Table F4-1. Evaluation of the Potential for Downward DNAPL Movement within Fractures
Final Remedial Investigation Report
Casmalia Resources Superfund Site
Casmalia, California

Items	unit	Gallery, 2004	RGPZ-7C,2004	Gallery, 1994	Gallery, 1998
DNAPL Density (ρ_N)	g/cm^{-3}	1.0851	1.0184	1.09	1.1
Water Density (ρ_w)	g/cm^{-3}	1	1	1	1
Arresting Upward Gradient	g/cm^{-4}	0.085	0.018	0.090	0.100

Note: Arresting upward gradient determined from buoyancy relationship between DNAPL and water $= (\rho_N - \rho_w)/\rho_w$

Well Pair adjacent to Gallery Well				
Well Name	RIPZ-23	GW-P(W)	Observed Vertical Gradient, i_m (positive upward)	Arresting gradient sufficient to retard downward flow through fractures
Aquifer Unit	UHSU	UHSU		
Elev. of Screened Zone Midpoint (ft MSL)	518.72	506.83		
Midpoint Elev. Difference (ft)		11.89		
Arresting Gradient (ft/ft) =				0.0851
Date	**GW Elevation (ft MSL)**			
11/17/04	519.24	516.48	-0.2321	No
11/22/04	519.49	516.58	-0.2447	No
12/06/04	518.88	516.45	-0.2044	No
12/14/04	517.03	516.40	-0.0530	No
12/20/04	515.98	518.03	0.1724	Yes
12/31/04	513.18	517.90	0.3970	Yes
01/04/05	512.63	517.80	0.4348	Yes
12/17/08	508.55	517.42	0.7460	Yes

Table F4-1. Evaluation of the Potential for Downward DNAPL Movement within Fractures
Final Remedial Investigation Report
Casmalia Resources Superfund Site
Casmalia, California

Well Pair between Gallery Well and PSCT				
Well Name	RGPZ-6B	RGPZ-6C	Observed vertical Gradient i_m (positive upward)	Arresting gradient sufficient to retard downward flow through fractures
Aquifer Unit	UHSU	LHSU		
Elev. of Screened Zone Midpoint (ft MSL)	446.40	377.70		
Midpoint Elev. Difference (ft)		68.70		
Arresting Gradient (ft/ft) =				0.0184
Date	**GW Elevation (ft MSL)**			
08/23/00	464.25	459.14	-0.0744	No
08/31/00	464.19	460.66	-0.0514	No
09/06/00	464.31	461.13	-0.0463	No
09/14/00	459.25	438.28	-0.3052	No
09/19/00	464.19	459.74	-0.0648	No
09/21/00	464.22	461.08	-0.0457	No
09/22/00	464.29	461.15	-0.0457	No
09/27/00	464.02	461.12	-0.0422	No
10/04/00	464.06	461.17	-0.0421	No
10/05/00	464.22	461.06	-0.0460	No
10/13/00	464.09	460.91	-0.0463	No
10/19/00	464.06	460.77	-0.0479	No
10/24/00	463.99	460.69	-0.0480	No
10/30/00	464.12	460.60	-0.0512	No
11/27/00	463.71	460.00	-0.0540	No
12/11/00	463.40	459.82	-0.0521	No
12/13/00	463.40	459.83	-0.0520	No
01/23/01	464.55	460.89	-0.0532	No
02/27/01	470.65	460.67	-0.1453	No
03/20/01	470.69	461.67	-0.1313	No
04/30/01	467.27	460.58	-0.0974	No
05/30/01	465.90	459.87	-0.0878	No
06/28/01	464.87	459.63	-0.0763	No
07/31/01	464.30	459.44	-0.0708	No
08/30/01	463.85	459.37	-0.0652	No
09/27/01	463.65	459.24	-0.0642	No
12/12/01	463.20	458.91	-0.0625	No
03/12/02	462.69	458.81	-0.0565	No
06/18/02	461.45	457.55	-0.0568	No
09/20/02	460.59	456.50	-0.0595	No
12/06/02	460.55	457.36	-0.0464	No
03/13/03	457.95	461.48	0.0514	Yes
06/26/03	460.43	458.09	-0.0341	No
09/24/03	459.20	457.43	-0.0258	No
11/19/03	458.85	457.34	-0.0220	No
12/30/03	459.15	456.90	-0.0328	No
01/27/04	458.76	456.00	-0.0402	No
02/24/04	460.49	456.53	-0.0577	No
03/26/04	461.49	457.75	-0.0545	No
04/23/04	461.63	457.74	-0.0566	No
05/14/04	460.05	457.65	-0.0349	No
08/26/04	459.10	457.40	-0.0248	No
11/16/04	458.55	455.85	-0.0393	No
02/28/05	459.77	460.69	0.0134	No
05/31/05	463.50	458.95	-0.0662	No
08/31/05	461.65	457.61	-0.0588	No
12/22/05	461.75	457.71	-0.0588	No
03/24/06	461.83	460.00	-0.0267	No
06/28/06	462.31	460.88	-0.0208	No
09/20/06	460.95	457.60	-0.0488	No
12/12/06	460.47	458.20	-0.0331	No
03/13/07	460.10	458.70	-0.0204	No
06/28/07	458.46	458.45	-0.0002	No
09/20/07	457.85	458.30	0.0065	No
12/27/07	457.39	458.04	0.0094	No
03/25/08	462.90	462.67	-0.0034	No
06/30/08	459.74	460.55	0.0118	No
09/24/08	458.80	459.65	0.0124	No
12/22/08	458.59	459.13	0.0078	No

Table F4-1. Evaluation of the Potential for Downward DNAPL Movement within Fractures
Final Remedial Investigation Report
Casmalia Resources Superfund Site
Casmalia, California

Well Pair between Gallery Well and PSCT				
Well Name	RGPZ-7C	RGPZ-7D	Observed Vertical Gradient, i_m (positive upward)	Arresting gradient sufficient to retard downward flow through fractures
Aquifer Unit	LHSU	LHSU		
Elev. of Screened Zone Midpoint (ft MSL)	369.60	322.60		
Midpoint Elev. Difference (ft)		47.00		
Arresting Gradient (ft/ft) =				0.0184
Date	**GW Elevation (ft MSL)**			
03/30/09	459.45	460.10	0.0094	No
08/31/00	458.45	456.28	-0.0462	No
09/06/00	459.83	456.08	-0.0798	No
09/19/00	459.92	345.87	-2.4266	No
09/21/00	459.99	347.56	-2.3921	No
09/22/00	460.02	348.42	-2.3745	No
09/27/00	460.00	352.22	-2.2932	No
10/04/00	460.11	357.07	-2.1923	No
10/05/00	460.09	357.79	-2.1766	No
10/13/00	460.04	362.81	-2.0687	No
10/19/00	459.97	366.57	-1.9872	No
10/24/00	459.92	369.29	-1.9283	No
10/30/00	459.95	372.92	-1.8517	No
11/27/00	459.54	385.96	-1.5655	No
12/11/00	459.34	392.13	-1.4300	No
12/13/00	459.34	392.13	-1.4300	No
01/23/01	465.73	412.85	-1.1251	No
02/27/01	459.62	444.39	-0.3241	No
03/20/01	460.40	465.58	0.1102	Yes
04/30/01	459.43	463.20	0.0802	Yes
05/30/01	458.88	462.27	0.0721	Yes
06/28/01	458.58	461.66	0.0655	Yes
07/31/01	458.46	461.44	0.0634	Yes
08/30/01	458.40	461.27	0.0610	Yes
09/27/01	458.29	461.07	0.0591	Yes
12/12/01	457.85	460.99	0.0668	Yes
03/12/02	457.83	460.54	0.0576	Yes
06/18/02	456.82	459.86	0.0647	Yes
09/20/02	456.21	459.22	0.0640	Yes
12/06/02	456.45	459.17	0.0579	Yes
01/23/03	457.43	459.48	0.0436	Yes
03/13/03	456.97	459.38	0.0513	Yes
04/30/03	456.58	459.07	0.0530	Yes
05/27/03	454.62	457.70	0.0655	Yes
06/06/03	456.98	458.53	0.0330	Yes
06/24/03	457.02	459.01	0.0423	Yes
07/02/03	456.95	458.92	0.0419	Yes
07/09/03	456.88	458.93	0.0436	Yes
08/14/03	456.42	458.57	0.0457	Yes
09/17/03	456.35	458.33	0.0421	Yes
09/24/03	456.32	458.20	0.0400	Yes
10/16/03	456.21	458.12	0.0406	Yes
11/13/03	456.16	457.95	0.0381	Yes
11/19/03	456.12	457.83	0.0364	Yes
12/18/03	456.07	457.78	0.0364	Yes
12/30/03	455.08	457.88	0.0596	Yes
01/20/04	455.33	457.73	0.0510	Yes
01/27/04	454.98	457.88	0.0617	Yes
02/24/04	455.28	457.80	0.0536	Yes
03/23/04	457.00	460.03	0.0644	Yes
03/26/04	456.98	459.87	0.0615	Yes
04/20/04	457.14	459.73	0.0551	Yes
05/14/04	456.83	458.78	0.0415	Yes
05/20/04	457.10	459.20	0.0447	Yes
06/21/04	456.53	458.58	0.0436	Yes
07/22/04	456.73	458.62	0.0402	Yes
08/24/04	456.53	458.38	0.0393	Yes
08/26/04	456.82	459.69	0.0610	Yes
10/08/04	456.49	458.19	0.0361	Yes
10/28/04	456.43	458.13	0.0361	Yes
11/16/04	455.23	457.82	0.0551	Yes
11/30/04	454.28	458.06	0.0804	Yes

Table F4-1. Evaluation of the Potential for Downward DNAPL Movement within Fractures
Final Remedial Investigation Report
Casmalia Resources Superfund Site
Casmalia, California

Well Pair between Gallery Well and PSCT				
Well Name	RGPZ-7C	RGPZ-7D	Observed Vertical Gradient, i_m (positive upward)	Arresting gradient sufficient to retard downward flow through fractures
Aquifer Unit	LHSU	LHSU		
Elev. of Screened Zone Midpoint (ft MSL)	369.60	322.60		
Midpoint Elev. Difference (ft)		47.00		
Arresting Gradient (ft/ft) =				0.0184
Date	**GW Elevation (ft MSL)**			
12/15/04	453.83	457.97	0.0881	Yes
01/25/05	459.03	463.73	0.1000	Yes
02/24/05	458.93	463.26	0.0921	Yes
02/28/05	457.23	459.78	0.0542	Yes
03/23/05	460.21	463.62	0.0725	Yes
04/26/05	459.80	462.60	0.0596	Yes
05/31/05	457.72	461.58	0.0821	Yes
06/21/05	457.68	461.27	0.0764	Yes
08/31/05	456.83	460.28	0.0734	Yes
10/06/05	456.73	459.96	0.0687	Yes
12/22/05	456.84	460.57	0.0793	Yes
01/19/06	458.43	459.17	0.0157	No
03/24/06	456.93	460.77	0.0817	Yes
03/27/06	458.68	458.98	0.0064	No
06/28/06	457.70	458.88	0.0251	Yes
09/20/06	456.48	458.68	0.0468	Yes
12/11/06	458.01	458.68	0.0142	No
03/13/07	458.45	458.35	-0.0021	No
06/28/07	457.98	458.01	0.0006	No
09/21/07	458.03	457.88	-0.0033	No
12/27/07	457.82	457.98	0.0034	No
03/31/08	462.23	457.15	-0.1081	No
06/30/08	460.33	458.50	-0.0390	No
09/25/08	459.43	458.82	-0.0130	No
12/23/08	459.05	459.01	-0.0009	No
03/31/09	462.73	460.33	-0.0511	No

Table F4-1. Evaluation of the Potential for Downward DNAPL Movement within Fractures
Final Remedial Investigation Report
Casmalia Resources Superfund Site
Casmalia, California

Well Pair immediately south of PSCT-1				
Well Name	RG-1B	RG-1C†	Observed Vertical Gradient, i_m (positive upward)	Arresting gradient sufficient to retard downward flow through fractures
Aquifer Unit	UHSU	LHSU		
Elev. of Screened Zone Midpoint (ft MSL)	420.21	363.28		
Midpoint Elev. Difference (ft)		56.93		
Arresting Gradient (ft/ft) =				0.0184
Date	**GW Elevation (ft MSL)**			
07/13/98	430.95	366.96	-1.1240	No
10/21/98	429.72	406.02	-0.4163	No
01/12/99	429.08	387.58	-0.7290	No
04/16/99	431.99	407.48	-0.4305	No
07/22/99	430.13	383.38	-0.8212	No
11/03/99	428.92	401.86	-0.4753	No
03/01/00	432.38	398.51	-0.5949	No
06/20/00	430.18	412.29	-0.3142	No
09/27/00	429.91	433.94	0.0708	Yes
12/13/00	428.45	433.49	0.0886	Yes
03/20/01	433.17	438.45	0.0928	Yes
06/28/01	430.33	437.38	0.1239	Yes
09/27/01	429.50	436.99	0.1316	Yes
12/11/01	429.61	436.81	0.1265	Yes
03/12/02	428.93	436.41	0.1314	Yes
06/18/02	427.83	434.68	0.1204	Yes
09/20/02	426.40	432.55	0.1081	Yes
12/06/02	426.23	432.09	0.1030	Yes
03/13/03	424.52	431.43	0.1214	Yes
06/25/03	426.33	433.39	0.1241	Yes
09/24/03	424.71	431.29	0.1156	Yes
11/19/03	424.21	430.39	0.1086	Yes
12/30/03	424.54	429.16	0.0812	Yes
01/22/04	424.35	428.51	0.0731	Yes
02/24/04	424.83	428.75	0.0689	Yes
03/26/04	426.18	432.36	0.1086	Yes
04/16/04	425.42	432.33	0.1214	Yes
05/13/04	425.93	432.86	0.1218	Yes
08/26/04	423.59	430.31	0.1181	Yes
11/16/04	423.68	429.22	0.0974	Yes
02/18/05	428.51	436.81	0.1458	Yes
05/31/05	428.78	436.91	0.1429	Yes
08/23/05	428.38	436.42	0.1413	Yes
12/20/05	425.23	425.46	0.0041	No
03/24/06	425.36	435.34	0.1754	Yes
06/28/06	428.58	437.07	0.1492	Yes
09/20/06	427.56	436.44	0.1560	Yes
12/08/06	425.08	432.30	0.1269	Yes
03/13/07	425.63	431.44	0.1021	Yes
06/28/07	423.48	429.81	0.1112	Yes
09/19/07	422.38	428.66	0.1104	Yes
12/17/07	421.78	428.06	0.1104	Yes
03/25/08	429.08	439.16	0.1771	Yes
06/27/08	429.02	437.81	0.1545	Yes
09/23/08	425.99	432.57	0.1156	Yes
12/19/08	423.87	430.74	0.1207	Yes
03/30/09	424.98	431.76	0.1191	Yes