Appendix J

Ground Water Remedy Performance Evaluation Plan

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J1.0 Plan Objective

This plan specifies the method, criteria, and reporting requirements for evaluating the progress of aquifer restoration within Operable Unit (OU) III of the Monticello Mill Tailings Site (MMTS) under the selected remedy of monitored natural attenuation.

J2.0 Monitored Natural Attenuation Performance Evaluation Method

The progress of aquifer restoration will be evaluated primarily by comparing temporal trends of uranium concentration in ground water, as determined by semiannual monitoring data, to concentrations predicted by numerical modeling (DOE 2004c). Uranium is the primary ground water contaminant at the site because it is the most widespread in extent and is the single greatest contributor to potential human health risk. Uranium trend analysis will be performed for separate regions of the aquifer using concentration averaging for samples from multiple wells for both the observed and model-predicted data sets. Specific criteria in this plan define whether the observed restoration rate for uranium meets expectations. Attenuation rates of contaminants of concern (COCs) other than uranium will also be evaluated.

J2.1 Aquifer Regions

Five aquifer regions, shown on Figure J−1, represent distinct areas of contamination, hydrogeology, and geographic position relative to the permeable reactive barrier and former millsite. Aquifer restoration will be evaluated separately for each region.

Region 1 encompasses the north margin of the former millsite and former source areas. Ground water restoration occurs by underflow from the west and inflows from recharge sources to the north. Significant quantities of ground water in this area is displaced to Montezuma Creek. Uranium concentrations are moderately low (see Table J−1) in this region, and except for manganese anomalies, the remaining COCs are below the respective remediation goals).

Table J−1. Monitor Wells for Trend Analysis

Region	Monitor Wells for Trend Analysis	Representative Uranium Concentrations[a] (micrograms per liter [µg/L])
1	T01-07, T01-12, T01-19, T01-35	100 to 220
2	T01-01, T01-02, T01-04, T01-05	175 to 400
3	88-85, 92-11, 92-07, PW-17, PW-28	200 to 950
4	MW00-06, MW00-07, R10-M1, 82-08	<30 to 300
5	P92-06, 92-08, 92-09	100 to 400

[a]October 1999 through October 2003; single-point extreme values excluded.

Region 2 encompasses the general area from Wetland 3 to the eastern boundary of the former millsite. Most or all of the ground water that flows from the former millsite passes through or originates in this area. Leakage from Wetland 3 may significantly influence ground water flow in

this region. Uranium concentrations are moderately high (Table J−1) and the remediation goal for each COC except nitrate is exceeded in this region.

Region 3 is the area between the former millsite and the permeable reactive barrier; Region 3 encompasses the area of highest contamination downgradient of the former millsite. The remediation goal for each COC except manganese is exceeded in this region. Minor leakage from Montezuma Creek may locally affect ground water quality.

Region 4 extends from the permeable reactive barrier to monitor well 82-08, approximately 750 feet east of the permeable reactive barrier. Ground water quality is affected by localized irrigation returns, uncontaminated effluent from the permeable reactive barrier, possible leakage from Montezuma Creek, and flow of contaminated ground water around the south end of the permeable reactive barrier system. As a result, the uranium concentration varies widely in this region. The ground water model used to predict uranium concentration did not simulate treatment by the permeable reactive barrier. Remediation goals are exceeded only by uranium and selenium in this region.

Region 5 extends east of monitor well 82-08 to nearly the terminus of the uranium plume. One location of selenium contamination occurs within this region; otherwise, uranium is the only COC that exceeds its remediation goal. The uranium plume extends slightly east of the most downgradient monitor well in Region 5 (well 92-09). Significant advancement of the uranium plume beyond well 92-09 is prevented by ground water discharge from the bedrock aquifer that causes dilution and displacement of contaminated alluvial ground water to Montezuma Creek through this area.

J2.2 Performance Evaluation Wells and Data Analysis

Table J−1 lists the monitor wells that are used for analyzing COC trends in each region of the aquifer and representative uranium concentrations. Wells that exhibit erratic concentrations in recent years, are spatially correlated, or pose sampling problems were generally avoided in compiling this list. Each well listed in Table J−1 has been used in characterizing aquifer conditions in the period following remediation of the former millsite and installation of the permeable reactive barrier. Many of the locations have been monitored since 1992. All wells listed in Table J−1 will be sampled semiannually in April and October. Ground water monitoring at numerous existing OU III wells not listed in Table J−1 or shown on Figure J−1 will also occur during the post- Record of Decision (ROD) period (see DOE 2004b). Several new monitor wells will be installed in the alluvial aquifer during 2004 to complement or replace selected wells listed in Table J−1 (see Section 2.2.3).

For each sampling event, the arithmetic mean of the uranium concentration, computed for each region using the wells listed in Table J−1, is plotted as a point on a graph of concentration in relation to time for that region. On the same graph, a second trend line represents the average of the model-predicted uranium concentration for the same wells, starting from October 2002. Figure J−2 illustrates example concentration trends for Regions 1, 2, and 3 based on recent monitoring results for wells listed in Table J−1. Because some wells were not sampled during each event indicated in the figure, conclusions regarding restoration progress are not implied on Figure J−2. The above method will be applied to the data beginning in October 2004.

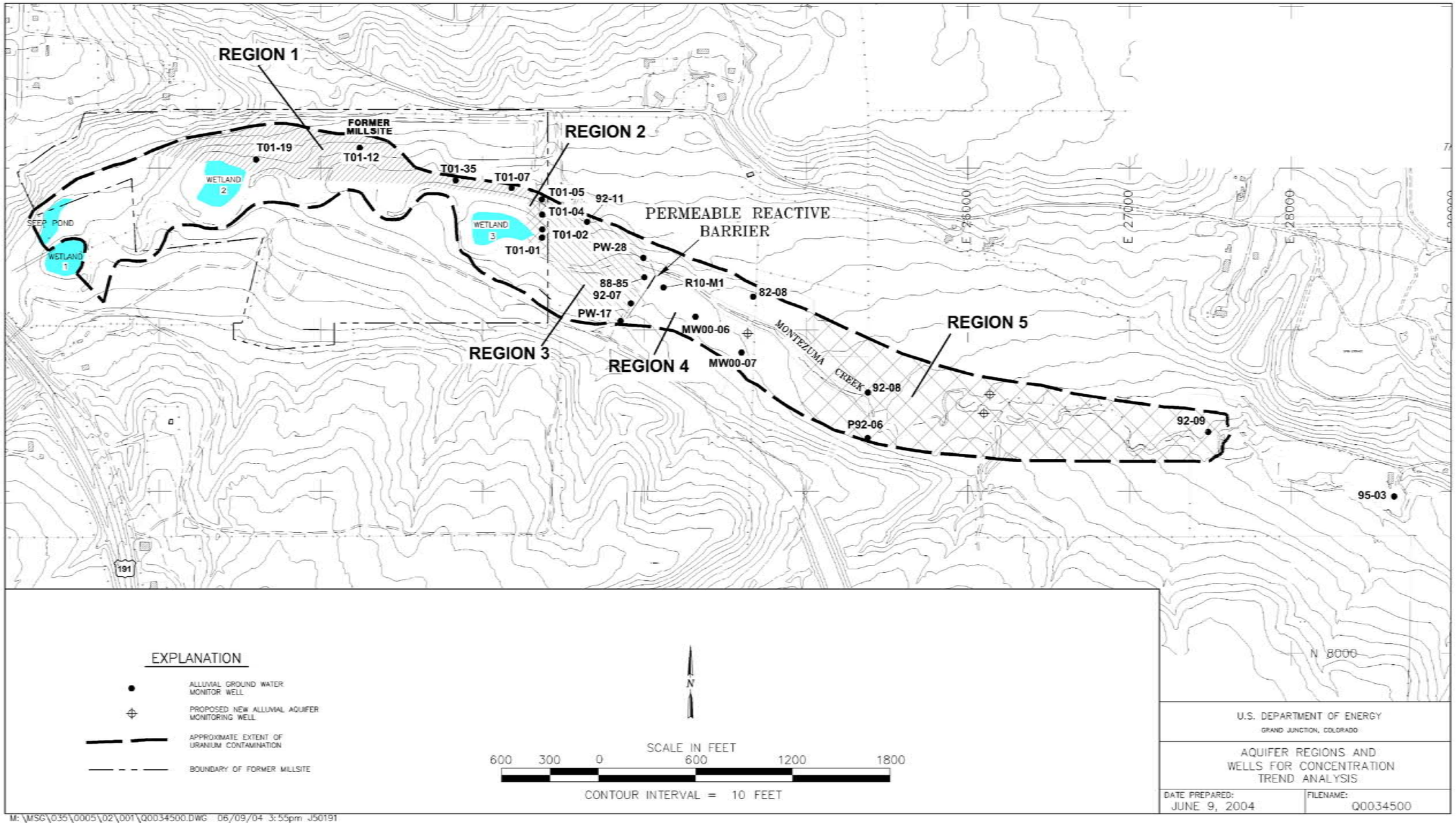

Figure J−1. Aquifer Regions and Wells for Concentration Trend Analysis

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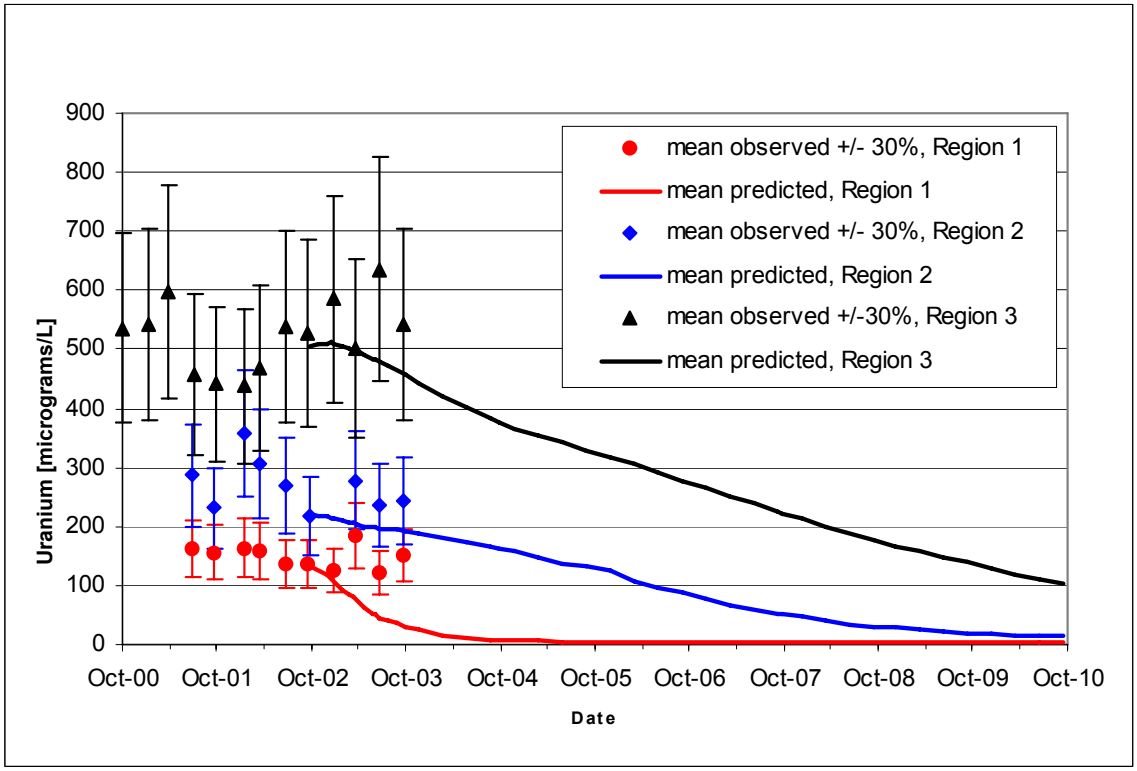

Figure J−2. Example Trend Analysis Graph

J2.2.1 Concentration Data Uncertainty Range

The uncertainty range displayed on Figure J−2 (± 30 percent) accounts for the cumulative effects of natural variation in ground water flow and geochemistry, sample collection bias, and laboratory analytical uncertainty on measured uranium concentrations. This range was determined by analyzing the measured concentration of uranium over time at selected OU III monitor wells, including most of those listed in Table J−1 and others in uncontaminated regions of the aquifer. Within the plume area, the variation in uranium was evaluated for the period of April 2000 through October 2003. At background locations, uranium concentrations dating to 1992 were evaluated.

For a given well, concentration residuals were calculated as the difference between the best-fit value, as determined by linear regression, and the observed concentration. Concentration residuals were calculated separately for background wells and wells within the uranium plume. For both of these data sets, the maximum and minimum percent differences of the concentration residuals computed for each well were averaged. The resulting overall range of the average concentration residuals was minus 20 to plus 30 percent. Observed concentrations for individual wells varied from the residual value by as much as 77 percent. Table J−2 through Table J−8 (at the end of this appendix) provide computational summaries of this uncertainty analysis.

J2.2.2 Model-Predicted Concentrations

Table J−9 through Table J−13 (at the end of this appendix) provide the uranium concentrations predicted by the ground water model (DOE 2004c) in 1-year increments for 50 years of simulated time, starting October 2002, for the monitor wells listed in Table J−1. Average uranium concentrations per well group (aquifer region) are also provided in the tables. Figure J−3 through Figure J−7 illustrate model-predicted uranium concentration trends at individual wells and as the group average within the respective aquifer region. The time scales for Figure J−2 through Figure J−7 do not extend through the full 50 years of simulation in order to show more clearly changes in the initial years.

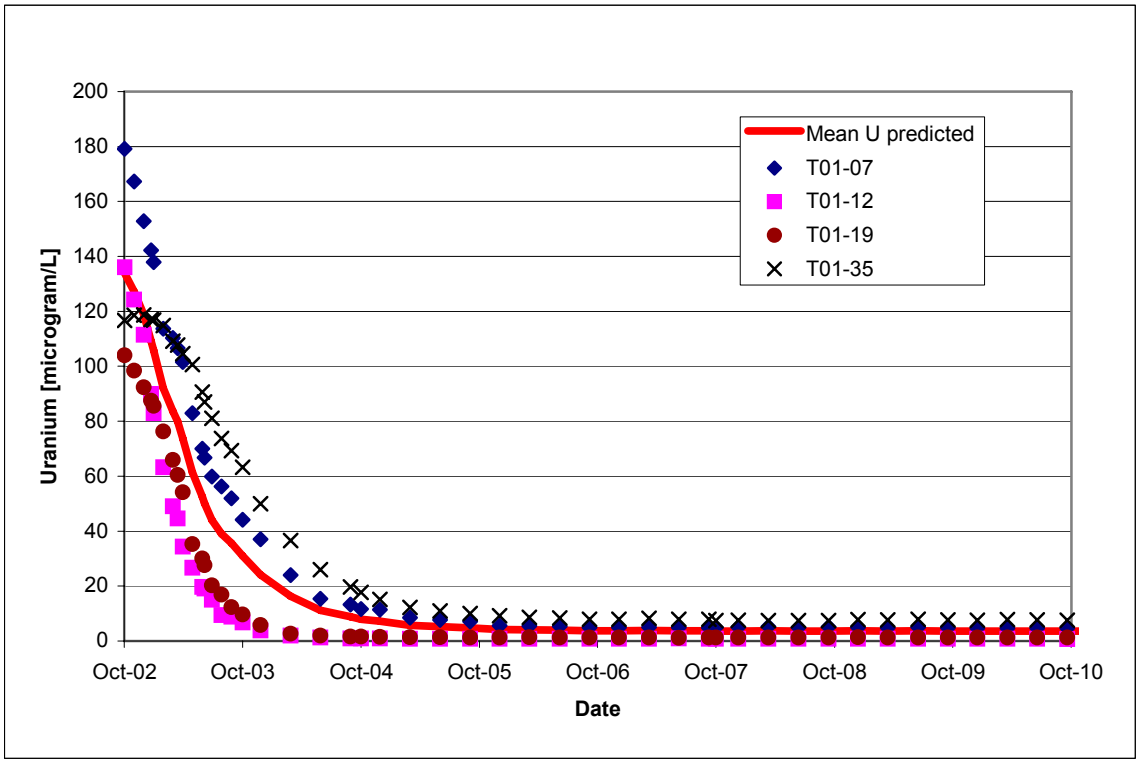

Figure J−3. Model-Predicted Uranium Concentrations, Region 1

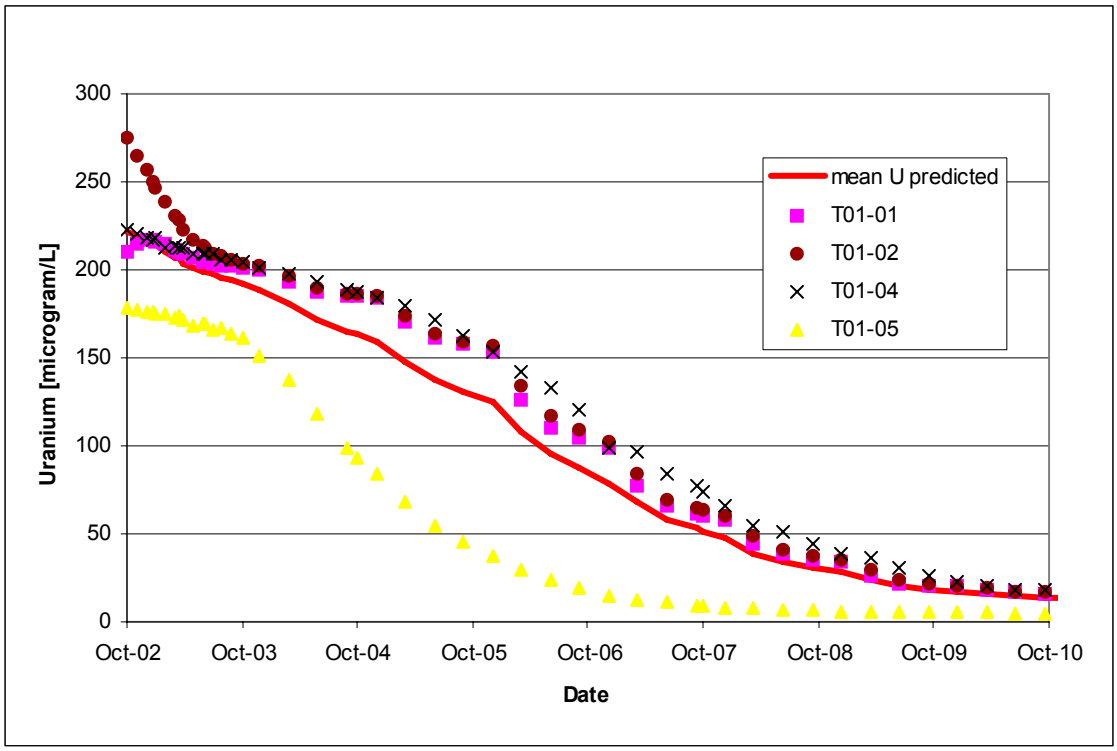

Figure J−4. Model-Predicted Uranium Concentrations, Region 2

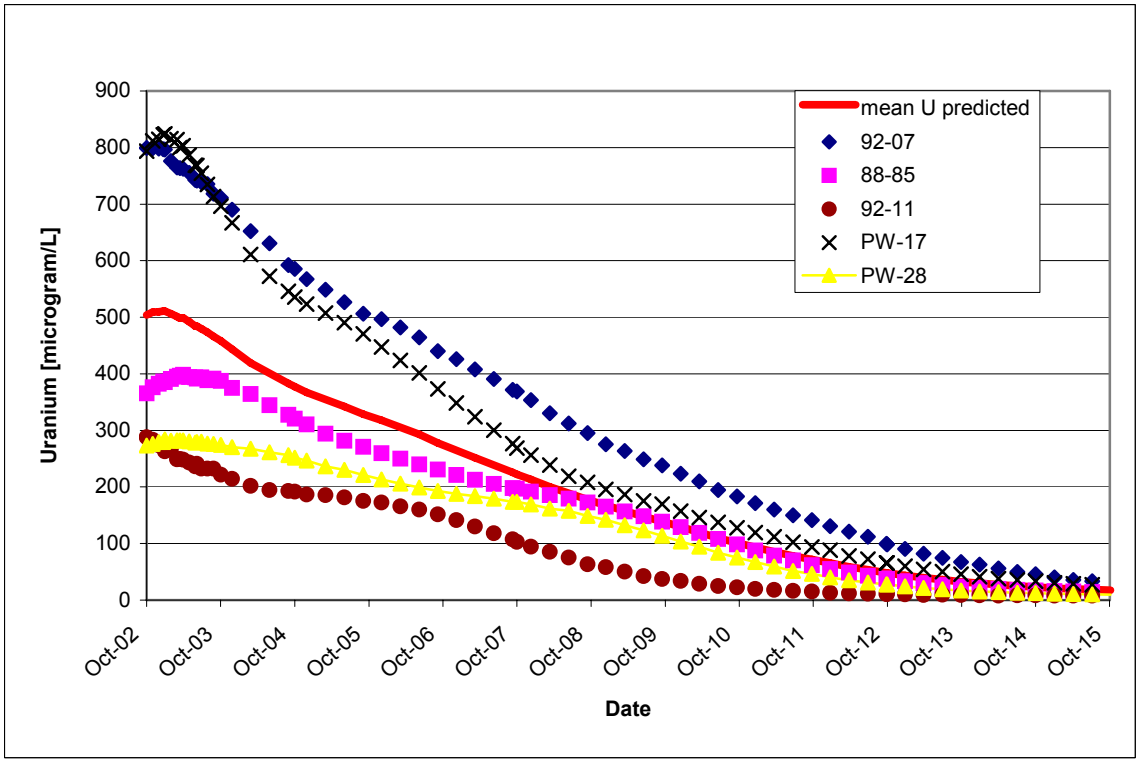

Figure J−5. Model-Predicted Uranium Concentrations, Region 3

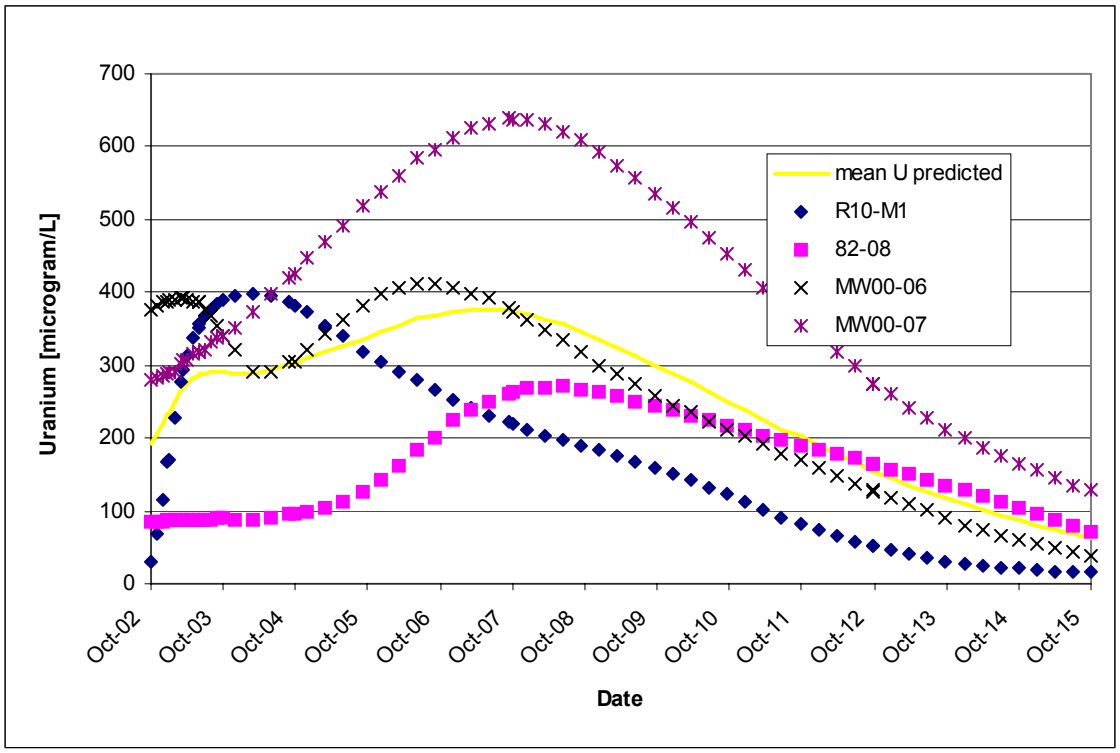

Figure J−6. Model-Predicted Uranium Concentrations, Region 4

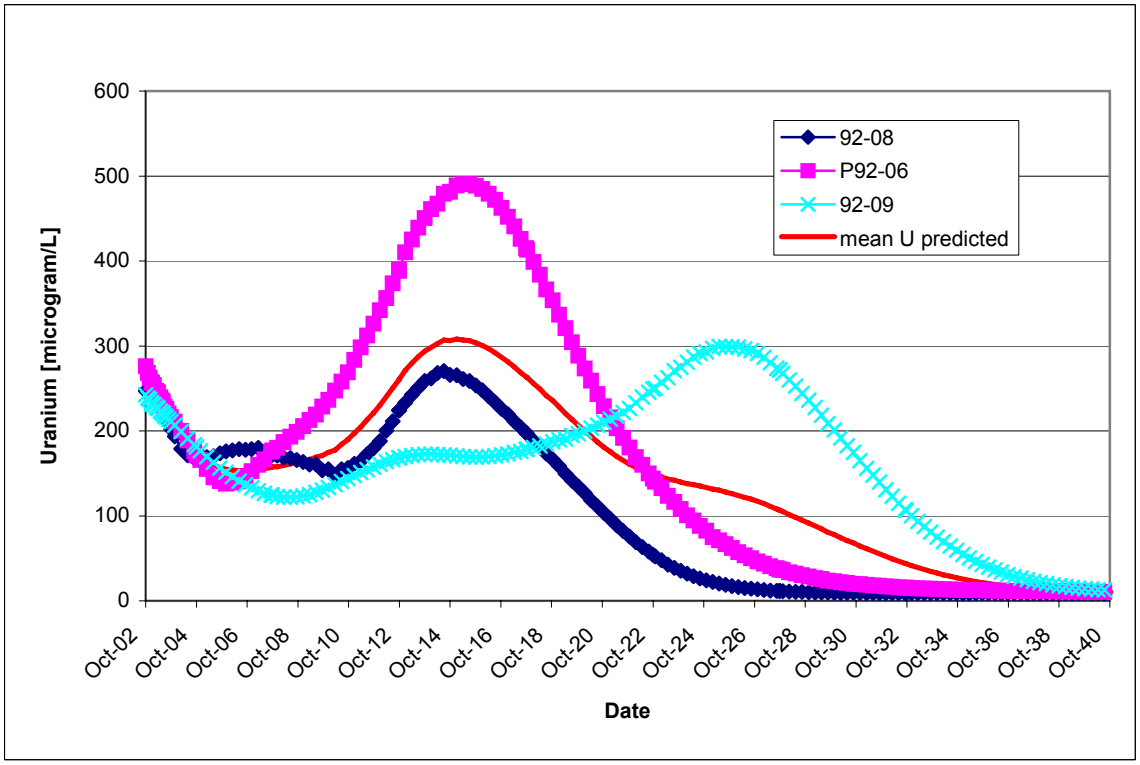

Figure J−7. Model-Predicted Uranium Concentrations, Region 5

J2.2.3 Addition of New Monitoring Wells

Three new wells will be installed into the alluvial aquifer in 2004 to complement the existing monitoring network. Proposed locations of the new wells are shown on Figure J−1. The new well proposed in Region 4 (see Figure J−1) will ultimately replace wells MW00-07 and 82-08 as a trend analysis well in that region. The limited saturated thickness (about 1 foot [ft]) and low yield of well MW00-07 pose sampling difficulties. Crop irrigation north of this well biases the monitoring results for samples from that location. The new well will be adjacent to and deeper than existing well 82-07 (well 82-07 is not shown on Figure J−1) where recent low water levels are periodically below the screen. The two proposed wells in Region 5 will improve monitoring resolution in that region of the aquifer which is expected to be last in reaching remediation goals.

The new wells will be sampled semiannually to establish a seasonal water quality profile, and their concentration trends will be evaluated qualitatively to expected rates of ground water restoration. As predicted by numerical modeling, quantitative performance criteria (Section 3.1) cannot be immediately applied to the new wells because the ground water model was not based on concentration input from those locations. In 2007 (during the 5-year review), a decision will be made whether quantitative performance measures will subsequently be applied to the new wells.

J3.0 Performance Criteria

J3.1 Quantitative Evaluation of Uranium Attenuation

The progress of monitored natural attenuation for uranium is expected to closely approximate the model-predicted concentration trends. As long as the lower limit of the uncertainty range (minus 30 percent) associated with the observed concentration average for uranium does not exceed the model-predicted value for three consecutive sampling events, the progress of monitored natural attenuation is considered to be consistent with the model trend. This method allows possible deviatory behavior to be interpreted during successive water years and provides a minimum number of data points to constitute a concentration "trend." Concentration trends at wells not listed in Table J−1 will be analyzed to assist in the general interpretation of monitored natural attenuation progress. The method described in Section 2.2 was applied to the data beginning in October 2004.

J3.1.1 Aquifer Region 4

The previously defined quantitative performance criteria do not immediately apply to Region 4 because of the general complexity of this region (see Section 2.1). A decision will be made in 2007 (during the 5-year review) whether those criteria will be subsequently applied to Region 4. The decision will consider the general progress of ground water restoration in this portion of the aquifer and the status of the permeable reactive barrier based on concentration trends and other indicators of flow dynamics (e.g., creek flow and ground water levels).

J3.2 Plume Expansion

Assessment of plume expansion uses a sentinel well located a short distance beyond the terminus of the uranium plume (well 95-03; Figure J−1). The ground water model predicts slight increases in uranium concentrations east of the current extent of the uranium plume but predicts that the concentrations will never exceed the remediation goal at the location of well 95-03. Unexpected plume expansion will be indicated by concentrations in ground water sample results that exceed the uranium remediation goal at well 95-03.

Ground water discharge from the Burro Canyon sandstone aquifer represents a significant local process that limits plume migration beyond its current extent in the eastern portion of OU III. Hydraulic heads at the alluvial and Burro Canyon aquifer wells in the area of concern, measured semiannually to determine vertical flow potentials, will complement water quality data in evaluating plume expansion criteria.

J3.3 Permeable Reactive Barrier Performance

The permeable reactive barrier will be monitored to ensure that no adverse impact to ground water quality or land use occurs. Permeable reactive barrier failure is indicated by loss of treatment effectiveness whereby COC concentrations in the permeable reactive barrier equal or exceed concentrations in the influent ground water, or when ground water mounding reaches the top of the permeable reactive media.

Concentration trend analysis will consider possible effects associated with the eventual decommissioning of the permeable reactive barrier. Such effects will depend on contaminant concentrations in ground water hydraulically upgradient of the permeable reactive barrier and whether the disturbance to the subsurface mobilizes contaminants to ground water or flow directions change following the removal of the permeable reactive barrier and replacement with clean fill.

J3.4 Other Contaminants of Concern

The progress of aquifer restoration for the remaining COCs (arsenic, manganese, molybdenum, nitrate, selenium, and vanadium) will be evaluated using concentration trends determined from semiannual monitoring. The rate at which these trends (at an individual well or averaged for a region of the aquifer) approach the respective remediation goal will be compared to the remediation time frame as a qualitative measure of restoration progress. These COCs are expected to attenuate to safe levels within the remediation time frame because they generally do not greatly exceed the respective remediation goals and are present only in the small area between the former millsite and permeable reactive barrier. Selenium mobilization from natural sources provides an exception (see Sections 5.3.1 and 7.2 of the ROD), as does manganese, which occurs in excess of its remediation goal only in ground water samples from locations on the former millsite.

J3.5 Surface Water Restoration

The selected remedy for OU III assumes that remediation goals for surface water will be achieved through aquifer restoration because of the strong interaction between surface water and ground water at the site and, with the exception of selenium, because the remediation goals for surface water and ground water are equal for the respective COCs. Therefore, ground water and surface water interaction cannot in itself cause remediation goals to be exceeded for COCs other than selenium. However, sufficient discharge of ground water that contains selenium at 50 µg/L (ground water remediation goal for selenium) may result in surface water concentrations that exceed the surface water remediation goal for selenium of 5 µg/L.

Attainment of surface water remediation goals will be tracked by continued water-quality monitoring during the post-ROD period at multiple locations on Montezuma Creek, in the constructed wetlands, and at ground water seeps. Figure J−8 illustrates the locations of the post-ROD surface water monitoring sites as identified in DOE 2004b. Specific criterion by which selenium concentration trends in surface water will initiate response actions pertaining to ecological risk are described in Appendix C of this ROD.

J4.0 Reporting Requirements and Response Action

Annual reports will document monitoring results and monitored natural attenuation performance for the period encompassing the previous two sampling events. Annual reports will be completed within 5 months after the second sampling event for the reporting period. Annual reports will include

- Water quality sample results and summary.
- Hydrogeologic data summary.
- Concentration trend analysis and comparison to performance criteria.
- Interpretation of any deviation from expected concentration trends.

Discussion of potential response actions under CERCLA will be initiated among U.S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), and the Utah Department of Environmental Quality (UDEQ) if, for any region of the aquifer, the lower limit of the uncertainty range (minus 30 percent) of the observed concentration average exceeds the model-predicted value for three consecutive sampling events. Example parameters that will be discussed include temporary climate changes (e.g., drought) from the assumed baseline conditions, changes in land use, identification of unremediated source material, and evaluation of discharge from the Burro Canyon aquifer. The sensitivity of the ground water model to the flow-and-transport variables (e.g., hydraulic conductivity, uranium partitioning coefficient) used to predict future concentrations will also be considered.

If the data are consistently above model predictions, a second assessment of the data will be performed during the 5-year review using additional statistical methods. In this evaluation, data for the region in question will be evaluated for the most recent 5-year period to determine if the observed trend for that period, assuming a 70-percent confidence interval, can meet the remediation goal in the established time frame. This second type of trend analysis accounts for

linearly decreasing concentrations over time, as distinct from the highly nonlinear response predicted by the model. If the linear trend indicates an unacceptable remediation time, DOE, EPA, and UDEQ will determine the need to implement a contingency remedy. If the linear trend indicates that clean-up levels will be met in an acceptable time, then the selected remedy will be continued.

For the remaining COCs, if significant increases in the concentrations occur unexpectedly, or if average concentrations for the aquifer regions persist above the remediation goal, the need for response action will be evaluated. Failure of the permeable reactive barrier will initiate a separate response in which a strategy for its decommissioning will be developed by DOE, EPA, and UDEQ.

J4.1 Plan Modification

This monitored natural attenuation performance evaluation plan may require modification during the post-ROD monitoring period. Plan modification may include reducing the scope of ground water monitoring as remediation goals are attained in regions of the aquifer, using wells other than those listed in Table J−1 for quantitative trend analysis, or redefining quantitative performance criteria. DOE, EPA, or UDEQ may formally propose such changes. Any approval or proposal will be done in consultation between these parties pursuant to the then current agreement (currently 1989 Federal Facilities Agreement).

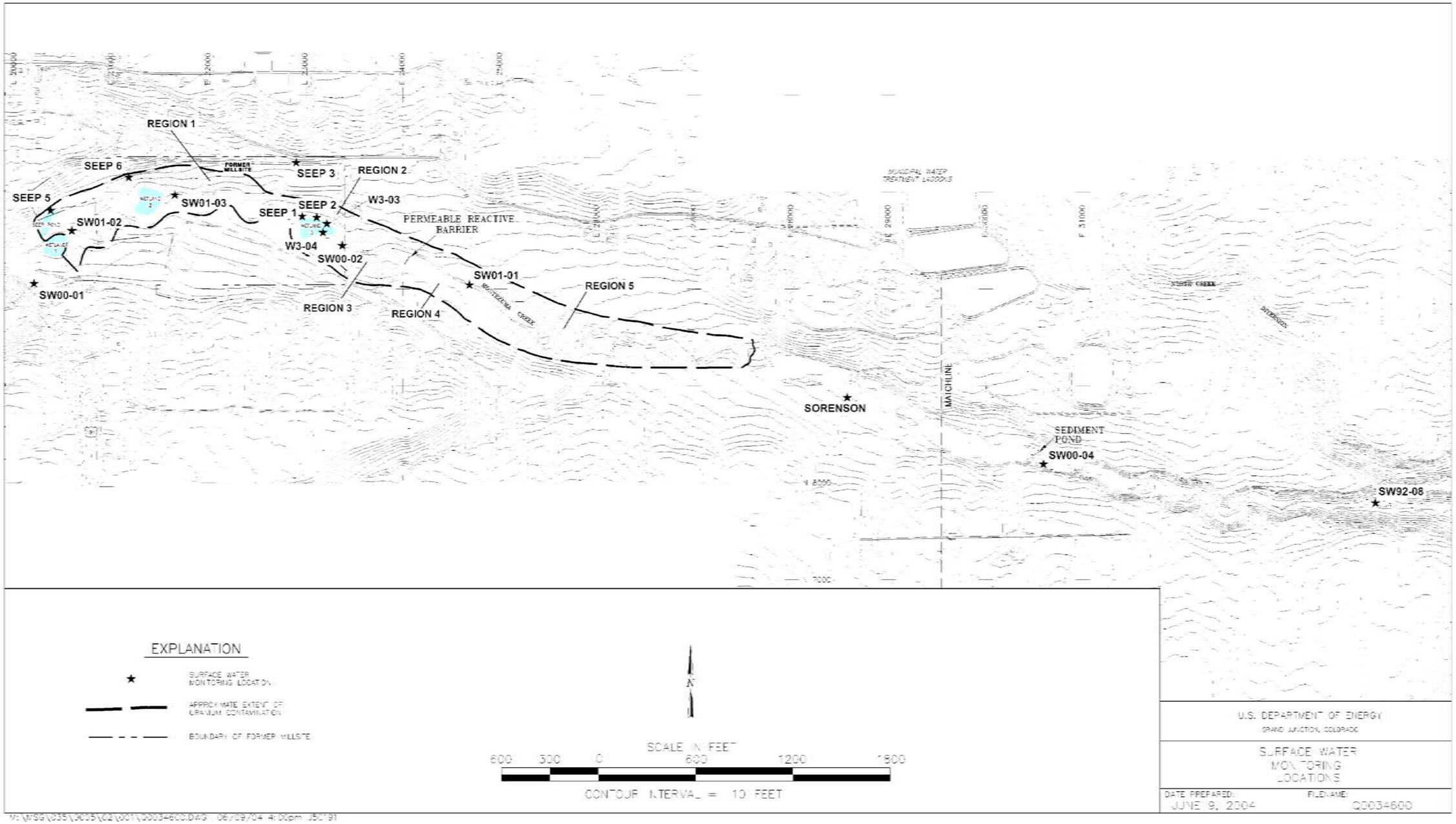

Figure J−8. Locations of the Post-ROD Surface Water Monitoring Sites

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Table J−2. Residuals Analysis Summary

Well	Uranium Variation in Aquifer Regions 1, 2, 3, 5.				
	Maximum Percent Difference		Minimum Percent Difference		
T01-07		5.0435		-5.2708	
T01-12		54.3744		-28.3703	
T01-19		12.5641		-7.5272	
T01-35		18.6413		-15.5926	
T01-01		77.4739		-38.2691	
T01-02		17.3254		-15.2688	
T01-04		22.2202		-15.6268	
T01-05		14.0194		-16.4590	
88-85		19.6685		-17.1713	
92-07		59.6514		-22.0929	
92-11		30.9175		-22.1384	
PW-17		20.0616		-14.8996	
PW-28		24.2677		-24.7583	
92-08		57.9051		-29.4098	
92-09		10.6220		-8.8181	
P92-02		3.6398		-3.2010	
P92-06		72.8809		-23.4040	
	Mean	30.6633	Mean	-18.1340	
Well	Uranium Variation at Background Locations				
	Maximum Percent Difference		Minimum Percent Difference		
92-01		14.16706		-16.968	
92-03		13.68651		-22.9633	
92-05		21.20232		-36.1803	
MW00-01		48.30178		-25.3276	
MW00-02		44.33328		-23.0294	
	Mean	28.33819	Mean	-24.8937	

Table J−3. Linear Regression Residuals Analysis: Uranium, Region 1 Wells

Observations								
Loc T01-07	Loc T01-07	Loc T01-12	Loc T01-12	Loc T01-19	Loc T01-19	Loc T01-35	Loc T01-35	
sample date	uran µg/l	sample date	uran µg/l	sample date	uran µg/l	sample date	uran µg/l	
07/11/2001	214	07/11/2001	164	07/11/2001	109	10/09/2001	159	
10/09/2001	201	10/09/2001	153	10/09/2001	111	01/31/2002	166	
01/31/2002	199	01/31/2002	161	01/31/2002	130	04/03/2002	155	
04/03/2002	203	04/03/2002	155	04/03/2002	128	07/09/2002	125	
07/09/2002	191	07/09/2002	119	07/09/2002	110	10/07/2002	115	
10/07/2002	183	10/07/2002	141	10/07/2002	105	01/13/2003	126	
04/08/2003	197	04/08/2003	282	04/08/2003	109	04/08/2003	148	
		07/07/2003	144	07/07/2003	109	07/07/2003	117	
Computational Summary								
Loc T01-07					**Loc T01-12**			
SUMMARY OUTPUT					SUMMARY OUTPUT			
Regression Statistics					*Regression Statistics*			
Multiple R	0.69				Multiple R	0.31163594		
R Square	0.48				R Square	0.097116959		
Adjusted R Square	0.37				Adjusted R Square	-0.053363547		
Standard Error	7.69				Standard Error	50.70147618		
Observations	7				Observations	8		
Loc T01-07					**Loc T01-12**			
RESIDUAL OUTPUT					RESIDUAL OUTPUT			
Observation	*Predicted Loc T01-07*	*Residuals*	*% difference*		*Observation*	*Predicted Loc T01-12*	*Residuals*	*% difference*
1	207.15	6.85	3.31		1	144.1387431	19.86125693	13.77926331
2	204.37	-3.37	-1.65		2	149.5916667	3.408333269	2.278424556
3	200.86	-1.86	-0.92		3	156.4987034	4.501296628	2.876251708
4	198.95	4.05	2.04		4	160.2551619	-5.255161896	-3.279246568
5	195.96	-4.96	-2.53		5	166.1322018	-47.13220184	-28.37029867
6	193.18	-10.18	-5.27		6	171.5851255	-30.58512551	-17.82504481
7	187.54	9.46	5.04		7	182.672737	99.32726304	54.37443195
		max % diff	**5.04**		8	188.1256606	-44.12566062	-23.4554183
		min % diff	**-5.27**				**max % diff**	**54.37**
							min % diff	**-28.37**
Loc T01-19					**Loc T01-35**			
SUMMARY OUTPUT					SUMMARY OUTPUT			
Regression Statistics					*Regression Statistics*			
Multiple R	0.312126766				Multiple R	0.681832728		
R Square	0.097423118				R Square	0.464895869		
Adjusted R Square	-0.053006362				Adjusted R Square	0.375711847		
Standard Error	9.757205407				Standard Error	16.05676988		
Observations	8				Observations	8		
Loc T01-19					**Loc T01-35**			
RESIDUAL OUTPUT					RESIDUAL OUTPUT			
Observation	*Predicted Loc T01-19*	*Residuals*	*% difference*		*Observation*	*Predicted Loc T01-35*	*Residuals*	*% difference*
1	117.8725355	-8.872535494	-7.527228847		1	159.0517341	-0.051734134	-0.032526608
2	116.8213209	-5.821320901	-4.983097996		2	151.8889542	14.11104575	9.290369944
3	115.4897824	14.51021758	12.56407041		3	147.9934073	7.006592709	4.734395158
4	114.7656124	13.23438764	11.53166647		4	141.8987612	-16.89876125	-11.90902662
5	113.6326366	-3.632636635	-3.196825087		5	136.243935	-21.24393502	-15.592573
6	112.581422	-7.581422042	-6.734167951		6	130.0864576	-4.086457573	-3.141339728
7	110.4439524	-1.44395237	-1.307407367		7	124.7457884	23.25421164	18.64127996
8	109.3927378	-0.392737777	-0.359016316		8	119.0909621	-2.090962132	-1.755768947
		max % diff	**12.56**				**max % diff**	**18.64**
		min % diff	**-7.53**				**min % diff**	**-15.59**

Table J−4. Linear Regression Residuals Analysis: Uranium, Region 2 Wells

Observations							
Loc T01-01	Loc T01-01	Loc T01-02	Loc T01-02	Loc T01-04	Loc T01-04	Loc T01-05	Loc T01-05
sample date	uran µg/l	sample date	uran µg/l	sample date	uran µg/l	sample date	uran µg/l
07/18/2001	326	07/18/2001	311	07/18/2001	221	10/09/2001	180
10/09/2001	321	01/31/2002	301	10/09/2001	192	01/31/2002	230
01/31/2002	651	04/03/2002	373	01/31/2002	251	04/03/2002	235
04/03/2002	331	07/10/2002	323	04/03/2002	282	07/10/2002	201
07/10/2002	326	10/08/2002	278	07/10/2002	226	10/08/2002	188
10/08/2002	193	04/09/2003	391	10/08/2002	213	04/09/2003	194
04/09/2003	291	07/07/2003	305	04/09/2003	233	07/07/2003	168

Computational Summary								
Loc T01-01					**Loc T01-02**			
SUMMARY OUTPUT					SUMMARY OUTPUT			
Regression Statistics					*Regression Statistics*			
Multiple R	0.329993297				Multiple R	0.172405518		
R Square	0.108895576				R Square	0.029723663		
Adjusted R Square	-0.069325309				Adjusted R Square	-0.164331605		
Standard Error	146.8904189				Standard Error	44.13532343		
Observations	7				Observations	7		
Loc T01-01					**Loc T01-02**			
RESIDUAL OUTPUT					RESIDUAL OUTPUT			
Observation	*Predicted Loc T01-01*	*Residuals*	*% difference*		*Observation*	*Predicted Loc T01-02*	*Residuals*	*% difference*
1	409.4980731	-83.49807308	-20.39034578		1	315.4811466	-4.481146618	-1.420416613
2	391.514606	-70.51460604	-18.01072168		2	321.0409392	-20.04093919	-6.242487092
3	366.8144224	284.1855776	77.47393784		3	322.7907216	50.20927838	15.55474647
4	353.3809892	-22.3809892	-6.33338801		4	325.5565068	-2.556506757	-0.785272819
5	332.147498	-6.147498003	-1.850833753		5	328.0965135	-50.09651351	-15.26883446
6	312.647353	-119.647353	-38.26910795		6	333.2611939	57.73880608	17.32539135
7	272.9970582	18.00294176	6.594555222		7	335.7729784	-30.77297838	-9.164816815
		max % diff	**77.47**				**max % diff**	**17.33**
		min % diff	**-38.27**				**min % diff**	**-15.27**
Loc T01-04					**Loc T01-05**			
SUMMARY OUTPUT					SUMMARY OUTPUT			
Regression Statistics					*Regression Statistics*			
Multiple R	0.135351376				Multiple R	0.491576988		
R Square	0.018319995				R Square	0.241647935		
Adjusted R Square	-0.178016006				Adjusted R Square	0.089977522		
Standard Error	31.25289678				Standard Error	23.77780404		
Observations	7				Observations	7		
Loc T01-04					**Loc T01-05**			
RESIDUAL OUTPUT					RESIDUAL OUTPUT			
Observation	*Predicted Loc T01-04*	*Residuals*	*% difference*		*Observation*	*Predicted Loc T01-05*	*Residuals*	*% difference*
1	226.065262	-5.065262001	-2.240619349		1	215.4631868	-35.46318679	-16.45904682
2	227.560489	-35.56048895	-15.62682921		2	209.4017832	20.59821684	9.836696006
3	229.6141742	21.38582583	9.313809094		3	206.1052303	28.89476969	14.01942573
4	230.7310907	51.26890932	22.22019978		4	200.89455	0.10545	0.052490224
5	232.4965394	-6.496539375	-2.794252075		5	196.1092313	-8.109231347	-4.135058453
6	234.1178698	-21.11786981	-9.020187064		6	186.3790834	7.62091658	4.088933393
7	237.414575	-4.414575014	-1.859437237		7	181.646935	-13.64693497	-7.512890309
		max % diff	**22.22**				**max % diff**	**14.02**
		min % diff	**-15.63**				**min % diff**	**-16.46**

Table J−5. Linear Regression Residuals Analysis: Uranium, Region 3 Wells

Observations

	Loc 88-85	Loc 92-07	Loc 92-11	Loc PW-17	Loc PW-28	Loc PW-28
date_sampled	uran µg/l	uran µg/l	uran µg/l	uran µg/l	date_sampled	uran µg/l
10/18/2000	402	709	270	973	10/18/2000	324
01/29/2001	442	647	423	833	01/29/2001	370
04/12/2001	419	1170	370	727	04/12/2001	304
07/19/2001	393	576	307	761	07/19/2001	247
10/16/2001	366	620	254	759	10/16/2001	206
01/29/2002	350	645	292	686	01/29/2002	216
04/02/2002	374	664	321	753	04/02/2002	233
07/10/2002	417	771	362	881	07/10/2002	263
10/01/2002	417	806	317	836	10/01/2002	256
01/14/2003	397	838	303	803	04/08/2003	270
04/08/2003	329	759	360	792		
07/09/2003	475	845	355	866		

Computational Summary

Loc 88-85

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.024160903
R Square	0.000583749
Adjusted R Square	-0.099357876
Standard Error	42.09817703
Observations	12

Loc 88-85

RESIDUAL OUTPUT

Observation	*Predicted Loc 88-85*	*Residuals*	*% difference*
1	399.9075892	2.092410787	0.523223576
2	399.5990192	42.40098083	10.61088211
3	399.3803239	19.61967609	4.912529466
4	399.086733	-6.086732995	-1.525165457
5	398.8201045	-32.82010452	-8.229300415
6	398.5055428	-48.50554283	-12.17186152
7	398.3168058	-24.31680581	-6.104890745
8	398.0202191	18.97978092	4.768546926
9	397.7715656	19.22843445	4.834039462
10	397.4570039	-0.457003862	-0.114981962
11	397.2053545	-68.20535451	-17.17130792
12	396.9297386	78.07026145	19.66853422
		max % diff	**19.67**
		min % diff	**-17.17**

Loc 92-07

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.135859654
R Square	0.018457846
Adjusted R Square	-0.07969637
Standard Error	164.1459361
Observations	12

Loc 92-07

RESIDUAL OUTPUT

Observation	*Predicted Loc 92-07*	*Residuals*	*% difference*
1	721.1815515	-12.18155148	-1.689110247
2	728.0083436	-81.00834357	-11.12739219
3	732.8467496	437.1532504	59.65138695
4	739.342144	-163.342144	-22.09290318
5	745.2410226	-125.2410226	-16.80543862
6	752.2003738	-107.2003738	-14.25157146
7	756.3759845	-92.3759845	-12.21297164
8	762.9376584	8.062341553	1.056749718
9	768.4388598	37.56114016	4.887980309
10	775.398211	62.601789	8.073501861
11	780.9656919	-21.96569193	-2.812632124
12	787.0634091	57.93659086	7.361108418
		max % diff	**59.65**
		min % diff	**-22.09**

Loc 92-11

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.081275103
R Square	0.006605642
Adjusted R Square	-0.092733793
Standard Error	49.9039732
Observations	12

Loc 92-11

RESIDUAL OUTPUT

Observation	*Predicted Loc 92-11*	*Residuals*	*% difference*
1	321.8700746	-51.87007463	-16.11522124
2	323.1042655	99.89573452	30.91749172
3	323.9789833	46.02101673	14.20493893
4	325.1532619	-18.15326194	-5.582986261
5	326.2196987	-72.21969869	-22.13836227
6	327.4778544	-35.47785442	-10.83366522
7	328.2327478	-7.232747848	-2.203542424
8	329.419009	32.58099104	9.89044049
9	330.4135511	-13.4135511	-4.059624992
10	331.6717068	-28.67170682	-8.644604357
11	332.6782314	27.32176861	8.212670992
12	333.7806155	21.21938455	6.357284864
		max % diff	**30.92**
		min % diff	**-22.14**

Loc PW-28

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.519495225
R Square	0.269875288
Adjusted R Square	0.178609699
Standard Error	46.02957224
Observations	10

Loc PW-28

RESIDUAL OUTPUT

Observation	*Predicted Loc PW-28*	*Residuals*	*% difference*
1	307.2362974	16.76370261	5.456289753
2	297.7443776	72.2556224	24.2676698
3	291.0170946	12.98290535	4.461217431
4	281.9859477	-34.98594767	-12.40698267
5	273.7841917	-67.78419173	-24.75825624
6	264.1079628	-48.10796283	-18.21526406
7	258.3022255	-25.30222548	-9.795589424
8	249.1789239	13.82107606	5.546647301
9	241.5300954	14.46990463	5.990932353
10	224.1128833	45.88711666	20.47500169
		max % diff	**24.27**
		min % diff	**-24.76**

Loc PW-17

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.038321931
R Square	0.00146857
Adjusted R Square	-0.098384573
Standard Error	81.56826183
Observations	12

Loc PW-17

RESIDUAL OUTPUT

Observation	*Predicted Loc PW-17*	*Residuals*	*% difference*
1	810.4172801	162.5827199	20.06160578
2	809.4685597	23.53144027	2.907023379
3	808.7961657	-81.79616566	-10.11332263
4	807.8934996	-46.89349964	-5.804416011
5	807.0737315	-48.07373153	-5.956547667
6	806.1065894	-120.1065894	-14.89959156
7	805.5263041	-52.52630408	-6.520743495
8	804.6144272	76.38557281	9.493438128
9	803.8499243	32.15007566	3.999512184
10	802.8827822	0.117217818	0.014599618
11	802.1090685	-10.10906846	-1.260310954
12	801.2616677	64.73833229	8.079549403
		max % diff	**20.06**
		min % diff	**-14.90**

Table J−6. Linear Regression Residuals Analysis: Uranium, Region 5 Wells

Observations

Loc 92-08 date_sampled	Loc 92-08 uran µg/l	Loc 92-09 date_sampled	Loc 92-09 uran µg/l	Loc P92-02 date_sampled	Loc P92-02 uran µg/l	Loc P92-06 date_sampled	Loc P92-06 uran µg/l
10-Jan-00	467	12-Apr-00	271	12-Apr-00	66	10-Jan-00	1080
12-Apr-00	337	02-Nov-00	283	02-Nov-00	62	12-Apr-00	895
26-Jul-00	227	10-Apr-01	281	10-Apr-01	59	26-Jul-00	697
02-Nov-00	276	16-Oct-01	265	16-Oct-01	54	02-Nov-00	546
29-Jan-01	363	02-Apr-02	272	02-Apr-02	54	10-Apr-01	550
10-Apr-01	316	07-Oct-02	260	07-Oct-02	52	19-Jul-01	604
19-Jul-01	281	09-Apr-03	319	09-Apr-03	46	16-Oct-01	492
16-Oct-01	292	07-Oct-03	285			02-Apr-02	414
02-Apr-02	257					11-Jul-02	364
11-Jul-02	241					07-Oct-02	306
07-Oct-02	261					09-Apr-03	352
09-Apr-03	488					09-Jul-03	439
07-Oct-03	311					07-Oct-03	903

Computational Summary

Loc 92-08

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.06
R Square	0.00
Adjusted R Square	-0.10
Standard Error	88.44
Observations	12.00

Loc 92-08

RESIDUAL OUTPUT

Observation	*Predicted Y*	*Residuals*	*% difference*
1	324.09	142.91	44.10
2	322.89	14.11	4.37
3	321.57	-94.57	-29.41
4	320.32	-44.32	-13.84
5	319.20	43.80	13.72
6	318.30	-2.30	-0.72
7	317.03	-36.03	-11.36
8	315.90	-23.90	-7.57
9	313.77	-56.77	-18.09
10	312.50	-71.50	-22.88
11	311.38	-50.38	-16.18
12	309.05	178.95	57.91
		max % diff	**57.91**
		min % diff	**-29.41**

Loc 92-09

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.35
R Square	0.13
Adjusted R Square	-0.05
Standard Error	20.01
Observations	7.00

Loc 92-09

RESIDUAL OUTPUT

Observation	*Predicted Y*	*Residuals*	*% difference*
1	268.95	2.05	0.76
2	272.55	10.45	3.84
3	275.42	5.58	2.03
4	278.78	-13.78	-4.94
5	281.79	-9.79	-3.48
6	285.14	-25.14	-8.82
7	288.37	30.63	10.62
		max % diff	**10.62**
		min % diff	**-8.82**

Loc P92-02

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.98
R Square	0.96
Adjusted R Square	0.96
Standard Error	1.37
Observations	7.00

Loc P92-02

RESIDUAL OUTPUT

Observation	*Predicted Y*	*Residuals*	*% difference*
1	65.27	0.63	0.97
2	61.92	0.18	0.29
3	59.25	-0.75	-1.26
4	56.10	-1.80	-3.20
5	53.31	0.89	1.67
6	50.17	1.83	3.64
7	47.19	-0.99	-2.09
		max % diff	**3.64**
		min % diff	**-3.20**

Loc P92-06

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.86
R Square	0.74
Adjusted R Square	0.71
Standard Error	123.71
Observations	12.00

Loc P92-06

RESIDUAL OUTPUT

Observation	*Predicted Y*	*Residuals*	*% difference*
1	851.11	228.89	26.89
2	807.99	87.01	10.77
3	759.24	-62.24	-8.20
4	712.83	-166.83	-23.40
5	638.30	-88.30	-13.83
6	591.43	12.57	2.13
7	549.71	-57.71	-10.50
8	470.96	-56.96	-12.09
9	424.09	-60.09	-14.17
10	382.84	-76.84	-20.07
11	296.59	55.41	18.68
12	253.93	185.07	72.88
		max % diff	**72.88**
		min % diff	**-23.40**

Table J−7. Uranium Concentration Variation: Background Locations

Well 92-01			
SUMMARY OUTPUT			
Regression Statistics			
Multiple R	0.105522584		
R Square	0.011135016		
Adjusted R Square	-0.153675815		
Standard Error	0.69475875		
Observations	8		
RESIDUAL OUTPUT			
Observation	*Predicted Y*	*Residuals*	*% difference*
1	5.595656162	0.204343838	3.651829782
2	5.569847159	-0.669847159	-12.02631131
3	5.559835046	0.640164954	11.51409977
4	5.540033311	-0.940033311	-16.96800828
5	5.518229154	0.781770846	14.1670602
6	5.47640077	-0.17640077	-3.221107755
7	5.441914602	0.558085398	10.2553134
8	5.398083796	-0.398083796	-7.374539024

MW00-01			
SUMMARY OUTPUT			
Regression Statistics			
Multiple R	0.124976429		
R Square	0.015619108		
Adjusted R Square	-0.107428504		
Standard Error	1.15283878		
Observations	10		
RESIDUAL OUTPUT			
Observation	*Predicted Y*	*Residuals*	*% difference*
1	5.236685903	-0.636685903	-12.15818391
2	5.26978024	-1.06978024	-20.30028182
3	5.326975889	2.573024111	48.30177882
4	5.360429947	0.139570053	2.603710043
5	5.392445121	0.007554879	0.140101168
6	5.456115749	0.243884251	4.469924436
7	5.490648971	-1.390648971	-25.32758838
8	5.523383587	-0.023383587	-0.423356202
9	5.58885282	-0.38885282	-6.957650028
10	5.654681774	0.545318226	9.643658975

Well 92-03			
SUMMARY OUTPUT			
Regression Statistics			
Multiple R	0.819116647		
R Square	0.670952082		
Adjusted R Square	0.506428123		
Standard Error	0.717607129		
Observations	4		
RESIDUAL OUTPUT			
Observation	*Predicted Y*	*Residuals*	*% difference*
1	4.381528144	0.418471856	9.550819758
2	3.634633285	-0.834633285	-22.96334236
3	2.902719124	0.397280876	13.68650768
4	2.481119447	0.018880553	0.76096913

MW00-02			
SUMMARY OUTPUT			
Regression Statistics			
Multiple R	0.259558486		
R Square	0.067370608		
Adjusted R Square	-0.065862163		
Standard Error	1.568932583		
Observations	9		
RESIDUAL OUTPUT			
Observation	*Predicted Y*	*Residuals*	*% difference*
1	7.037214156	-1.537214156	-21.84407241
2	6.928409028	3.071590972	44.33327997
3	6.738298969	-0.338298969	-5.020539617
4	6.625906859	-1.525906859	-23.029404
5	6.517101731	-0.017101731	-0.262413139
6	6.309056761	0.290943239	4.611517215
7	6.193077669	-1.193077669	-19.26469734
8	6.08307688	1.21692312	20.00505901
9	5.867857946	0.032142054	0.547764693

Well 92-05			
SUMMARY OUTPUT			
Regression Statistics			
Multiple R	0.153477295		
R Square	0.02355528		
Adjusted R Square	-0.074089192		
Standard Error	0.915663985		
Observations	12		

RESIDUAL OUTPUT			
Observation	*Predicted Y*	*Residuals*	*% difference*
1	4.857432909	-1.757432909	-36.18028169
2	4.868343225	0.431656775	8.866605235
3	4.889709259	0.810290741	16.57134807
4	4.907438522	0.892561478	18.1879299
5	4.9296001	-1.0296001	-20.88607755
6	5.032907149	1.067092851	21.20231547
7	5.073479885	0.126520115	2.493754154
8	5.115871006	0.184128994	3.599171945
9	5.159398619	0.740601381	14.35441291
10	5.177923425	-0.277923425	-5.367468813
11	5.189288337	-0.789288337	-15.20995338
12	5.198607565	-0.398607565	-7.667583285

Table J−8. Uranium Concentration Variation: Background Locations

Observations					
Date Sampled	**Loc 92-01**	**Loc 92-03**	**Loc 92-05**	**Loc MW00-01**	**Loc MW00-02**
	Uranium (mg/L)	**Uranium (mg/L)**	**Uranium (mg/L)**	**Uranium (mg/L)**	**Uranium (mg/L)**
11/12/1992	0.0058	0.0048			
03/08/1993	0.0049				
04/22/1993	0.0062				
07/20/1993	0.0046				
07/22/1993			0.0031		
10/26/1993	0.0063		0.0053		
10/27/1993		0.0028			
05/02/1994	0.0053		0.0057		
10/04/1994	0.006	0.0033			
10/05/1994			0.0058		
04/18/1995			0.0039		
04/19/1995	0.005	0.0025			
04/08/1996					
07/23/1996					
10/13/1997			0.0061		
10/14/1997					
04/21/1998					
10/05/1998			0.0052		
10/06/1998					
04/13/1999					
10/13/1999			0.0053		
10/25/1999					
04/10/2000					
08/01/2000				0.0046	
08/02/2000					0.0055
10/30/2000			0.0059		
11/01/2000				0.0042	0.01
04/09/2001				0.0079	0.0064
04/10/2001					
04/11/2001			0.0049		
07/11/2001				0.0055	
07/12/2001					0.0051
07/20/2001			0.0044		
10/08/2001				0.0054	
10/10/2001			0.0048		
10/11/2001					0.0065
10/17/2001					
04/03/2002				0.0057	0.0066
07/08/2002				0.0041	
07/09/2002					0.005
10/07/2002				0.0055	
10/08/2002					
10/09/2002					0.0073
04/07/2003				0.0052	0.0059
10/07/2003				0.0062	

Table J−9. Model-Predicted Uranium Concentrations at Selected Region 1 Wells

Model Time Day	Model Time Yr	Normalized Time Calendar	T01-07 U (µg/L)	T01-12 U (µg/L)	T01-19 U (µg/L)	T01-35 U (µg/L)	Mean U Predicted U (µg/L)
0	0.0	15-Oct-02	179.1	136.1	104.0	116.7	134.0
365	1.0	15-Oct-03	44.2	6.8	9.7	63.3	31.0
730	2.0	14-Oct-04	11.7	0.9	1.6	17.7	8.0
1067	2.9	16-Sep-05	7.1	0.8	1.3	10.1	4.8
1436	3.9	19-Sep-06	4.9	0.8	1.3	8.0	3.7
1825	5.0	14-Oct-07	4.9	0.8	1.2	7.5	3.6
2173	6.0	26-Sep-08	5.1	0.8	1.3	7.4	3.7
2264	6.2	26-Dec-08	4.9	0.8	1.4	7.8	3.7
2542	7.0	29-Sep-09	4.8	0.8	1.3	7.7	3.7
2911	8.0	03-Oct-10	4.7	0.8	1.3	7.5	3.6
3279	9.0	07-Oct-11	4.8	0.8	1.3	7.8	3.7
3650	10.0	12-Oct-12	4.9	0.8	1.3	7.5	3.6
4015	11.0	12-Oct-13	4.6	0.8	1.3	7.8	3.6
4384	12.0	15-Oct-14	4.8	0.8	1.3	7.9	3.7
4752	13.0	19-Oct-15	4.7	0.8	1.3	7.4	3.6
5121	14.0	22-Oct-16	5.0	0.8	1.3	7.7	3.7
5475	15.0	11-Oct-17	4.9	0.8	1.3	7.7	3.7
5490	15.0	25-Oct-17	4.5	0.8	1.3	7.7	3.6
5859	16.1	29-Oct-18	5.0	0.8	1.3	7.7	3.7
6227	17.1	02-Nov-19	4.8	0.8	1.4	7.9	3.7
6596	18.1	04-Nov-20	4.9	0.8	1.3	7.6	3.6
6965	19.1	08-Nov-21	4.7	0.8	1.3	7.9	3.7
7300	20.0	10-Oct-22	4.7	0.8	1.3	7.6	3.6
7611	20.9	17-Aug-23	4.6	0.8	1.3	7.5	3.5
7980	21.9	19-Aug-24	4.9	0.8	1.3	7.5	3.6
8439	23.1	22-Nov-25	4.8	0.8	1.3	7.8	3.7
8808	24.1	26-Nov-26	4.8	0.8	1.3	7.6	3.6
9125	25.0	09-Oct-27	5.0	0.8	1.2	7.5	3.6
9544	26.1	30-Nov-28	4.9	0.8	1.3	7.6	3.6
9821	26.9	04-Sep-29	4.8	0.8	1.3	7.8	3.7
10191	27.9	09-Sep-30	4.7	0.8	1.3	7.9	3.7
10562	28.9	15-Sep-31	4.8	0.8	1.3	7.5	3.6
10654	29.2	16-Dec-31	4.8	0.8	1.2	7.6	3.6
10747	29.4	18-Mar-32	4.6	0.8	1.2	7.9	3.6
10950	30.0	07-Oct-32	4.7	0.8	1.3	7.8	3.7
11302	31.0	24-Sep-33	4.7	0.8	1.3	7.8	3.6
11672	32.0	29-Sep-34	5.0	0.8	1.2	7.6	3.7
12042	33.0	04-Oct-35	5.1	0.8	1.2	8.0	3.8
12413	34.0	09-Oct-36	4.8	0.8	1.3	8.0	3.7
12782	35.0	13-Oct-37	4.8	0.8	1.3	8.0	3.7
13153	36.0	19-Oct-38	5.1	0.8	1.3	7.8	3.8
13523	37.0	24-Oct-39	5.0	0.8	1.2	7.8	3.7
13893	38.1	28-Oct-40	4.8	0.8	1.3	7.9	3.7
14262	39.1	01-Nov-41	4.6	0.8	1.4	7.8	3.6

Table J−9 (continued). Model-Predicted Uranium Concentrations at Selected Region 1 Wells

Model Time Day	Model Time Yr	Normalized Time Calendar	T01-07 U (µg/L)	T01-12 U (µg/L)	T01-19 U (µg/L)	T01-35 U (µg/L)	Mean U Predicted U (µg/L)
14600	40.0	05-Oct-42	4.8	0.8	1.3	8.0	3.7
14997	41.1	06-Nov-43	5.0	0.8	1.2	8.0	3.8
15330	42.0	04-Oct-44	4.9	0.8	1.2	7.9	3.7
15695	43.0	04-Oct-45	5.0	0.8	1.3	7.8	3.7
16060	44.0	04-Oct-46	4.9	0.8	1.3	7.8	3.7
16425	45.0	04-Oct-47	4.9	0.8	1.4	7.7	3.7
16836	46.1	18-Nov-48	4.8	0.8	1.3	7.9	3.7
17206	47.1	23-Nov-49	5.1	0.8	1.3	7.9	3.8
17573	48.1	25-Nov-50	4.7	0.8	1.3	7.9	3.7
17851	48.9	30-Aug-51	4.7	0.8	1.3	7.7	3.6
18250	50.0	02-Oct-52	5.0	0.8	1.3	7.6	3.7

Table J−10. Model-Predicted Uranium Concentrations at Selected Region 2 Wells

Model Time Day	Model Time Yr	Normalized Time Calendar	T01-01 U (µg/L)	T01-02 U (µg/L)	T01-04 U (µg/L)	T01-05 U (µg/L)	Mean U Predicted U (µg/L)
0	0.0	15-Oct-02	209.8	274.6	223.2	178.0	221.4
365	1.0	15-Oct-03	201.2	203.7	204.4	160.9	192.6
730	2.0	14-Oct-04	185.3	186.2	187.7	93.5	163.2
1067	2.9	16-Sep-05	157.6	159.1	162.6	45.0	131.1
1436	3.9	19-Sep-06	104.0	109.1	120.0	18.8	88.0
1825	5.0	14-Oct-07	60.4	63.5	73.4	9.1	51.6
2173	6.0	26-Sep-08	35.4	37.9	44.3	6.4	31.0
2264	6.2	26-Dec-08	33.5	35.7	38.7	5.9	28.5
2542	7.0	29-Sep-09	21.0	22.1	25.7	5.5	18.6
2911	8.0	03-Oct-10	16.3	16.7	17.8	5.1	14.0
3279	9.0	07-Oct-11	14.1	14.3	13.3	4.7	11.6
3650	10.0	12-Oct-12	13.0	13.1	11.8	4.8	10.7
4015	11.0	12-Oct-13	12.0	12.1	10.8	4.7	9.9
4384	12.0	15-Oct-14	11.8	11.8	10.4	4.7	9.7
4752	13.0	19-Oct-15	11.4	11.4	10.2	4.7	9.4
5121	14.0	22-Oct-16	11.4	11.3	10.3	4.5	9.4
5475	15.0	11-Oct-17	11.4	11.3	10.3	4.9	9.5
5490	15.0	25-Oct-17	11.4	11.3	10.2	4.8	9.4
5859	16.1	29-Oct-18	11.4	11.3	10.2	4.7	9.4
6227	17.1	02-Nov-19	11.4	11.3	10.2	4.7	9.4
6596	18.1	04-Nov-20	11.4	11.3	10.2	4.5	9.3
6965	19.1	08-Nov-21	11.4	11.3	10.2	4.7	9.4
7300	20.0	10-Oct-22	11.4	11.3	10.3	5.0	9.5
7611	20.9	17-Aug-23	11.4	11.3	10.2	4.8	9.4
7980	21.9	19-Aug-24	11.4	11.3	10.4	4.8	9.5
8439	23.1	22-Nov-25	11.4	11.3	10.2	4.6	9.4
8808	24.1	26-Nov-26	11.4	11.3	10.2	4.9	9.4
9125	25.0	09-Oct-27	11.4	11.3	10.2	4.8	9.4
9544	26.1	30-Nov-28	11.4	11.3	10.3	4.7	9.4
9821	26.9	04-Sep-29	11.4	11.3	10.3	4.8	9.4
10191	27.9	09-Sep-30	11.4	11.3	10.3	4.8	9.4
10562	28.9	15-Sep-31	11.4	11.3	10.2	4.8	9.4
10654	29.2	16-Dec-31	11.4	11.3	10.4	4.9	9.5
10747	29.4	18-Mar-32	11.4	11.3	10.3	4.9	9.5
10950	30.0	07-Oct-32	11.4	11.3	10.2	4.7	9.4
11302	31.0	24-Sep-33	11.4	11.3	10.2	4.9	9.4
11672	32.0	29-Sep-34	11.4	11.3	10.3	4.7	9.4
12042	33.0	04-Oct-35	11.4	11.3	10.1	4.4	9.3
12413	34.0	09-Oct-36	11.4	11.3	10.3	4.8	9.5
12782	35.0	13-Oct-37	11.4	11.3	10.2	5.0	9.5
13153	36.0	19-Oct-38	11.4	11.3	10.1	4.8	9.4
13523	37.0	24-Oct-39	11.4	11.3	10.4	4.7	9.4
13893	38.1	28-Oct-40	11.4	11.3	10.3	4.7	9.4
14262	39.1	01-Nov-41	11.4	11.3	10.5	4.9	9.5

Table J−10 (continued). Model-Predicted Uranium Concentrations at Selected Region 2 Wells

Model Time Day	Model Time Yr	Normalized Time Calendar	T01-01 U (µg/L)	T01-02 U (µg/L)	T01-04 U (µg/L)	T01-05 U (µg/L)	Mean U Predicted U (µg/L)
14600	40.0	05-Oct-42	11.4	11.3	10.4	4.6	9.4
14997	41.1	06-Nov-43	11.4	11.3	10.6	4.9	9.5
15330	42.0	04-Oct-44	11.4	11.3	10.4	4.4	9.4
15695	43.0	04-Oct-45	11.4	11.3	10.3	4.9	9.5
16060	44.0	04-Oct-46	11.4	11.3	10.3	4.6	9.4
16425	45.0	04-Oct-47	11.4	11.3	10.3	5.0	9.5
16836	46.1	18-Nov-48	11.4	11.3	10.4	4.7	9.5
17206	47.1	23-Nov-49	11.4	11.3	10.4	4.6	9.4
17573	48.1	25-Nov-50	11.4	11.3	10.3	4.8	9.5
17851	48.9	30-Aug-51	11.4	11.3	10.2	4.8	9.4
18250	50.0	02-Oct-52	11.4	11.3	10.4	4.9	9.5

Table J−11. Model-Predicted Uranium Concentrations at Selected Region 3 Wells

Model Time Day	Model Time Yr	Normalized Time Calendar	92-07 U (µg/L)	88-85 U (µg/L)	92-11 U (µg/L)	PW-17 U (µg/L)	PW-28 U (µg/L)	Mean U Predicted U (µg/L)
0	0.0	15-Oct-02	799.5	365.6	288.0	793.6	273.2	504
365	1.0	15-Oct-03	711.1	387.7	221.8	696.3	274.4	458
730	2.0	14-Oct-04	585.7	320.7	191.9	535.6	251.9	377
1067	2.9	16-Sep-05	506.2	270.8	175.4	470.7	221.0	329
1436	3.9	19-Sep-06	440.2	230.7	151.7	373.1	192.7	278
1825	5.0	14-Oct-07	368.8	196.9	103.0	268.5	173.9	222
2173	6.0	26-Sep-08	295.3	172.3	63.1	208.3	148.8	178
2264	6.2	26-Dec-08	275.2	165.4	58.0	195.6	142.0	167
2542	7.0	29-Sep-09	237.9	138.7	37.1	169.4	113.7	139
2911	8.0	03-Oct-10	183.4	98.2	22.6	127.9	75.3	101
3279	9.0	07-Oct-11	141.4	61.6	15.2	93.9	46.5	72
3650	10.0	12-Oct-12	98.7	37.9	10.5	65.5	27.6	48
4015	11.0	12-Oct-13	67.4	23.7	8.8	45.7	16.8	32
4384	12.0	15-Oct-14	45.7	16.9	8.6	33.1	12.2	23
4752	13.0	19-Oct-15	30.3	13.7	7.5	25.5	9.8	17
5121	14.0	22-Oct-16	21.6	12.2	7.6	21.2	8.8	14
5475	15.0	11-Oct-17	17.3	11.4	7.2	18.3	8.1	12
5490	15.0	25-Oct-17	17.2	11.3	7.3	18.5	8.1	12
5859	16.1	29-Oct-18	15.0	10.9	7.3	16.7	7.8	12
6227	17.1	02-Nov-19	13.1	10.6	7.3	15.4	7.7	11
6596	18.1	04-Nov-20	12.1	10.6	7.1	14.5	7.6	10
6965	19.1	08-Nov-21	11.5	10.6	7.2	13.7	7.7	10
7300	20.0	10-Oct-22	11.3	10.5	7.4	13.7	7.5	10
7611	20.9	17-Aug-23	11.1	10.5	7.2	13.2	7.6	10
7980	21.9	19-Aug-24	11.0	10.5	7.2	12.8	7.7	10
8439	23.1	22-Nov-25	10.9	10.5	7.3	12.6	7.7	10
8808	24.1	26-Nov-26	10.9	10.5	7.0	12.5	7.7	10
9125	25.0	09-Oct-27	10.9	10.5	7.1	12.1	7.6	10
9544	26.1	30-Nov-28	10.9	10.5	7.4	12.1	7.6	10
9821	26.9	04-Sep-29	10.9	10.5	7.4	12.0	7.6	10
10191	27.9	09-Sep-30	10.8	10.5	7.1	11.8	7.6	10
10562	28.9	15-Sep-31	10.8	10.5	7.3	11.9	7.6	10
10654	29.2	16-Dec-31	10.8	10.5	7.4	11.9	7.7	10
10747	29.4	18-Mar-32	10.8	10.5	7.6	11.9	7.7	10
10950	30.0	07-Oct-32	10.8	10.5	7.3	11.8	7.7	10
11302	31.0	24-Sep-33	10.8	10.5	7.3	11.6	7.7	10
11672	32.0	29-Sep-34	10.8	10.5	7.3	11.4	7.6	10
12042	33.0	04-Oct-35	10.8	10.5	7.4	11.3	7.6	10
12413	34.0	09-Oct-36	10.8	10.5	7.1	11.3	7.7	9
12782	35.0	13-Oct-37	10.8	10.5	7.4	11.3	7.5	9
13153	36.0	19-Oct-38	10.8	10.5	7.3	11.2	7.7	9
13523	37.0	24-Oct-39	10.8	10.5	7.2	11.1	7.7	9
13893	38.1	28-Oct-40	10.8	10.5	7.1	11.1	7.6	9
14262	39.1	01-Nov-41	10.8	10.5	7.3	11.0	7.6	9

Table J−11 (continued). Model-Predicted Uranium Concentrations at Selected Region 3 Wells

Model Time Day	Model Time Yr	Normalized Time Calendar	92-07 U (µg/L)	88-85 U (µg/L)	92-11 U (µg/L)	PW-17 U (µg/L)	PW-28 U (µg/L)	Mean U Predicted U (µg/L)
14600	40.0	05-Oct-42	10.8	10.5	7.3	10.9	7.7	9
14997	41.1	06-Nov-43	10.8	10.5	7.4	10.8	7.7	9
15330	42.0	04-Oct-44	10.8	10.6	7.3	10.8	7.6	9
15695	43.0	04-Oct-45	10.8	10.5	7.5	10.9	7.7	9
16060	44.0	04-Oct-46	10.8	10.5	7.3	10.8	7.6	9
16425	45.0	04-Oct-47	10.8	10.6	7.5	10.7	7.5	9
16836	46.1	18-Nov-48	10.8	10.6	7.4	10.7	7.7	9
17206	47.1	23-Nov-49	10.8	10.5	7.2	10.6	7.7	9
17573	48.1	25-Nov-50	10.8	10.5	7.4	10.6	7.7	9
17851	48.9	30-Aug-51	10.8	10.5	7.3	10.5	7.8	9
18250	50.0	02-Oct-52	10.8	10.5	7.3	10.3	7.9	9

Table J−12. Model-Predicted Uranium Concentrations at Selected Region 4 Wells

Model Time Day	Model Time Yr	Normalized Time Calendar	MW00-07 U (µg/L)	MW00-06 U (µg/L)	R10-M1 U (µg/L)	82-08 U (µg/L)	Mean U Predicted U (µg/L)
0	0.0	15-Oct-02	279.3	374.9	30.3	84.8	192.3
365	1.0	15-Oct-03	341.5	339.8	391.0	89.4	290.4
730	2.0	14-Oct-04	426.4	305.8	380.8	95.8	302.2
1067	2.9	16-Sep-05	519.0	381.6	317.8	125.5	336.0
1436	3.9	19-Sep-06	596.5	411.1	265.3	201.0	368.5
1825	5.0	14-Oct-07	638.2	373.5	218.4	263.3	373.3
2173	6.0	26-Sep-08	608.4	319.4	189.2	267.4	346.1
2264	6.2	26-Dec-08	592.5	300.4	183.0	264.5	335.1
2542	7.0	29-Sep-09	535.0	259.0	160.1	245.5	299.9
2911	8.0	03-Oct-10	452.4	212.3	122.2	216.0	250.7
3279	9.0	07-Oct-11	366.7	170.9	82.6	188.9	202.3
3650	10.0	12-Oct-12	275.5	127.4	51.0	164.0	154.5
4015	11.0	12-Oct-13	211.9	90.3	31.3	135.6	117.3
4384	12.0	15-Oct-14	163.5	61.3	20.8	103.5	87.3
4752	13.0	19-Oct-15	128.2	39.5	15.6	72.0	63.8
5121	14.0	22-Oct-16	97.4	27.8	13.2	46.4	46.2
5475	15.0	11-Oct-17	73.1	20.3	11.9	30.2	33.9
5490	15.0	25-Oct-17	72.2	20.6	11.9	29.3	33.5
5859	16.1	29-Oct-18	53.8	16.0	11.2	19.0	25.0
6227	17.1	02-Nov-19	40.8	14.1	10.9	13.8	19.9
6596	18.1	04-Nov-20	31.8	12.7	10.7	11.0	16.6
6965	19.1	08-Nov-21	26.1	11.9	10.6	9.7	14.6
7300	20.0	10-Oct-22	22.6	11.5	10.6	9.0	13.4
7611	20.9	17-Aug-23	20.0	11.3	10.6	8.6	12.6
7980	21.9	19-Aug-24	17.8	11.1	10.6	8.5	12.0
8439	23.1	22-Nov-25	16.1	11.0	10.6	8.3	11.5
8808	24.1	26-Nov-26	14.9	10.9	10.6	8.3	11.2
9125	25.0	09-Oct-27	14.2	10.9	10.6	8.3	11.0
9544	26.1	30-Nov-28	13.5	10.8	10.6	8.3	10.8
9821	26.9	04-Sep-29	13.2	10.8	10.6	8.3	10.7
10191	27.9	09-Sep-30	12.8	10.8	10.6	8.4	10.6
10562	28.9	15-Sep-31	12.4	10.7	10.6	8.3	10.5
10654	29.2	16-Dec-31	12.4	10.7	10.6	8.3	10.5
10747	29.4	18-Mar-32	12.3	10.7	10.6	8.2	10.5
10950	30.0	07-Oct-32	12.2	10.7	10.6	8.3	10.5
11302	31.0	24-Sep-33	11.9	10.7	10.6	8.3	10.4
11672	32.0	29-Sep-34	11.7	10.7	10.6	8.4	10.4
12042	33.0	04-Oct-35	11.5	10.7	10.6	8.3	10.3
12413	34.0	09-Oct-36	11.4	10.7	10.6	8.3	10.2
12782	35.0	13-Oct-37	11.3	10.7	10.6	8.3	10.2
13153	36.0	19-Oct-38	11.0	10.7	10.6	8.3	10.2
13523	37.0	24-Oct-39	10.8	10.7	10.6	8.2	10.1
13893	38.1	28-Oct-40	10.7	10.7	10.6	8.3	10.1
14262	39.1	01-Nov-41	10.5	10.7	10.6	8.4	10.0

Table J−12 (continued). Model-Predicted Uranium Concentrations at Selected Region 4 Wells

Model Time Day	Model Time Yr	Normalized Time Calendar	MW00-07 U (µg/L)	MW00-06 U (µg/L)	R10-M1 U (µg/L)	82-08 U (µg/L)	Mean U Predicted U (µg/L)
14600	40.0	05-Oct-42	10.5	10.6	10.6	8.3	10.0
14997	41.1	06-Nov-43	10.4	10.6	10.6	8.3	10.0
15330	42.0	04-Oct-44	10.3	10.6	10.6	8.2	9.9
15695	43.0	04-Oct-45	10.2	10.6	10.6	8.2	9.9
16060	44.0	04-Oct-46	10.1	10.6	10.6	8.3	9.9
16425	45.0	04-Oct-47	9.9	10.6	10.6	8.2	9.8
16836	46.1	18-Nov-48	9.8	10.6	10.6	8.3	9.8
17206	47.1	23-Nov-49	9.8	10.6	10.6	8.3	9.8
17573	48.1	25-Nov-50	9.8	10.6	10.6	8.3	9.8
17851	48.9	30-Aug-51	9.7	10.6	10.6	8.3	9.8
18250	50.0	02-Oct-52	9.7	10.6	10.6	8.4	9.8

Table J−13. Model-Predicted Uranium Concentrations at Selected Region 5 Wells

Model Time Day	Model Time Yr	Normalized Time Calendar	P92-06 U (µg/L)	P92-02 U (µg/L)	92-09 U (µg/L)	92-08 U (µg/L)	Mean U Predicted U (µg/L)
0	0.0	15-Oct-02	276.1	52.0	242.7	247.0	204.5
365	1.0	15-Oct-03	216.4	63.1	211.0	202.2	173.2
730	2.0	14-Oct-04	171.1	77.0	181.0	167.6	149.1
1067	2.9	16-Sep-05	140.7	75.9	156.4	173.7	136.7
1436	3.9	19-Sep-06	146.7	79.7	136.6	177.8	135.2
1825	5.0	14-Oct-07	177.1	87.7	124.2	172.0	140.3
2173	6.0	26-Sep-08	198.9	97.7	122.3	165.8	146.2
2264	6.2	26-Dec-08	205.5	99.9	123.4	163.4	148.1
2542	7.0	29-Sep-09	228.7	108.4	130.4	153.5	155.3
2911	8.0	03-Oct-10	268.9	121.2	144.0	156.3	172.6
3279	9.0	07-Oct-11	326.2	134.1	157.6	179.5	199.4
3650	10.0	12-Oct-12	389.7	144.4	168.2	224.4	231.7
4015	11.0	12-Oct-13	450.3	148.9	172.6	258.8	257.6
4384	12.0	15-Oct-14	481.3	145.5	171.2	266.1	266.0
4752	13.0	19-Oct-15	488.5	138.5	169.3	253.4	262.4
5121	14.0	22-Oct-16	462.4	130.9	171.9	226.2	247.8
5475	15.0	11-Oct-17	415.1	125.5	178.3	197.6	229.1
5490	15.0	25-Oct-17	413.1	124.9	178.7	196.5	228.3
5859	16.1	29-Oct-18	353.8	121.8	187.2	166.3	207.3
6227	17.1	02-Nov-19	288.5	118.8	196.6	134.6	184.6
6596	18.1	04-Nov-20	229.0	117.6	210.0	103.7	165.0
6965	19.1	08-Nov-21	180.6	123.8	226.3	75.7	151.6
7300	20.0	10-Oct-22	143.9	134.1	249.3	54.2	145.4
7611	20.9	17-Aug-23	116.3	150.8	270.8	38.8	144.2
7980	21.9	19-Aug-24	88.3	170.9	291.3	26.5	144.3
8439	23.1	22-Nov-25	62.2	188.3	299.0	17.4	141.7
8808	24.1	26-Nov-26	46.3	192.4	291.1	13.5	135.8
9125	25.0	09-Oct-27	37.0	189.2	271.7	11.6	127.4
9544	26.1	30-Nov-28	28.4	175.8	236.3	10.1	112.7
9821	26.9	04-Sep-29	23.9	161.3	208.7	9.7	100.9
10191	27.9	09-Sep-30	20.1	140.0	174.6	9.3	86.0
10562	28.9	15-Sep-31	17.5	116.0	139.7	9.1	70.6
10654	29.2	16-Dec-31	17.0	111.9	130.9	9.0	67.2
10747	29.4	18-Mar-32	16.4	103.7	123.2	9.0	63.1
10950	30.0	07-Oct-32	15.5	91.4	106.2	9.0	55.5
11302	31.0	24-Sep-33	14.2	73.0	80.8	8.9	44.2
11672	32.0	29-Sep-34	13.1	54.4	59.4	9.0	34.0
12042	33.0	04-Oct-35	12.4	39.3	42.8	8.9	25.8
12413	34.0	09-Oct-36	11.8	27.3	31.0	8.9	19.8
12782	35.0	13-Oct-37	11.4	19.9	23.0	8.9	15.8
13153	36.0	19-Oct-38	11.0	14.8	17.7	8.9	13.1
13523	37.0	24-Oct-39	10.8	11.2	14.5	8.9	11.3
13893	38.1	28-Oct-40	10.5	9.3	12.4	8.9	10.3
14262	39.1	01-Nov-41	10.3	8.2	11.1	8.9	9.6
14600	40.0	05-Oct-42	10.2	7.6	10.4	8.9	9.3

Table J−13 (continued). Model-Predicted Uranium Concentrations at Selected Region 5 Wells

Model Time Day	Model Time Yr	Normalized Time Calendar	P92-06 U (µg/L)	P92-02 U (µg/L)	92-09 U (µg/L)	92-08 U (µg/L)	Mean U Predicted U (µg/L)
14997	41.1	06-Nov-43	10.0	7.2	9.8	8.9	9.0
15330	42.0	04-Oct-44	9.9	7.0	9.6	8.9	8.8
15695	43.0	04-Oct-45	9.7	6.9	9.3	8.9	8.7
16060	44.0	04-Oct-46	9.6	6.8	9.2	8.9	8.6
16425	45.0	04-Oct-47	9.4	6.8	9.1	8.9	8.5
16836	46.1	18-Nov-48	9.3	6.8	8.9	8.9	8.5
17206	47.1	23-Nov-49	9.2	6.8	8.9	8.8	8.4
17573	48.1	25-Nov-50	9.1	6.8	8.8	8.9	8.4
17851	48.9	30-Aug-51	9.1	6.7	8.8	8.8	8.4
18250	50.0	02-Oct-52	9.0	6.7	8.8	8.8	8.3

End of current text