Umetco Minerals Corporation

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March 4, 2002

ATTENTION: Document Control Desk
Mr. Melvyn Leach, Chief
U.S. Nuclear Regulatory Commission
Fuel Cycle Licensing Branch, NMSS
Mail Stop T-8A33
Two White Flint North, 11545 Rockville Pike
Rockville, MD 20852-2738

Attn: Elaine Brummett

RE: Gas Hills, Wyoming License Number SUA-648, Docket #40-0299
ACL Application

Dear Mr. Leach:

Enclosed please find the revised *Groundwater Monitoring Plan*, Appendix M of Umetco's ACL Application. The NRC staff has expressed a concern that the plume in the southwest flow regime would skirt MW74. Accordingly, Umetco proposes to delete MW74 from the monitoring plan and construct a new well, MW82, which is appropriately located to monitor the southwest flow regime.

The revised *Groundwater Monitoring Plan* provides the location for the new monitor well and predicted trends used to establish action limits.

If you or your staff have any questions, please call me at (970) 256-8836 or Mr. Tom Gieck at (970) 256-8889.

Sincerely,

TE Gieck for

Curtis O. Sealy, P.E.
General Manager

TEG:ses
Enclosure
Copy: COS
JSH
EE Ley
WDEQ – R. Hoy w/attachment
DOE – Art Kleinrath w/attachment
Gas Hills File

NMSS01 Public

02-043.doc

Appendix M

Groundwater Monitoring Plan
Gas Hills, Wyoming

Umetco Minerals Corporation
2754 Compass Drive, Suite 280
Grand Junction, Colorado 81506

March 2002

Contents

Tables*

** Sulfate and chloride target levels for non-POC model validation wells are provided in Attachment M-1, Tables 2 through 5.*

Figures

Also see Attachment M-1 Figures 1.a through 8.b.

Attachments

1.0 INTRODUCTION

This groundwater monitoring plan was developed in support of (revised) License Condition (LC) 35, which stipulates that Umetco implement a groundwater compliance monitoring program and identify appropriate actions to be taken if the Alternate Concentration Limits (ACLs) for groundwater are exceeded. In accordance with LC 35, this appendix identifies the groundwater monitoring locations for each flow regime, presents the associated monitoring plan, and describes how Umetco will define and address potential exceedances of ACLs and/or target levels established for non-licensed indicator constituents.

2.0 MONITORING APPROACH

Three types of monitoring wells are included in the Gas Hills site groundwater compliance monitoring program:

(1) the existing point of compliance (POC) wells;

(2) non-POC wells for the purposes of tracking any future (unexpected) downgradient and/or vertical contaminant migration; and

(3) a subset of the downgradient non-POC wells defined above, for the purposes of validating the site geochemical and groundwater flow model and to ensure that sulfate and chloride—non-licensed constituents regulated by the Wyoming Department of Environmental Quality (WDEQ)—do not exceed model predictions and/or WDEQ standards.

Table M-1 defines the POC and non-POC monitoring wells and summarizes the corresponding monitoring approach, including the sampling frequency and the specific analytes to be monitored. Groundwater monitoring locations are shown on Figure M-1 for both the Western and Southwestern flow regimes.

2.1 Point of Compliance Wells

The four existing POC wells—Western Flow Regime (WFR) wells MW1 and MW21A and Southwestern Flow Regime (SWFR) wells GW7 and GW8—will be sampled annually with analysis for ACL constituents. In addition, MW21A and GW7—located at or near the leading edge of the plume in their respective flow regimes—will be sampled semi-annually with analysis for sulfate, chloride, and natural uranium. GW7 has consistently had the highest observed concentrations of several licensed constituents, and is considered a "hot spot" within the SWFR contaminant plume.

2.2 Non-POC Wells

Non-POC monitoring wells were selected to provide early detection of any future downgradient or vertical contaminant migration, and/or to verify the groundwater flow and geochemical modeling results presented in the ACL application. These wells are identified in Table M-1 and shown on Figure M-1. Rationales supporting their selection are documented in Table M-2.

Table M-1 Gas Hills Site Groundwater Compliance Monitoring Wells

Well Type	Western Flow Regime Wells †	Southwestern Flow Regime Wells ‡	Monitoring Approach§
Point of Compliance (POC) Wells	**MW1*** MW21A	**GW7*** GW8	Wells to be sampled annually for ACL constituents. Sampling to be conducted every June until license termination, with results to be submitted to the NRC by September 30 of the same year. ——— *Asterisked wells—MW1 and GW7—to be sampled semi-annually for natural uranium (U-nat), sulfate, and chloride.
Non-POC Wells	MWI64 MW70A MW25 **MW71B**** **MW28**** MW77 Iron Spring	PW4 **MW72**** **MW82**** Note: MW82 is proposed new well, to be installed in Spring 2002.	Sampling of these non-POC wells will be conducted semi-annually with analyses for sulfate, chloride, and U-nat. Except for chloride and sulfate monitoring at the four model validation wells (explained below), *this sampling will be conducted for information and tracking purposes only*—i.e., results will not be assessed for exceedances. ——— **Results for asterisked wells—MW71B, MW28, MW72, and MW82—will be used to verify model results (see below).
Model Validation Wells (*subset of above non-POC wells*)	MW71B MW28	MW72 MW82	Semi-annual sampling for chloride and sulfate as described above. Results will be compared with the target levels derived for the applicable timeframe. See Section 3.0 and **Attachment M-1 Tables 2 through 5.**

† Alternate Concentration Limits (ACLs) established for the Western Flow Regime POC wells MW1 and MW21A are as follows: Arsenic = 1.8 mg/l; Beryllium = 1.64 mg/l; Lead-210 = 35.4 pCi/l; Nickel = 13.0 mg/l; combined Radium-226 and -228 = 250 pCi/l; Selenium = 0.161 mg/l; Thorium-230 = 57.4 pCi/l; and Uranium-natural (U-Nat) = 11.9 mg/l. Action levels for chloride and sulfate are listed in Table M-3.

‡ ACLs established for the Southwestern Flow Regime POC wells GW7 and GW8 are: Arsenic = 1.36 mg/l; Beryllium = 1.70 mg/l; Lead-210 = 46.7 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. Action levels for chloride and sulfate are listed in Table M-3.

§ Results of monitoring will be provided in the Groundwater Monitoring Review as required by License SUA-648.

Table M-2 Rationales Supporting Selection of Non-POC Monitoring Wells

WESTERN FLOW REGIME	
Monitoring Well	**Basis for Selection**
MWI64	This well is located at the downgradient edge of the Above-Grade Tailings Impoundment (AGTI) and exhibits some of the highest observed values for beryllium, nickel, lead-210, radium 226+228, natural uranium, gross alpha, chloride and sulfate. This well is within the "hot spot" area of the plume.
MW70A	This location is approximately 1,700 feet to the northwest of the restricted area. This well is screened in the upper portion of the Western Flow Regime and will monitor radial flow from the AGTI.
MW25	Water quality data and isoconcentration plots indicate this well, located approximately 1,500 feet hydraulically downgradient of the AGTI, would be appropriately located to monitor the leading edge of the plume.
MW71B**	This well is approximately 2,500 feet downgradient of the AGTI. It is screened in the lower portion of the Western Flow Regime and will indicate potential vertical migration.
MW28**	This well is located 2,500 feet hydraulically downgradient of the AGTI. Water quality data and isoconcentration plots indicate that there has been no impact from site-derived constituents. This location is a few hundred feet in advance of the groundwater plume and will provide the earliest indication of migration.
MW77	This location is near the proposed land transfer boundary, 4000 feet hydraulically downgradient of the AGTI, and is representative of water quality at the Point of Exposure (POE). Modeling indicates that site-derived constituents will reach this location in 70 to 80 years but will not degrade water quality to less than its current Class III status.
Iron Spring	This spring, approximately 10,000 feet from the AGTI, is the closest discharge point for groundwater migrating from the site. Groundwater modeling indicates no significant impacts to water quality resulting from site-derived constituents.
SOUTHWESTERN FLOW REGIME	
Monitoring Well	**Basis for Selection**
PW4	PW4 – This well is located 200 feet south of POCs GW7 and GW8. Once extraction is terminated, groundwater will migrate from GW7 toward PW4. Water quality data and isoconcentration plots indicate this well has been marginally impacted from site-derived constituents and is near the downgradient edge of the plume. This location will provide early monitoring within the Southwestern Flow regime plume.
MW72**	MW72 – Water quality data and isoconcentration plots indicate this well, located 1,000 feet southwest of the A-9 Repository, may be impacted from site derived constituents and is located near the downgradient edge of the groundwater plumes migrating from the site.
MW82**	MW82 – This proposed well is the furthest downgradient location from the A-9 repository (approximately 1,200 feet). The well location was selected based on its position along the modeled axis of the plume and also because it is upgradient of PRI's proposed Mine Unit 5.

Note: All wells listed above will be sampled semi-annually for analysis of sulfate, chloride, and U-nat. Sulfate and chloride results for asterisked (**) wells—MW71B, MW28, MW72, and MW82—will also be used to verify model results.

The non-POC monitoring locations listed in Table M-2 were selected on the basis of one or more of the following criteria, with input from the U.S. Nuclear Regulatory Commission:

- location within the plume and in "hot spot" locations;
- location proximal to extraction wells;
- location at downgradient edge of the plume;
- downgradient of site impacts; and/or
- a discharge point for groundwater (e.g., springs).

Sampling of non-POC wells will be conducted semi-annually with analyses for sulfate, chloride, and natural uranium as indicated in Table M-1.

3.0 MODEL VALIDATION COMPONENT OF COMPLIANCE MONITORING: CHLORIDE AND SULFATE

A subset of the non-POC wells defined above—WFR wells MW71B and MW28 and SWFR wells MW72 and MW82 (proposed new well; see below)—will be compared with target levels established for chloride and sulfate (see Attachment M-1). Although chloride and sulfate are not licensed constituents, they do have groundwater protection standards set by the Wyoming Department of Environmental Quality (WDEQ). More importantly, these constituents are minimally attenuated and therefore should provide the earliest indication of site-derived contaminant migration along groundwater flowpaths. As such, target levels were derived for the purposes of validating the sulfate and chloride model simulations. The monitoring approach is summarized in Table M-1, and detailed supporting information is provided in Attachment M-1. Target levels established for individual model validation wells are documented in Attachment M-1, Tables 2 through 5.

Proposed New Monitoring Well MW82

MW82, the proposed new well, will be located along the axis of the modeled chloride and sulfate plumes migrating from the A-9 Repository. No existing wells are suitably located for this purpose. The well will be incorporated into the groundwater monitoring plan, designed to support License Condition 35.

MW82 will be completed within the Upper Wind River aquifer (above the mudstone unit that separates the Upper and Lower Wind River aquifers), near existing well MW30 (a Lower Wind River aquifer completion). Approximate coordinates of MW82 are N 788300 and E 835800. This location was selected because it is downgradient of the A-9 Repository and along the flowpath of groundwater migrating from that impoundment. The location is also hydraulically upgradient of the Power Resources, Inc. (PRI) proposed Mine Unit No. 5 and the underground Thunderbird and ROX mines. The elevation of the water table beneath the proposed well location is projected to be at 6790. Ground surface elevation is approximately 6840. Depth to water will be approximately 50 feet. The well will be constructed similar to previous monitoring wells MW72 and MW74 and will be screened across the upper 15-20 feet of the Upper Wind River aquifer. MW30 already provides sufficient monitoring at that location for the deeper hydrologic flow system within the Lower Wind River.

4.0 EXCEEDANCE IDENTIFICATION AND VERIFICATION RESAMPLING

The monitoring approach described above and in Table M-1 was developed to ensure that the groundwater ACLs are met, as well as to provide early detection of downgradient or vertical migration of site contaminants. As such, a mechanism for identifying exceedances and implementing appropriate responses to those exceedances, must be identified.

4.1 General Approach to Identifying Exceedances

In identifying exceedances, the overall intent is to allow early detection of potential ACL or target level exceedances, while minimizing the probability of false positive results—e.g., exceedances attributable to laboratory error or transient anomalous increases. Prediction limits are already built into both the ACLs and the target levels established for non-ACL (indicator) constituents. Therefore, comparison of the single values (e.g., ACL vs. monitoring result) should suffice. However, several factors must be accounted for when evaluating results and identifying exceedances. These factors are discussed below.

Significant Figures

Significant figures must be accounted for when comparing predicted values with measured values. The following general approach should be employed. For results less than 1000 mg/l, comparisons between measured values and predicted values should be based on 2 significant figures. For results exceeding 1000 mg/l, comparisons should be made on the basis of 3 significant figures. [Refer to Attachment M-1, Table 2 for a useful example.]

Verification Resampling

Verification resampling is an integral component of exceedance identification. To avoid "false positives" due to laboratory error and/or transient increases, a statistically significant exceedance will not be declared or reported until the results of verification resampling are known. Umetco's proposed approach to verification sampling is discussed below and in Table M-3.

4.2 ACL Constituents at Point of Compliance Wells

If any POC sample exceeds the ACL for one or more constituents, another sample will be analyzed within 3 months of obtaining the results, for the constituent(s), to rule out laboratory error or transient increase. If the first verification (re)sample also results in an exceedance of the same ACL, Umetco will notify the NRC within 30 days of receiving the second results. Contingent upon NRC approval, an additional verification sample may be collected before corrective action measures are considered (within 3 months of obtaining the second result).

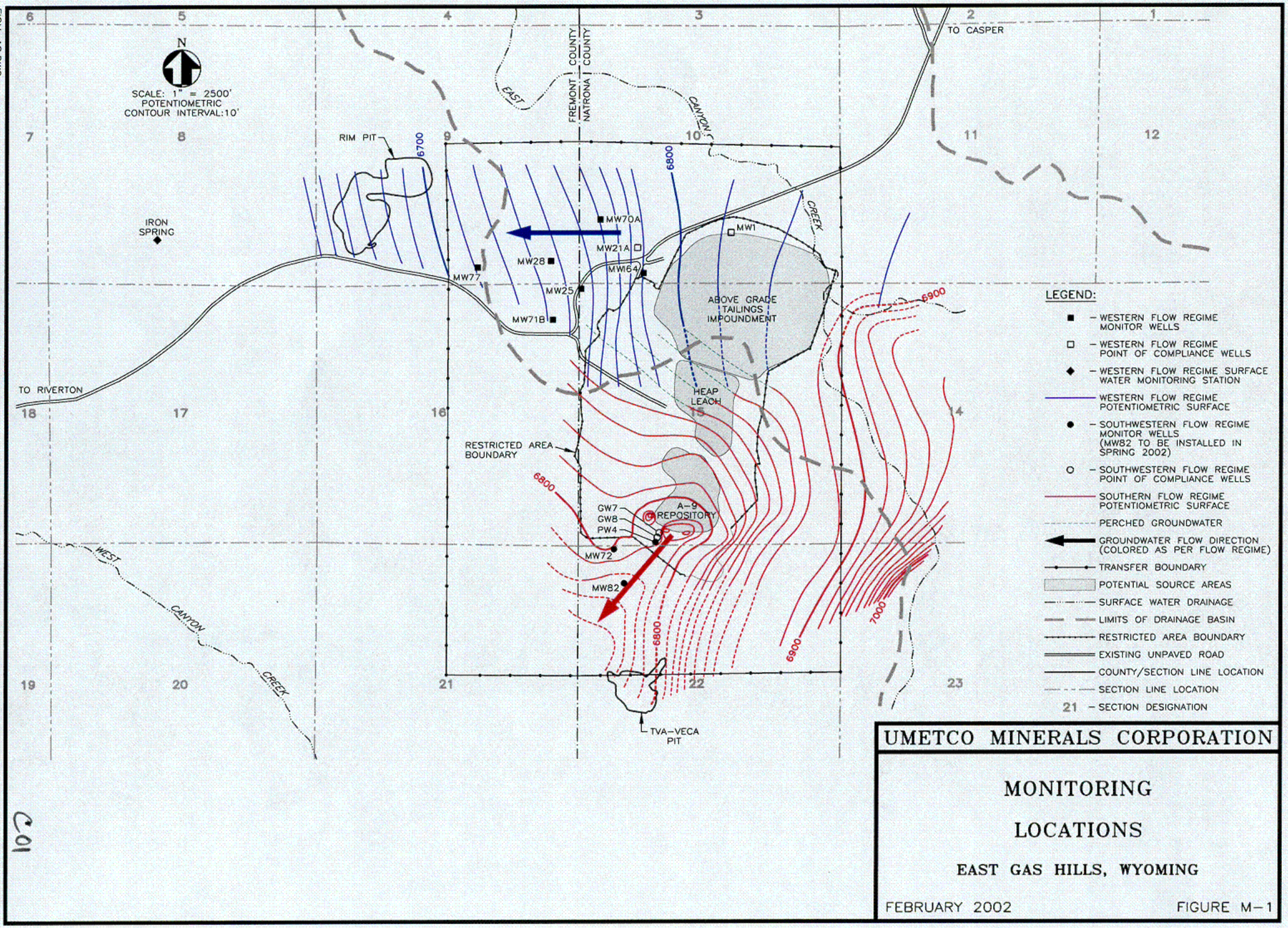
If the second verification (re)sample also results in an exceedance, Umetco will provide an "action plan" to the NRC within 60 days of receiving the second verification sample results. This action plan will describe appropriate corrective action(s), if necessary, and/or further analysis to ensure that no risk will be incurred at point of exposure (POE) locations. Such an analysis may require reassessment of model simulations and assumptions. This approach is detailed in Table M-3.

4.3 Chloride and Sulfate at Model Validation Wells

As discussed above, chloride and sulfate are included in the monitoring plan for a subset of the non-POC wells to evaluate the predictions made by modeling and/or to track the downgradient migration of site-related constituents. As described in Table M-3, exceedance of the chloride and/or sulfate target levels will trigger additional response, including, but not limited to, confirmation sampling and/or reassessment of the model simulations and assumptions. Consideration will be given to the degree of the exceedance and the potential impacts to water quality at the POE. . The potential for non-site related factors (e.g., mining impacts) must also be considered when identifying potential exceedances for these indicator parameters, in particular for sulfate. Response actions for exceedance of these parameters will be less rigorous than those discussed above for ACL constituents due to the conservatism already built into the model and the low probability that target level exceedances would adversely impact potential risks at POE locations.

Table M-3 Exceedance Identification and Action Approaches

Monitoring Endpoint	Exceedance Identification and Verification Resampling Approach	Actions to be Implemented if Exceedances are Verified
ACL Constituents at POC Wells	If any POC sample exceeds the ACL for one or more constituents (accounting for significant figures), another sample will be analyzed within 3 months of obtaining the results for the constituent(s). [*Re-analysis is only necessary for the constituent(s) exceeding the ACLs.*]	If the first verification (re)sample also results in an exceedance of the same ACL, Umetco will notify the NRC within 30 days of receiving the second results. Contingent upon NRC approval, an additional verification sample may be collected before corrective action measures are considered (within 3 months of obtaining the second result). If the second verification (re)sample also results in an exceedance, Umetco will provide an "action plan" to the NRC within 60 days of receiving the second verification sample results. This action plan will describe appropriate corrective action(s), *if necessary*, and/or further analysis to ensure that no risk will be incurred at point of exposure (POE) locations. Such an analysis may require reassessment of model simulations and assumptions.
Chloride and Sulfate in Model Validation Wells MW71B, MW28, MW72, and MW82	If any sample exceeds the corresponding target level for chloride or sulfate (see Attachment M-1 tables), another sample will be analyzed within 3 months of obtaining the results. If the first verification sample also exceeds the target level(s), another verification sample will be collected (within 3 months of the first).	Exceedance of three consecutive samples—the semi-annual sample, followed by two verification samples—is required before an exceedance of sulfate and chloride target levels is declared. NRC reporting requirements are the same as those identified above. Exceedances of chloride and/or sulfate target levels will trigger additional response, including but not limited to reassessment of the model simulations and assumptions. Corrective actions are not anticipated for these parameters, however, as exceedance of the target levels is expected to have a negligible impact on potential risks at the POE.
Chloride, Sulfate, and U-Nat at Remaining Non-POC Wells	None required. As indicated in Table M-2, *this sampling will be conducted for information and tracking purposes only*—i.e., results will not be assessed for exceedances.	Not Applicable.



N
SCALE: 1" = 2500'
POTENTIOMETRIC CONTOUR INTERVAL:10'
RIM PIT
IRON SPRING
TO RIVERTON
TO CASPER
FREMONT COUNTY
NATRONA COUNTY
EAST
CANYON
CREEK
WEST
CANYON
CREEK
6700
6800
6900
7000
MW70A
MW21A
MW164
MW1
MW28
MW25
MW77
MW71B
ABOVE GRADE TAILINGS IMPOUNDMENT
HEAP LEACH
RESTRICTED AREA BOUNDARY
GW7
GW8
PW4
A-9 REPOSITORY
MW72
MW82
TVA-VECA PIT
LEGEND:
– WESTERN FLOW REGIME MONITOR WELLS
– WESTERN FLOW REGIME POINT OF COMPLIANCE WELLS
– WESTERN FLOW REGIME SURFACE WATER MONITORING STATION
WESTERN FLOW REGIME POTENTIOMETRIC SURFACE
– SOUTHWESTERN FLOW REGIME MONITOR WELLS (MW82 TO BE INSTALLED IN SPRING 2002)
– SOUTHWESTERN FLOW REGIME POINT OF COMPLIANCE WELLS
SOUTHERN FLOW REGIME POTENTIOMETRIC SURFACE
PERCHED GROUNDWATER
GROUNDWATER FLOW DIRECTION (COLORED AS PER FLOW REGIME)
TRANSFER BOUNDARY
POTENTIAL SOURCE AREAS
SURFACE WATER DRAINAGE
LIMITS OF DRAINAGE BASIN
RESTRICTED AREA BOUNDARY
EXISTING UNPAVED ROAD
COUNTY/SECTION LINE LOCATION
SECTION LINE LOCATION
21 – SECTION DESIGNATION
UMETCO MINERALS CORPORATION
MONITORING
LOCATIONS
EAST GAS HILLS, WYOMING
FEBRUARY 2002
FIGURE M–1
C01

FIGM–1S.DWG

Attachment M-1

Target Level Derivation and Model Validation Approach for Chloride and Sulfate

Gas Hills, Wyoming

Umetco Minerals Corporation
2754 Compass Drive, Suite 280
Grand Junction, Colorado 81506

March 2002

Tables

Figures

Target Level Derivation and Model Validation Approach for Chloride and Sulfate

Introduction

A methodology is presented for validation of the Gas Hills groundwater flow and contaminant transport simulations of sulfate and chloride. These constituents are minimally attenuated and should provide the earliest indication of site-derived contaminant migration along groundwater flowpaths. Model results for selected wells that are included in the long-term groundwater monitoring are provided as graphs to allow for comparison with analytical measurements. A 95% UCL is included in the graphs that accounts for the variability in the analytical data. Future analytical measurements at observation wells MW28, MW71B, MW72, and proposed well MW82 should remain less than the 95% UCLs, herein referred to as target levels, for corresponding simulation times.

This attachment describes the selection and development of the concentration targets to be used for validating the sulfate and chloride model simulations. As indicated in the preceding appendix text, exceedance of the target levels will trigger additional response, including, but not limited to, confirmation sampling and/or reassessment of the model simulations and assumptions.

Methodology

Peak concentrations of sulfate and chloride at the Points of Exposure (POE) for the Western Flow Regime (WFR) and Southwestern Flow Regime (SWFR) are anticipated to occur in approximately 80 and 100 years, respectively. To provide a shorter frame of reference to compare model results to measured concentrations, intermediate observation points were selected. The monitor wells selected for short-term model validation results are listed below:.

Model Validation Well	Flow Regime	Nearest Impoundment	Distance from Impoundments (ft)
MW28	WFR	AGTI	2000
MW71B	WFR	AGTI	2000
MW72	SWFR	A-9 Repository	1000
MW82	SWFR	A-9 Repository	1200

*MW82 is proposed monitoring well location (see preceding Appendix M text).

The model results for chloride and sulfate are plotted for each of the observation wells. Initial conditions in the model represent the chloride and sulfate plume configuration at the beginning of the year 2000. Plots were constructed to show simulation results for 10 years and 50 years. The 10-year plots represent changes in concentration at the specified well from the year 2000 to 2010 and provide sufficient detail to allow comparison of measured (actual) data with the simulated results. Measured analytical data for 2000 and 2001 are also included on the 10-year plots. The 50-year plots provide a view of the long-term trends in concentration and compare the simulated data to WDEQ water quality standards.

Uncertainty or variability in analytical data is addressed through the use of upper confidence limits (UCLs). The 95% UCL is presented on each of the 10-year plots and was derived as follows. A standard deviation was calculated for the analytical data reported for each well from 1997 through 2001 for sulfate and chloride (Table 1). The standard deviation was multiplied by 1.96. The product of the standard deviation and 1.96 for each well was then added to the simulated results for that well to represent the 95% UCL. A standard deviation could not be calculated for MW82 because that well has not been drilled. Therefore, the standard deviation calculations for MW72 for chloride and sulfate were applied to MW82.

The 95% UCL plotted on the 10-year simulation figures should be used as the target for comparing analytical measurements to the model results. For example, as shown in Figure 1a, analytical measurements of chloride collected in January 2000 and January 2001 for observation well MW71B fall beneath the 95% UCL for the corresponding simulation times. This indicates that the model has over-predicted chloride values at that location, further evidence of the conservatism of the model. In the event that analytical measurements exceed the 95% UCL for corresponding simulation times, a confirmatory sampling event will be conducted as described in Table M-3 (see previous). Consideration will be given to the degree of the exceedance and the potential impacts to water quality at the POE.

For example, the 95% UCL for chloride at MW28 in 2005 is 14.3 mg/L. If an analytical measurement in 2005 for chloride at MW28 was 16.0 mg/L, then that would be an exceedance. However, the maximum simulated chloride value at MW28 occurs in 2036 at 73 mg/L and the maximum simulated value at the POE is 76 mg/L in 2055. Both values are significantly below the WDEQ Class I standard of 250 mg/L. Therefore, a slight exceedance of the 95% UCL for chloride at MW28 is not likely to pose a threat to human health or the environment.

Model Results

Results of the model simulations for chloride transport for each of the observation points are provided in Figures 1a through 4b. Graphs of chloride concentration versus time are shown for simulation periods of 10 years and 50 years. The figures show generally increasing trends in chloride concentration during early years, with concentrations peaking at about 30 to 35 years in the WFR wells (Figures 1a, 1b, 2a and 2b). Chloride concentration reaches a maximum within 3 to 4 years at MW72 (Figures 3a and 3b), and in about 45 years at MW82 (Figures 4a and 4b). All simulated values remain below the WDEQ Class I chloride standard of 250 mg/L as shown on the 50-year graphs. Also note that the 2000 and 2001 analytical chloride measurements (plotted on the 10-year graphs) fall below the plot of the 95% UCL.

Results of the model simulations for sulfate transport for each of the observation points are provided in Figures 5a through 8b. Again, graphs are shown for simulation periods of 10 years and 50 years. The figures are similar to the chloride results, showing generally increasing trends in sulfate concentrations during early years, with concentrations peaking at about 30 to 35 years in the WFR wells (Figures 5a, 5b, 6a and 6b). Sulfate concentration reaches a maximum at 10 years at MW72 (Figures 7a and 7b). At MW82, the sulfate concentration levels off at approximately 750-800 mg/L after 45 years (Figure 7b). Note that all simulated values remain below the WDEQ Class III sulfate standard of 3,000 mg/L, and that the 2000 and 2001 analytical sulfate measurements fall below the plots of the 95% UCL. **Corresponding target levels derived for the 10-year simulation period (2000-2010) are provided in Tables 2 through 5.**

Tables

Table 1. Calculation of Standard Deviation for Sulfate and Chloride Data Sets for MW28, MW71B, and MW72: 1997 through 2001. Gas Hills, Wyoming.

MW28	Measurement Date	Chloride	Sulfate
	2/3/1997	4	359
	4/30/1997	6	388
	7/25/1997	5	374
	10/8/1997	6	407
	1/28/1998	6	435
	4/28/1998	6	432
	7/29/1998	6	445
	10/20/1998	5	435
	1/19/1999	6	479
	1/20/2000	5.8	500
	1/15/2001	7.5	540
	Standard Deviation	0.87	54.57
	1.96 x Std Dev	1.71	106.96

MW71B	Measurement Date	Chloride	Sulfate
	8/12/1997	8	379
	11/17/1997	8	361
	1/27/1998	8	377
	5/5/1998	9	384
	8/12/1998	9	395
	11/3/1998	9	367
	1/26/1999	9	413
	1/20/2000	11	410
	1/16/2001	14	430
	Standard Deviation	1.94	23.04
	1.96 x Std Dev	3.81	45.15

MW72	Measurement Date	Chloride	Sulfate
	8/14/1997	108	569
	8/27/1997	101	599
	11/18/1997	99	492
	3/17/1998	109	607
	5/21/1998	105	641
	8/20/1998	121	668
	11/11/1998	106	664
	1/11/1999	110	835
	2/29/2000	120	1000
	1/16/2001	110	1100
	Standard Deviation	7.13	197.27
	1.96 x Std Dev	13.97	386.65

Table 2. Target Values Derived for Western Flow Regime Well MW71B

Year	Chloride (mg/l) Annual Target Range	Chloride (mg/l) June Target	Sulfate (mg/l) Annual Target Range	Sulfate (mg/l) June Target
2000	14 – 19 (actual = 11)	–	470 – 533 (actual = 410)	--
2001	20 – 25 (actual = 14)	--	535 – 625 (actual = 430)	--
2002	25 – 31	28	633 – 738	683
2003	31 – 37	34	740 – 837	792
2004	38 – 45	41	846 – 945	889
2005	45 – 51	48	947 – 1,036	994
2006	52 – 58	54	1,042 – 1,130	1,081
2007	58 – 64	61	1,132 – 1,208	1,173
2008	64 – 70	67	1,214 – 1,289	1,247
2009	70 – 76	73	1,291 – 1,361	1,326
2010	76 (January 2010)	--	1,361 (Jan-10)	--

Note:

Significant figures must be accounted for when comparing predicted values with measured values. A general rule is as follows: For results less than 1000 mg/l, comparisons between measured values and predicted values should be based on 2 significant figures. For results exceeding 1000 mg/l, comparisons should be made on the basis of 3 significant figures. For example, a June 2009 sulfate result of 1,334 mg/l at MW71B would not be considered an exceedance of the corresponding 1,326 mg/l target level. Also note that the target levels shown above reflect the 95% upper confidence limits (UCLs) about the actual predicted values, a factor that must be accounted for when reviewing the synopses of predicted trends provided below.

MW71B, Predicted Chloride Trends:*

Increasing through approximately 2025, with 10-yr plateau of about 100-110 mg/l, followed by subsequent slight gradual attenuation (Figures 1.a and 1.b). All predicted values are well below the WDEQ Class I groundwater standard of 250 mg/l.

MW71B, Predicted Sulfate Trends:

Increasing through approx. 2025, with 10-yr plateau of approx. 2000 mg/l, followed by subsequent attenuation (Figures 5.a and 5.b). All predicted values are well below the WDEQ Class III groundwater standard of 3,000 mg/l.

Table 3. Target Values Derived for Western Flow Regime Well MW28

Year	Chloride (mg/l) Annual Target Range	Chloride (mg/l) June Target	Sulfate (mg/l) Annual Target Range	Sulfate (mg/l) June Target
2000	7 – 8 (actual = 5.8)	--	607 – 668 (actual = 500)	--
2001	8 – 9 (actual = 7.5)	--	670 – 726 (actual = 540)	--
2002	9 – 11	10	730 – 787	757
2003	11 – 12	12	788 – 839	816
2004	12 – 14	13	844 – 895	866
2005	14 – 16	15	896 – 942	920
2006	16 – 19	17	945 – 991	965
2007	19 – 21	20	992 – 1,032	1,014
2008	21 – 24	22	1,036 – 1,077	1,054
2009	24 – 27	25	1,078 – 1,117	1,097
2010	27 (January 2010)	--	1,117 (Jan-10)	--

See notes following Table 2.

MW28, Predicted Chloride Trends:

Increasing through approx. 2030, with plateau at approx. 75 mg/l, followed by subsequent gradual attenuation (Figures 2.a and 2.b). All predicted values are well below the WDEQ Class I groundwater standard of 250 mg/l.

MW28, Predicted Sulfate Trends:

Increasing through approx. 2030, peaking at approx. 1500 mg/l, followed by subsequent attenuation (Figures 6.a and 6.b). All predicted values are well below the WDEQ Class III groundwater standard of 3,000 mg/l.

Table 4. Target Values Derived for Southwestern Flow Regime Well MW72

Year	Chloride (mg/l) Annual Target Range	Chloride (mg/l) June Target	Sulfate (mg/l) Annual Target Range	Sulfate (mg/l) June Target
2000	139 – 160 (actual = 120)	--	1,388 – 1,550 (actual = 1,000)	--
2001	161 – 173 (actual = 110)	--	1,552 – 1,606 (actual = 1,110)	--
2002	174 – 179	177	1,609 – 1,644	1,629
2003	179 – 180	180	1,644 – 1,660	1,654
2004	174 – 179	177	1,661 – 1,674	1,668
2005	169 – 174	172	1,674 – 1,684	1,679
2006	164 – 169	167	1,684 – 1,689	1,686
2007	160 – 164	162	1,689 – 1,691	1,690
2008	158 – 160	159	1,691 – 1,693	1,692
2009	157 – 158	157	1,693 – 1,695	1,694
2010	156 (January 2010)	--	1,695 (Jan-10)	--

See notes following Table 2.

MW72, Predicted Chloride Trends:

Slightly increasing through 2003, peaking at about 165 mg/l, and subsequent slight attenuation to ≤ 100 mg/l (Figures 3a and 3b). All predicted values are well below the WDEQ Class I groundwater standard of 250 mg/l.

MW72, Predicted Sulfate Trends:

Increasing very gradually through about 2010 (with negligible increase after 2005), followed by plateau of about 1300 mg/l (through approx. 2015-2020), followed by subsequent gradual attenuation (Figures 8.a and 8.b). All predicted values are well below the WDEQ Class III groundwater standard of 3,000 mg/l.

Table 5. Target Values Derived for Southwestern Flow Regime Well MW82 (Proposed New Well)

Year	Chloride (mg/l) Annual Target Range	Chloride (mg/l) June Target	Sulfate (mg/l) Annual Target Range	Sulfate (mg/l) June Target
2000	11.3 – 12.2	--	496 – 500	--
2001	12.2 – 12.9	--	490 – 496	--
2002	12.9 – 13.5	13.2	490 – 560	525
2003	13.5 – 14.1	13.8	560 – 704	630
2004	14.1 – 14.8	14.5	704 – 719	710
2005	14.8 – 15.6	15.2	718 – 719	720
2006	15.6 – 16.6	16.1	718 – 790	750
2007	16.6 – 18.1	17.4	790 – 930	860
2008	18.1 – 19.9	19.0	918 – 930	920
2009	19.9 – 22.3	21.1	918 – 1029	970
2010	22.3		1030	

MW82 to be installed in Spring 2002; see notes following Table 2. **These estimates are based on model predictions, and assume no impacts from surrounding PRI activities and/or naturally occurring mineralization.**

MW82, Predicted Chloride Trends:

Increasing until approximately 2045 (with assumed baseline at 0 mg/l), peaking at about 100 mg/l, with subsequent decline (Figures 4a and 4b). All predicted values are well below the WDEQ Class I groundwater standard of 250 mg/l.

MW82, Predicted Sulfate Trends:

Step-like increase until approximately 2020 (from assumed baseline of 500 mg/l), peaking at about 1500 mg/l, with subsequent gradual decline, followed by extended plateau at about 750-800 mg/l (Figures 7a and 7b). All predicted values are well below the WDEQ Class III groundwater standard of 3,000 mg/l.

Figures

**Figure 1a. Simulated Chloride Trends at MW71B (10 Years)-Western Flow Regime
Gas Hills Wyoming, Umetco Minerals Corporation**

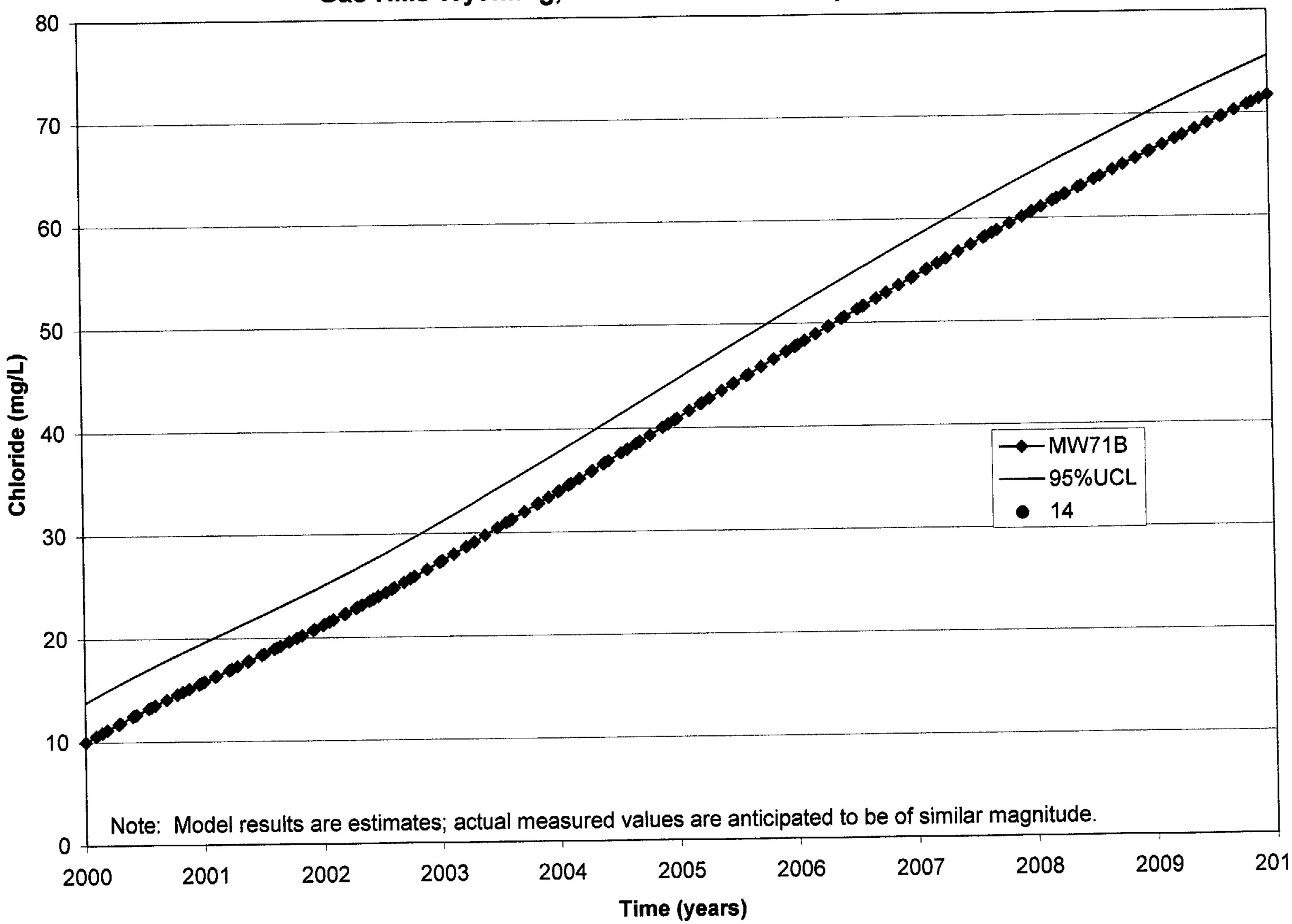
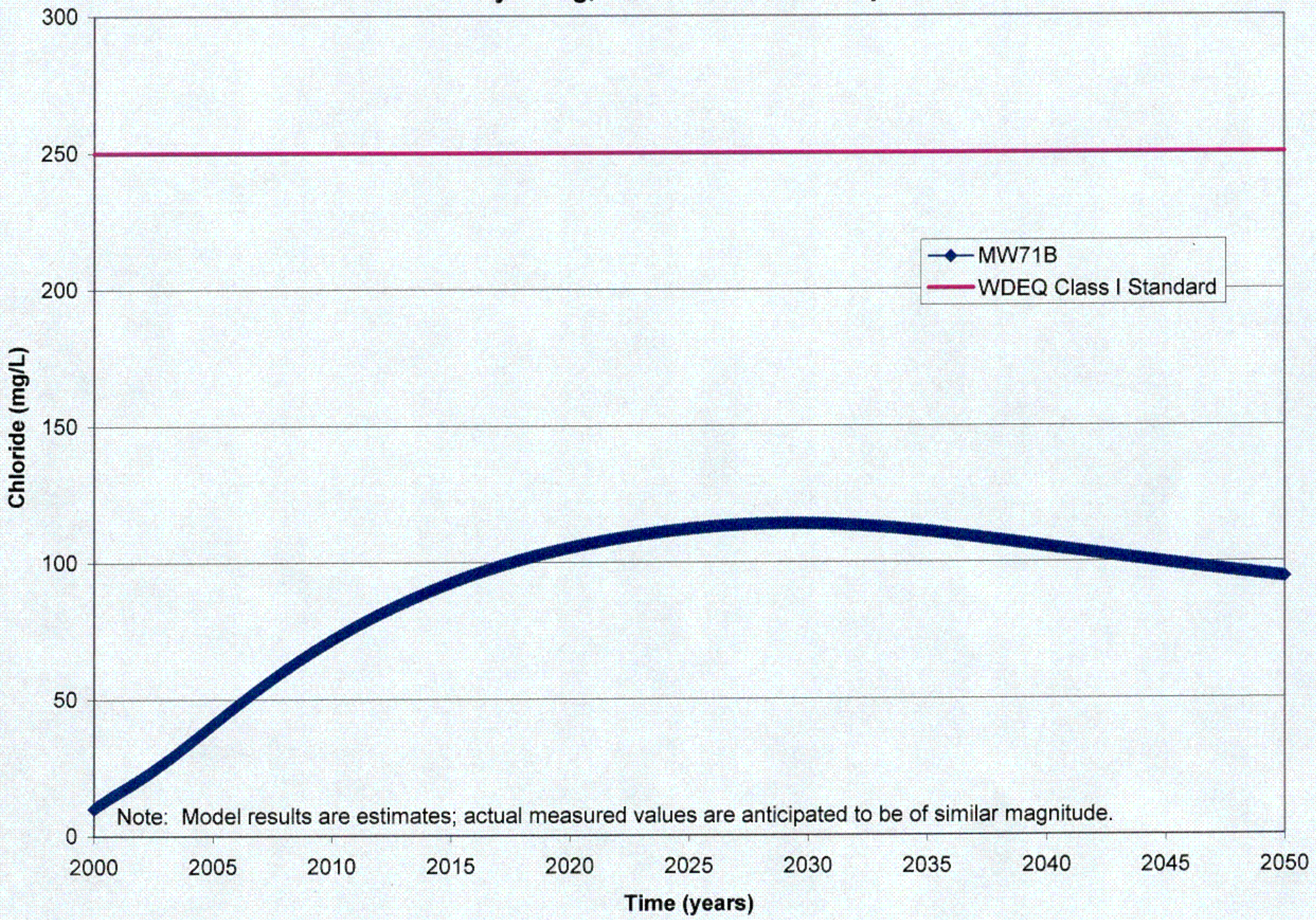
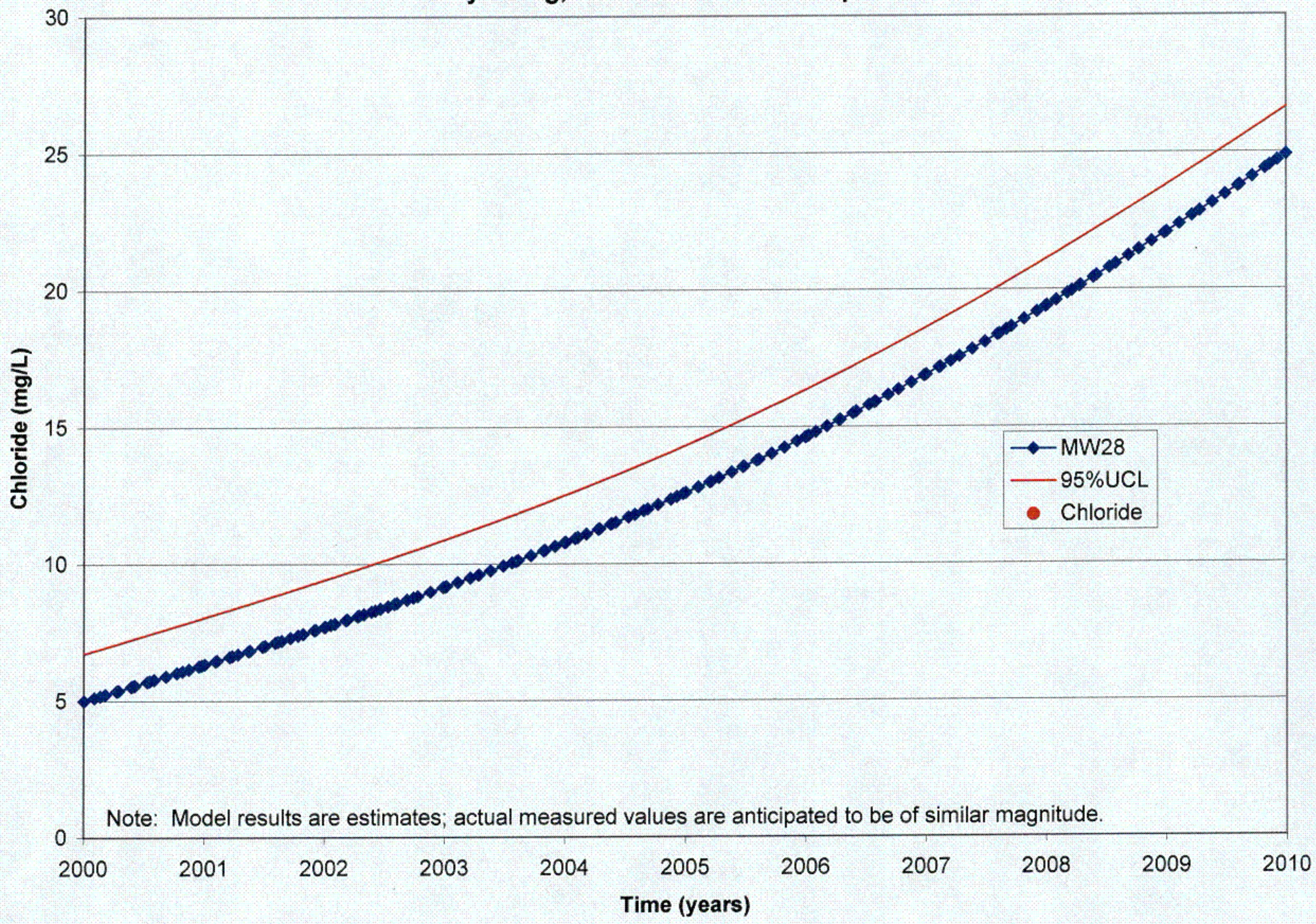


Figure 1b. Simulated Chloride Trends at MW71B (50 Years)- Western Flow Regime Gas Hills Wyoming, Umetco Minerals Corporation



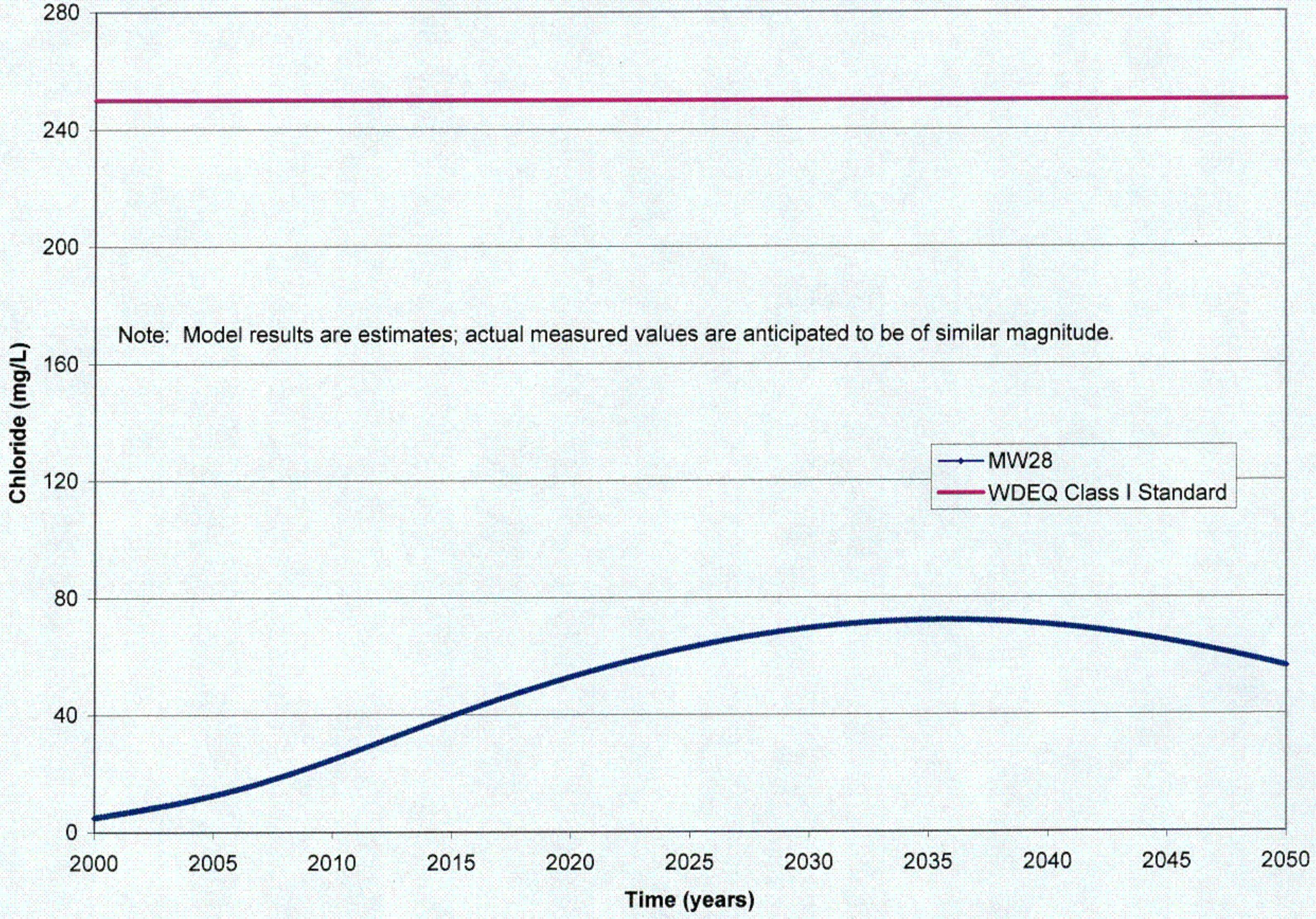
C02

Figure 2a. Simulated Chloride Trends at MW28 (10 Years)-Western Flow Regime
Gas Hills Wyoming, Umetco Minerals Corporation



C03

Figure 2b. Simulated Chloride Trends at MW28 (50 Years)-Western Flow Regime
Gas Hills Wyoming, Umetco Minerals Corporation



C04

Figure 3a. Simulated Chloride Trends at MW72 (10 Years)-Southwestern Flow Regime
Gas Hills Wyoming, Umetco Minerals Corporation

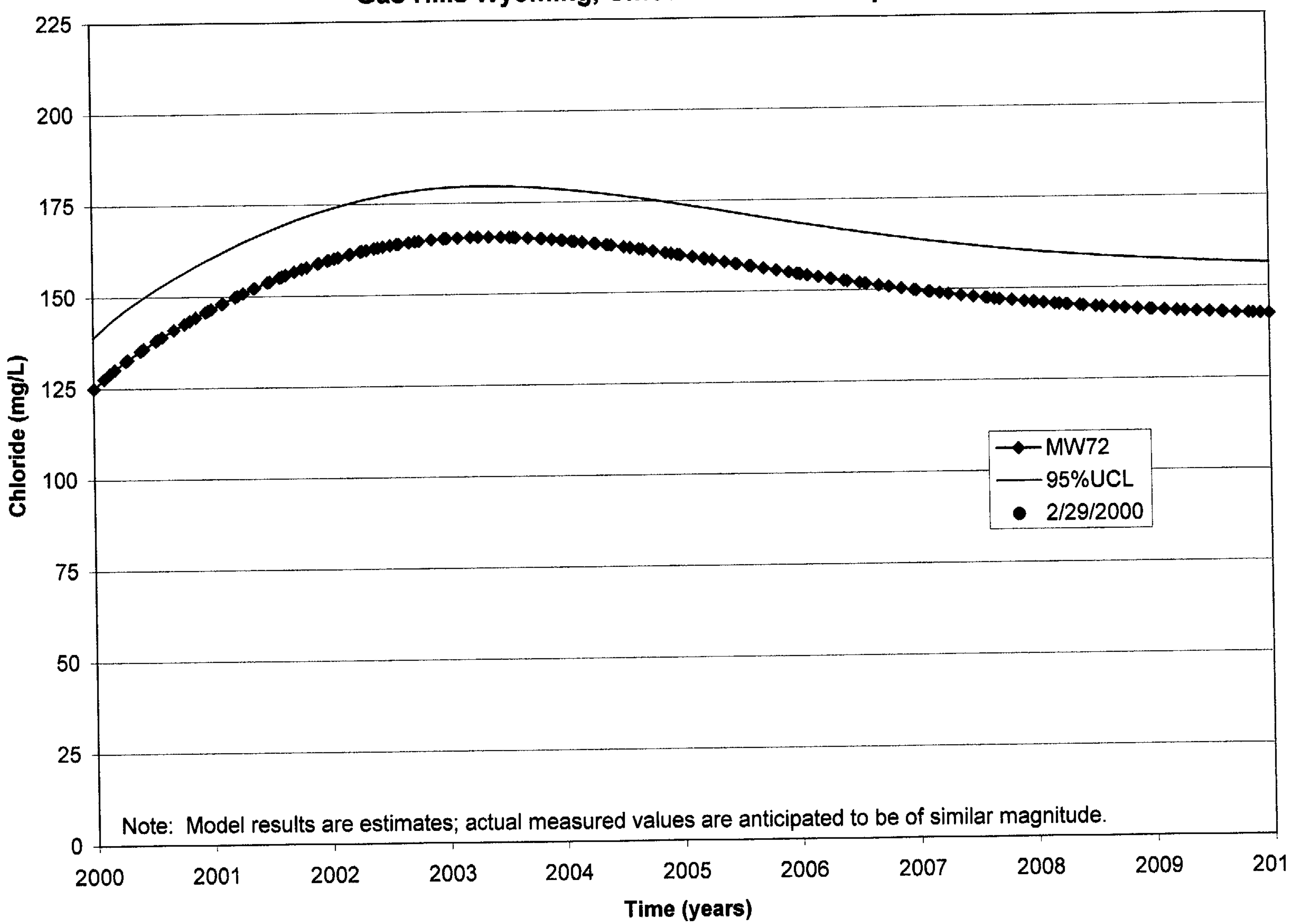
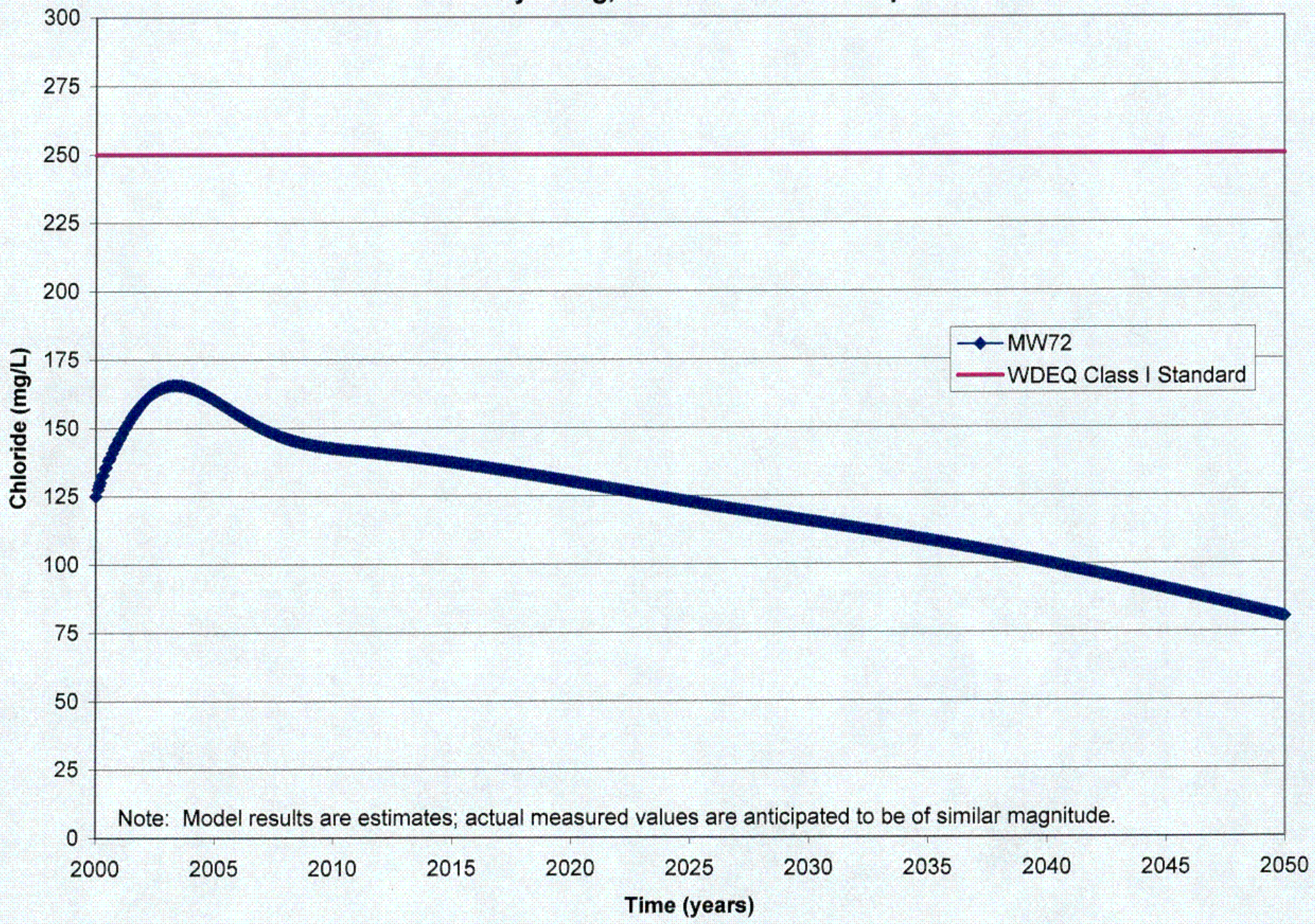


Figure 3b. Simulated Chloride Trends at MW72 (50 Years)-Southwestern Flow Regime Gas Hills Wyoming, Umetco Minerals Corporation



C05

Figure 4a. Simulated Chloride Trends at MW82 (10 Years)-Southwestern Flow Regime
Gas Hills Wyoming, Umetco Minerals Corporation

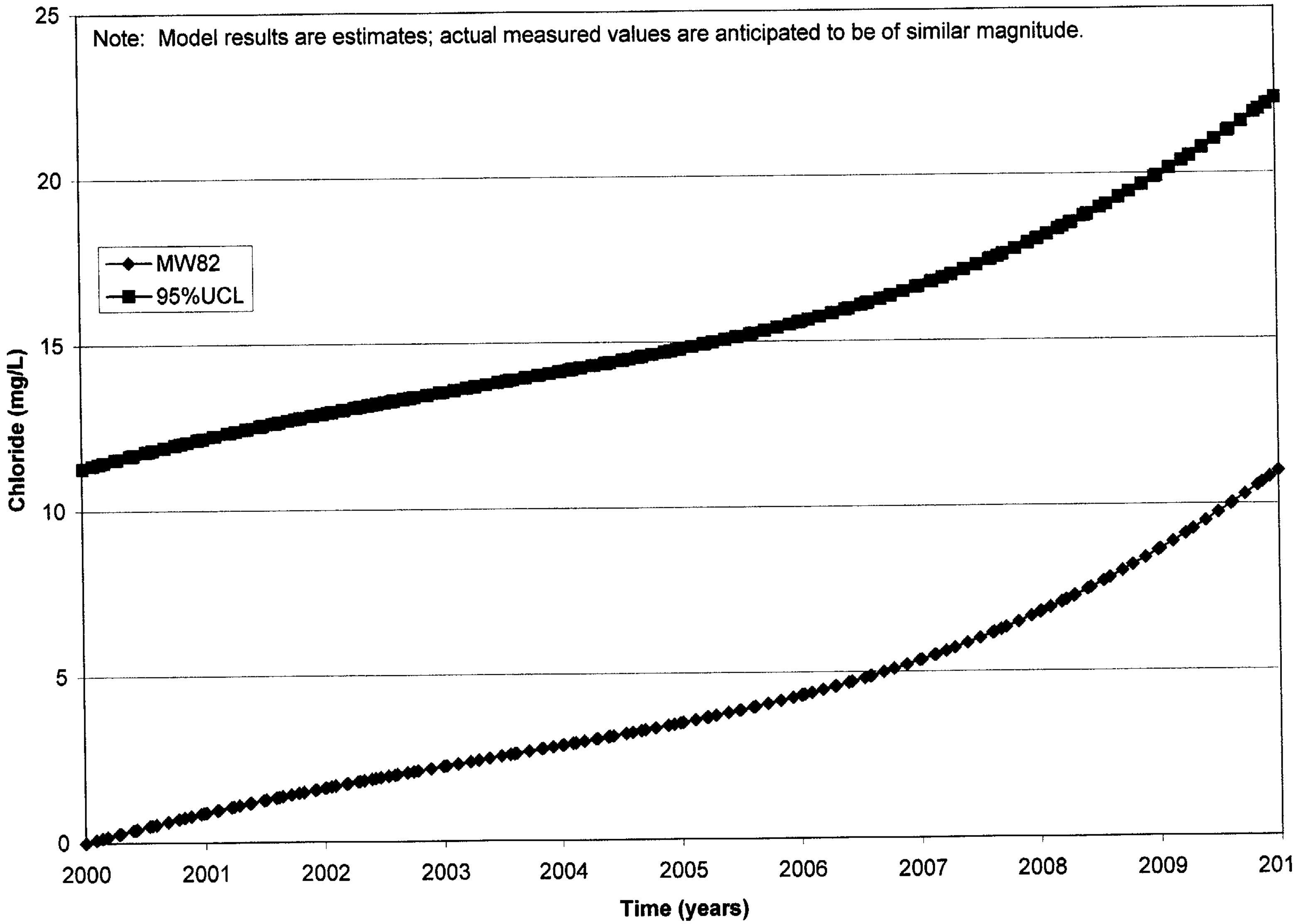
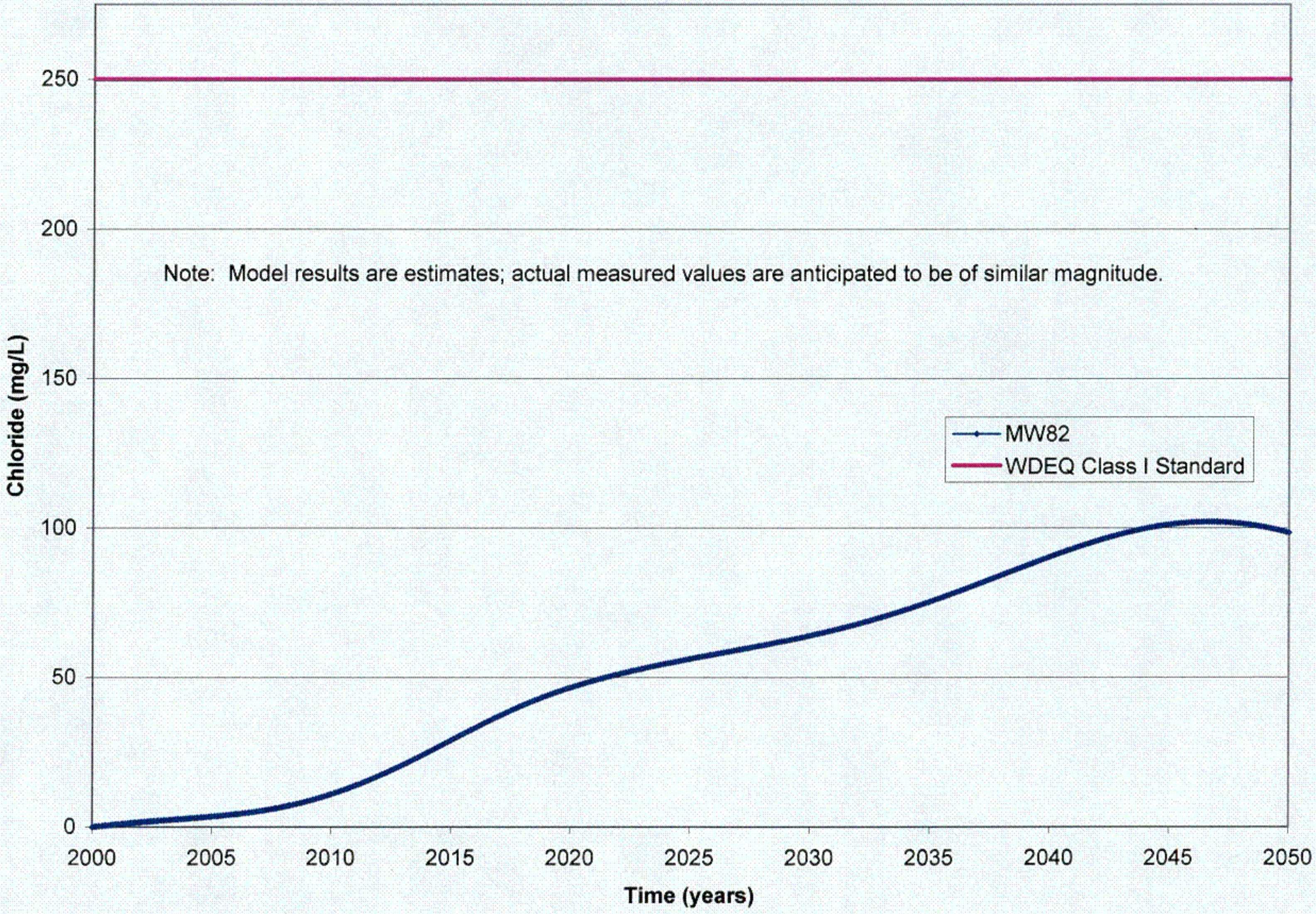


**Figure 4b. Simulated Chloride Trends at MW82 (50 Years)-Southwestern Flow Regime
Gas Hills Wyoming, Umetco Minerals Corporation**



C06

Figure 5a. Simulated Sulfate Trends at MW71B (10 Years)-Western Flow Regime Gas Hills Wyoming, Umetco Minerals Corporation

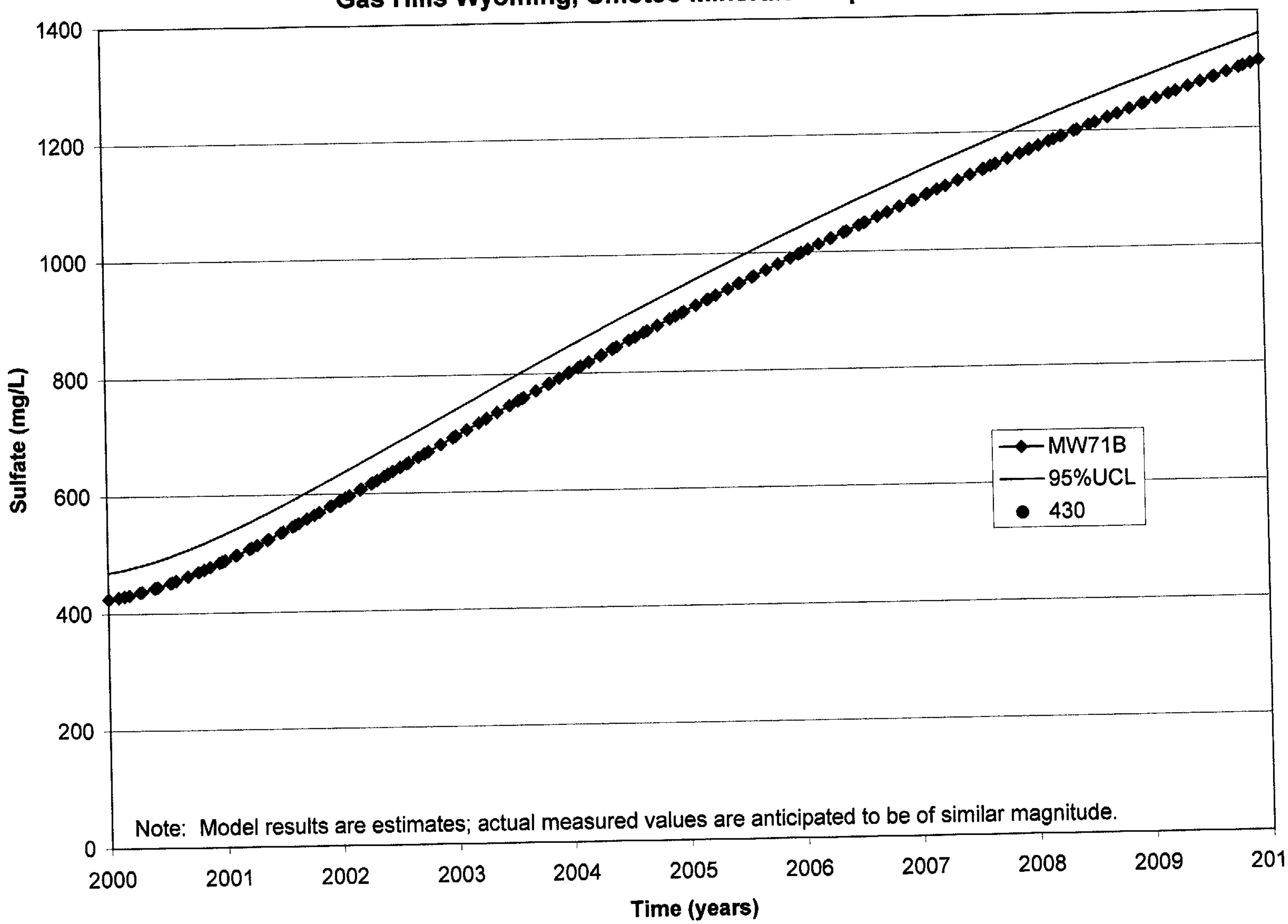
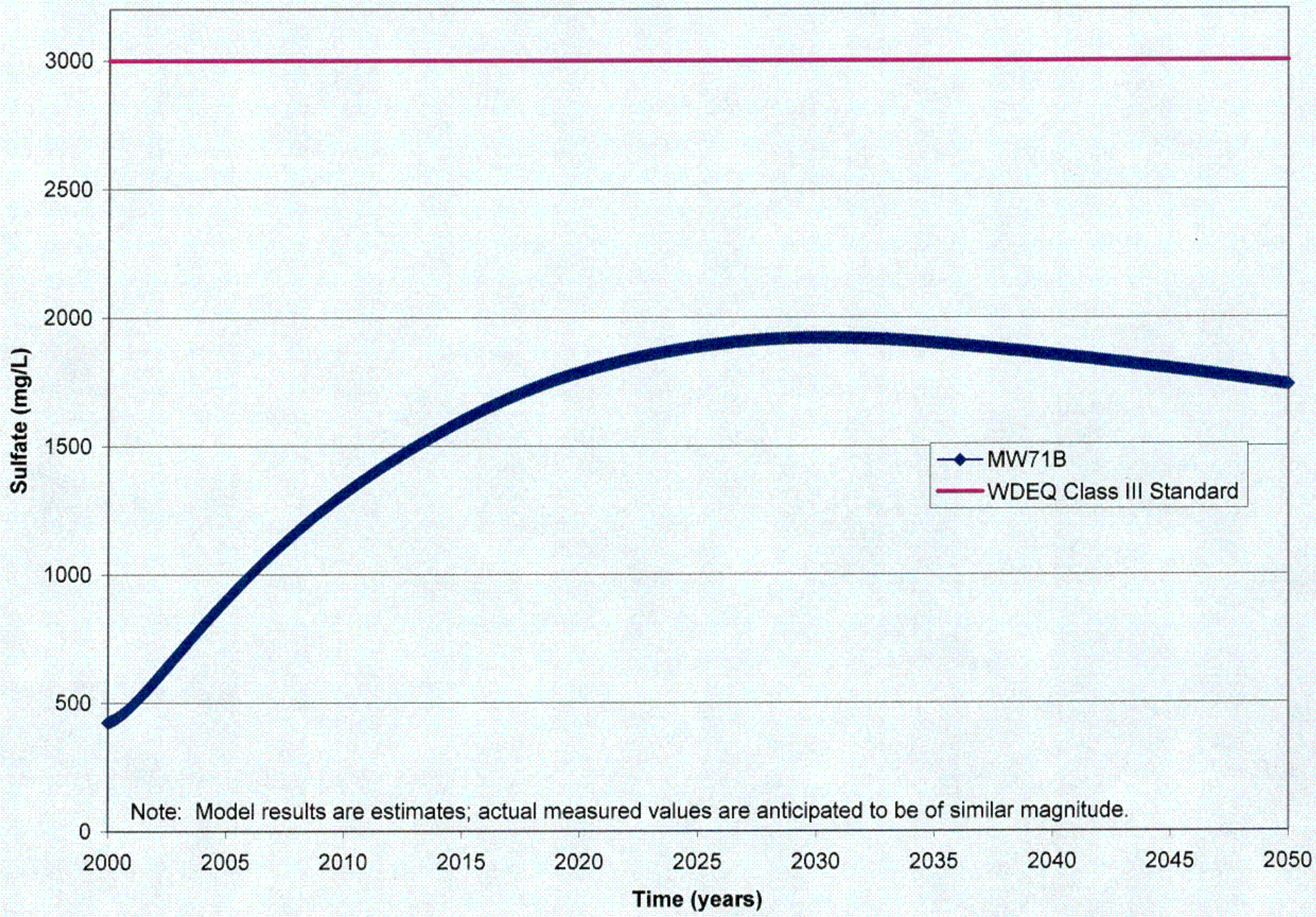


Figure 5b. Simulated Sulfate Trends at MW71B (50 Years)-Western Flow Regime Gas Hills Wyoming, Umetco Minerals Corporation



C07

Figure 6a. Simulated Sulfate Trends at MW28 (10 Years)-Western Flow Regime
Gas Hills Wyoming, Umetco Minerals Corporation

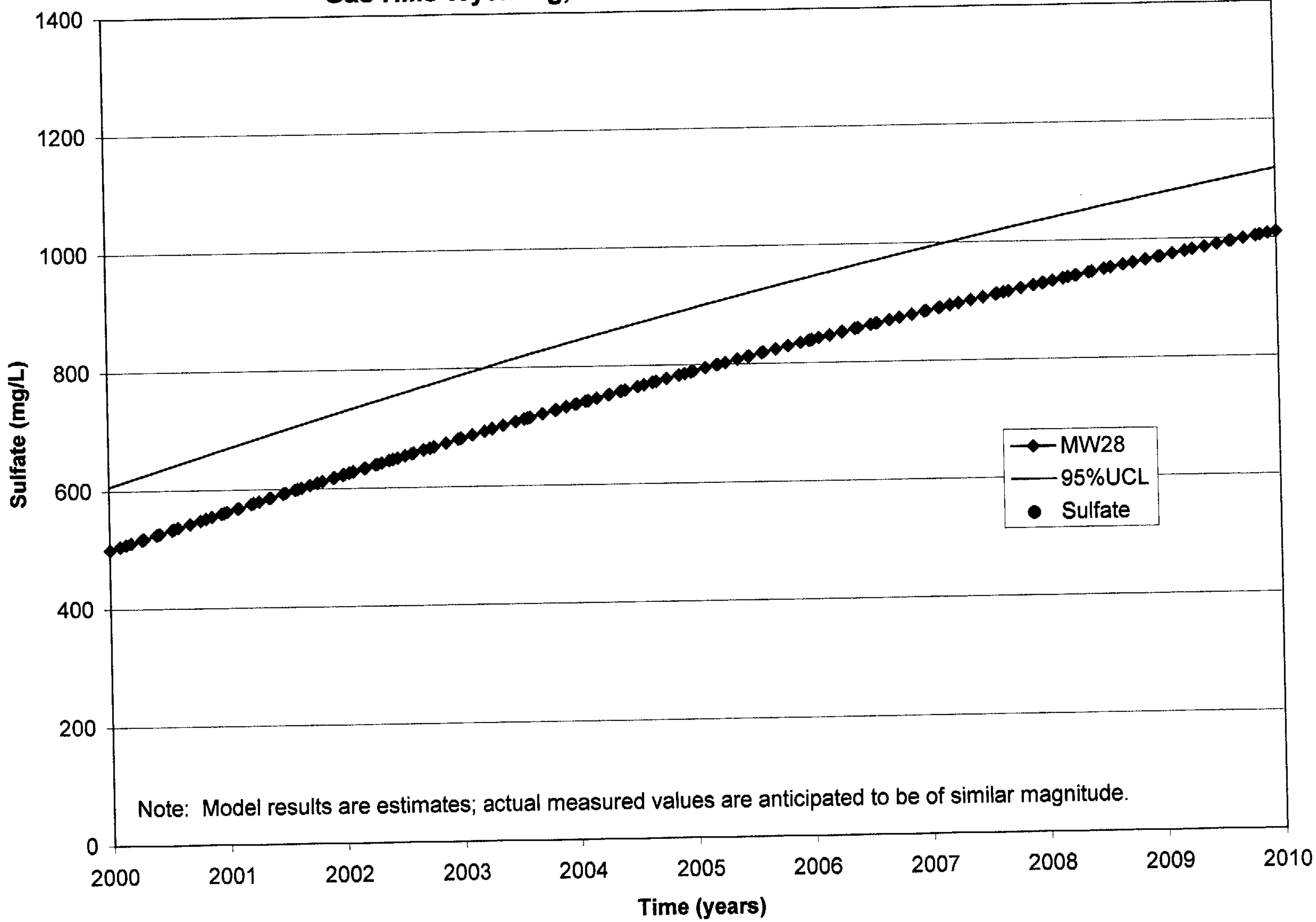
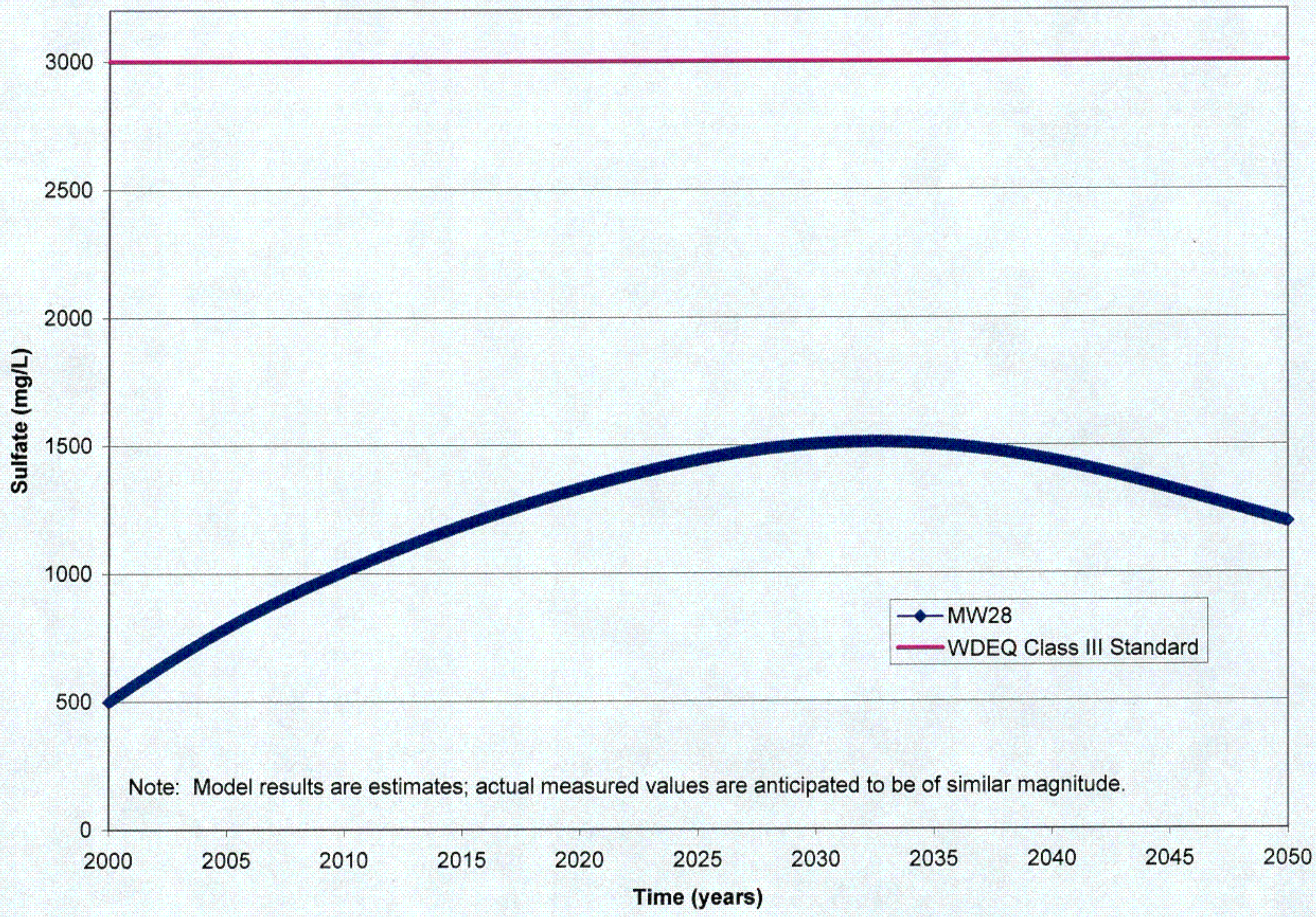
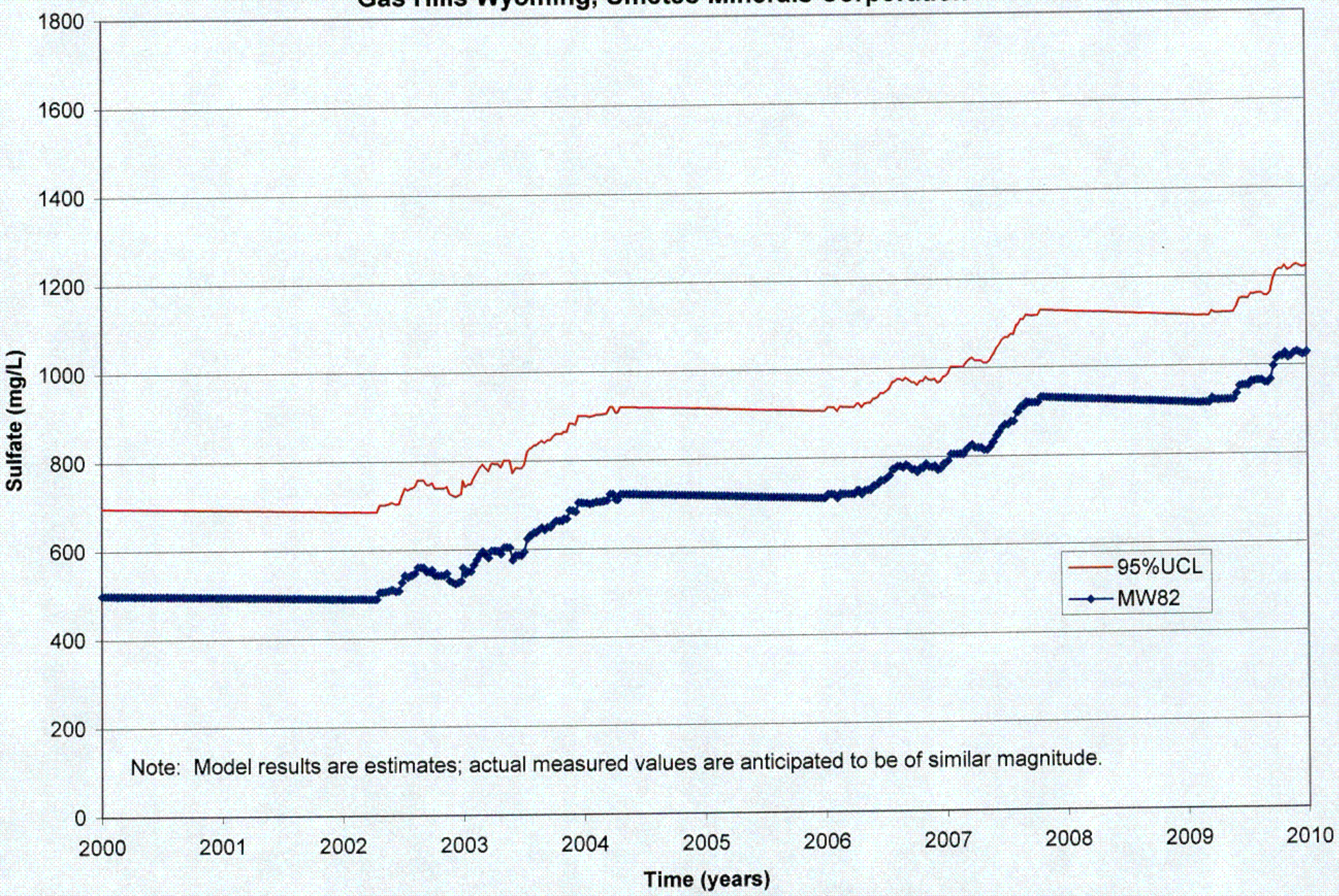


Figure 6b. Simulated Sulfate Trends at MW28 (50 Years)-Western Flow Regime
Gas Hills Wyoming, Umetco Minerals Corporation



C08

**Figure 7a. Simulated Sulfate Trends at MW82 (10 Years)-Southwestern Flow Regime
Gas Hills Wyoming, Umetco Minerals Corporation**



C09

Figure 7b. Simulated Sulfate Trends at MW82 (50 Years)-Southwestern Flow Regime Gas Hills Wyoming, Umetco Minerals Corporation

C10

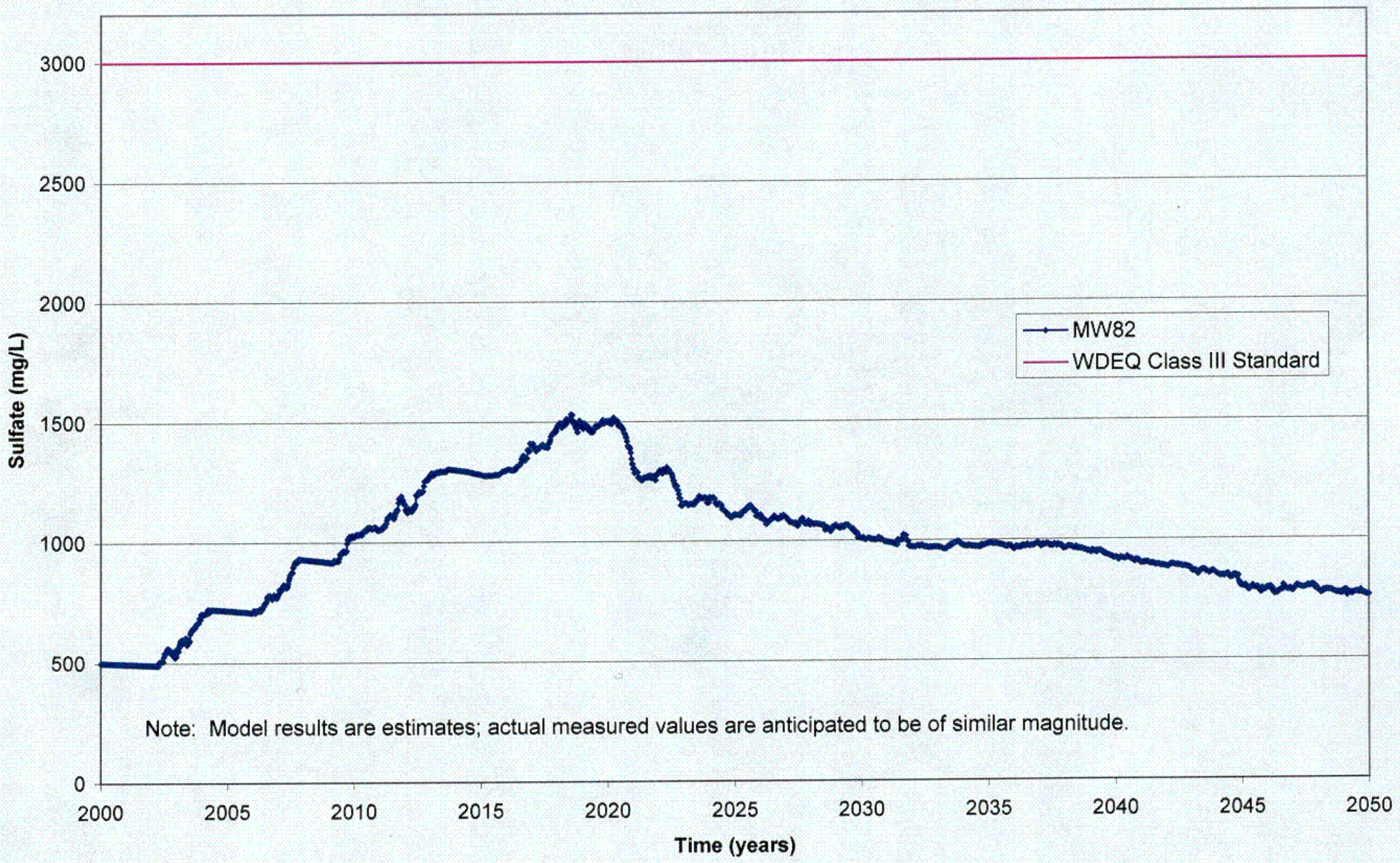


Figure 8a. Simulated Sulfate Trends at MW72 (10 Years)-Southwestern Flow Regime
Gas Hills Wyoming, Umetco Minerals Corporation

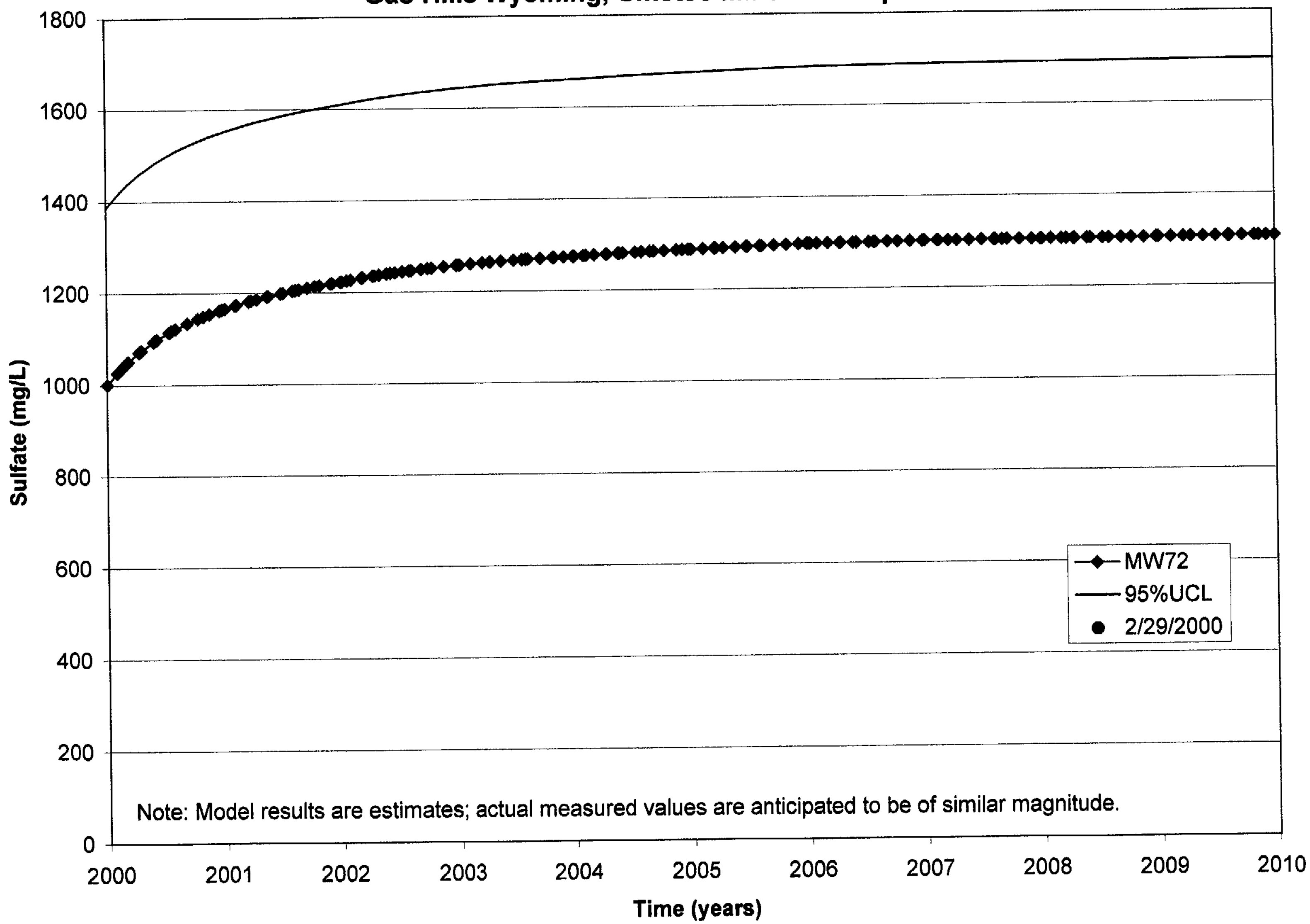
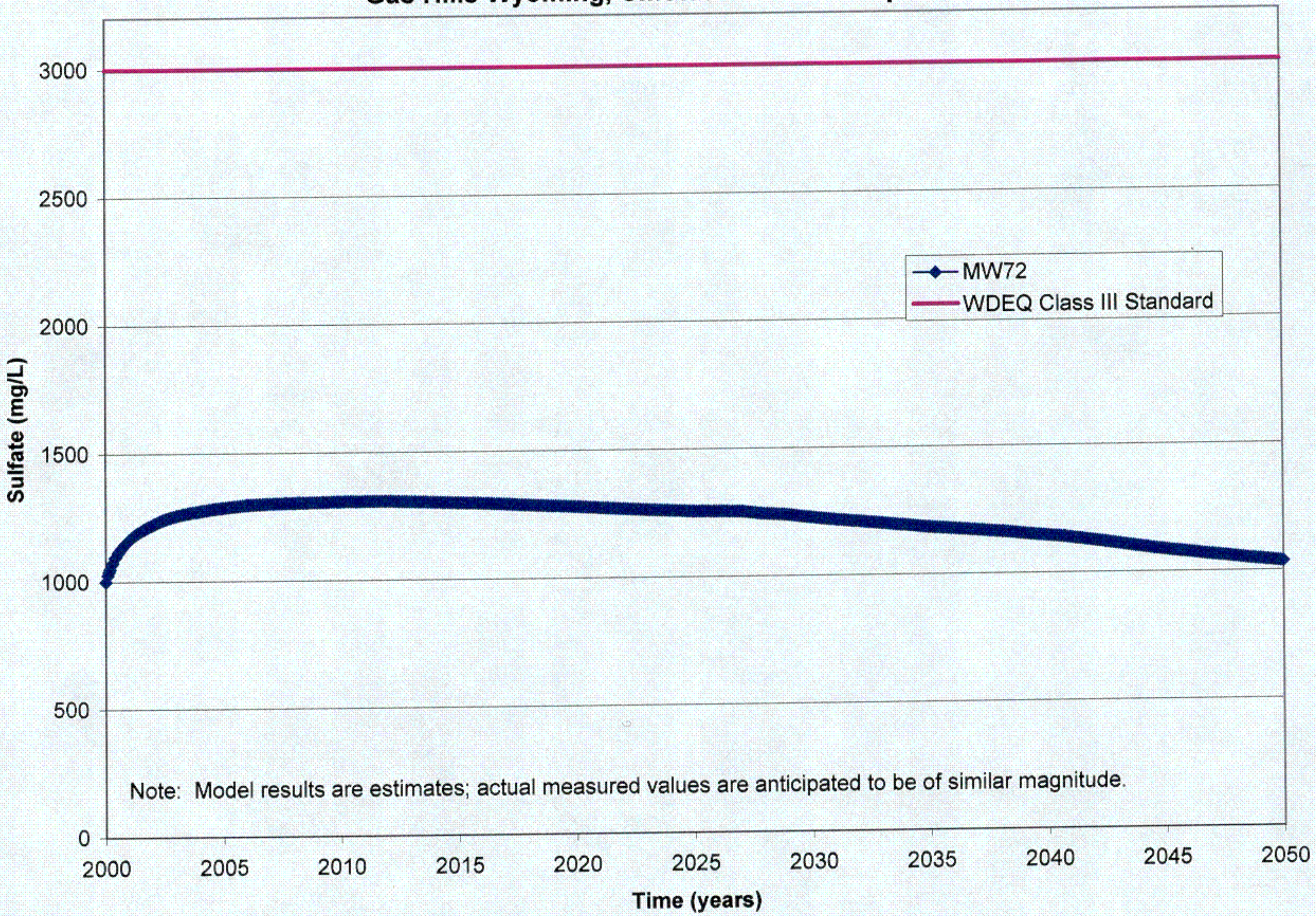


Figure 8b. Simulated Sulfate Trends at MW72 (50 Years)-Southwestern Flow Regime Gas Hills Wyoming, Umetco Minerals Corporation



C11