

CERCLA Site Close Out How Clean is Clean? An EPA Perspective

Herb Levine
US EPA, Region IX
SERDP-ESTCP



Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE NOV 2010	2. REPORT TYPE	3. DATES COVERED 00-00-2010 to 00-00-2010	
4. TITLE AND SUBTITLE CERCLA Site Close Out. How Clean is Clean? An EPA Perspective		5a. CONTRACT NUMBER	
		5b. GRANT NUMBER	
		5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)		5d. PROJECT NUMBER	
		5e. TASK NUMBER	
		5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Environmental Protection Agency, Region 9, 75 Hawthorne Street, San Francisco, CA, 94105		8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR'S ACRONYM(S)	
		11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited			
13. SUPPLEMENTARY NOTES Presented at the 15th Annual Partners in Environmental Technology Technical Symposium & Workshop, 30 Nov ? 2 Dec 2010, Washington, DC. Sponsored by SERDP and ESTCP.			
14. ABSTRACT This talk will focus on a regulatory perspective related to site closure and attainment of cleanup standards. Often two major questions arise in evaluating the attainment of a cleanup standard (1) Is the site really contaminated because a few samples are above the cleanup standard? (2) Is the site really ?clean? because the sampling shows that the majority of samples are below the cleanup standard? Statistical methods allow for decision making under uncertainty and permit valid extrapolation of information which can be used with confidence to determine whether the site meets the cleanup standard. A case study will be presented which presents some of these methods.			
15. SUBJECT TERMS			
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified	Same as Report (SAR)
			18. NUMBER OF PAGES 33
			19a. NAME OF RESPONSIBLE PERSON

EPA PERSPECTIVE ON SITE CLOSURE: HOW CLEAN IS CLEAN?

MR. HERB LEVINE
U.S. Environmental Protection Agency
Region 9
75 Hawthorne Street
San Francisco, CA 94105
(415) 972-3062
levine.herb@epa.gov

This talk will focus on a regulatory perspective related to site closure and attainment of cleanup standards. Often two major questions arise in evaluating the attainment of a cleanup standard:

- (1) Is the site really contaminated because a few samples are above the cleanup standard?
- (2) Is the site really “clean” because the sampling shows that the majority of samples are below the cleanup standard?

Statistical methods allow for decision making under uncertainty and permit valid extrapolation of information which can be used with confidence to determine whether the site meets the cleanup standard. A case study will be presented which presents some of these methods.

Attainment of Cleanup Standards

Congressional mandate in CERCLA 121(d)(2)(A):

“...remedial actions shall require a level ...which at least attains MCLs established under the Safe Drinking Water Act and water quality criteria ...section 304 or 303 of the Clean Water act, where such goals or criteria are relevant and appropriate under the circumstances of the release....”



Attainment of Cleanup Standards Policy

- NCP preamble sets forth EPA's policy that for groundwater “ **remediation levels generally should be attained throughout the contaminated plume**, or at and beyond the edge of the waste management area when waste is left in place.”



Attainment of Cleanup Standards Technical Guidance

- 1992 Methods for Evaluating the Attainment of Cleanup Standards Volume 2:Groundwater, presents statistical methods which address attainment evaluation
- 1994 Methods for Monitoring Pump and Treat Performance, Chapter four updates statistical methods



Attainment of Cleanup Standards

1992 Guidance

- Attainment hypotheses:
- is the site really contaminated because of few samples are above the cleanup standard?
- is the site really 'clean' because the sampling shows the majority of samples to be below the clean up standard?



Attainment of Cleanup Standards

1992 guidance

- Definition of attainment:

The groundwater in a well attains the cleanup standard if, based on statistical tests, it is unlikely that the average concentration (or a percentile) is greater than the cleanup standard.



Region IX Groundwater Sites

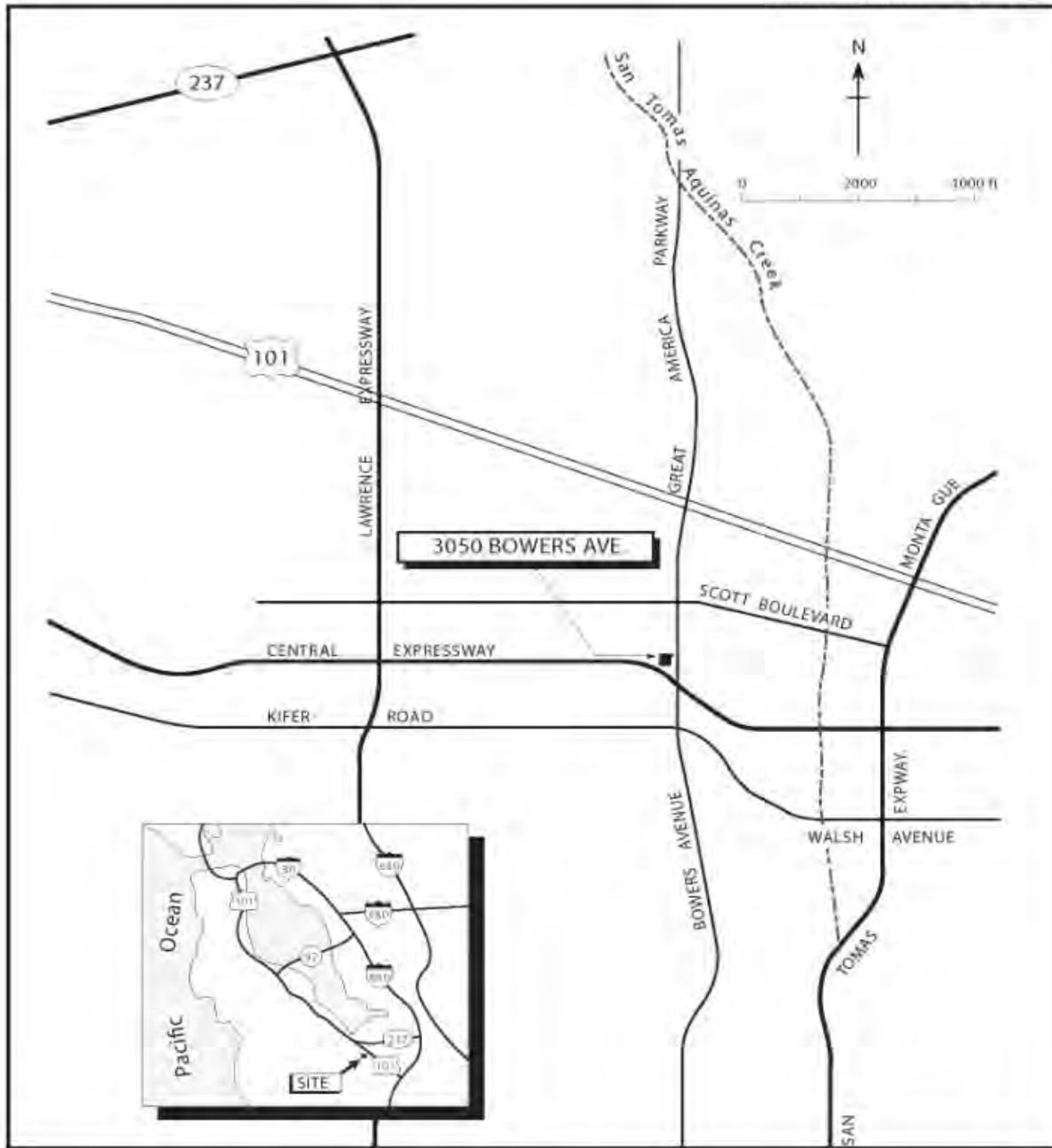
- Region IX has 128 sites on the NPL, 113 have groundwater contamination
- Like other Regional offices RPMs are assigned many sites and have to prioritize their time
- Many sites are not addressed due to lack of resources
- Low hanging fruit, closeout sites which have attained cleanup goals

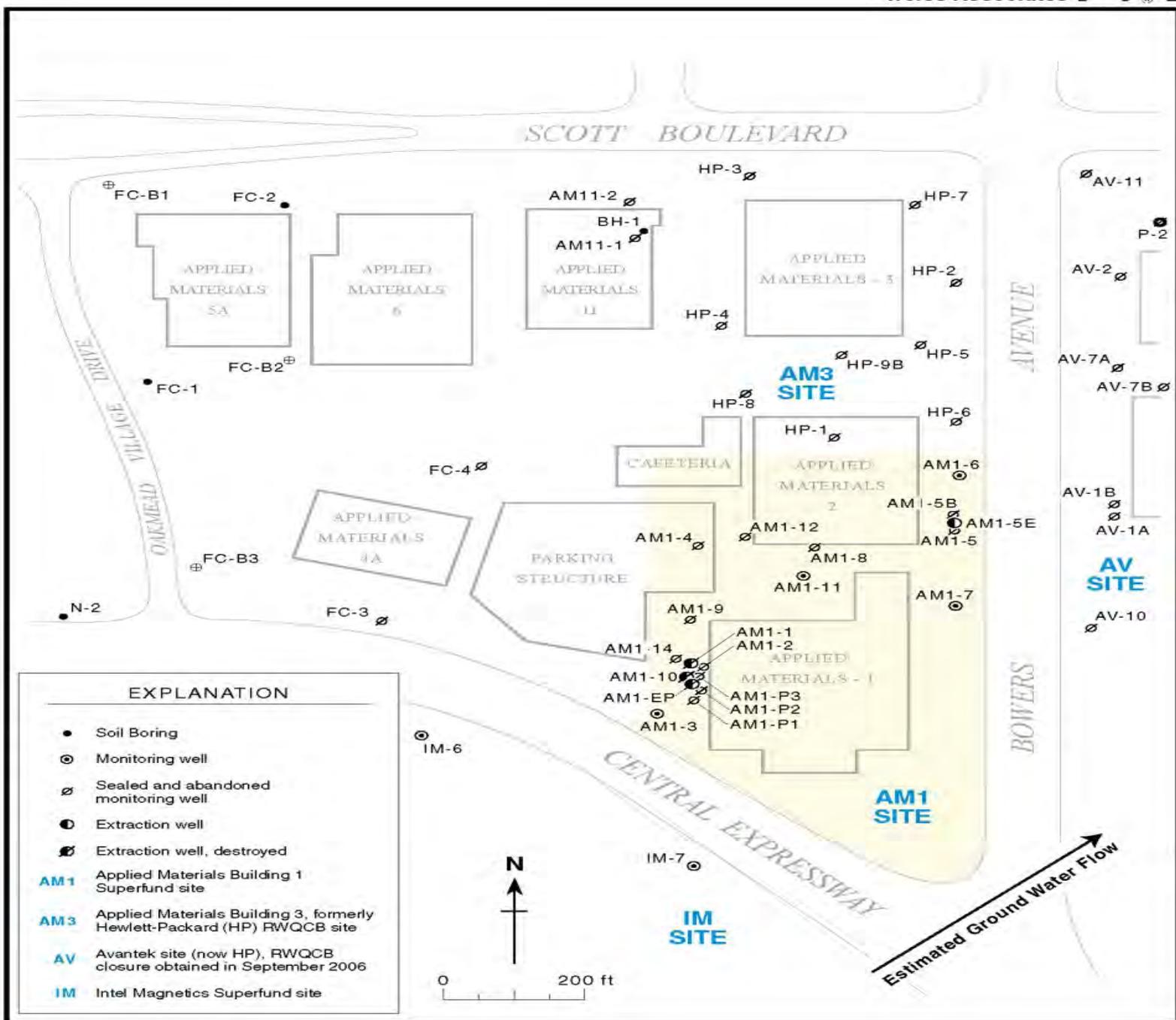


Background information

- Many Superfund Sites in California had releases of solvents in the 1980s
- These sites performed removal actions at their source areas and initiated ground water extraction
- After initial success the extraction remedy effectiveness declined and were optimized and later shut off, relied on MNA w/o ROD amendment (State lead)
- Long term monitoring depicted a slow and steady decline towards contaminant clean up levels







EXPLANATION

- Soil Boring
- ⊙ Monitoring well
- ⊘ Sealed and abandoned monitoring well
- ⦿ Extraction well
- ⦿ Extraction well, destroyed
- AM1** Applied Materials Building 1 Superfund site
- AM3** Applied Materials Building 3, formerly Hewlett-Packard (HP) RWQCB site
- AV** Avantek site (now HP), RWQCB closure obtained in September 2006
- IM** Intel Magnetics Superfund site



0 200 ft

Estimated Ground Water Flow



Applied Materials Inc

Applied Materials, Inc. - Santa Clara, CA

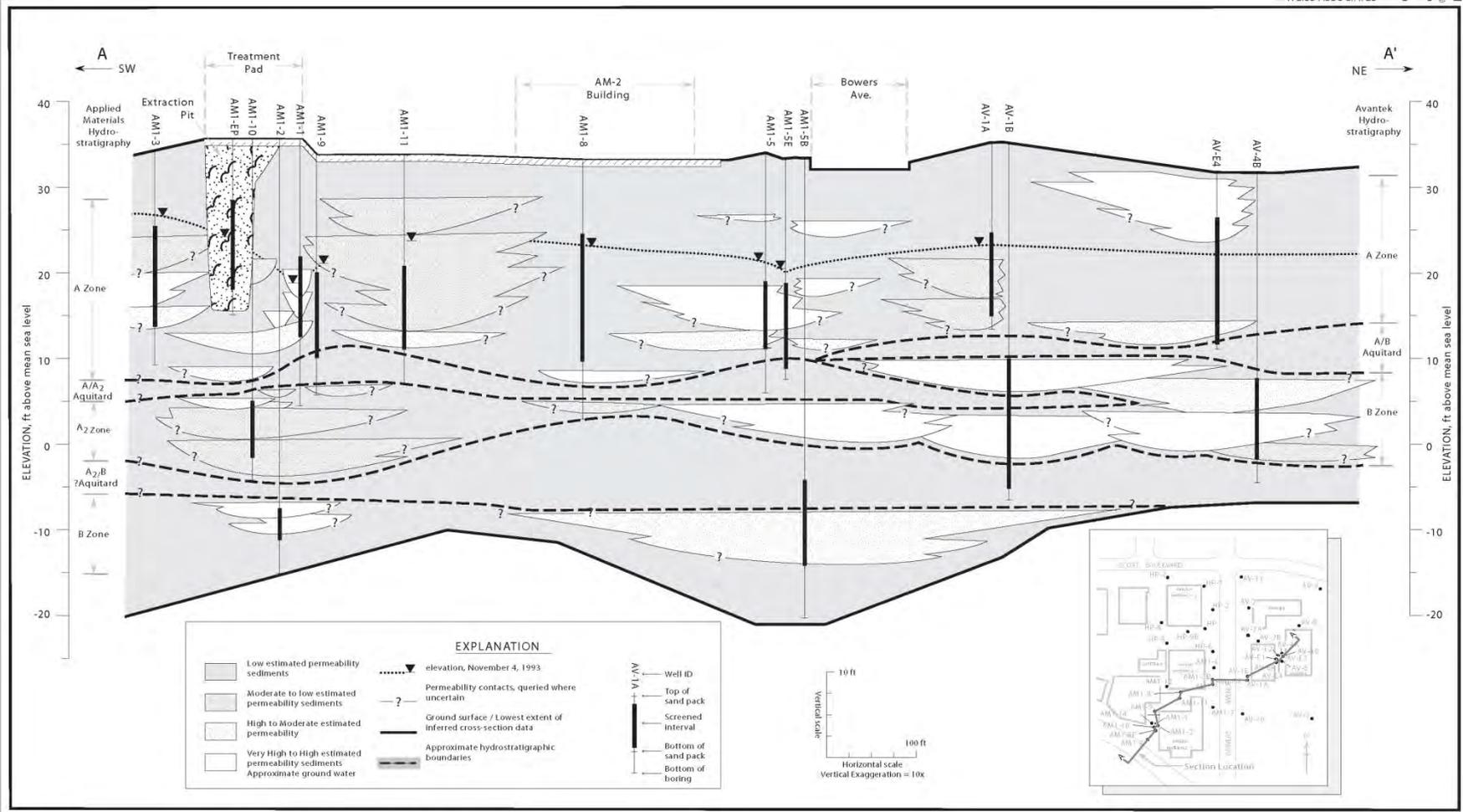
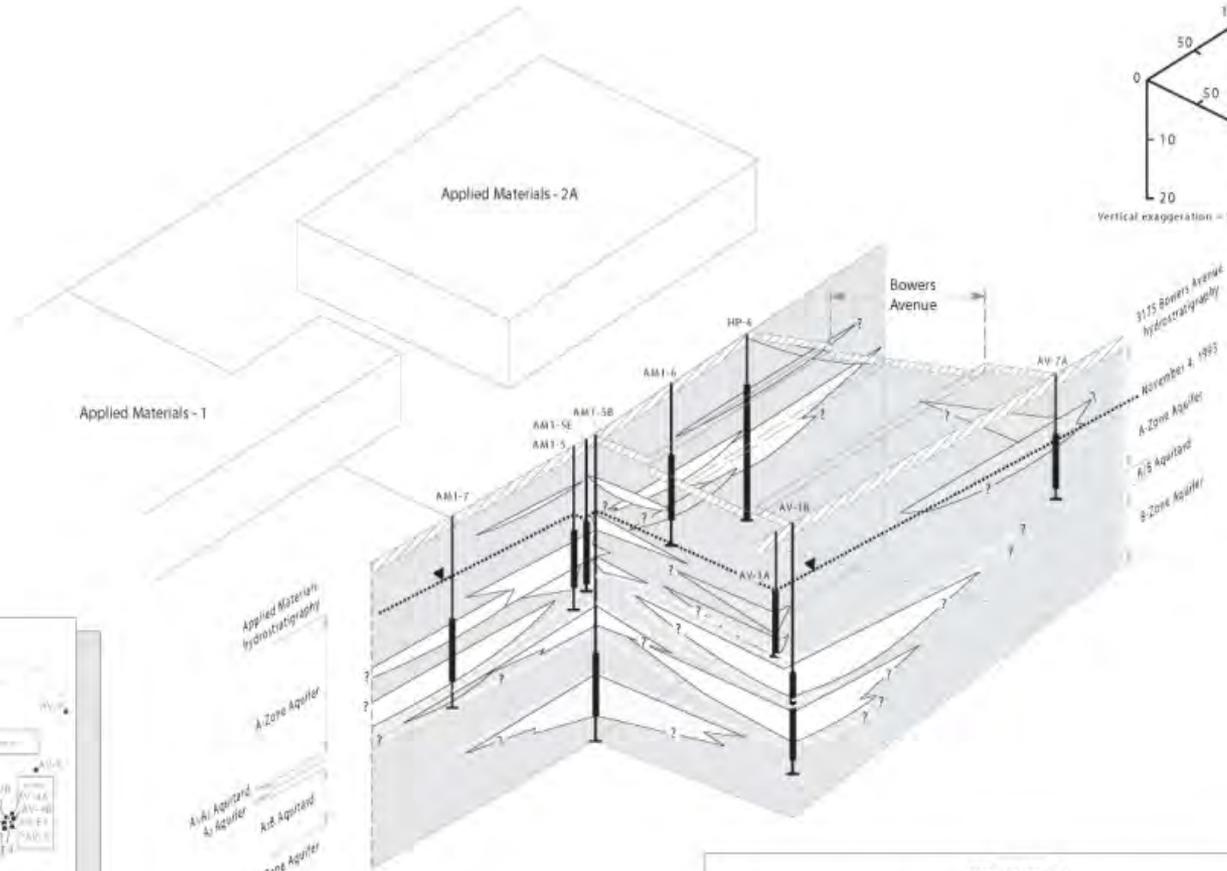
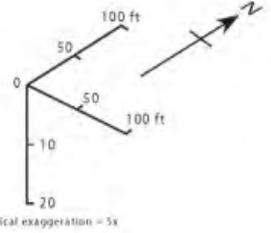


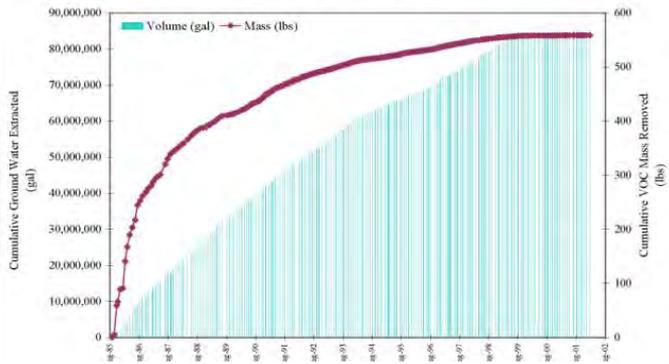
Figure 2. Geologic Section A-A' - Applied Materials Building 1 and Vicinity, Santa Clara, California



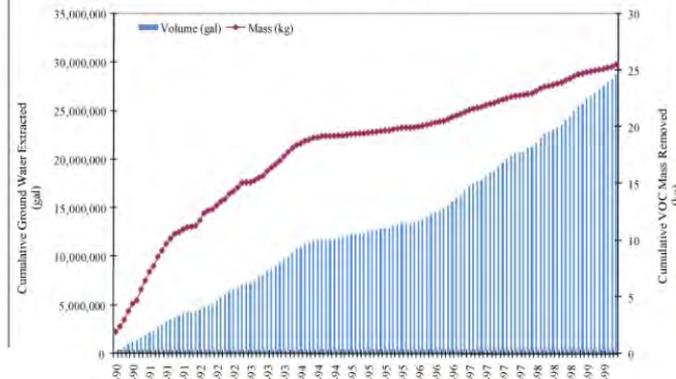
EXPLANATION

Low estimated permeability sediments	Very high to high estimated permeability sediments	AM1-7 — Well ID
Moderate to low estimated permeability sediments	Asphalt / concrete / baserock	Screened interval
High to moderate estimated permeability	Approximate ground water elevations, November 4, 1993	Bottom of boring

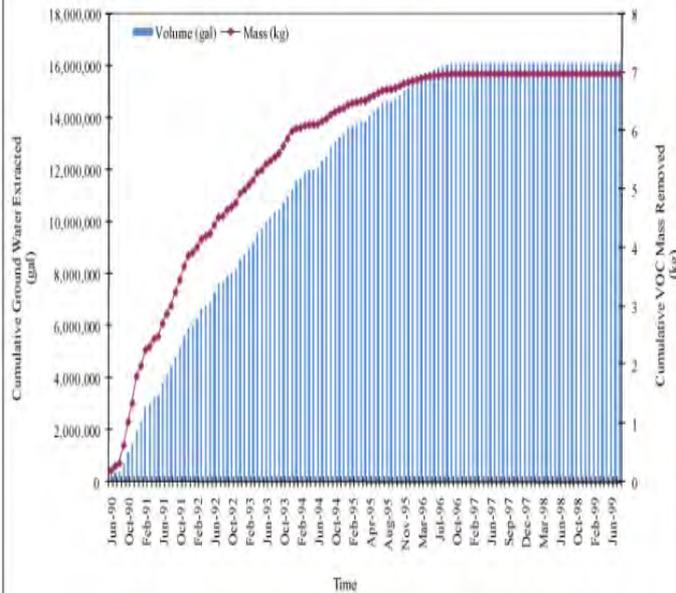
Mass Removal History - Applied Materials Building 1
August 1985 through February 2002



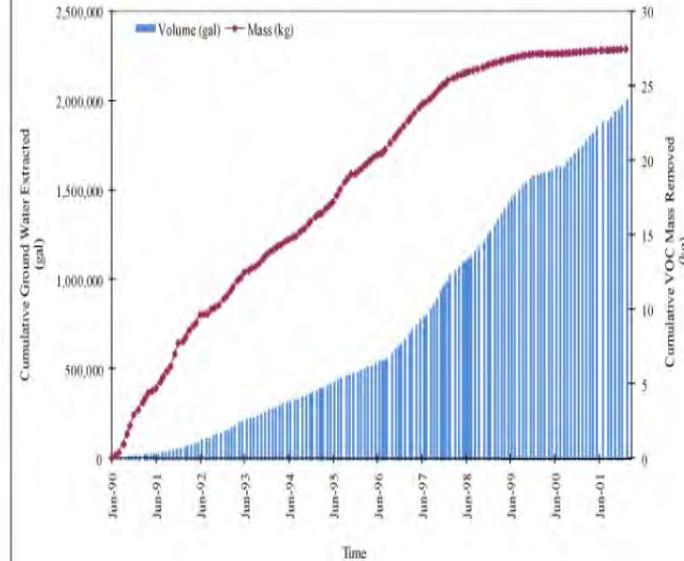
Mass Removal History - Well AMI-1
June 1990 through August 1999



Mass Removal History - Well AMI-5E
June 1990 through September 1996

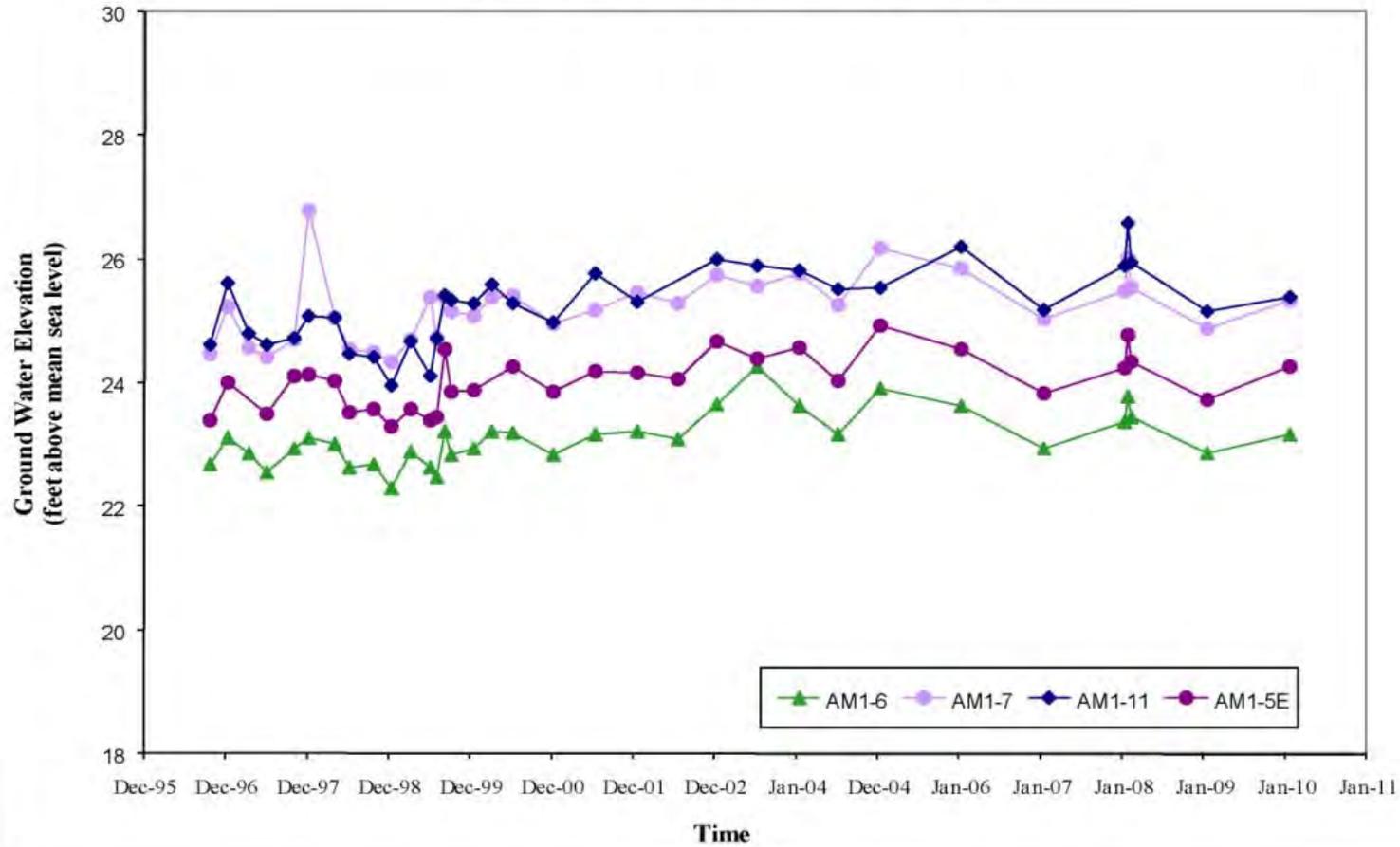


Mass Removal History - Well AMI-10
June 1990 through February 2002

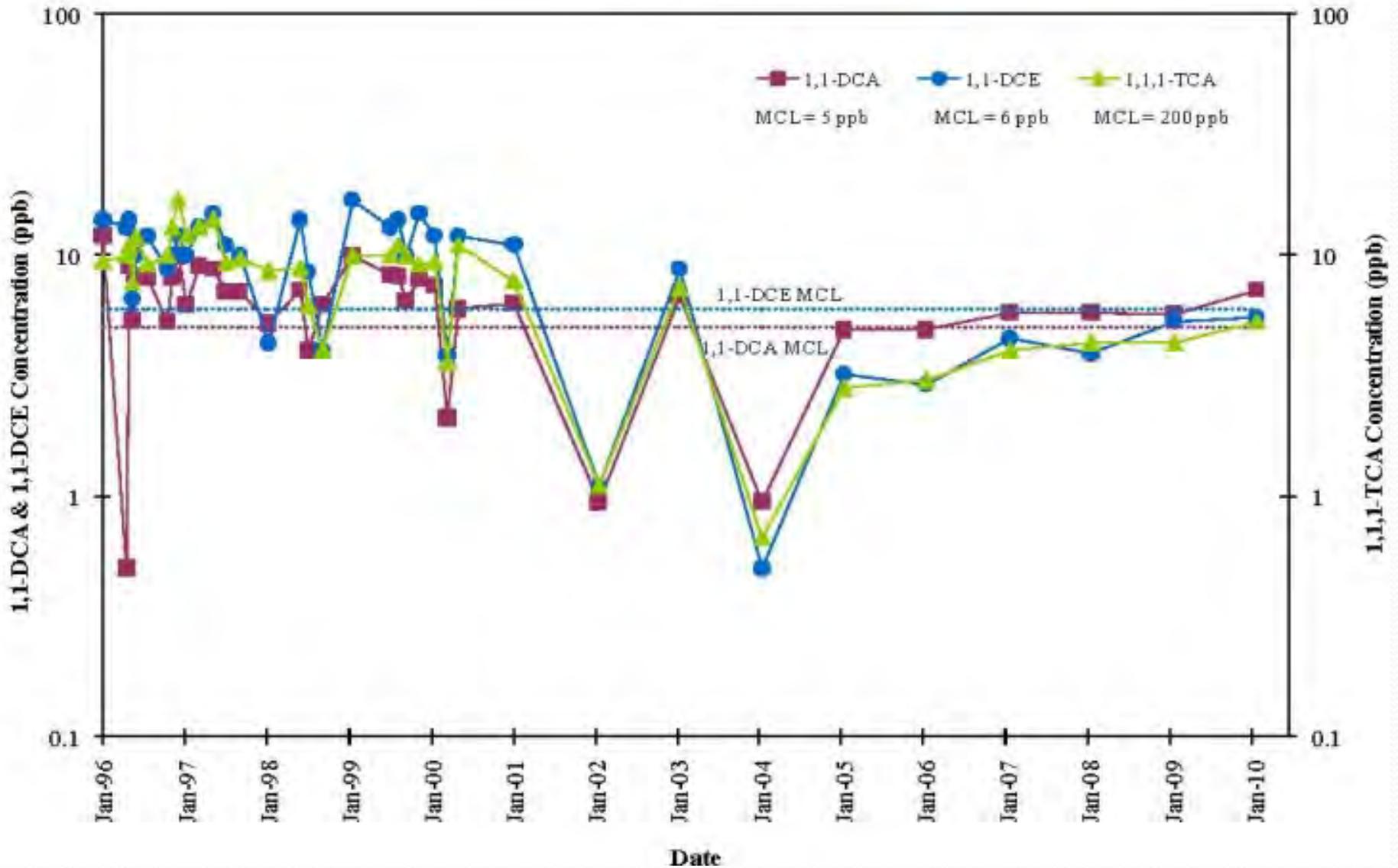


Hydrographs

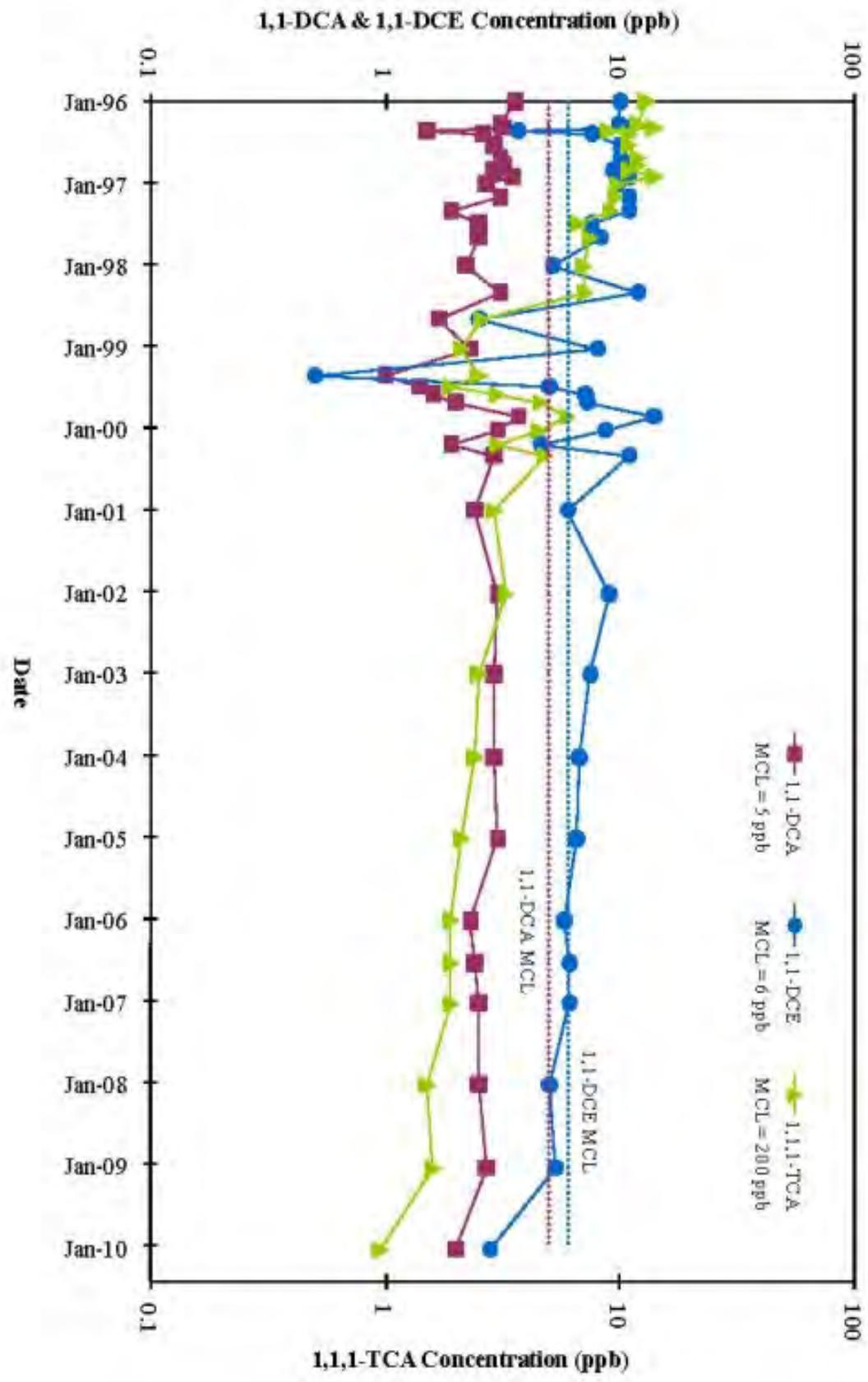
A-Zone Wells AM1-5E, AM1-6, AM1-7, & AM1-11



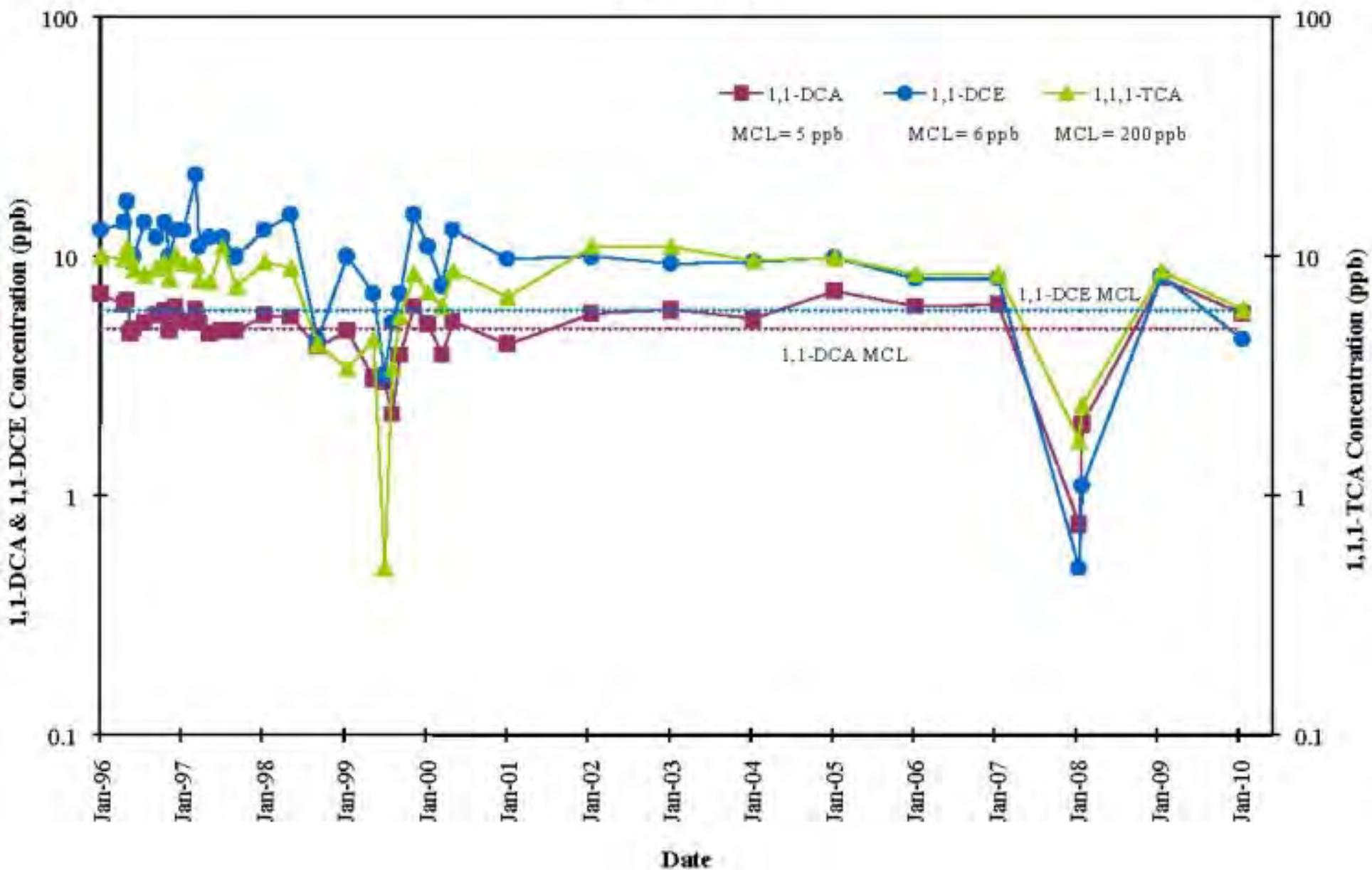
Well AM1-5E (1996-2010)



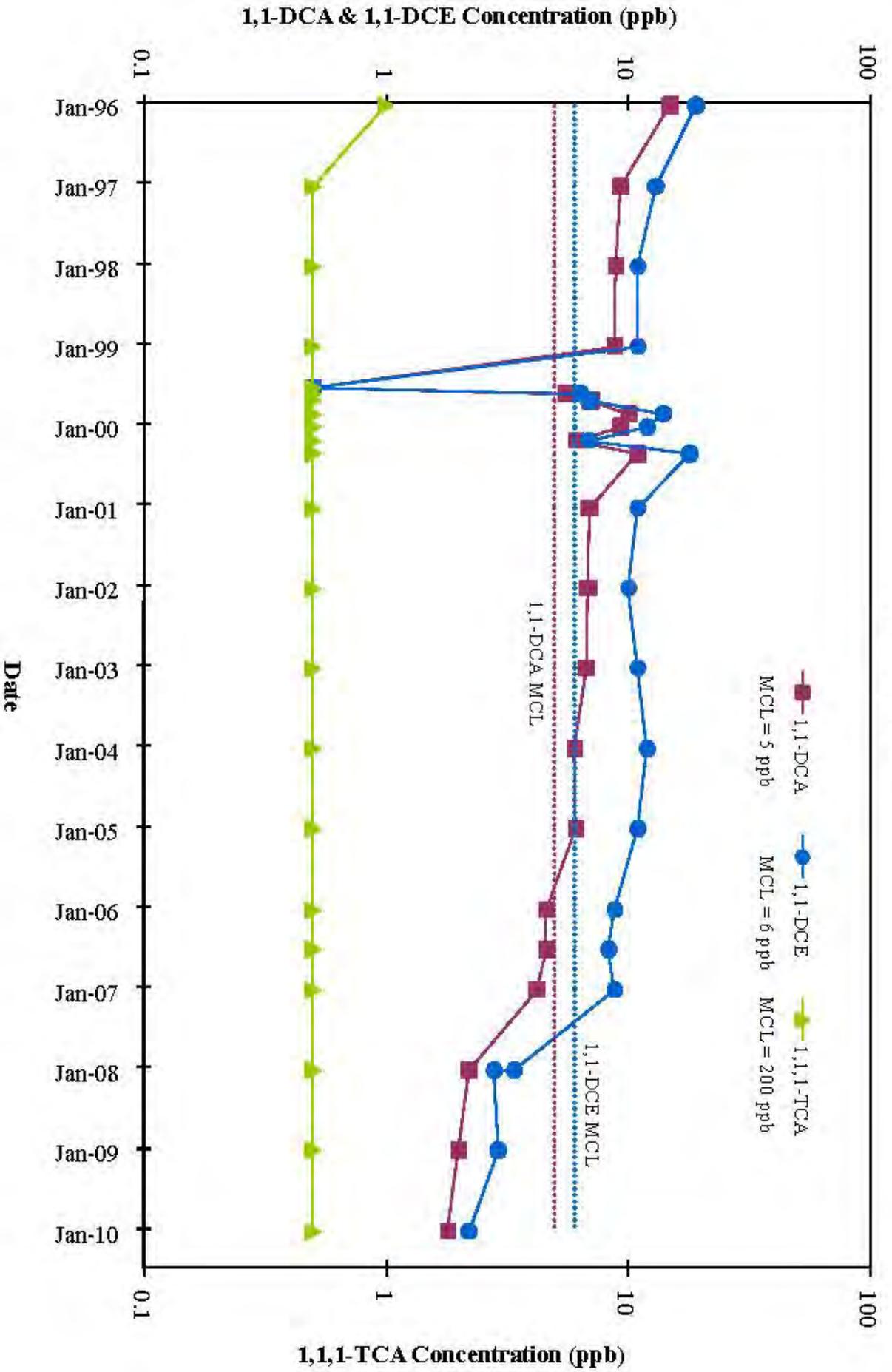
**Well AM1-6
(1996-2010)**



Well AM1-7 (1996-2010)



**Well AM1-11
(1996-2010)**



Attainment Evaluation at Site

- Responsible Party presented an evaluation of attainment using existing wells using 1992 guidance.
- That evaluation associated four wells into a group based on contaminant and sampling history, well construction, and geographical location
- The AM evaluation averaged the data into a single value and determined that the cleanup standard had been met everywhere throughout the plume



Attainment of Cleanup Standards 1992 Guidance

- Two possible ways to evaluate attainment of multiple wells:
 - Assess each well individually
 - Associate selected wells into groups



Associate Wells

1992 guidance

- Restrictions on associating wells into a group:
 - wells should be within similar concentration contour
 - wells must not be outside of the plume
 - wells should be screened in the same interval
 - wells should be sampled and analyzed at the same event

Intended for data sets where concentrations fluctuate above and below the clean up standard.



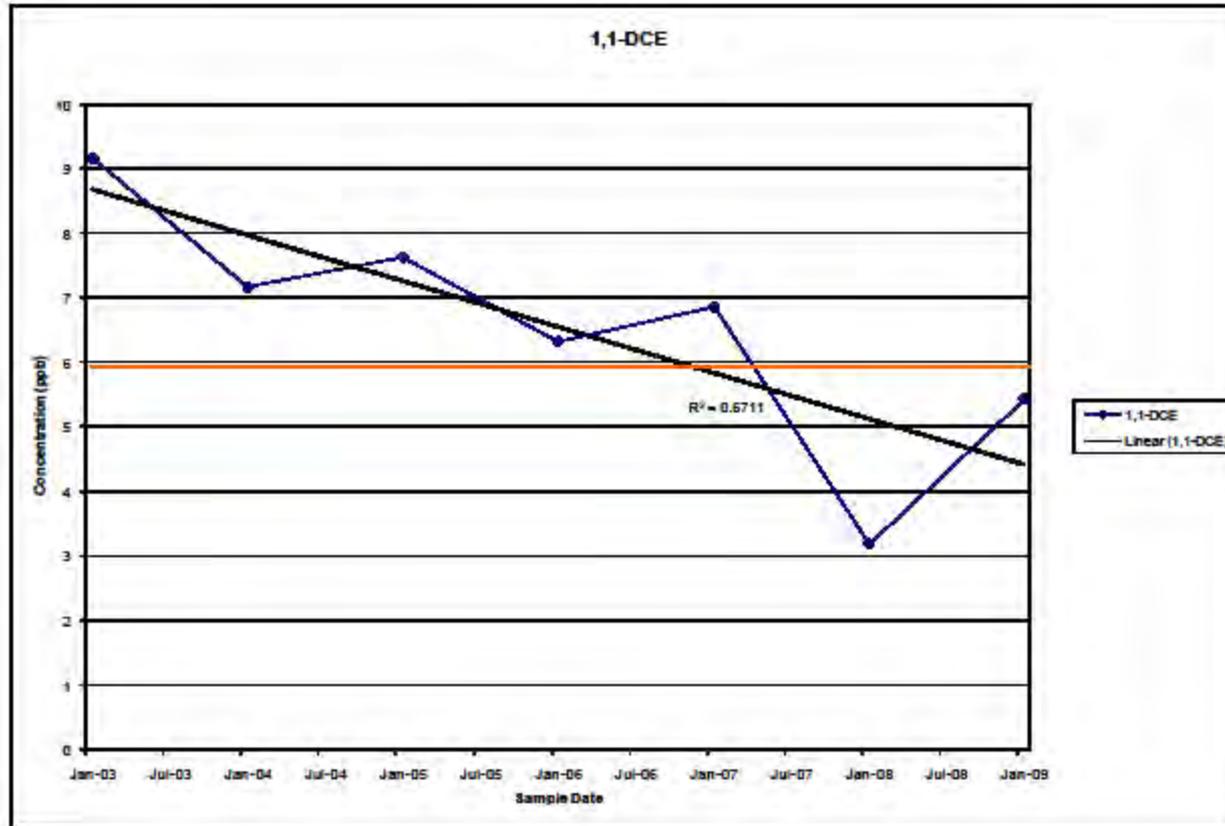


Figure 7. Annual Average 1,1-Dichloroethene Concentrations in Representative A-Zone Monitoring Wells, Applied Materials Building 1 and Vicinity, Santa Clara, California

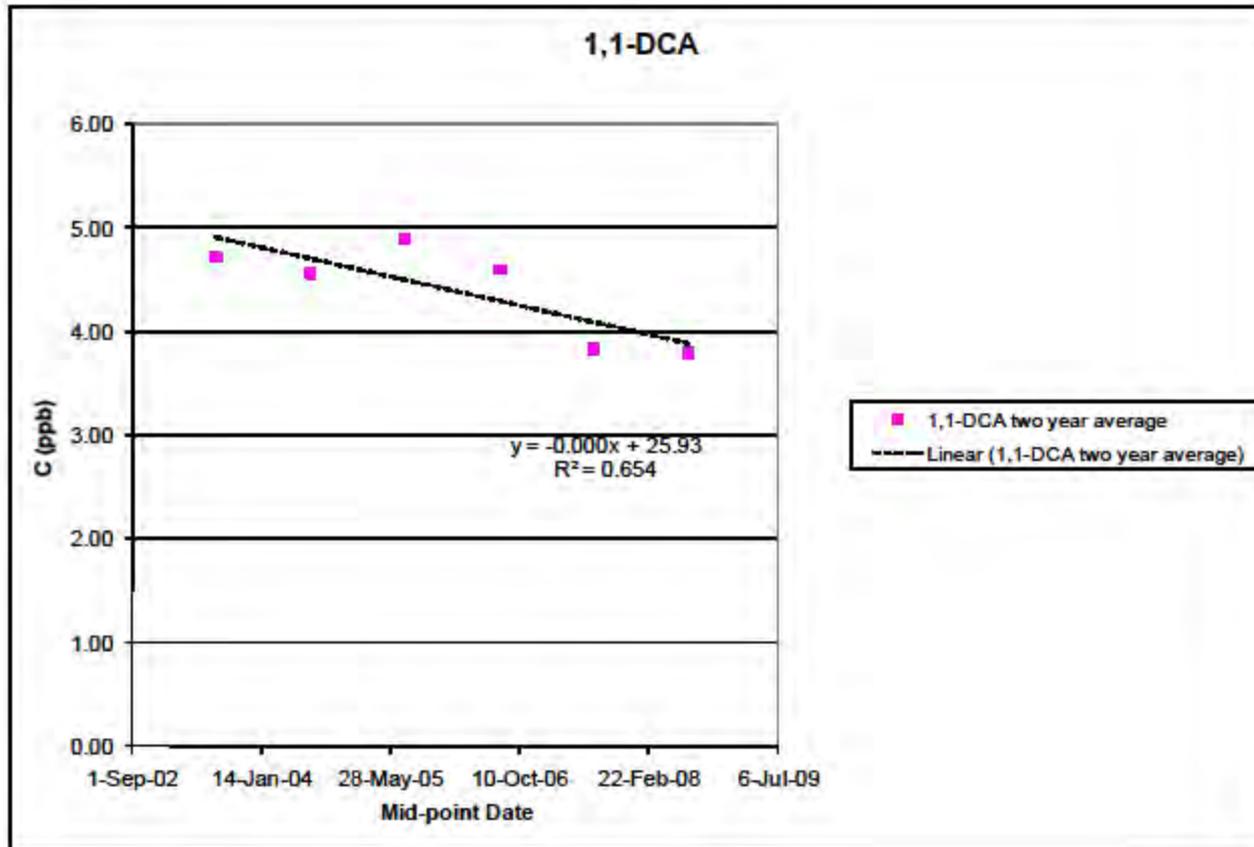


Figure 8. 1,1-Dichloroethane Plume Running Average, Representative A-Zone Monitoring Wells, Applied Materials Building 1 and Vicinity, Santa Clara, California

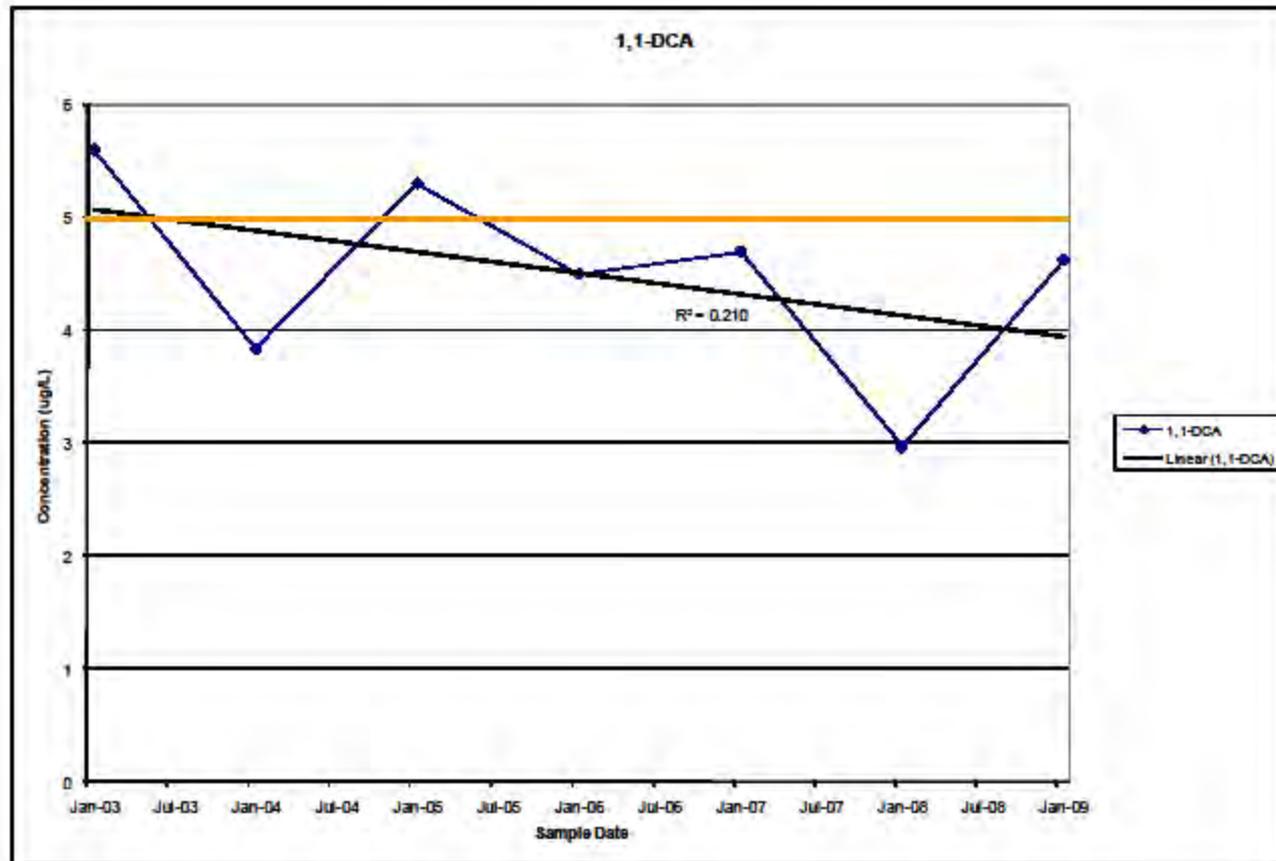


Figure 6. Annual Average 1,1-Dichloroethane Concentrations in Representative A-Zone Monitoring Wells, Applied Materials Building 1 and Vicinity, Santa Clara, California

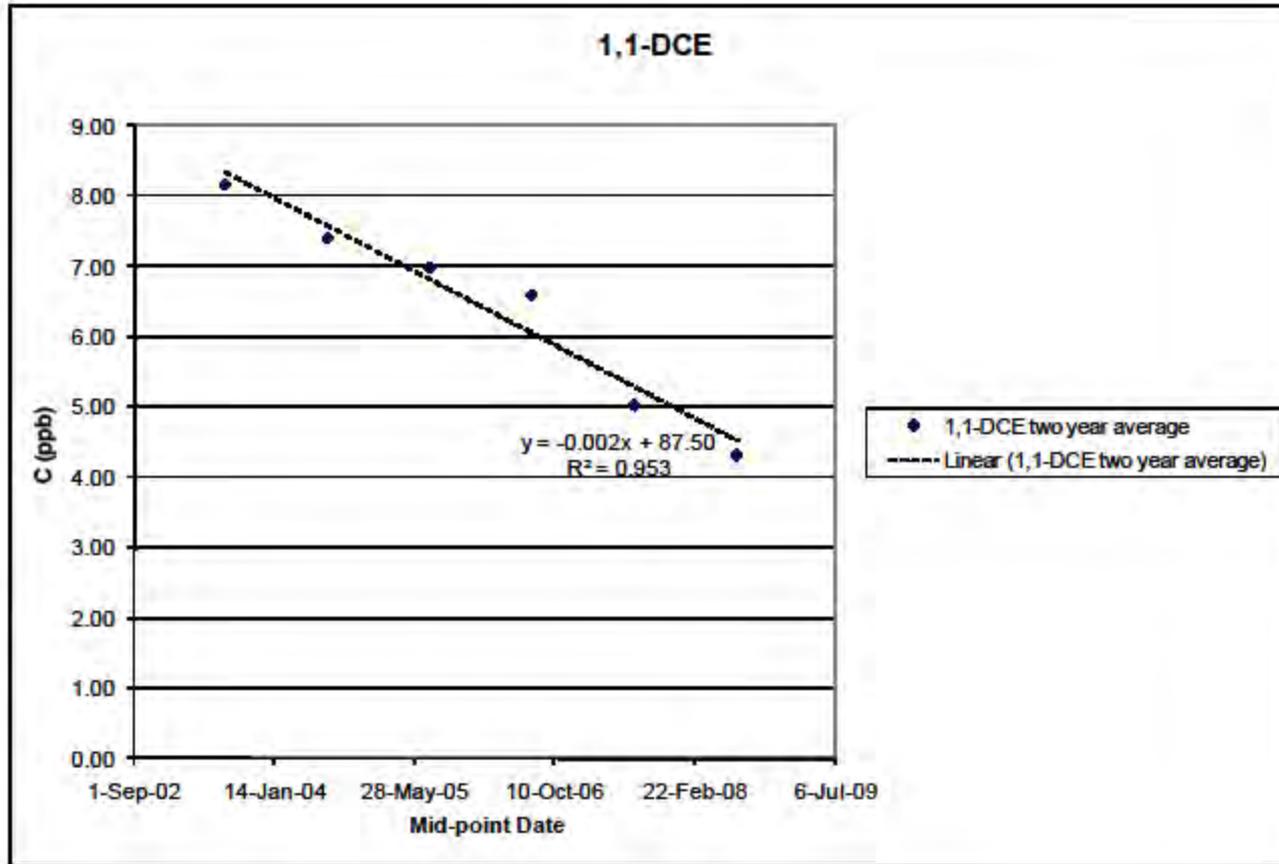


Figure 9. 1,1-Dichloroethene Plume Running Average, Representative A-Zone Monitoring Wells, Applied Materials Building 1 and Vicinity, Santa Clara, California

Attainment of Cleanup Standards 1994 Guidance

- Recommended time frame for attainment analysis is 2 to 5 years

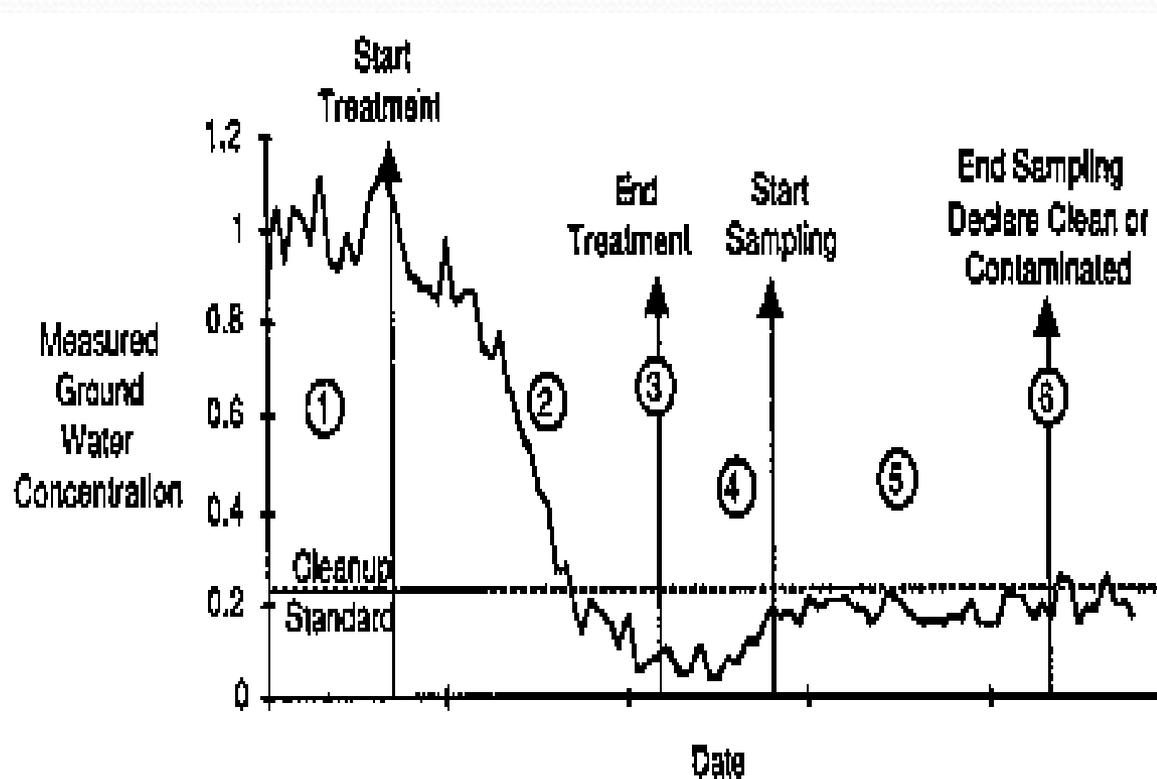
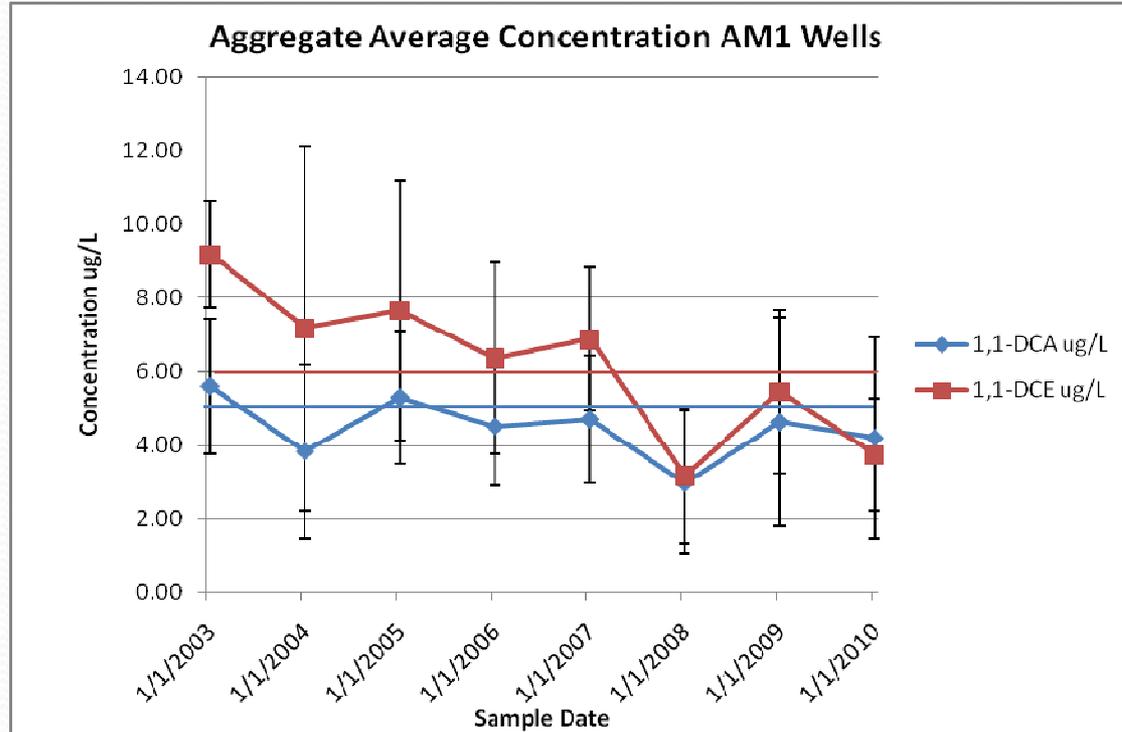


Table 1: Spatial Average results and Statistics (2003 – 2010)

Sample Date	Spatial Average Concentration [ug/L] All Wells	Standard Deviation
1,1-Dichloroethane (MCL 5)		
1/9/2003	5.60	1.83
1/14/2004	3.84	2.36
1/12/2005	5.30	1.80
1/12/2006	4.51	1.60
1/16/2007	4.70	1.72
1/16/2008	2.97	1.95
1/20/2009	4.63	2.82
1/20/2010	4.20	2.72
1,1-Dichloroethene (MCL 6)		
1/9/2003	9.18	1.45
1/14/2004	7.18	4.95
1/12/2005	7.65	3.53
1/12/2006	6.36	2.58
1/16/2007	6.88	1.95
1/16/2008	3.17	1.84
1/20/2009	5.45	2.21
1/20/2010	3.75	1.52



- Notes:
1. Concentrations are averages for wells AM1-6, AM1-7, AM1-11 and AM1-5E for dates indicated.
 2. The chart shows concentration vs. time with error bars representing the standard deviation for each point
 3. MCL are shown as straight line for DCA and DCE

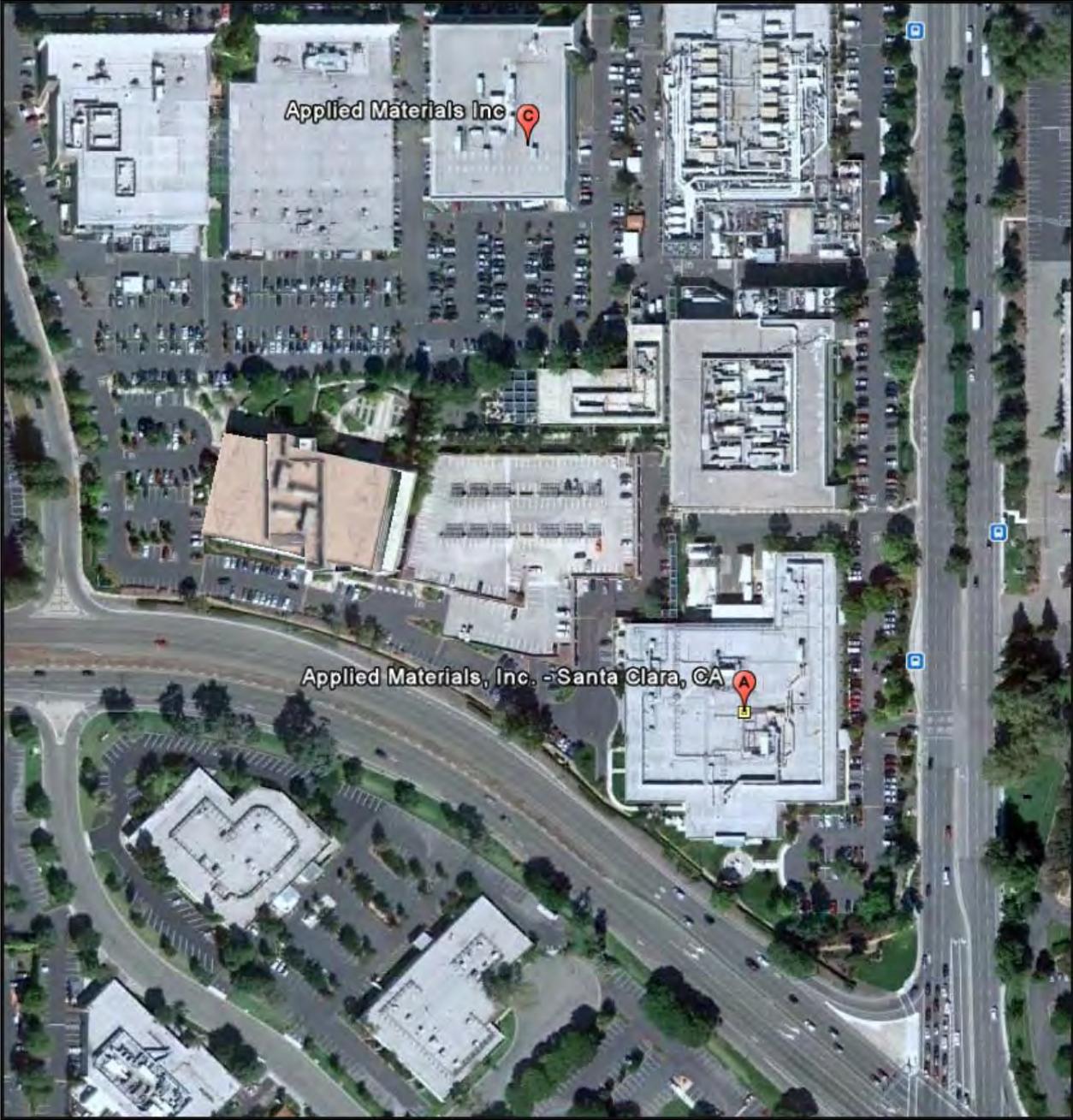
Concentrations 2006-2010

Well	LCL	UCL	90%		95%		99%				
			LCL	UCL	LCL	UCL	LCL	UCL			
name	Min	Max	Mean	Median	SD						
1,1 Dichloroethane MCL 5											
AM1-11	1.8	4.6	2.96	2.2	1.33	1.69	4.22	1.309	4.611	0.22	5.698
AM1-5E	4.9	7.2	5.88	5.8	0.83	5.09	6.67	4.85	6.9	4.17	7.59
AM1-6	2	2.7	2.42	2.5	0.26	2.17	2.67	2.1	2.74	1.89	2.95
AM1-7	2	8.1	5.68	6.2	2.24	3.55	7.82	2.9	8.46	1.07	10.29
1,1, Dichloroethene MCL 6											
AM1-11	2.2	8.8	5.22	3.4	3.3	2.1	8.36	1.13	9.31	-1.566	12
AM1-5E	2.9	5.5	4.42	4.5	1.01	3.4	5.43	3.1	5.71	2.23	6.61
AM1-6	2.8	6.1	4.84	5	1.23	3.67	6.01	3.32	6.36	2.32	7.37
AM1-7	1.1	8.3	6.02	8.1	3.2	3	9.05	2.1	9.9	-0.52	12.6
Spatial Average											
1,1 DCA	2.42	5.88	4.24	4.32	1.8	2.1	6.4	1.4	7.1	-1	9.5
1,1 DCE	4.42	6.02	5.13	5.03	0.7	4.3	6	4	6.2	3.1	7.1

Attainment Evaluation

- Site conceptual model: site underlain by heterogeneous soils, remaining organic contaminants slowly diffusing out of marine mud into alluvial sands
- Remedial actions taken: source removal, P&T with follow on MNA have reduced contaminant levels to or below the ROD specified cleanup levels
- No receptors at site
- Conclude site RAOs met using single well and multiple well statistics





Applied Materials Inc



Applied Materials, Inc. - Santa Clara, CA



Attainment Conclusion

- For sites with similar CSM and data sets EPA Region IX goal is to close out these sites and delist from the NPL
- EPA Region IX prefers an open approach using existing guidance, either individual wells or well groups.
- EPA Region IX currently developing a policy document which reiterates national EPA policy and guidance and clarifies associating wells into groups.

