pb-210 has been calculated to be within the range of background at the POE for 1,000 years (Umetco 2001a, 2001b, 2001c, and 2006e).

Regulatory Framework

Criterion 5B(5) requires that the concentration limits for individual constituents must not exceed:

1) The Commission-approved background concentration of a constituent in the ground water;
2) The respective value given in Table 5C of Appendix A, if the constituent is listed in that table, and if the background level of the constituent is below the value listed (which correspond to EPA's maximum concentration limits (MCLs) for drinking water); or
3) An ACL established by the Commission.

Criterion 5B(6) states that ACL can be established on a site-specific basis, provided it is demonstrated that:

4) The constituents will not pose a substantial present or potential hazard to human health or the environment, as long as the ACL are not exceeded; and
5) The ACL are as low as is reasonably achievable (ALARA), after considering practicable corrective actions.

Factors used in evaluating the ACL application, as outlined in criterion 5B(6), can be found in the Appendix of this report.

DESCRIPTION OF AMENDMENT REQUEST:

The Umetco East Gas Hills site contains two reclaimed disposal areas: the Above Ground Tailings Impoundment (Impoundment) and the A-9 Repository. The license establishes a separate ground water protection standard for each area. The proposed amendment request addresses the Pb-210 ground water protection standard for the A-9 Repository, which is established at POC wells GW-7 and GW-8, located southwest of the repository (see Figure 1). These wells are used to monitor water quality in the upper most ground water unit beneath the A-9 Repository, which is defined as the Southwest Flow Regime (SWFR).

The ACL application requests that License Condition 35 be amended by raising the current Pb-210 concentration limit in the SWFR from 46.7 pCi/L (approved ACL, March 2002) to 189 pCi/L (Umetco 2005a). The proposed Pb-210 concentration is the highest value detected from a monitor well in the SWFR (GW3, March 24, 1987).

TECHNICAL EVALUATION:

The current ACL application contains virtually the same analytical approach that was used by Umetco in its previous ACL application (Umetco 2001a and 2001b). Umetco's previous application and associated analytical work was reviewed and approved by the NRC in March 2002 (NRC 2002b). Both proposals evaluate two ground water velocities which were derived from a ground water flow (MODFLOW) and particle-tracking (MODPATH) simulation of the SWFR: a maximum SWFR ground water velocity of 0.28 ft/day and an average value of 0.167 ft/day.

As before, the computer code PHREEQC (Parkhurst 1995) was used by Umetco to model chemical speciation, mass transfer (e.g., dissolution, precipitation, ion exchange, and absorption), and mass transport (movement of successive pore volumes through the SWFR from the POC to the POE) at and down gradient the Umetco mill site. Umetco used the MINTEQ geochemical database supplemented with additional thermodynamic data/equations for radium and thorium.

The initial assumptions/conditions used in Umetco's SWFR Pb-210 PHREEQC simulations include:

6) Flow and transport from the POC to the POE is one-dimensional, and extends 1,646 m (5,400 feet) from the toe of the A-9 Repository through the POC well GW-8 and well MW-74 to a point overlying Power Resources Incorporated's Gas Hills Mine Unit No. 5 (T 33 N, R 89 W, Section 22). The model is composed of 54 cells, each 30.5 m (100 feet) long.
7) Two flow rates are modeled for the SWFR, 0.167 ft/d and 0.28 ft/d, corresponding to 612 and 1,022 shifts, respectively, for approximately 1,000 years of transport. In Umetco's model, the ground water leaving the POC takes 40.4 and 34.6 years, respectively, to reach the POE.
8) Initial conditions in the first five cells (approximately 500 feet) are based on concentrations (including pH, temperature, and oxidation-reduction measurements)

measured in January 2001 in POC well GW-8. Initial conditions in the remaining 49 cells (approximately 4,900 feet) use concentrations from well MW-74, which, based on the low concentrations of chloride, sulfate, and licensed constituents, appear to be outside the influence of the A-9 Repository.

9) Reduction in source term concentrations occurs over time due to declining drainage from the impoundments, advective and dispersive processes, and chemical reactions. The initial Pb-210 source concentration is 189 pci/L and is reduced in each simulation as shown in Table 1.

10) Solute dispersivity of 50 m is used.

11) Mass of the adsorbing surface is 45.9 grams hydrous ferric oxide/liter of water (assuming 107 g/mol hydrous ferric oxide, 0.2% hydrous ferric oxide, 15% porosity, and 2.1 g/cm^3 bulk density).

12) Surface site density for Type 1 (high-energy) binding sites is 0.0021 moles/liter of water (assuming 0.429 moles of iron/liter of water, and 0.005 moles sites/mole of iron).

13) Surface site density for Type 2 (weak) binding sites is 0.086 moles/liter of water (assuming 0.429 moles of iron/liter of water, and 0.2 moles sites/mole of iron).

14) Quantity of exchange sites is 1.2 moles/liter of water (assuming cation exchange capacity of 10 cmol/Kg, 15% porosity, and 2.1 g/cm^3 bulk density).

15) Chemical equilibria among dissolved species and sorption sites are instantaneous.

16) No solid phases are allowed to equilibrate with the initial (before transport) ground waters assigned to the cells. Precipitation during the transport simulation is allowed if solutions become saturated with respect to the phases, calcite, gypsum, uraninite, coffinite, ferroselite ($FeSe_2$), radium sulfate, nickel selenide and anglesite ($PbSO_4$).

TABLE 1
Southwestern Flow Regime Pb-210 Source Terms

Percent Reduction	0	33	50	75	90
Concentration	189 pCi/L	126 pCi/L	94.4 pCi/L	47.2 pCi/L	19 pCi/L
Time (yrs) for 0.167 ft/day velocity	0 to 7	8 to 10	11 to 16	17 to 36	37 to 1000
Time (yrs) 0.280 ft/day velocity	0 to 6	7 to 9	10 to 16	17 to 35	36 to 1000

POE results for 1,000 years from Umetco's (2005a) Pb-210 simulations for the SWFR are shown in Figures 2 and 3. For the 0.167 ft/day simulation (Figure 2), at the POE, the peak Pb-210 concentration was 0.232 pCi/L at between 119 to 120 years. Concentrations became asymptotic (i.e., starting at 0.120 pCi/L) beginning around 147 years. Beginning around 729 years through 1,000 years, Pb-210 concentrations were 0.115 pCi/L. Both peak and asymptotic values are below the upper Pb-210 background limit.

For the 0.280 ft/day simulation (Figure 3), at the POE, the peak Pb-210 concentration was 0.239

pCi/L at about 159 years. Concentrations became asymptotic (i.e., starting at 0.120 pCi/L) beginning around 218 years. Beginning around 889 years through 1,000 years, Pb-210 concentrations were 0.113 pCi/L. Similar to the 0.167 ft/day results, both peak and asymptotic values are below the upper Pb-210 background limit.

Additional Sensitivity Analysis

Following the staff's initial review, and conversations and correspondence with WDEQ, Land Quality Division (LQD) staff (WDEQ 2006), two issues were identified concerning the Umetco (2005a) geochemical simulations: the potential impact of higher sulfate and other constituents in down gradient baseline areas and the potential impact of significantly higher sulfate concentrations in the source area.

Down Gradient Baseline Values

In Umetco's (2005a) simulations, data from monitor well MW-74 (January 2001) was utilized as the baseline data for cells 6 through 54. However, data from other down gradient monitor wells (e.g., MW-72 and PRI monitor well VECA-3) show significantly different chemical conditions, particularly with respect to sulfate and alkalinity (Umetco 2004b and 2005b). Table 2 lists selected constituent concentrations for wells MW-72, MW-74, and PRI's VECA-3.

TABLE 2
Cells 6 to 54 Baseline Concentrations (mg/L)

	pH	S(6)	Cl	Fe(2)	K	Alkalinity as HCO3
Umetco (2005a), MW-74 (Figures 2 and 3)	6.69	24.1	9.1	0.1	4.2	35
Umetco (2006c) MW-72 (Figures 4 and 9)	6.48	1,190	115	4	17	400
PRI monitor well VECA-3	7.68	1,070	74	2.98	16	208

In response to these concerns, Umetco performed a number of additional simulations. Of particular interest was the run containing the following initial/baseline assumptions: increased initial sulfate source term concentration to 3,500 mg/L, updated initial conditions in the first five cells to well GW-8 2005 data, and replaced down gradient baseline data (cells 6 through 54) with results from well MW-72 (Umetco 2006c).

Figure 4 represents the 0.280 ft/day simulation results from the POC to the POE for selected years. As can be seen, at 1,000 years, the Pb-210 high concentration was about 20 mg/L at 1,000 feet from the POC. Pb-210 concentrations remain above the upper background level out to a distance of about 2,000 feet from the POC, at which point they remain within the background range out to the POE. Figure 5 shows that for the entire 1,000 year simulation period, POE concentrations of Pb-210 are well within background levels for both the 0.167 ft/day and 0.280 ft/day simulations.

TABLE 3 Sulfate Source Reduction (mg/L)					
Sulfate - Umetco Figures 2 and 3	2,650	1,980	1,661	1,161	860
Sulfate - Umetco Figures 4 and 5	3,500	2,546	2,089	1,375	946
Time (yrs) for 0.167 ft/day velocity	0 to 7	8 to 10	11 to 16	17 to 36	37 to 1,000
Time (yrs) 0.280 ft/day velocity	0 to 6	7 to 9	10 to 16	17 to 35	36 to 1,000

Higher Sulfate Source Terms

Umetco acknowledges that certain constituents (e.g., chloride and sulfate) are minimally attenuated and can provide an early indication of site-derived contaminant migration (Umetco 2005a). In their review of Umetco's previous ACL application, Wyoming LQD identified a sulfate "hot spot" at monitor well GW-3, located down gradient of the A-9 Repository and up gradient of POC wells GW-7 and GW-8. Sulfate levels at GW-3 have historically varied between approximately 8,000 and 13,200 mg/L. LQD postulated that Umetco's model may be underestimating long-term concentration changes if the elevated sulfate levels migrate further down gradient (WDEQ 2001). Umetco's most recent annual report (Umetco 2005b) indicates that sulfate levels appear to be increasing in POC well GW-8 and have reached the 3,000 ppm level. Umetco's POC well GW-8 graph contains the results of the last seven sampling events. The trend of increasing sulfate concentrations in GW-8 is more powerfully illustrated in Figure 1 of WDEQ (2006), which graphs over 50 points and shows an order-of-magnitude increase. Consequently, the staff suggests that Umetco's annual report constituent tend graphs for the southwestern flow regime (e.g., Pb-210, uranium, radium-226 and 228, chloride and sulfate) should include, where available, the last 10 years of data.

In response to this concern, Umetco performed additional sensitivity analyses where the initial sulfate source term was increased to 6,000 mg/L, 9,000 mg/L, 12,000 mg/L and 15,000 mg/l (Umetco 2006e). As in Umetco's previous simulations, a decreasing source term was used (Umetco 2006e, Table 2). Anion-cation charge balances were artificially balanced for each simulation to account for the increase in sulfate (Umetco 2006e, Table 1). Figure 6 is Umetco's 0.280 ft/day simulation results from the POC to the POE at 1,000 years. As can be seen, increasing sulfate in the source term results in increasing Pb-210 concentrations down gradient of the POC. However, PB-210 concentrations fall to within background levels at approximately 2,500 feet down gradient of the POC. Figure 7 shows Pb-210 POE concentrations for the entire 1,000 year simulation using the same initial source terms as Figure 8. As can be seen, Pb-210 levels are within back ground levels in all the simulations for the entire 1,000 year period.

Of particular interest in Figure 7 are the apparent drops in Pb-210 concentrations in the 6,000 mg/L and 9,000 mg/L curves at 200 years and 500 years, respectively. Further analysis by Umetco indicated that each drop corresponded to an analogous increase in Pb-210 concentrations at "strong"' adsorption sites (Figures 8 and 9). Apparently, with the increased

initial sulfate source term, it takes longer for the sulfate to wash out and for the Pb-210 to adsorb on to the strong sites.

ENVIRONMENTAL REVIEW:

During its review of the amendment request, the NRC staff performed an environmental assessment (EA) as required under 10 CFR 51.21, for this licensing action. The requested activity does not meet any of the criteria in Part 51.20 requiring an environmental impact statement.

The draft EA was provided to the WDEQ on December 13, 2006. Comments received were addressed in the final EA that was approved on January 23, 2006. The notice of a finding of no significant impact was published in the *Federal Register* on January 27, 2006.

PROPOSED LICENSE CONDITIONS:

Based on Umetco's June 17, 2005 letter, discussions with Umetco technical staff, and supplemental analyses provided by Umetco staff on January 6, 10, and 24, 2006, the following changes should be made to License Condition 35.

License Condition 35 - EDIT

The Alternate Concentration Limits (ACL) for ground water contained in Umetco's application dated May 11 and May 18, 2001, as revised by submittals of July 30, 2001, December 3, 2001, March 4 and October 2, 2002, and June 17, 2005 have been approved for this site. The licensee shall implement a ground water compliance monitoring program that includes the following.

A. Unchanged

B. Unchanged

C. Comply with the following ACL in the southwestern flow regime at POC wells GW7 and GW8: arsenic = 1.36 mg/l, beryllium = 1.70 mg/l, lead-210 = ~~46.7~~ 189 pCi/l, nickel = 9.34 mg/l, combined radium-226 and 228 = 353 pCi/l, selenium = 0.53 mg/l, thorium-230 = 44.8 pCi/l, and uranium-natural = 34.1 mg/l.

D. Unchanged

E. Unchanged.

[Applicable Amendments: 6, 8, 11, 15, 21, 31, 32, 34, 40, 41, 43, 48, 50, 53, 56]

CONCLUSION:

As stated in NRC (1996), “natural processes ... may attenuate hazardous constituents between the POC and the POE ... ACLs for hazardous constituents established at the POC may be greater than appropriate health and environmental concentration limits for those constituents at the POE, and still be protective of human health and the environment.” Based on Umetco’s simulation results, it does not appear that raising the current Pb-210 ACL from 46.7 pCi/L to 189 pCi/L at the POC will result in concentrations above background levels at the POE. Moreover, implementing the proposed ACL will not pose a substantial present or potential hazard to human health or the environment.

To better track the concentration trends of constituents of interest in the SWFR, the staff suggests that at a minimum, for both the POC and non-POC wells included in the sampling program, the last 10 years of data should, where available, be include in the graphs.

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Umetco (2001b) Volume II, Final Application for Alternate Concentration Limits for Gas Hills, Wyoming. May 31, 2001 [Adams Accession Nos. ML011450325 and ML021200261]

Umetco (2002a) Correspondence from Curtis Sealy to Melvyn Leach, NRC, revised Groundwater Monitoring Plan, Appendix M. March 4, 2002 [Adams Accession No. ML020670552]

Umetco (2002b) Correspondence from Curtis Sealy to Dan Gillen, NRC, License Amendment Request. October 2, 2002 [Adams Accession No. ML022890267]

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Umetco (2005b) Annual Report for Gas Hills, Wyoming - July 2004 through June 2005. September 30, 2004 [Adams Accession No. ML052860191]

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Umetco (2006a) E-mail from David Levy, Telesto Solutions, Inc. to Paul Michalak concerning Gas Hills model re-run. January 6, 2006 [Adams Accession No. ML060130581]

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Umetco (2006d) E-mail from David Levy, Telesto Solutions, Inc. to Paul Michalak concerning lead species. March 9, 2006 [Adams Accession No. ML060820192]

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WDEQ (2006) Correspondence from Roberta Hoy, LQD to Paul Michalak, NRC. Subject: proposal to Raise the Alternate Concentration Limit (ACL) for lead-210 in well GW-7 Umetco Minerals Corporation. January 10, 2006. [Adams Accession No. ML060190686]