Energy Laboratories Inc
Workorder Receipt Checklist

UR Energy USA Inc

C09050746

Login completed by: Kimberly Humiston

Reviewed by:

Reviewed Date:

Date and Time Received: 5/22/2009 8:35 AM

Received by: al

Carrier name: Hand Del

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature:	5°C		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Contact and Corrective Action Comments:

Per phone conversation with John Cash 5-22-09 14:30, disregard the sample ID's on the sample container labelS. Follow the numerical number on the lid and correspond with the number and ID listed on the Chain of Custody.Samples for dissolved metals were subsampled, filtered and preserved with 1/2 mL HNO_3 in lab upon receipt to pH <2. Total metals samples were preserved with 1/2 mL HNO_3 upon receipt to pH <2 in the laboratory. In accordance with the Clean Water Act, these samples must be held for 24 hours prior to analysis. Nitrate+Nitrite samples were preserved with 1/2 mL H_2SO_4 to pH <2.

Page 7 of 8

Table MU1 4-1a Monitor and Observation Wells

Monitor Ring (M) Wells & Trend Well (TW) [1]		Overlying Aquifer Monitor (MO) Wells	Underlying Aquifer Monitor (MU) Wells & Observation Well (OW)	Production Zone Monitor (MP) Wells
M-101	M-116	MO-101	MU-101	MP-101
M-102	M-117	MO-102	MU-102	MP-102
M-103	M-118	MO-103	MU-103	MP-103
M-104	M-119	MO-104	MU-104	MP-104
M-105	M-120A [2]	MO-105	MU-105	MP-105
M-106	M-121	MO-106	MU-106	MP-106
M-107	M-122	MO-107	MU-107	MP-107
M-108	M-123	MO-108	KPW-2 [4]	MP-108
M-109	M-124	MO-109	MU-109	MP-109
M-110	M-125	MO-110	MU-110	MP-110
M-111	M-126	MO-111	MU-111	MP-111
M-112	M-127	MO-112	MU-112	MP-112
M-113	M-128	MO-113	MU-113	MP-113
M-114	TW1-1	MO-114 [3]	OW1-1	---
M-115	---	---	---	---

1 Detailed monitor well information (e.g., well depths, screened intervals) provided in Attachment MU1 2-1.

2 Well M-120 failed the MIT, was properly abandoned and was replaced with well M-120A.

3 Well MO-114 was added to this list to ensure adequate monitoring near the Lost Creek Fault and associated splinter fault.

4 Well MU-108 failed the MIT, was properly abandoned and replaced with well KPW-2, which was originally used as a pump test well within the same horizon as and 17 feet from well MU-108.

	Area		Line	
ZONE A	85800		435	460
	39039		54	
	17265		145	
	26266		170	
	9106		425	
	177,476	(4.1 Acres)	175	
			597	
			168	
			2,629 ft ✓	

	Area		Line		
zone 3	288 808		169		
	19214		62		
	452 663		165		
	399 206		448		
	18 220		129		
	1,178,111	(27.0 Acres)	973 ft		
Zone 2	58335		182	92	742
	147 325	(4.7 Acres)	172	821	
	205,660		735	320	
			178	1015	
			3,262 ✓		
Zone 1	47722		185	173	
	84685		305	292	
	29357	(3.7 Acres)	162	163	
	161 764		245		
		39.5 Acres	1525 ✓		

9.6 Acres

37 PM 1-13-1 13 wells

ML020?0040

William Paul Goranson, P.E.
Manager, Radiation Safety
Regulatory Compliance and Licensing

Rio Algom

Rio Algom Mining Corp.
6305 Waterford Boulevard
Suite 325, Oklahoma City
Oklahoma 73118

405.858.4807 tel
405.810.2860 fax

October 22, 2001

CERTIFIED MAIL 7000 1670 0013 4034 8431
RETURN RECIEPT REQUESTED

Melvyn Leach
Chief, Fuel Cycle Licensing Branch
Division of Fuel Cycle Safety and Safeguards
U.S. Nuclear Regulatory Commission
Mail Stop T-8A33
Washington, DC 20555

Subject: **Re: Amendment 1 to Source Material License SUA-1548**
Flare Factor Estimate Change and Justification
License No: SUA-1548 Docket No: 40-8964
Smith Ranch Facility

Dear Mr. Leach:

In response to Amendment 1 to Source Material License SUA-1548, dated September 27, 2001, Rio Algom Mining Corp. is submitting changes to the license application dated November 15, 1999, as amended. These changes include amended language in Sections 6.2.7 and 6.2.8 as well as changes in Appendix 7 for Chapter 6 of Volume I of the License Application. These changes reflect the methodology used by RAMC to estimate the flare factor of its wellfields for the development of the reclamation bond amount. As justification for the flare factor estimate methodology, RAMC has also attached the groundwater modeling report performed by a groundwater consultant. This report will be amended to the license application as Appendix K in Volume V.

The methodology for estimating flare factor, as well as the modeling report, has been reviewed and approved by Wyoming DEQ - Land Quality Division for purposes of bonding. If you have any questions, please call me at (405) 858-4807.

Sincerely,

William Paul Goranson, P.E.
Manager, Radiation Safety, Regulatory
Compliance and Licensing

Enclosures

CC: John Lusher, NRC
Marvin Freeman, RAMC (w/o attachment)
Bill Ferdinand, RAMC
John Cash, RAMC
John McCarthy, RAMC

NMSS01 public

Rec'd 01/18/02

(NRC & WDEQ/LQD Related Activity)

SECTION 7

GROUNDWATER RESTORATION COSTS

Cost Summary

ITEM	COSTS ($97)
7.1 Groundwater Restoration	$3,605,272
Total Cost	$3,605,272

7.1 Groundwater Restoration Costs

Basis: Table 7.1, Table 7.2 & Table 7.3, 7.4, 7.5 and 7.6 - Groundwater Restoration Basis

Table 7.1
Affected Pore Volume Estimate

Wellfield	Number of Perimeter Injection Wells	Measured Pattern Area (ft^2)	Perimeter Inj Wells per Unit Area	Number of Patterns	Average Open Interval (ft)	Effective Porosity	Flare Factor from Fig 7-1	Pattern Affected Pore Volume (gal/ pattern)	Wellfield Affected Pore Volume (gallons)
1	170	1115229	1.52E-004	116	18	0.27	1.7	594,146	68,920,890
3	147	1622462	9.06E-005	162	20	0.27	1.5	606,801	98,301,728
3 ext	97	782800	1.24E-004	76	14	0.27	1.5	436,839	33,199,800
4	163	1334798	1.22E-004	128	18	0.27	1.5	568,636	72,785,467
4A	142	1050576	1.35E-004	101	18	0.27	1.5	567,199	57,287,069

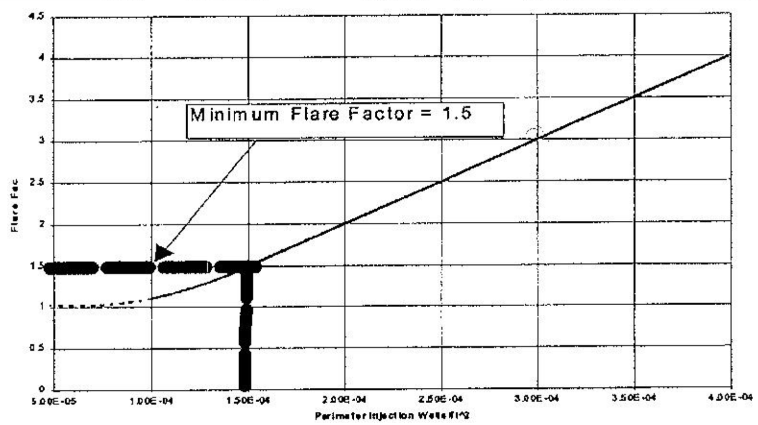


Figure 7-1. Predicted wellfield flare factor for RAMC commercial wellfields, as a function of wellfield scale

Methodology for Flare Factor Determination

Figure 7-1 is derived from Figure 3-16 in *"Evaluation and Simulation of Wellfield Restoration at the RAMC Smith Ranch Facility"* dated October 29, 1999 (provided as Appendix K of this application). This document was submitted to the Wyoming DEQ - Land Quality Division with a letter dated December 13, 1999 for review. In that document, RAMC proposes a methodology developed through hydraulic and geochemical modeling that uses the geometry of the wellfield to estimate a Flare Factor. In this case, the number of perimeter injection wells are counted, the surface area of the wellfield pattern is measured using a wellfield map, a ratio is developed of the # of perimeter injection wells to the surface area of the wellfield patterns. That ratio is located on the horizontal axis of figure 7-1 (above). From that intercept, a vertical line is projected to intersect the curve. At that intersection, a horizontal line is projected to intercept the vertical axis. The estimated flare factor is derived from that intercept.

On May 11, 2000, RAMC met with LQD to discuss the review of the document and RAMC's proposed

3.2.2.2 Net Production Rate

Another parameter found to have a significant impact on horizontal flare factor is the net pattern production rate. The net production rate is similar to the bleed rate, but provides more information concerning the magnitude of injection and extraction. For example, a 100 gpm pattern would have a larger flare factor than an equivalent 10 gpm pattern, although both may have an identical bleed rate. The net production rate incorporates both the bleed rate and the magnitude of pattern production in a single parameter.

A sensitivity analysis of net production rate (on a per well basis) was conducted by simulating two cases: 1) a 0.08 gpm/well net production rate, and 2) a 0.125 gpm/well net production rate. Results of this analysis are provided on Figure 3-8. Modeled particle distributions are provided in Attachment B.

As expected, results of this analysis demonstrate that the horizontal flare factor decreases significantly as the net production rate decreases. RAMC's commercial wellfields possess very low net production rates (less than 0.08 gpm/well). Alternatively, the Q-sand pilot wellfield possessed a much larger net production rate (greater than 1.2 gpm/well). This result suggests that care must be taken to ensure that modeled "ideal" test patterns possess equivalent net production rates as the commercial wellfields they are intended to simulate.

3.2.2.3 Aquifer Transmissivity (Thickness Variation)

Transmissivity variations were found to have a modest impact on horizontal flare factor. Transmissivity variations in the Q-sand and Wellfield 1 are not substantial; transmissivity typically varies from 500 to 1500 gpd/ft across the large majority of the wellfield, with an average of approximately 1000 gpd/ft. Variations in transmissivity are due almost entirely to changes in aquifer thickness.

A sensitivity analysis of aquifer transmissivity was conducted by simulating two cases: 1) transmissivity of 1500 gpd/ft (+50%), and 2) transmissivity of 500 gpd/ft (-50%). Transmissivity was assumed to vary due to changes in aquifer thickness (hydraulic conductivity was held constant). Modeled particle distributions are provided in Attachment B.

Results of this analysis indicate that a 50 % increase in transmissivity (thickness) results in a 30 % decrease in horizontal flare. Likewise, a 50 % decrease in transmissivity results in only a 5 % increase in pattern flare. These results suggest that wellfield flare factors are not particularly sensitive to aquifer transmissivity variation relative to other parameters tested.

3.2.2.4 Kh/Kv Ratio

The ratio of horizontal to vertical hydraulic conductivity (Kh/Kv) was shown to have a significant impact on both horizontal and vertical flare factors. Although the impact of the

Kh/Kv ratio on the vertical flare could be predicted, the impact on the horizontal flare was somewhat surprising.

The sensitivity analysis of the Kh/Kv ratio required that three-dimensional modeling techniques be employed. MODFLOW (McDonald and Harbaugh, 1988) and MODPATH (Pollock, 1989) were utilized for this purpose. This analysis was conducted as part of the Wellfield 1 flow model simulation described in Section 3.2.3 and Attachment C.

A sensitivity analysis of the Kh/Kv ratio was conducted by simulating three cases: 1) Kh/Kv = 1.0, 2) Kh/Kv = 10, and 3) Kh/Kv = 100. Results of this analysis are presented on Figure 3.9. MODPATH particle traces for these simulations are provided in Attachment C.

Results of this analysis indicate that horizontal and vertical flare factors decrease significantly as the Kh/Kv ratio decreases. Using a Kh/Kv ratio of 100:1, there is essentially no vertical flare and a minimal horizontal flare of 1.7. As discussed in Section 3.2.3 of this report, a Kh/Kv ratio of 100:1 is believed to be representative for RAMC's commercial wellfield(s).

It should be noted that the total simulation time assumed in the sensitivity analyses (and wellfield simulations) does not appear to have a substantial impact on wellfield flare factors. After only months of operation, the wellfields appear to have reached a pseudo- steady state condition with respect to mine fluid expansion and the radius of influence of production/injection wells (assuming flow rates remain constant). This observation suggests that steady-state flow model simulations should provide similar results as those using transient assumptions.

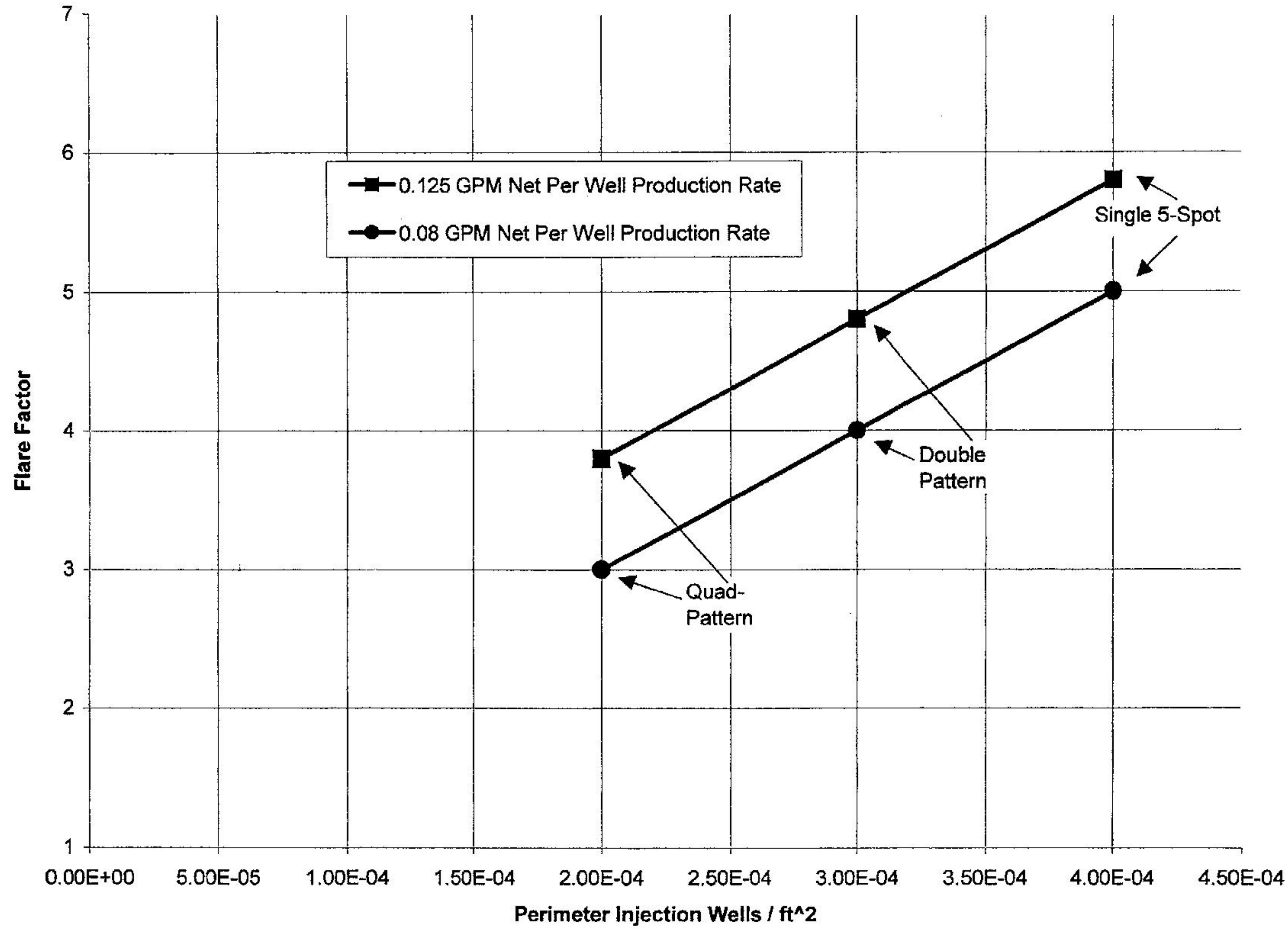
3.2.3 Wellfield Flow Model Simulation and APV Calculation

The affected pore volume of RAMC's commercial Wellfield 1 was computed with the aid of a three-dimensional flow model (MODFLOW) and particle tracking techniques (MODPATH).

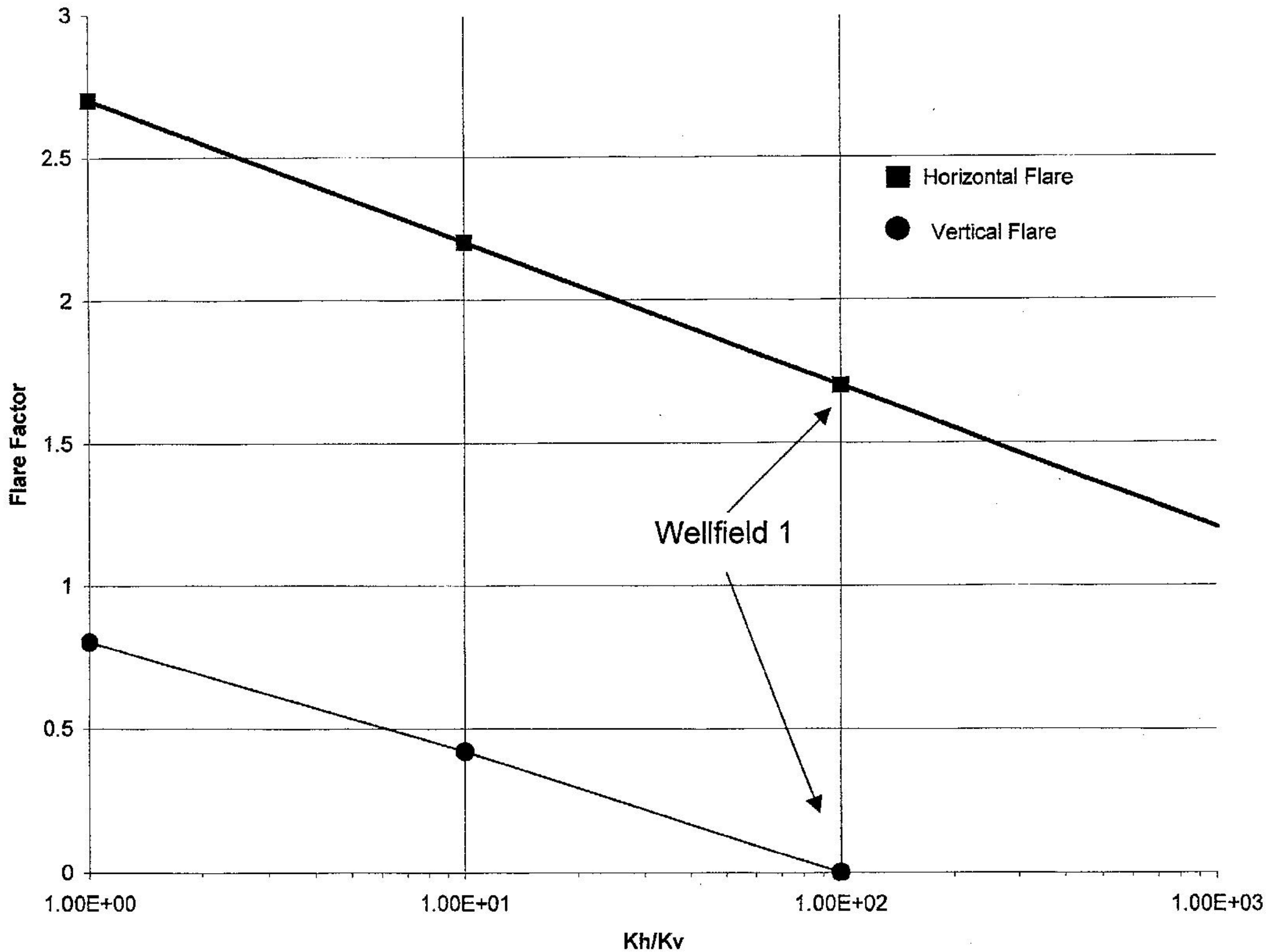
The MODFLOW model of Wellfield 1 consists of 154 Rows, 200 Columns, and 3 layers. Elevation maps of the top and bottom of the Q-sand were digitized and imported directly into the MODFLOW simulator (GW Vistas). The production zone was simulated as a separate (middle) layer, and was assigned a uniform thickness of 18 feet. Boundary conditions for the model were assigned as general heads (not constant heads) at sufficient distances from the wellfield to preclude negative boundary effects from injection/production. The model grid and boundary conditions are provided in Attachment C.

Wellfield operations were simulated using all 112 production wells and 212 injection wells. Based on the most recent production data, the wellfield is currently operating near its maximum historical production rate of 1750 gpm with a 5 % bleed (1741 gpm injection). This combined production rate was divided evenly among production and injection wells for the simulation.

The MODFLOW model was calibrated to approximate pre-development conditions based on water levels observed in the Q-sand prior to the multi-well pump tests conducted in February of



Lewis Water Consultants *Environmental Science/Engineering/Modeling*	**RAMC Smith Ranch Facility** Figure 3-8. Flare factor sensitivity analyses, pattern scale and net production rate	Date: **9/14/99** Project: **RAMC Wellfield Evaluation** File: **land.ppt**



Lewis Water Consultants
Environmental Science/Engineering/Modeling

RAMC Smith Ranch Facility

Figure 3-9. Flare factor sensitivity analyses, Kh/Kv ratio

Date:	**9/14/99**
Project:	**RAMC Wellfield Evaluation**
File:	**land.ppt**

5.0 SUMMARY AND CONCLUSIONS

RAMC has completed a detailed evaluation and simulation of commercial wellfield restoration at the Smith Ranch facility. Previous estimates of wellfield restoration conducted by WDEQ/LQD have relied solely on estimates of affected pore volume (flare factor) derived from results of limited, small-scale groundwater flow modeling. RAMC believes that flare factors developed by WDEQ/LQD have been over-estimated due to 1) the small-scale nature of the flow modeling, 2) the methodology employed to estimate the flare factor (plotting of velocity vectors), and 3) inappropriate assumptions used to calculate the vertical flare. Further, the WDEQ/LQD methodology does not consider all factors necessary to estimate wellfield restoration with reasonable accuracy. In contrast, RAMC's evaluation includes a detailed examination of all factors affecting wellfield restoration timing (and cost), including:

- pore volume flushing requirements for RAMCs commercial wellfield(s)
- the affect of reducing agents and RO treatment on wellfield restoration
- the affected pore volume size as computed by full-scale simulation of a commercial wellfield, and
- the sensitivity of the flare factor to wellfield scale (and other parameters)

Results of this work can be used to establish reliable estimates of restoration timing and cost for all of RAMCs commercial wellfields. Given these results, wellfield restoration at the Smith Ranch facility can be accomplished well within original time and cost estimates. Based on these findings, there is no technical basis to support an increase in bonding requirements as proposed by WDEQ/LQD.