

**ESCM Technology, Inc.**  
*Environmental & Engineering Consultants*

1781 Mars Hill Road  
Watkinsville, Georgia 30677  
phone: (706) 769-4434  
fax: (706) 769-1431  
e-mail: [escm@negia.net](mailto:escm@negia.net)

July 18, 1997

Alameda County  
Division of Environmental Protection  
Department of Environmental Health  
1131 Harbor Bay Parkway, 2nd Floor  
Alameda, CA 94502

Attn: Mr. Barney Chan

RE: Risk Based Corrective Action Report (dated April 25, 1997)  
Printpack, Inc. Facility (formerly James River Corporation)  
2101 Williams Street  
San Leandro, CA

Dear Mr. Chan:

Per your telephone conversation with Mr. Ed Shaw of ESCM on July 14, 1997, we are enclosing a copy of the above referenced report for your review. If you have any questions regarding the Printpack facility, please call us at (706) 769-4434. We appreciate your assistance with this project.

Sincerely,

Brian W. Merkley  
Project Scientist

enclosures

cc: Doug Cook, Printpack  
Ed Shaw, ESCM

ENVIRONMENTAL  
PROTECTION

97 JUL 23 PM 2:12

**Risk Based Corrective Action Report**

**Printpack, Inc., Facility  
2101 Williams Street  
Alameda County  
San Leandro, California**

ENVIRONMENTAL  
PROTECTION  
97 JUL 23 PM 2:12

Prepared for:

**Alameda County Health Care Services Agency  
Department of Environmental Health  
1131 Harbor Bay Parkway, Suite 250  
Alameda, California 94502-6577**

and

**Printpack, Inc.  
4335 Wendell Drive, S.W.  
Atlanta, Georgia 30336**

Prepared by:

**ESCM Technology, Inc.  
1781 Mars Hill Road  
Watkinsville, Georgia 30677**

April 25, 1997

ESCM Technology, Inc. has been commissioned by Printpack, Inc. to conduct environmental remediation work at their San Leandro, California facility. The facility is located at 2101 Williams Street, Alameda County, San Leandro, California (Figure 1). The facility was previously owned by the James River Corporation which employed Environmental Science & Engineering, Inc., as their consultant.

A letter dated December 21, 1995, from the Alameda County Health Care Services, Environmental Protection Division (EPD), directed that the following quarterly ground-water analyses be conducted for seven consecutive quarters from monitor wells:

<u>Well</u>	<u>Analysis</u>
W-10	BTEX, MIBK, and acetone
W-7 and W-8	TPHd and TPHmo*
W-3, W-5, W-6, W-7 W-8, W-9, W-10, and B-1.	Ground-water elevation readings only

(Ground-water monitor well locations are shown on Figure 2A through 2F)

\*TPHd and TPHmo are analyses for diesel and motor oil, respectively

A meeting was held on December 5, 1996, with Mr. Dale Klettke of the Alameda EPD. Representatives of Printpack and ESCM attended this meeting. The following items were discussed during this meeting:

ESCM would install a more aggressive system to remove the free phase hydraulic fluid from monitor well TW-1. Mr. Klettke advised that the Alameda EPD would consider this task complete once the free phase product was reduced to a thickness of 1/8 inch or less.

The existing ground-water data and a final series of ground-water elevation measurements (to be collected during December 1996) would be collected. Further, quarterly monitoring would not be required unless circumstances indicate that such additional data are required.

A series of ground-water samples would be collected from monitor wells W-7, W-8, W-10, TW-2, and TW-3. Samples collected from wells W-7, W-8, and W-10 would be analyzed for TPHd, TPHhf (hydraulic fluid), acetone, MIBK, and BTEX. Samples collected from monitor wells TW-2 and TW-3 would be analyzed for TPHhf and BTEX.

ESCM would prepare a Risk Based Corrective Action (RBCA) Plan for the facility once the data had been collected. If the data and the RBCA plan supported "Clean Closure", then the Alameda EPD would review and issue a closure approval for the site. The Alameda EPD

anticipated that completion of the review would require approximately 60 days from the issuance of a properly prepared and certified document. After issuance of the "Clean Closure", Printpack would have the existing monitor wells properly closed.

A more aggressive free phase hydraulic fluid removal system was installed to in late January 1997. Ground-water elevation data were collected in December 1996, and a report was submitted to the Alameda EPD with the gauging results. Ground-water samples were collected during January 1997, and analyses have been conducted in conformance with the December 1996 discussions. ESCM has completed preparation of a RBCA plan for the facility. The results are reported herein.

### **DISCUSSION OF RESULTS:**

#### **- GROUND-WATER FLOW DIRECTION -**

The ground-water elevations for the various monitor wells are presented in Table 1. The ground-water elevation data were used to prepare ground-water contour maps of the surficial aquifer at the site (Figures 2A through 2F). Ground-water flow is due west toward San Francisco Bay.

#### **- FREE PHASE HYDRAULIC FLUID -**

A non-hazardous food-grade hydraulic fluid release was detected during January 1993, when the plant was owned by the James River Corporation (JRC). A monitoring/recovery well (TW-1) was installed in the area of the release and recovery operations were started by JRC. Approximately eight gallons of free phase hydraulic fluid was recovered from TW-1 between January 1993 and January 1997.

ESCM installed a SWAP-4<sup>®</sup> free phase hydrocarbon removal system in monitor well TW-1 during the last week of January 1997. The SWAP-4<sup>®</sup> system is a skimmer system that removes only free floating (nonaqueous phase liquid (NAPL)) hydrocarbons. Between January 27, 1997, and February 24, 1997, more than 60 gallons of free phase hydraulic fluid were removed from well TW-1. No other liquids were removed.

Free phase hydrocarbons were not detected in monitor well TW-1 on February 24, 1997. The skimmer system remained operational between February 27, 1997 and March 14, 1997. No additional hydrocarbons were removed by the SWAP-4<sup>®</sup> system during this period. No free phase liquid hydrocarbons were observed in well TW-1 on March 14, 1997, and the SWAP-4<sup>®</sup> system was removed.

ESCM personnel visited the facility again on March 26, 1997. A gauging tape with hydrocarbon and water-finding paste was lowered into well TW-1; no floating free phase hydrocarbons were detected in the well. A disposable bailer was slowly lowered into the monitor well and removed; no free phase liquid hydrocarbons were observed in the bailer.

## - GROUND-WATER ANALYSES -

Ground-water samples were collected at the site on January 22, 1997. Samples collected from W-7, W-8, and W-10 were analyzed for TPHd, TPHhf, acetone, MIBK, and BTEX. Ground-water collected from monitor wells TW-2 and TW-3 were analyzed for TPHhf and BTEX. A summary of the ground-water sampling analytical results since December 1995 is presented in Table 2. TPH-hf was detected in monitor well TW-2 at a concentration of 390  $\mu\text{g/L}$  (0.39 mg/L (ppm)). Acetone was detected in well W-10 at a concentration of 2,400  $\mu\text{g/L}$  (2.4 mg/L (ppm)). The results of the other ground-water analyses were "Non Detect" for all constituents of concern in all monitor wells.

## -AQUIFER CHARACTERISTICS-

Three slug tests, two rising head and one falling head, were conducted on January 23, 1997, in monitor well TW-2 to determine the hydraulic conductivity of the unconfined aquifer. The field data are presented in Appendix A. The data indicate that the average hydraulic conductivity for the well is  $3.39 \times 10^{-3}$  cm/sec (9.62 ft/day). Two soil samples were collected on January 23, 1997, and forwarded to a laboratory for analysis. The laboratory reported that the average soil porosity is 0.398, and the effective porosity was estimated at 0.35. The hydraulic gradient at the site was calculated using the contour maps of the water table. An average ground-water flow velocity of 0.12 ft/day was calculated using hydraulic conductivity, effective porosity, and the average ground-water gradient (0.0045) of the aquifer.

## -BIOACTIVITY AND ACETONE BIODEGRADATION-

Ground-water samples from monitor wells TW-2 and W-10 were collected on January 23, 1997, and analyzed for methane concentration as an indicator of bioattenuation activity. Dissolved methane was detected at a concentration of 25,000 ppmv in W-10 and was not detected in well TW-2. These data indicate that bioactivity is occurring in W-10 but not in TW-2.

Acetone has been detected in monitor well W-10 since June 1994 (Table 3). The acetone concentrations have steadily decreased from the original 150,000  $\mu\text{g/L}$  to the recently reported 2,400  $\mu\text{g/L}$ . This decrease along with the measurement of significant concentrations of dissolved methane in the groundwater confirms that biological degradation of the acetone is occurring at a substantial rate. Additionally, acetone has not been detected in either of the two immediately down gradient monitor wells (W-7 and W-8).

## - FATE AND TRANSPORT MODEL -

A "worst case" fate and transport simulation of the dissolved phase acetone (only remaining constituent of concern) was conducted using the BIOSCREEN Natural Attenuation Decision Support System modeling package. BIOSCREEN is published by the U.S. Environmental Protection Agency (Appendix B).

The dissolved phase acetone plume is approximately 4000 feet up gradient of the nearest receptor, San Francisco Bay. Simulations were conducted to evaluate the potential for the dissolved phase plume to reach the bay. An effective porosity of 0.35 was used in the simulations. A field seepage velocity of 45.1 feet per year was calculated for the aquifer. The "worst case" simulation data indicate that the dissolved-phase acetone would reach equilibrium (i.e., stop moving) after approximately nine years and would migrate a maximum distance of 630 feet from the source (Appendix B). Due to the conservative ("worst-case") nature of the simulation, the model results indicate that the plume has already reached down gradient wells W-7 and W-8. However, acetone has not been detected in these wells. These results substantiate the conclusion that the simulation was conducted using "worst case" input data. The simulation also indicates that the maximum concentration of acetone that could occur at the leading edge of the plume would be 1 µg/L (ppb) and would not migrate beyond the Printpack property.

### **RISK BASED CORRECTIVE ACTION:**

The following Risk Based Corrective Action (RBCA) data are presented in conformance with the ASTM Standard ES-94. The RBCA process is a rational and consistent, streamlined decision process for selecting appropriate corrective actions. In this process traditional components of a corrective action are integrated with USEPA recommended risk and exposure limits. A tiered approach is used in the RBCA process.

#### **- STEP 1: INITIAL SITE ASSESSMENT -**

The initial site assessment was previously completed for this site and has been commented on by the Alameda EPD. During the December 1996 meeting with the Alameda EPD, it was agreed that removal of the free phase hydraulic fluid and presentation of data that the acetone constituents posed no threat to off-site receptors, would be sufficient to obtain a "Clean Closure" for the Printpack facility.

#### **- STEP 2: SITE CLASSIFICATION AND INITIAL RESPONSE ACTION -**

Free phase hydraulic fluid was removed from the aquifer during the initial response. All free phase hydraulic fluid has been removed.

Table 3 from the ASTM RBCA Guidance Manual provides a Classification of 4 ("No reasonable potential threat to human health or to environmental resources"):

- 1 No immediate threat to Human Health, Safety, or Sensitive environmental Receptors.
- 1.1 No explosive levels or concentrations of vapors that could cause acute health effects are present in a residence or other building.
- 1.2 No explosive levels of vapors are present in subsurface utility systems, and no buildings or residences are impacted.

- 1.3 No free product is present in significant quantities at ground surface, on surface water bodies, in utilities other than water supply lines, or in surface water runoff.
- 1.4 No active public water supply well, public water supply line, or public surface water intake is impacted or immediately threatened.
- 1.5 No ambient vapor/particulate concentrations exceed concentrations of concern from an acute exposure or safety viewpoint.
- 1.6 No sensitive habitat or sensitive resources (sport fish, economically important species, threatened and endangered species, etc.) Are impacted and affected.
- 2 No short term (0 to 2 years) Threat to Human Health Safety, or Sensitive Environmental Receptors.
  - 2.1 There is no potential for explosive levels, or concentrations of vapors that could cause acute effects, to accumulate in a residence or other building.
  - 2.2 No shallow contaminated surface soils are open to public access, and there are no dwellings, parks, playgrounds, day-care centers, schools, or similar use facilities within 500 ft of any impacted soils.
  - 2.3 No non-potable water supply wells are impacted or immediately threatened.
  - 2.4 No groundwater is impacted where a public or domestic water supply well is producing from the impacted aquifer is located within two years projected ground-water travel distance down gradient of the known extent of contamination.
  - 2.5 No groundwater is impacted where a public or domestic water supply well is producing from a different interval which is located within the known extent of contamination.
  - 2.6 There is no impacted surface water, storm water, or ground-water discharge within 500 feet of a sensitive habitat, nor surface water body used for human drinking water or contact recreation.
- 3 There are no Long Term (>2 years) Threats to Human Health, Safety, or Sensitive Environmental Receptors.
  - 3.1 There are no subsurface soils (>3 feet) that are impacted and the depth between impacted soils and the first potable aquifer is greater than 50 feet.
  - 3.2 Groundwater is impacted but there are no potable water supply wells producing from the impacted interval that are located >2 years ground-water travel time from the dissolved plume.
  - 3.3 Groundwater is impacted but there are no non-potable water supply wells producing from the impacted interval that are located >2 years ground-water travel time from the dissolved plume.
  - 3.4 Groundwater is impacted but there are no non-potable water supply wells that produce from the impacted interval located within the known extent of contamination.
  - 3.5 There are no impacted surface waters, storm waters, or ground-water discharges within 1500 feet of a sensitive habitat, or surface water body used for human drinking water or contact recreation (4000'+ to San Francisco Bay).
  - 3.6 There are no shallow contaminated surface soils open to public access and there are no dwellings, parks, playgrounds, day-care centers, schools, or similar use facilities within 500 feet of those soils.

- 4 There is No Demonstrable Long-Term Threat to Human Health, Safety, or Sensitive Environmental Receptors.**
- 4.1 A non-potable aquifer with no existing local use is impacted, but it is not impacted off-site (i.e., beyond the facility property boundary).
- 4.2 Impacted soils are located more that 3 feet below ground surface but not more than 50 feet above the nearest aquifer. However the BIOSCREEN model indicates that the dissolved-phase constituents will not migrate offsite due to natural attenuation of the leachate.
- 4.3 Groundwater is impacted, but there are no non-potable wells located down gradient outside the known extent of contamination that produce groundwater from a non-impacted zone.

**-STEP 3: COMPARISON OF SITE CONDITIONS WITH RISK BASED SCREENING LEVELS AND CORRECTIVE ACTION SELECTION -**

A reasonable potential exposure scenario and risk evaluation was completed using Figure 2 (Exposure Scenario Evaluation Flowchart) from the ASTM RBCA Guide. There are no current or projected receptors based upon the exposure scenarios.

A Material Safety Data Sheet (MSDS) for acetone is included as Appendix C. The MSDS indicated the following:

Threshold Limit Value (TLV/TWA):	1780 mg/M <sup>3</sup>
Short Term Exposure Limit (STEL):	2375 mg/M <sup>3</sup>
Permissible Exposure Limit (PEL):	2400 mg/M <sup>3</sup>
Acetone is not a Carcinogen	
Upper Flammable Limit	13%
Lower Flammable Limit	2.6%
Acetone is not Reactive	
Hazardous Polymerization will not Occur	
LD50 (IPR-Mouse)	1297 mg/Kg

According to the OSHA Regulated Hazardous Substances Industrial Exposure and Control Technologies Manual, published by the U.S. Department of Labor in February 1990, pages 14 through 21:

LD (Ingestion-Human)	0.5g/Kg for 70 Kg person
----------------------	-----------------------------

Acetone is not controlled by either the Primary Drinking Water Standards (40 CFR 141) nor by the Secondary Drinking Water Standards (40 CFR 143).



The California Code of Regulations, Title 22, Section 66261.126, Appendix X - List of Chemical Names and Common Names for Hazardous Wastes and Hazardous Materials, lists acetone as being ignitable only. It does not lists acetone as being toxic, corrosive, reactive, or as being extremely hazardous. (See Appendix D).

**The above data indicates that a Risk Based Screening Level of 1,297 mg/Kg (ppm) would be conservatively appropriate for acetone.**

**- STEP 4: EVALUATION OF RESULTS -**

The current acetone source concentration of 2,400 µg/L (ppb) is 2.7 orders of magnitude less than the Risk Based Screening Level of 1,297 mg/Kg (ppm). Therefore no further analysis (i.e., Tier Upgrade) is recommended. It is recommended that a "Clean Closure" be granted at this site.

**CONCLUSIONS AND SUMMARY**

The collected and developed data indicate that there are no environmental risks associated with the acetone constituent detected in monitor well W-10 nor with the hydraulic fluid detected in monitor well TW-1. The acetone has not migrated down gradient to the nearest monitor well W-8, approximately 110 feet down gradient, since January 1993. The non-hazardous hydraulic fluid has been removed. It is recommended that all monitor wells be properly closed and that no further action be required at this facility (i.e., Clean Closure).

**FIGURES**

**TABLES**

**APPENDICES**

**A. Slug Test Analyses**

**B. BIOSCREEN Simulation**

**C. Acetone MSDS**

**D. California Code of Regulations, Title 22, Section 66261.126, Appendix X - List of Chemical Names and Common Names for Hazardous Wastes and Hazardous Materials**

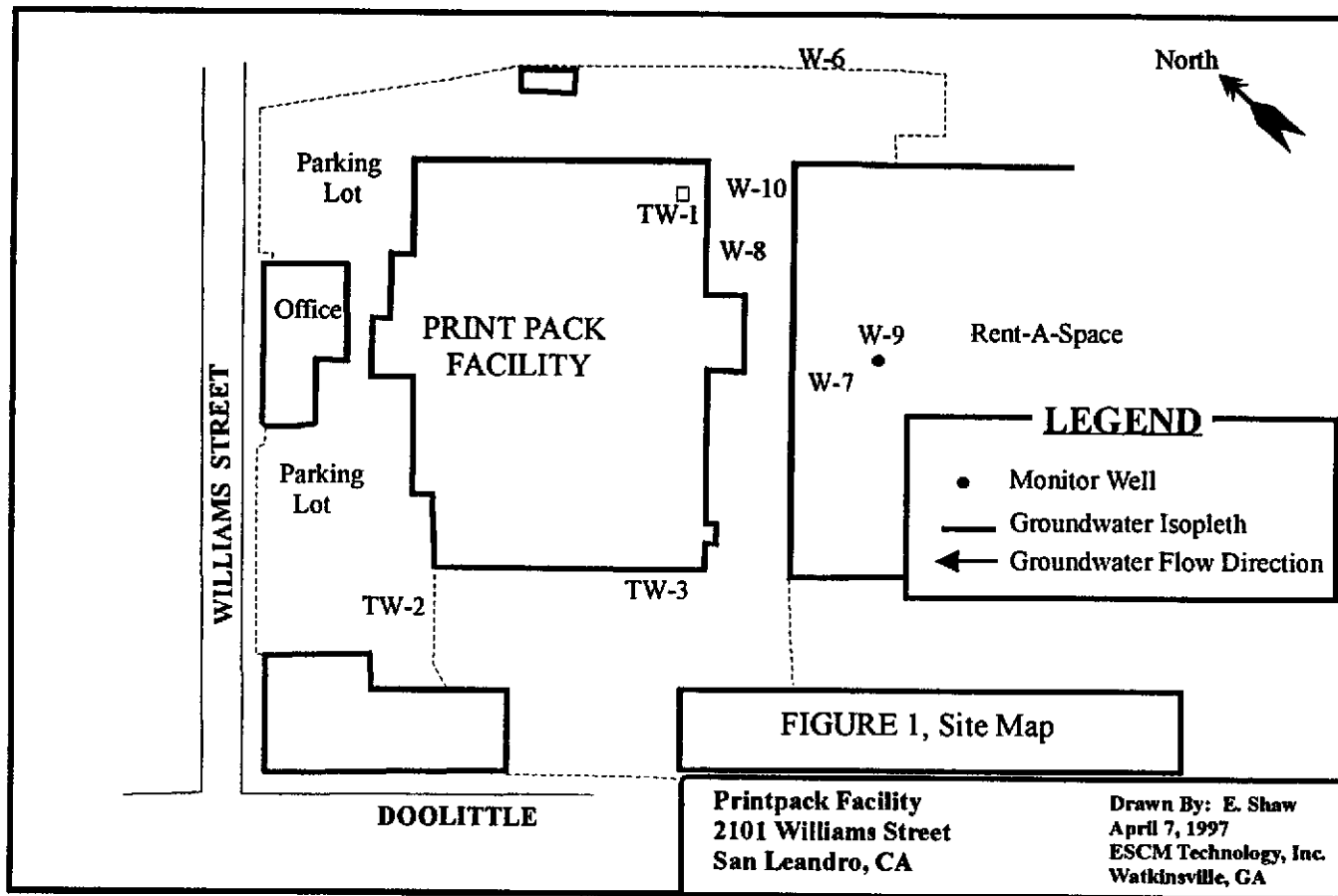
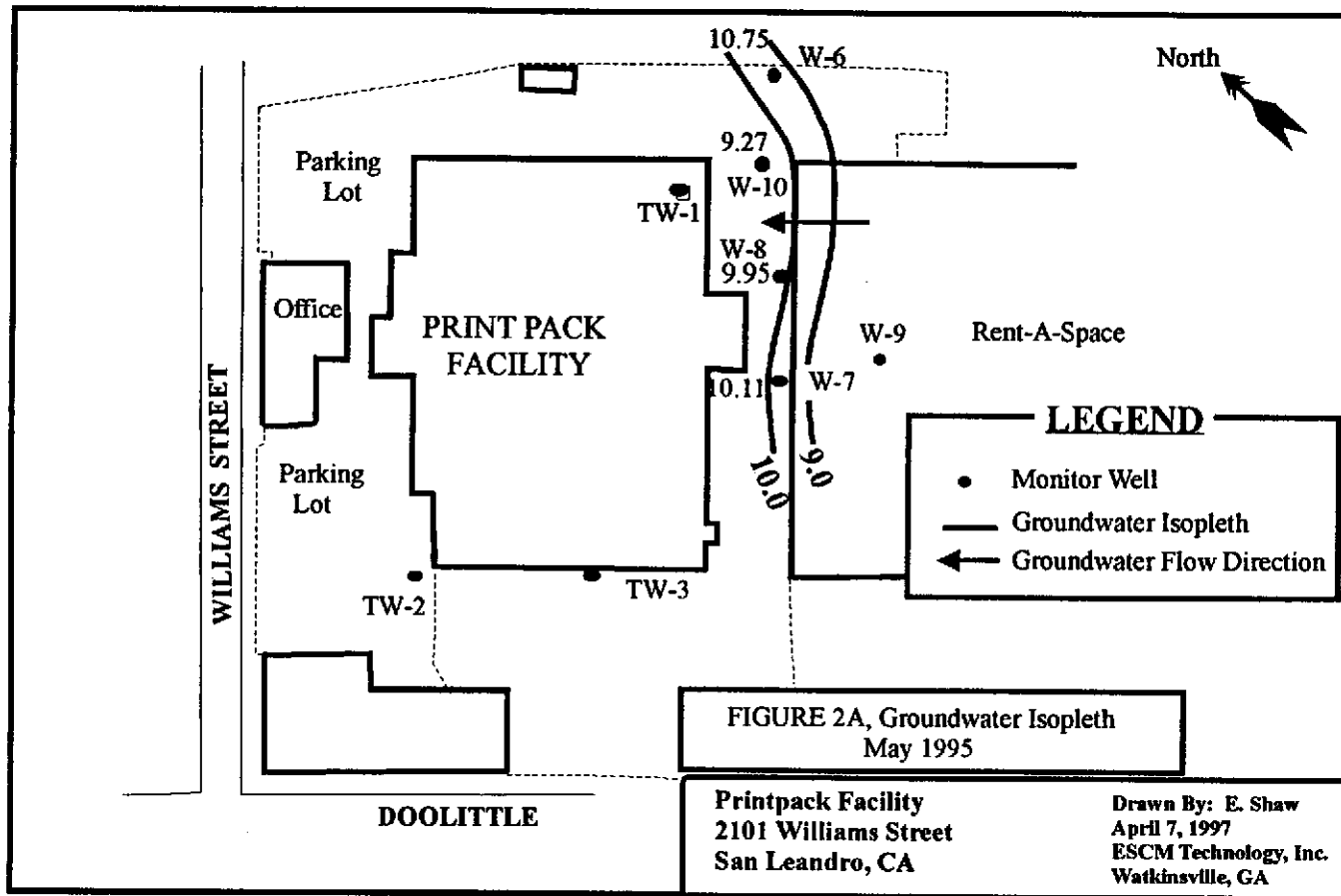
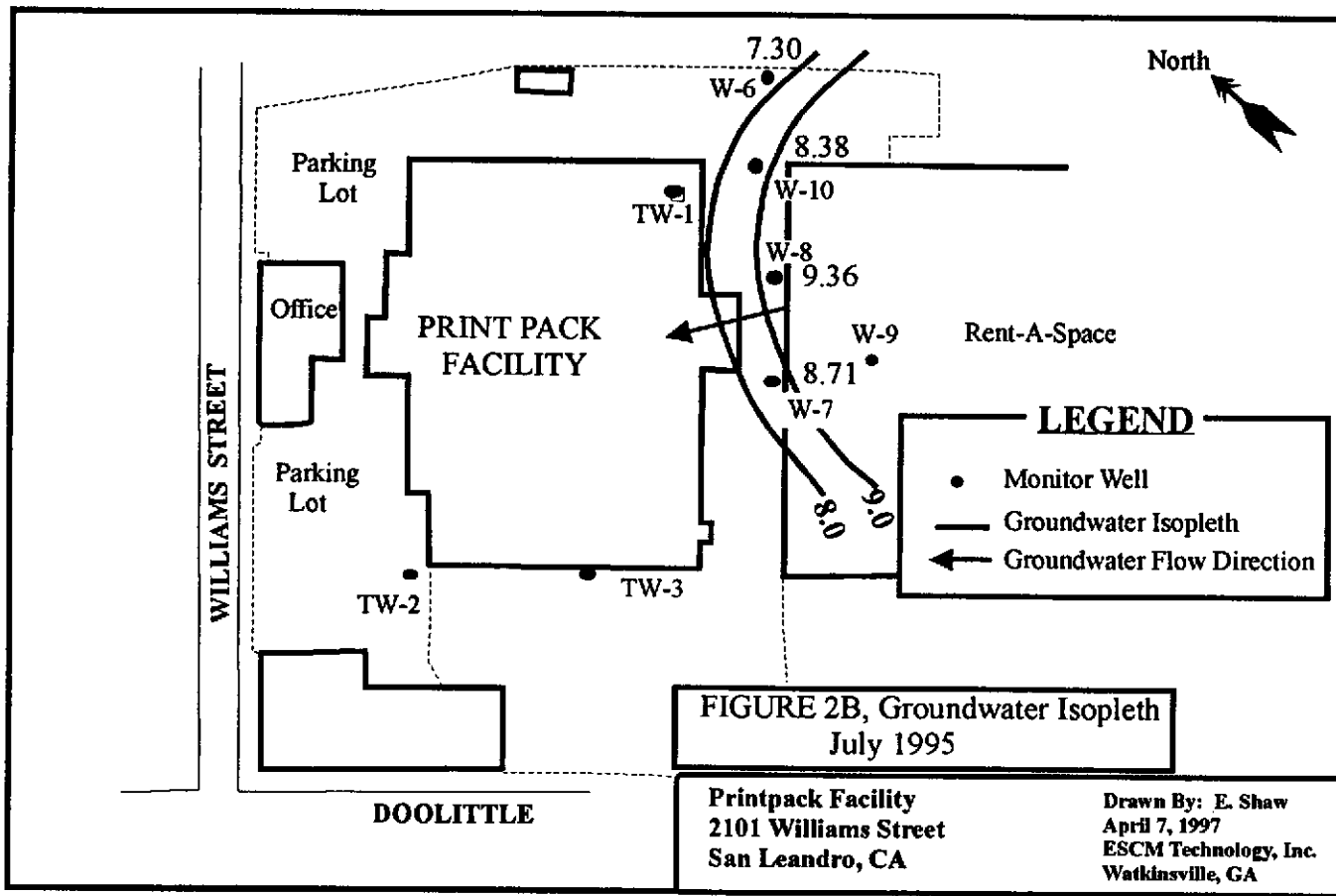


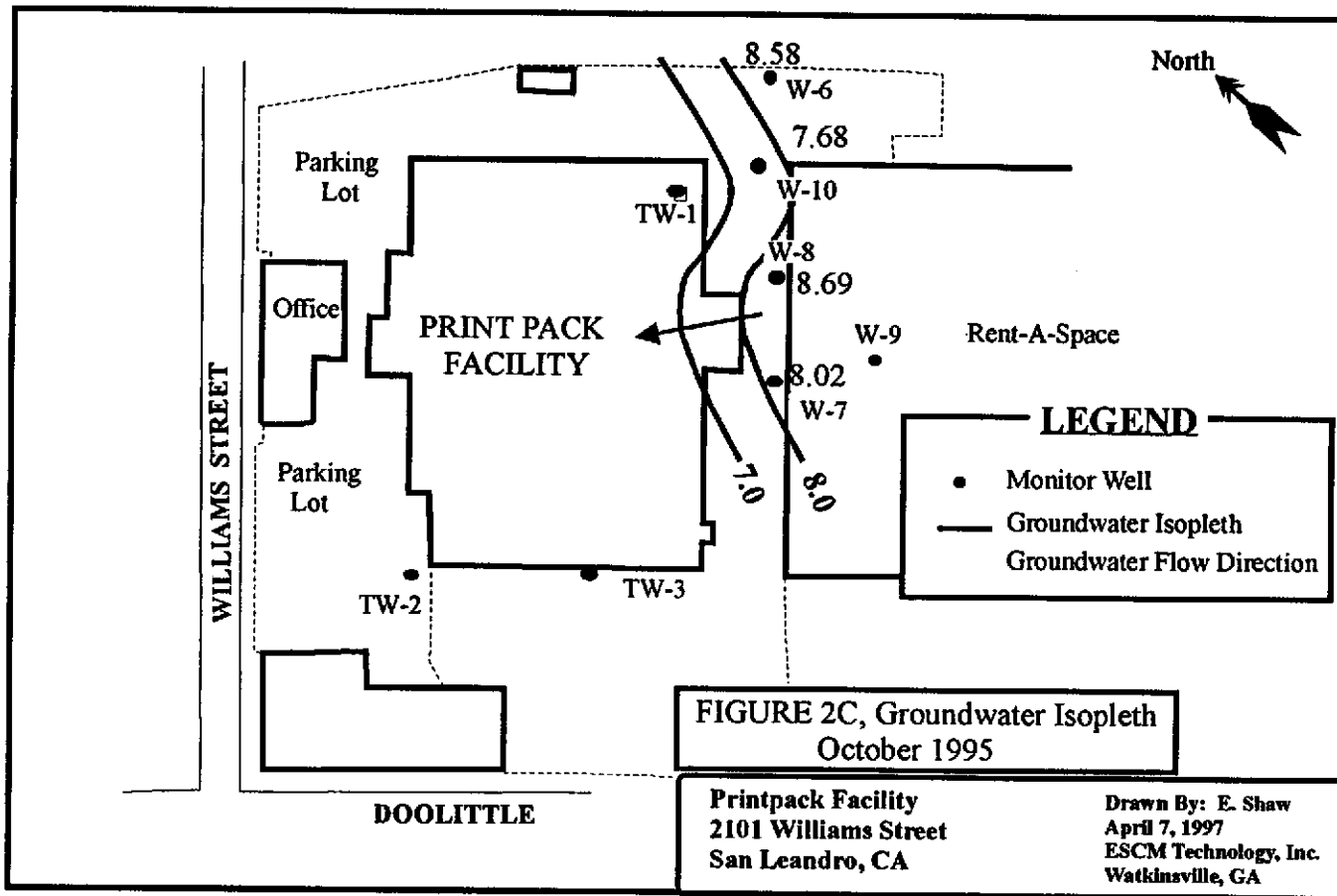
FIGURE 1, Site Map

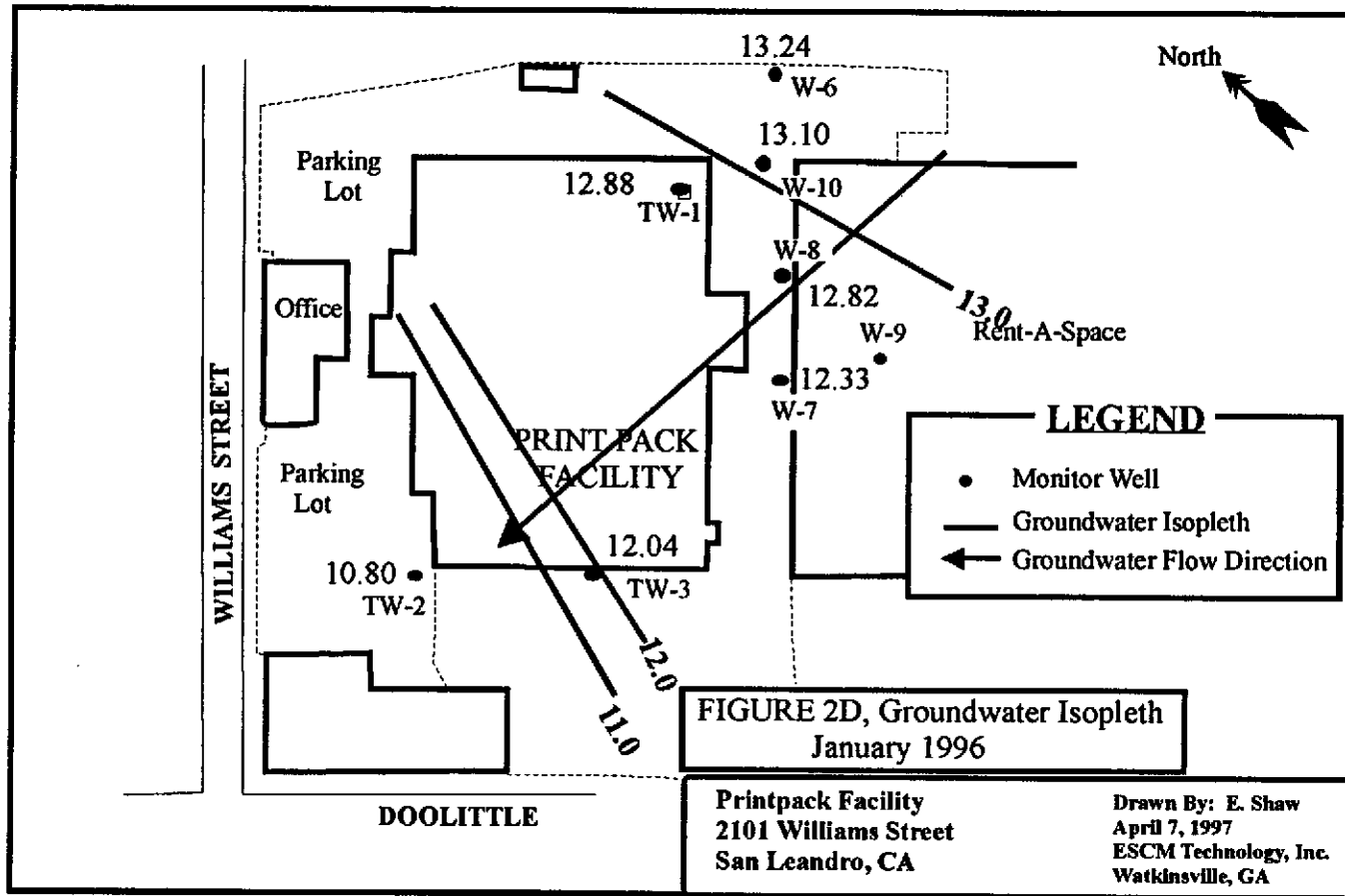
Printpack Facility  
 2101 Williams Street  
 San Leandro, CA

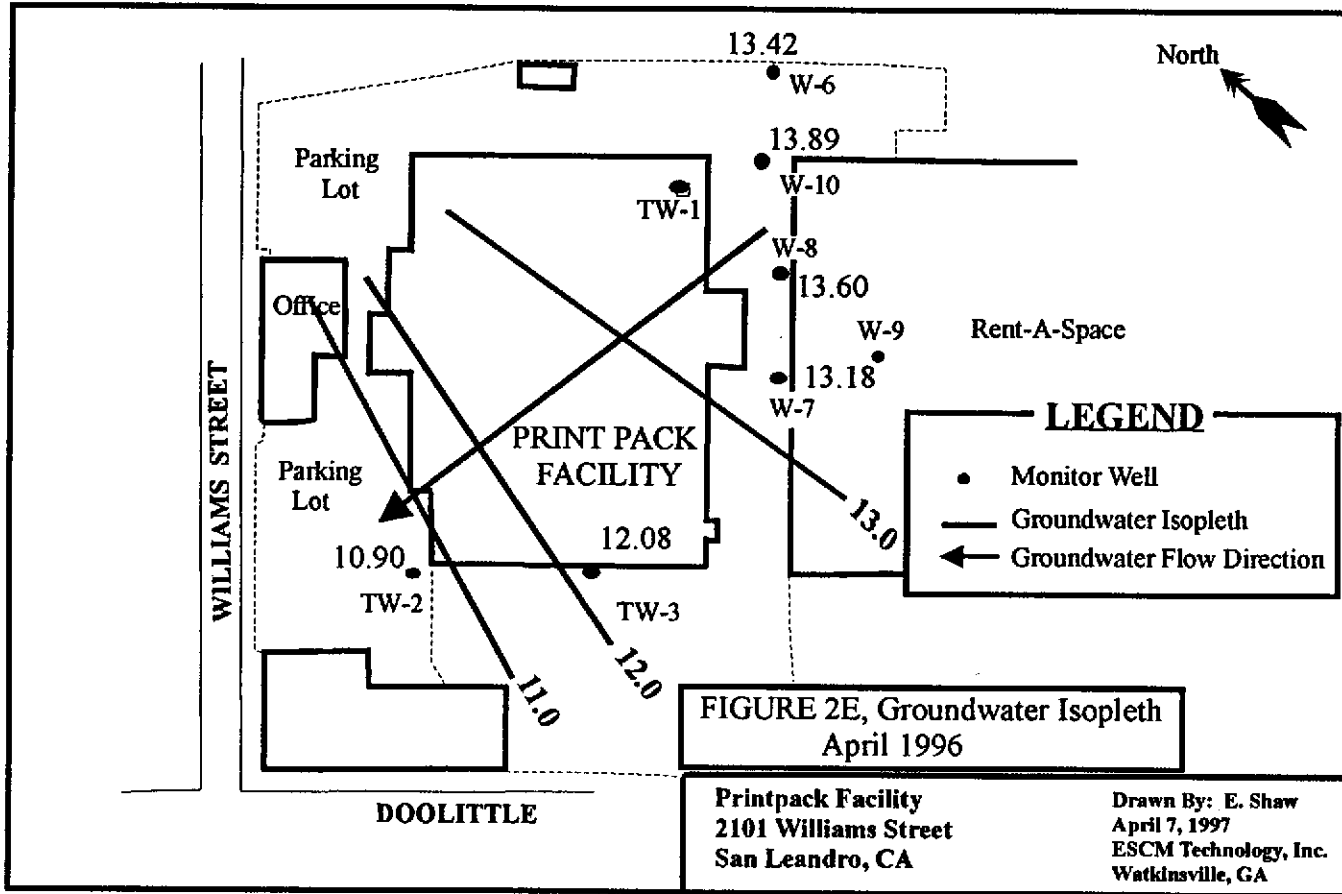
Drawn By: E. Shaw  
 April 7, 1997  
 ESCM Technology, Inc.  
 Watkinsville, GA



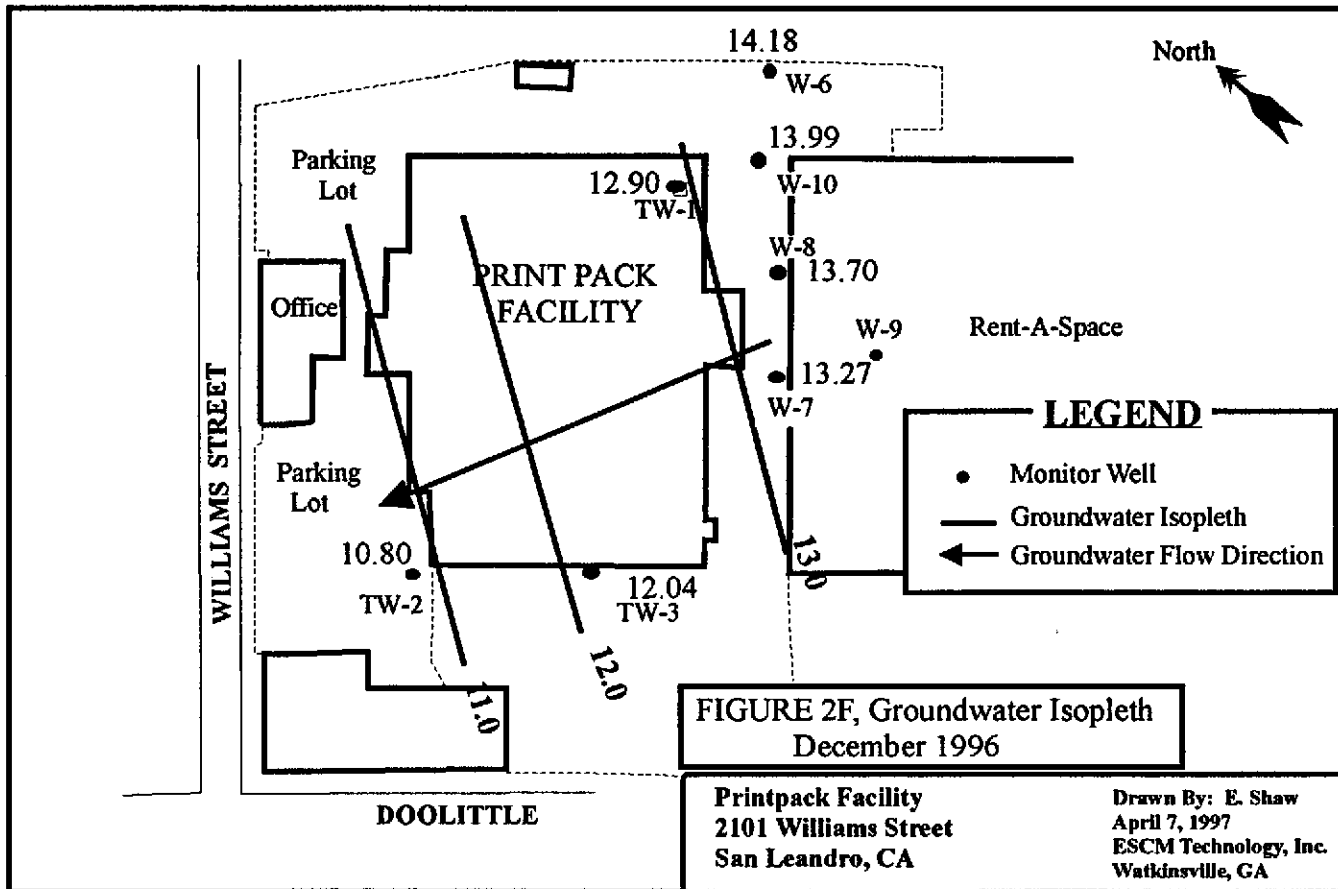












**TABLE 1**  
**GROUND-WATER ELEVATION DATA SUMMARY**  
**PRINTPACK FACILITY**  
**2101 WILLIAMS STREET**  
**SAN LEANDRO, CALIFORNIA**  
**APRIL 14, 1997**

Monitor Well	W-6	W-7	W-8	W-10	B-1	TW-1	TW-2	TW-3
Sample Date								
May 1995	10.75	10.11	9.95	9.27	10.2			
July 1995	7.30	8.71	9.36	8.38	5			
Oct 1995	8.58	8.02	8.69	7.68	9.34			
Jan 1996	13.24	12.33	12.82	13.10	8.61	12.88	10.50	11.47
April 1996	13.42	13.18	13.60	13.89	13.1	ND	10.90	12.04
Dec 1996	14.18	13.27	13.70	13.99	3	12.90		12.04
					13.9		10.80	
					5			
					14.0			
					0			

**TABLE 2**  
**GROUND-WATER SAMPLE ANALYTICAL RESULTS**  
**PRINTPACK FACILITY**  
**2101 WILLIAMS STREET**  
**SAN LEANDRO, CALIFORNIA**  
**APRIL 14, 1997**

Monitor Well	Sample Date	TPH-D (µg/L)	TPH-HF (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylben (µg/L)	Xylenes (µg/L)	Acetone (µg/L)	MIBK (µg/L)
TW-2	12/28/95 04/11/96 01/22/97	NA	2200	ND	ND	ND	ND	NA	NA
		NA	ND	ND	ND	ND	ND	NA	NA
		NA	390	ND	ND	ND	ND	NA	NA
TW-3	12/28/95 04/11/96 01/22/97	NA	ND	ND	ND	ND	ND	NA	NA
		NA	ND	0.58	ND	ND	ND	NA	NA
		NA	ND	ND	ND	ND	ND	NA	NA
W-7	12/28/95 04/11/96 01/22/97	ND	ND	ND	ND	ND	ND	NA	NA
		ND	ND	NA	NA	NA	NA	NA	NA
		ND	ND	ND	ND	ND	ND	ND	ND
W-8	12/28/95 04/11/96 01/22/97	NA	NA	NA	NA	NA	NA	NA	NA
		ND	ND	NA	NA	NA	NA	NA	NA
		ND	ND	ND	ND	ND	ND	ND	ND
W-10	12/28/95 04/11/96 01/22/97	1700	2500	1.8	91	11	64	NA	NA
		NA	NA	2.2	100	12	62	1400	NA
		ND	ND	ND	ND	ND	ND	0	ND
								2400	

NA means analyte not applicable to this sample round  
 ND means not detected above the reporting limit

**TABLE 3**  
**ACETONE CONCENTRATIONS IN MONITOR WELL "W-10"**  
**PRINTPACK FACILITY**  
**2101 WILLIAMS STREET**  
**SAN LEANDRO, CALIFORNIA**  
**APRIL 14, 1997**

<u>DATE</u>	<u>CONCENTRATI</u> <u>ON</u> <u>mg/L</u>
JUN 94	150,000
SEP 94	74,000
DEC 94	18,000
FEB 95	47,000
MAY 95	21,000
JUL 95	19,000
OCT 95	39,000
APR 96	14
DEC 96	2.4

**Appendix A**  
**Slug Test Analyses**

Horslev unconfined slug test where  $L/R > 8$ , Calculate K.

See p. 196 of Fetter

Enter the following in column F

	For: Well	Withdrawal Method
r is the well casing radius	4	
	0.16666	
R is the well screen (see photocopy) radius		0.33333
L is the length of the well screen (gravel pack below water table)		20
L/R ratio > 8 validate equation		60.0006
To is time takes for the water level to rise or fall 37 percent of the initial change		28

$$K = 0.0001 \text{ feet/sec} = 3.09E-03 \text{ cm/sec}$$

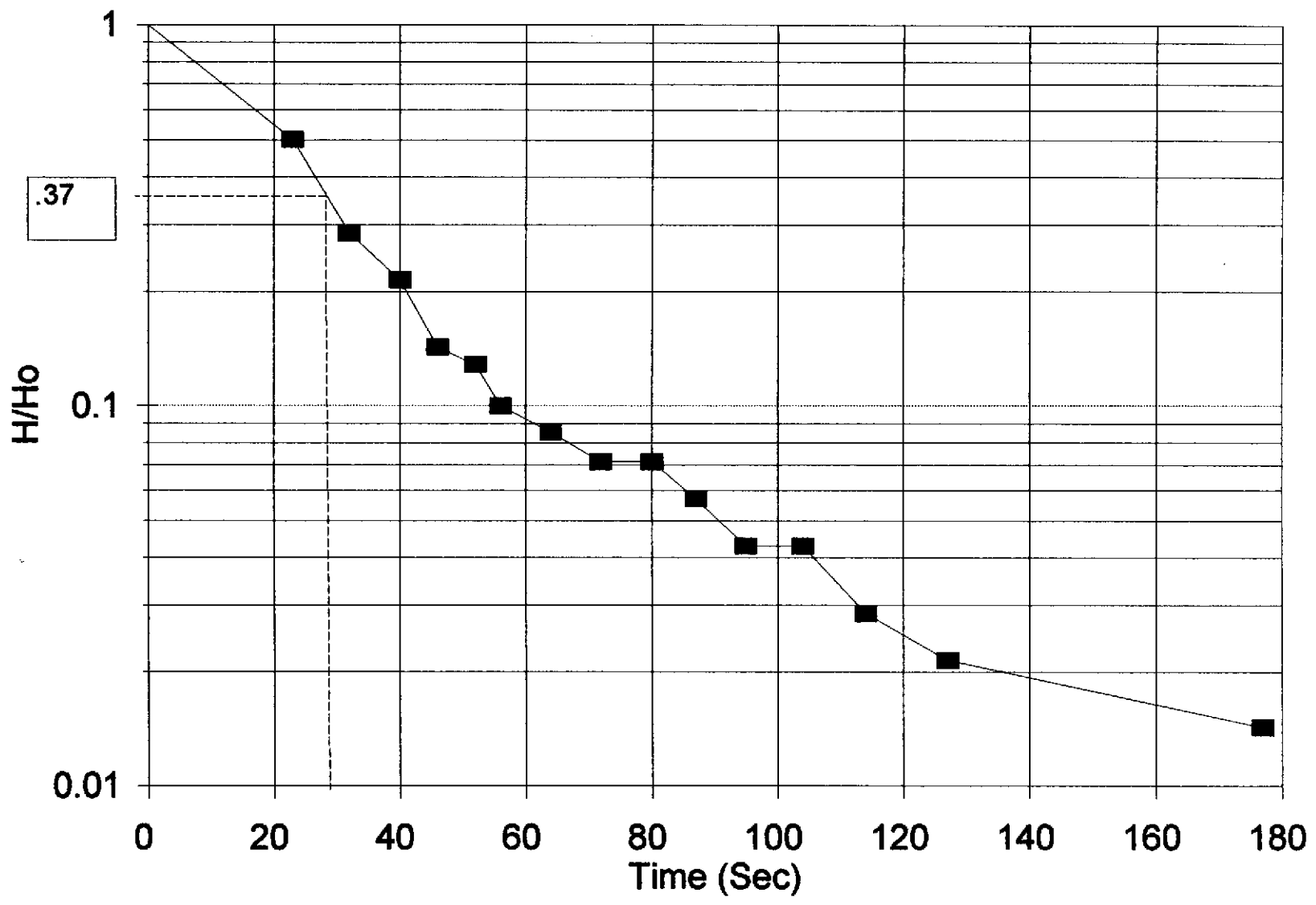
$$= 8.77292 \text{ feet/day}$$

**W-4 - WITHDRAWL METHOD**

TEST # 2

Time Seconds	Depth to Water	Delta lev. water	H/Ho
Static	10.7	0	
0	11.4	0.7 = Ho	1
23	11.05	0.35	0.5
32	10.9	0.2	0.2857143
40	10.85	0.15	0.2142857
46	10.8	0.1	0.1428571
52	10.79	0.09	0.1285714
56	10.77	0.07	0.1
64	10.76	0.06	0.0857143
72	10.75	0.05	0.0714286
80	10.75	0.05	0.0714286
87	10.74	0.04	0.0571429
95	10.73	0.03	0.0428571
104	10.73	0.03	0.0428571
114	10.72	0.02	0.0285714
127	10.715	0.015	0.0214286
177	10.71	0.01	0.0142857
150	10.7	0	0
176	10.7	0	0
190	10.7	0	0
200	10.7	0	0
240	10.7	0	0

Well 4





Horslev unconfined slug test where  $L/R > 8$ , Calculate K.

See p. 196 of Fetter

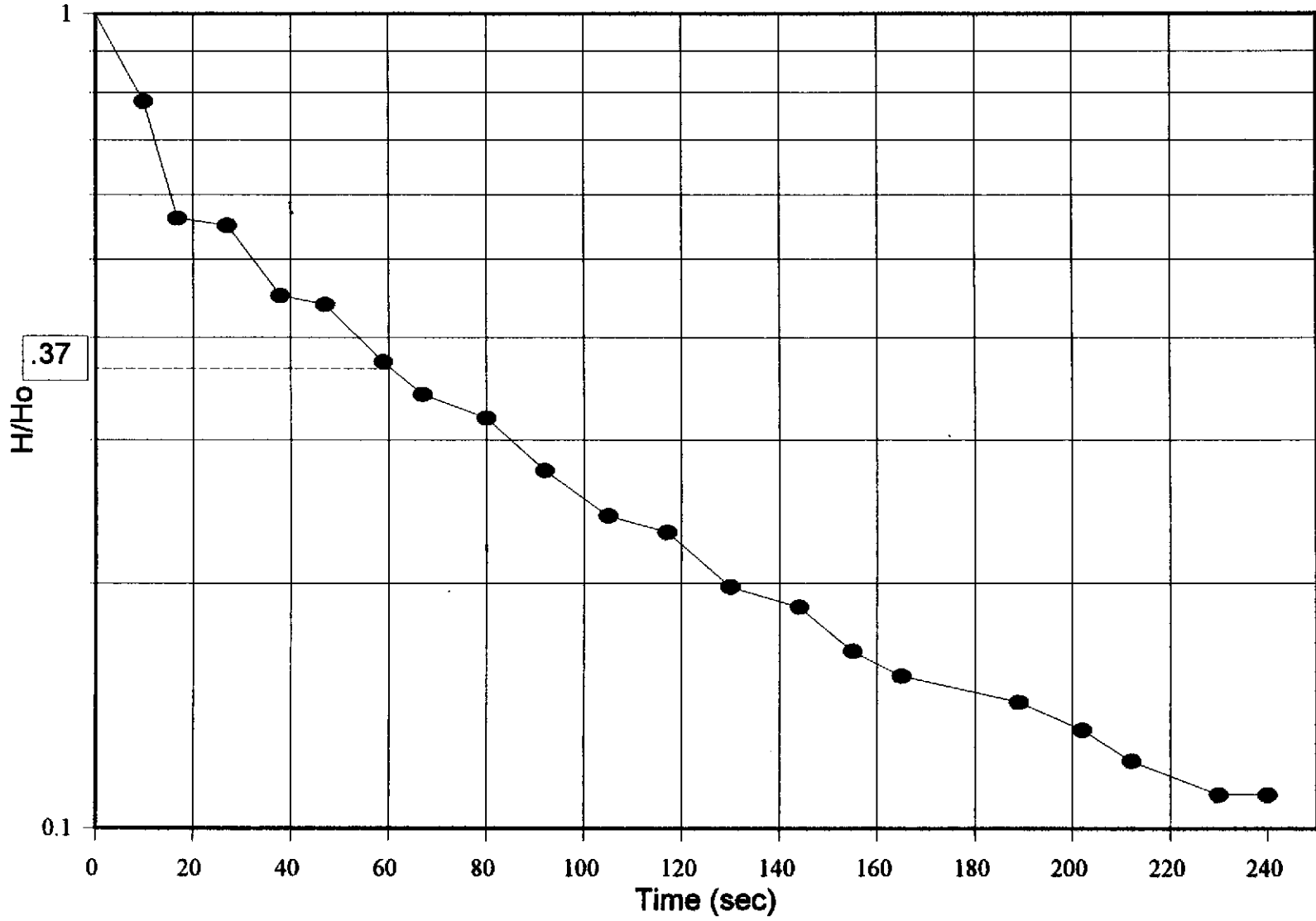
Enter the following in column F

	For: Well	Withdrawl Method
r is the well casing radius	TW-2	
	0.16666	
R is the well screen (see photocopy) radius	0.33333	
L is the length of the well screen (gravel pack below water table)	5.01	
L/R ratio > 8 validate equation	15.0302	
To is time takes for the water level to rise or fall 37 percent of the initial change	60	

$$K = 0.00013 \text{ feet/sec} = 3.82E-03 \text{ cm/sec}$$

$$= 10.8177 \text{ feet/day}$$

TW-2



PRINT PACK - SAN LEANDRO, CA.

12/14/96

TW-2 - WITHDRAWAL METHOD

TEST # 2

Time Seconds	Depth to Water	Delta lev. water	H/Ho
Static	14.99	0	
0	15.9	0.91 = Ho	1
10	15.7	0.71	0.7802198
17	15.5	0.51	0.5604396
27	15.49	0.5	0.5494505
38	15.4	0.41	0.4505495
47	15.39	0.4	0.4395604
59	15.33	0.34	0.3736264
67	15.3	0.31	0.3406593
80	15.28	0.29	0.3186813
92	15.24	0.25	0.2747253
105	15.21	0.22	0.2417582
117	15.2	0.21	0.2307692
130	15.17	0.18	0.1978022
144	15.16	0.17	0.1868132
155	15.14	0.15	0.1648352
165	15.13	0.14	0.1538462
189	15.12	0.13	0.1428571
202	15.11	0.12	0.1318681
212	15.1	0.11	0.1208791
230	15.09	0.1	0.1098901
240	15.09	0.1	0.1098901
240	15.09	0.1	0.1098901
258	15.08	0.09	0.0989011
270	15.07	0.08	0.0879121
325	15.05	0.06	0.0659341
520	15.03	0.04	0.043956

Horslev unconfined slug test where  $L/R > 8$ , Calculate K.

See p. 196 of Fetter

Enter the following in column F

	For: Well	Injection Method
r is the well casing radius	TW-2	
	0.16666	
R is the well screen (see photocopy) radius	0.33333	
L is the length of the well screen (gravel pack below water table)	5.01	
L/R ratio > 8 validate equation	15.03	
To is time takes for the water level to rise or fall 37 percent of the initial change	70	

$$K = 0.00011 \text{ feet/sec} = 3.27E-03 \text{ cm/sec}$$

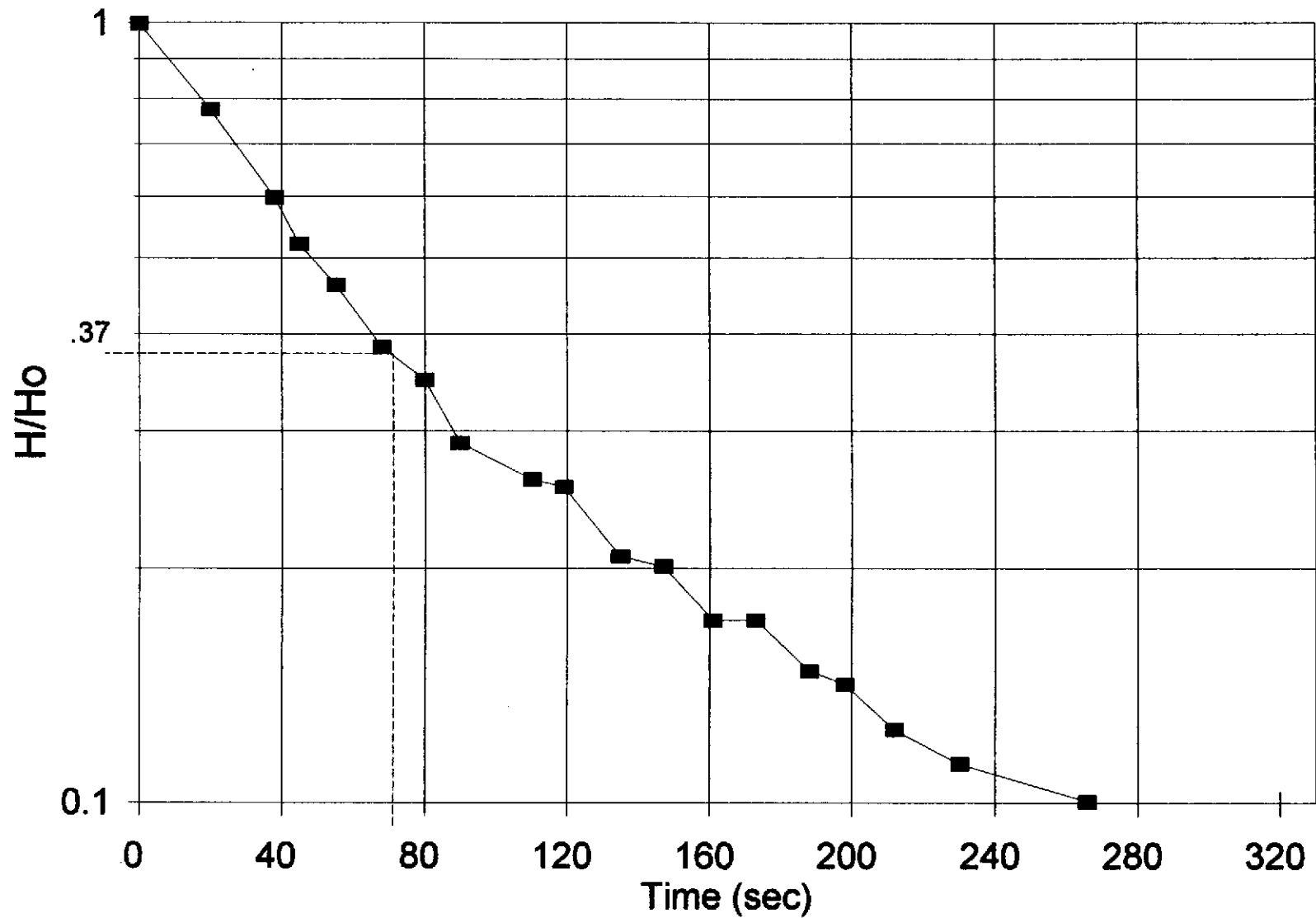
$$= 9.27231 \text{ feet/day}$$

**TW-2 - Injection Method**

TEST # 3

Time Seconds	Depth to Water	Delta lev. (absolute) water - H	H/Ho
Static	14.99	0	
0	13.3	1.69 = Ho	1
20	13.68	1.31	0.775148
38	13.98	1.01	0.597633
45	14.11	0.88	0.52071
55	14.21	0.78	0.461538
68	14.34	0.65	0.384615
80	14.4	0.59	0.349112
90	14.5	0.49	0.289941
110	14.55	0.44	0.260355
119	14.56	0.43	0.254438
135	14.64	0.35	0.207101
147	14.65	0.34	0.201183
161	14.7	0.29	0.171598
173	14.7	0.29	0.171598
188	14.74	0.25	0.147929
198	14.75	0.24	0.142012
212	14.78	0.21	0.12426
230	14.8	0.19	0.112426
266	14.82	0.17	0.100592
280	14.84	0.15	0.088757
300	14.85	0.14	0.08284
330	14.88	0.11	0.065089
360	14.89	0.1	0.059172

TW-2 - Injection



## **Simulation of the Fate and Transport of Dissolved-Phase Acetone at the Printpack, Inc., Facility, San Leandro, California**

**INTRODUCTION** - The fate and transport of acetone in groundwater were simulated at the Printpack, Inc., facility in San Leandro, California. The simulation was conducted using the BIOSCREEN Natural Attenuation Decision Support System. BIOSCREEN is a one-dimensional analytical model published by the U.S. Environmental Protection Agency (<sup>1</sup>Newell and McLeod, 1996).

The model can be used to simulate the movement of a solute in groundwater. The natural attenuation of the solute can be simulated with or without the effects of biodegradation. The output data can be presented as graphs of the following: solute transport with no decay, solute transport with first-order decay and solute transport with instantaneous biodegradation reaction.

A dissolved-phase acetone plume has been detected in groundwater at the Printpack facility. The nearest receptor is San Francisco Bay which is approximately 4000 feet down gradient from the site. Simulations were conducted to evaluate the potential for the dissolved-phase plume to reach the bay. Because the acetone has been detected in only one monitor well on the property, model calibration was not possible. Therefore, the simulation was conducted using field-measured input data whenever possible, however, field-measured data were not available, the conservative input data (i.e., "worst case") were used.

Biodegradation rates are calculated by the BIOSCREEN model using either a first-order decay constant or an instantaneous reaction model (IRM). The first-order decay rate can be input directly into the model or can be calculated based on the half-life of the solute. The degradation rates calculated by the instantaneous reaction model are based on reduction/oxidation (redox) reactions in the subsurface. The redox potential is calculated using the concentration of five aerobic and anaerobic electron acceptors in the dissolved plume.

---

<sup>1</sup>Newell, C.J., et al., 1996. BIOSCREEN, Natural Attenuation Decision Support System, Users Manual, Version 1.3, U.S. EPA, 63 pp.

BIOSCREEN also allows the user to conduct a simulation using either an infinite or finite source. If an infinite source is chosen, the concentration of solute at the source remains constant throughout the simulation ("most conservative" scenario). A finite source mass can be input based on an estimate of the dissolvable mass of solute in the subsurface. The declining source mass is expressed as a first-order decay process.

**INITIAL CONDITIONS** - The initial conditions of the model are:

$C(x,y,z,0) = 0$       The initial concentration = 0 for  $x,y,z, >0$

$C(0,Y,Z,0) = C_0$       The source concentration for each vertical plane source =  $C_0$  at time 0

**KEY MODEL ASSUMPTIONS** -

The aquifer and flow field are homogeneous and isotropic.

The ground-water velocity is fast enough that molecular diffusion in the dispersion terms can be ignored.

Adsorption is a reversible process represented by a linear isotherm.

**KEY MODEL LIMITATIONS** -

The model should not be applied where pumping systems create a complicated flow field.

The model should not be applied where vertical flow gradients affect contaminant transport.

The model should not be applied where hydrogeologic conditions change dramatically over the simulation domain.



**GOVERNING EQUATION** - The Domenico analytical model is used in BIOSCREEN to simulate the transport and decay of the solute. The following equation is used in the model:

$$\frac{C(x,y,z,t)}{(C_0 + BC)} = \frac{1}{8} \exp \left[ \frac{x}{\alpha_x} \left( 1 - (1 + 4\lambda \alpha_x / v)^{\frac{1}{2}} \right) \right] \\ \operatorname{erfc} \left[ \frac{\left( x - vt(1 + 4\lambda \alpha_x / v)^{\frac{1}{2}} \right)}{2(\alpha_x vt)^{\frac{1}{2}}} \right] \\ \left\{ \operatorname{erf} \left[ \frac{y + Y/2}{2(\alpha_y x)^{\frac{1}{2}}} \right] - \operatorname{erf} \left[ \frac{y - Y/2}{2(\alpha_y x)^{\frac{1}{2}}} \right] \right\} \\ \left\{ \operatorname{erf} \left[ \frac{Z}{2(\alpha_z x)^{\frac{1}{2}}} \right] - \operatorname{erf} \left[ \frac{-Z}{2(\alpha_z x)^{\frac{1}{2}}} \right] \right\} - BC$$

where:  $v = \frac{K \cdot i}{\theta_e R}$        $BC = \Sigma \frac{C(ea)_n}{UF_n}$

**Definitions:**

BC	Biodegradation Capacity	UF <sub>n</sub>	Utilization factor for electron acceptors
C(x,y,z,t)	Predicted concentration	α <sub>x</sub>	Longitudinal dispersivity (ft)
C <sub>s</sub>	Source Concentration (mg/L)	α <sub>y</sub>	Transverse dispersivity (ft)
C <sub>0</sub>	Source Concentration at t=0 (mg/L)	α <sub>z</sub>	Vertical dispersivity (ft)
x	Distance down gradient of source (ft)	θ <sub>e</sub>	Effective soil porosity
y	Distance from plume centerline (ft)	λ	1st-order decay rate (day <sup>-1</sup> )
z	Distance from surface to measurement point (Assumed=0, conc. assumed at top)	v	Ground-Water seepage velocity (ft/yr)
C(ea) <sub>n</sub>	Concentration of electron acceptor in groundwater (mg/L)	K	Hydraulic conductivity (ft/yr)
Y	Source width	R	Constituent retardation factor
		I	Hydraulic gradient (ft/ft)
		Z	Source depth

**SIMULATION INPUT DATA AND RESULTS** - The fate and transport of dissolved-phase acetone in groundwater were simulated at the Printpack, Inc., facility in San Leandro, California. Acetone has been detected in one monitor well (MW-10) at the facility since 1994.

**DATA INPUT** - The following data were input for the simulations (Figure 1, Table 1):

1. **Flow Velocity Data** - The seepage velocity used in the simulation was calculated using field measured values for hydraulic conductivity and hydraulic gradient. ESCM conducted slug tests at the facility and calculated a hydraulic conductivity of  $3.4 \times 10^{-3}$  cm/sec for the surficial aquifer. The hydraulic gradient was calculated using gauging data collected at the site. A hydraulic gradient of 0.0045 was used for the simulations. The effective porosity was estimated at 0.35.

2. **Dispersion Data** - The longitudinal, transverse and vertical dispersivity were calculated by the BIOSCREEN model. The following equation is used in the BIOSCREEN model to estimate these parameters:

$$\text{Alpha } x = 3.28 \cdot 0.83 \cdot \left[ \log_{10} \left( \frac{L_p}{3.28} \right)^{2.414} \right]$$

$$\text{Alpha } y = 0.10 \text{ Alpha } x$$

$$\text{Alpha } z = \text{very low (i.e., } 1 \times 10^{-99} \text{ ft.)}$$

where:

Alpha x	Longitudinal dispersivity
Alpha y	Transverse dispersivity
Alpha z	Vertical dispersivity
$L_p$	Plume length, in feet

A plume length of 300 feet was used for the simulations based on a "most conservative" or "worst case" estimate.

# BIOSCREEN Natural Attenuation Decision Support System

Air Force Center for Environmental Excellence

Version 1.3

Printpack  
San Leandro, CA  
Run Name

## Data Input Instructions:

1. Enter value directly....or
  2. Calculate by filling in grey cells below. (To restore formulas, hit button below).
- Variable\* → Data used directly in model.  
20 → Value calculated by model. (Don't enter any data).

### 1. HYDROGEOLOGY

Seepage Velocity*	Vs	45.1	(ft/yr)
or			
Hydraulic Conductivity	K	3.4E-03	(cm/sec)
Hydraulic Gradient	i	0.0045	(ft/ft)
Porosity	n	0.35	(-)

### 2. DISPERSION

Longitudinal Dispersivity*	alpha x	13.8	(ft)
Transverse Dispersivity*	alpha y	1.4	(ft)
Vertical Dispersivity*	alpha z	0.0	(ft)
or			
Estimated Plume Length	Lp	300	(ft)

### 3. ADSORPTION

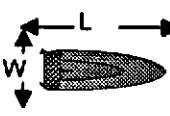
Retardation Factor*	R	1.0	(-)
or			
Soil Bulk Density	rho	1.65	(kg/l)
Partition Coefficient	Koc	0.01	(L/kg)
Fraction Organic Carbon	foc	1.60E-01	(-)

### 4. BIODEGRADATION

1st Order Decay Coeff*	lambda	1.8E+0	(per yr)
or			
Solute Half-Life	t-half	0.38	(year)
or Instantaneous Reaction Model			
Delta Oxygen*	DO	4	(mg/L)
Delta Nitrate*	NO3	10	(mg/L)
Observed Ferrous Iron*	Fe2+	24	(mg/L)
Delta Sulfate*	SO4	0	(mg/L)
Observed Methane*	CH4	17	(mg/L)

### 5. GENERAL

Modeled Area Length*	420	(ft)
Modeled Area Width*	100	(ft)
Simulation Time*	8	(yr)



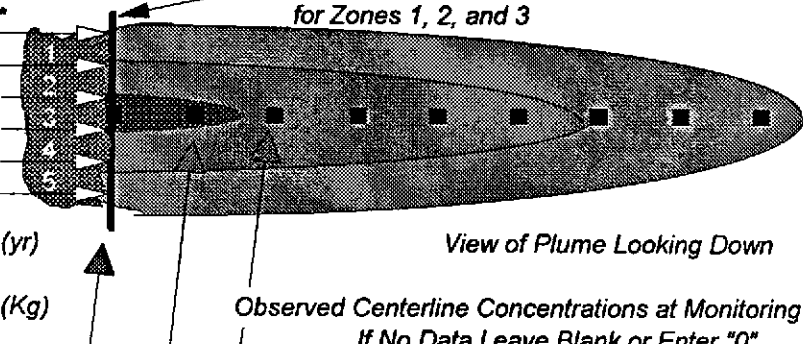
### 6. SOURCE DATA

Source Thickness in Sat.Zone\* 20 (ft)

Source Zones:

Width* (ft)	Conc. (mg/L)*
10	37.5
20	75
40	150
20	75
10	37.5

Source Decay (see Help):  
Source Half-life\* Infinite (yr)  
Soluble Mass Infinite (Kg)  
In NAPL, Soil Infinite (Kg)



### 7. FIELD DATA FOR COMPARISON

Concentration (mg/L)	Dist. from Source (ft)	0	42	84	126	168	210	252	294	336	378	420

### 8. CHOOSE TYPE OF OUTPUT TO SEE:

**RUN CENTERLINE**

View Output

**RUN ARRAY**

View Output

**Help**

Recalculate This Sheet

Paste Example Dataset

Restore Formulas for Vs, Dispersivities, R, lambda, other

Figure 1. Input Data Used in the Acetone Transport Simulations

Table 1  
Input Data for BIOSCREEN Simulation at the Printpack, Inc., Facility

Input Parameters	Input data
Hydraulic Conductivity (K)*	3.4 x 10 <sup>-3</sup> cm/sec
Hydraulic Gradient (I)*	0.0045 cm/cm
Effective Porosity (n)**	0.35
Seepage Velocity†	45.1 ft/yr
Plume Length**	300 ft
Longitudinal Dispersivity†	13.8 ft
Transverse Dispersivity†	1.4 ft
Vertical Dispersivity†	0.0 ft
Retardation Factor†	1.0 (no retardation)
Solute Half-Life**	0.38 yrs
1st-Order Decay Coefficient†	1.8/yr
Source Data, zones 1 & 5** Width, Concentration	10 ft, 37.5 mg/L
Source Data, zone 2 & 4** Width, Concentration	20 ft, 75 mg/L
Source Data, zone 3** Width, Concentration	40 ft, 150 mg/L
Source Zone Thickness**	20 ft
Soluble Source Mass**	Infinite
Source Half-Life†	Infinite

\* - Field-Measured, † - Calculated by model, \*\* - Estimated based on "worst case" values

3. Adsorption Data - The effects of adsorption can be simulated by the BIOSCREEN model. The model can be used to calculate a retardation factor using the following equation:

$$R = 1 + \frac{K_d \cdot \rho_b}{n}$$

where:

$\rho_b$	-	bulk density
$K_d$	=	$K_{oc} \cdot f_{oc}$
$K_d$	-	distribution coefficient
$K_{oc}$	-	organic carbon-water partition coefficient
$f_{oc}$	-	fraction organic carbon of uncontaminated soil

The user is also allowed to directly enter a retardation factor if site-specific data are not available. The retardation factors calculated by the model use bulk density, fraction of organic carbon (foc) and the organic carbon partitioning coefficient (Koc) to calculate the retardation factor. A retardation factor of 1 (i.e., no retardation) was used to simulate the "most conservative" conditions.

4. Biodegradation - The effects of biodegradation can be simulated by the BIOSCREEN model using two different methods. One method simulates biodegradation as a first-order decay process. A first-order decay constant can be input directly into the model or the model will calculate the constant based on the half-life of the solute being modeled. The equation used to calculate the first-order constant is as follows:

$$k = 0.639 / t_{1/2}$$

where:

$k$	-	first-order decay constant
$t_{1/2}$	-	solute half-life

A first-order decay constant was used in the simulations conducted by ESCM at the Printpack facility. A half-life of 0.38 years was used in the simulation. The half life of acetone in groundwater ranges from 2 to 14 days<sup>2</sup>. A half-life of 0.38 years was used to simulate "worst case" conditions. This half-life was based on a value one order of magnitude greater than the maximum estimated half-life. A decay constant of 1.8/year was calculated by the model.

---

<sup>2</sup>Howard, P.H., et al., 1991. Handbook of Environmental Degradation Rates, Lewis Publishers, Chelsea, Michigan, pp. 97-98.

The second method used in the BIOSCREEN model to simulate biodegradation is based on an instantaneous reaction model. The instantaneous reaction model uses the concentration of various electron acceptors in the groundwater to estimate the amount of biodegradation of the solute. The instantaneous reaction model has not yet gained widespread use in the environmental industry and was not used for the simulations conducted by ESCM.

5. Source Data - The source data used in the simulations are based on five user-defined source zones. The source zones are defined as the concentrations of the dissolved-phase solute at various plume widths. The depth of source zone is also input by the user.

The source zones were defined using plume maps and laboratory analyses of ground-water samples collected at this site. The concentration of acetone in the source zones was selected to match "worst case" site concentrations. The center zone (zone 3) was defined as a 40 foot wide band with a acetone concentration of 150 mg/L. The center zone was flanked by 20 foot zones (zones 2 and 4) with acetone concentrations of 75 mg/L. The two outer source zones (zones 1 and 5) were defined as 10 foot wide bands with a acetone concentration of 37.5 mg/L. A plume depth of 20 feet was used in the simulations. The source zone concentrations were based on "worst case" scenarios.

6. Source Half-Life - The user can input two different types of sources into the BIOSCREEN model. The source can be either infinite (i.e., constant source concentration) or the model can be used to approximate a source half-life. An infinite source was selected to simulate "worst case" conditions.

7. Field Data for Comparison - Because acetone has only been detected in one monitor well (MW-10), and the source of the acetone has not been identified, the simulation data could not be compared to field data.

**RESULTS OF THE SIMULATION** - The simulation results have been analyzed to determine the likelihood that the dissolved-phase acetone plume will affect the nearest receptor. The nearest receptor is San Francisco Bay which is approximately 4000 feet down gradient of the Printpack facility. Simulations were conducted for several time periods until the plume reached equilibrium (i.e., no longer moved).

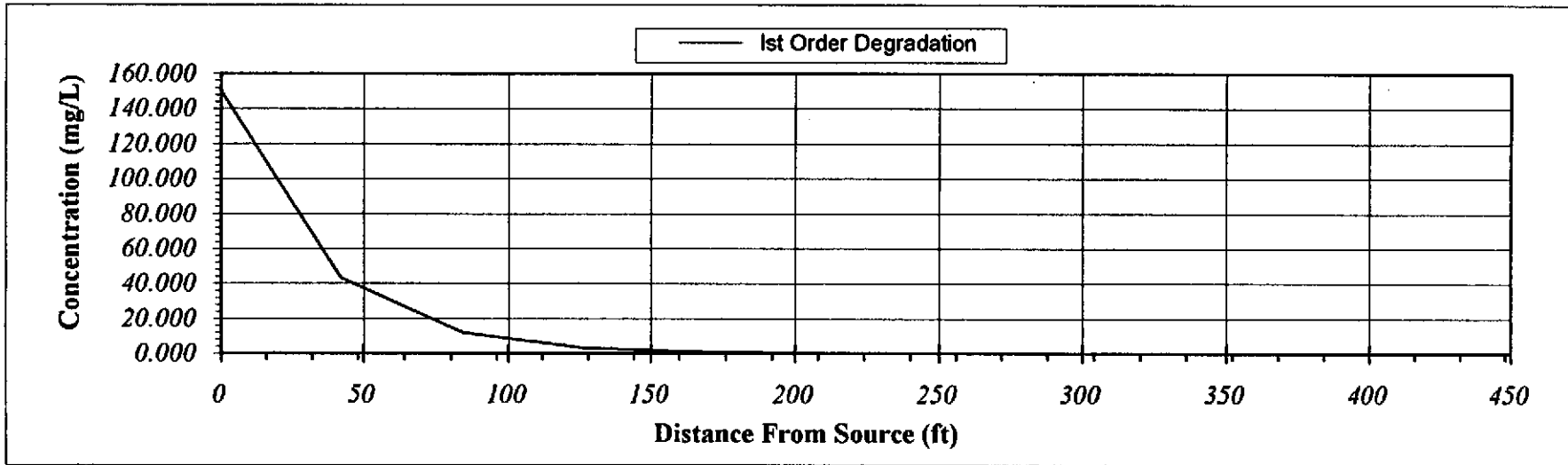
Analysis of the simulation data indicates that the plume will reach equilibrium in approximately eight years, will migrate a maximum distance of 420 feet from monitor well MW-10, will not migrate off site and the maximum concentration of the leading edge of the plume will be 1  $\mu\text{g/L}$  (ppb) (Figure 2). Examination of the historical dissolved-phase acetone data indicate that the concentration of this constituent decreased exponentially (Figure 3). An exponential decrease is indicative of first-order degradation kinetics, and supports the use of first-order degradation in the BIOSCREEN simulation.

**CONCLUSIONS** - Field-measured data were used for the simulations whenever possible. The simulations were conducted using "worst case" values for biodegradation, retardation, source concentrations and source half-life. The model could not be calibrated to field data because acetone has only been detected in one well (MW-10) at the facility. The model was used to simulate the fate and transport of acetone for an eight year period. This simulation indicates that the dissolved-phase acetone plume at the Printpack Facility will not reach the nearest receptor and will not migrate off site. These data also indicate that the plume will migrate a maximum of 420 feet from monitor well MW-10, and the maximum concentration of the acetone will be 1  $\mu\text{g/L}$  (ppb) at this distance.

**DISSOLVED ACETONE CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)**  
**Printpack, Inc. Facility, San Leandro, California**

*Distance from Source (ft)*

<b>TYPE OF MODEL</b>	<b>0</b>	<b>42</b>	<b>84</b>	<b>126</b>	<b>168</b>	<b>210</b>	<b>252</b>	<b>294</b>	<b>336</b>	<b>378</b>	<b>420</b>
<b>1st Order Decay</b>	150.000	43.280	12.027	3.367	0.949	0.269	0.077	0.022	0.006	0.002	0.001
<i>Field Data from Site</i>											



**Calculate Animation**

Time:

**Return to Input**

**Recalculate This Sheet**

Figure 2. Simulation of Acetone Movement in Groundwater - 8 Year Period



### Concentration of Acetone in Groundwater

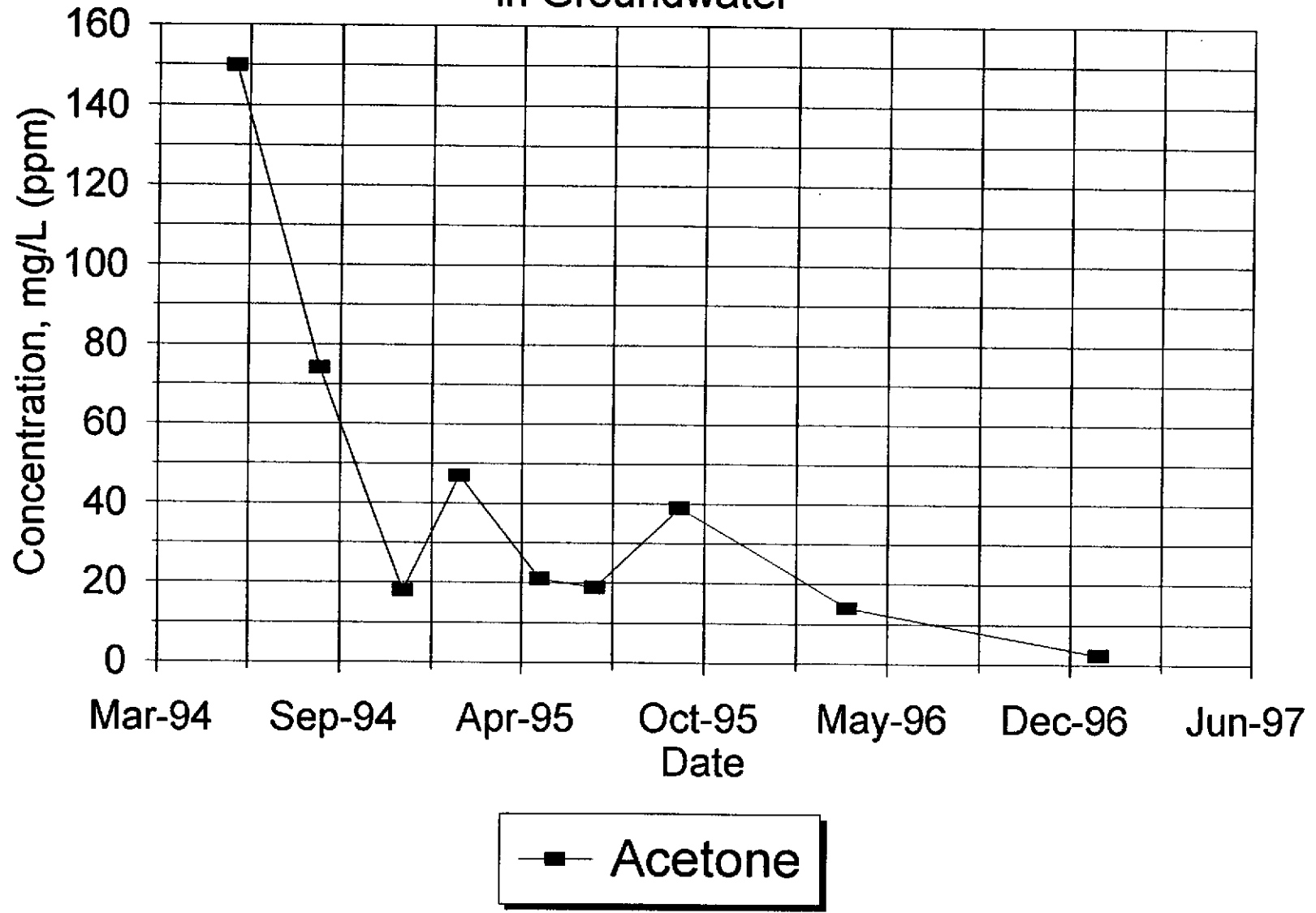


Figure 3. Exponential Decrease in the Concentration of Acetone in Groundwater

**Appendix B**  
**BIOSCREEN Simulation**

MSDS for ACETONE

Page 1

## 1 - PRODUCT IDENTIFICATION

PRODUCT NAME: ACETONE  
 FORMULA: (CH<sub>3</sub>)<sub>2</sub>CO  
 FORMULA WT: 58.08  
 CAS NO.: 67-64-1  
 NIOSH/RTECS NO.: AL3150000  
 COMMON SYNONYMS: DIMETHYL KETONE; METHYL KETONE; 2-PROPANONE  
 PRODUCT CODES: 9010,9006,9002,9254,9009,9001,9004,5356,A134,9007,9005,9005  
 9008  
 EFFECTIVE: 08/27/86  
 REVISION #02

## PRECAUTIONARY LABELLING

BAKER SAF-T-DATA(TM) SYSTEM

HEALTH - 1 SLIGHT  
 FLAMMABILITY - 3 SEVERE (FLAMMABLE)  
 REACTIVITY - 2 MODERATE  
 CONTACT - 1 SLIGHT

HAZARD RATINGS ARE 0 TO 4 (0 = NO HAZARD; 4 = EXTREME HAZARD).

## LABORATORY PROTECTIVE EQUIPMENT

SAFETY GLASSES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER

## PRECAUTIONARY LABEL STATEMENTS

DANGER  
 CAUSES IRRITATION  
 EXTREMELY FLAMMABLE

HARMFUL IF SWALLOWED OR INHALED

KEEP AWAY FROM HEAT, SPARKS, FLAME. AVOID CONTACT WITH EYES, SKIN, CLOTHING.  
 AVOID BREATHING VAPOR. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH  
 ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING. IN CASE OF FIRE,  
 USE ALCOHOL FOAM, DRY CHEMICAL, CARBON DIOXIDE - WATER MAY BE INEFFECTIVE.  
 FLUSH SPILL AREA WITH WATER SPRAY.

SAF-T-DATA(TM) STORAGE COLOR CODE: RED (FLAMMABLE)

## 2 - HAZARDOUS COMPONENTS

COMPONENT	%	CAS NO.
ACETONE	90-100	67-64-1

## 3 - PHYSICAL DATA

BOILING POINT: 56 C ( 133 F)      VAPOR PRESSURE(MM HG): 181

MSDS for ACETONE

Page 2

MELTING POINT: -95 C ( -139 F) VAPOR DENSITY(AIR=1): 2.0  
SPECIFIC GRAVITY: 0.79 EVAPORATION RATE: ~10  
(H2O=1) (BUTYL ACETATE=1)  
SOLUBILITY(H2O): COMPLETE (IN ALL PROPORTIONS) % VOLATILES BY VOLUME: 100  
APPEARANCE & ODOR: CLEAR, COLORLESS LIQUID WITH A FRAGRANT SWEET ODOR.

---

#### 4 - FIRE AND EXPLOSION HAZARD DATA

---

FLASH POINT (CLOSED CUP: -18 C ( 0 F) NFPA 704M RATING: 1-3-0  
FLAMMABLE LIMITS: UPPER - 13.0 % LOWER - 2.6 %

#### FIRE EXTINGUISHING MEDIA

USE ALCOHOL FOAM, DRY CHEMICAL OR CARBON DIOXIDE.  
(WATER MAY BE INEFFECTIVE.)

#### SPECIAL FIRE-FIGHTING PROCEDURES

FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE. MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL.

#### UNUSUAL FIRE & EXPLOSION HAZARDS

VAPORS MAY FLOW ALONG SURFACES TO DISTANT IGNITION SOURCES AND FLASH BACK. CLOSED CONTAINERS EXPOSED TO HEAT MAY EXPLODE. CONTACT WITH STRONG OXIDIZERS MAY CAUSE FIRE.

---

#### 5 - HEALTH HAZARD DATA

---

THRESHOLD LIMIT VALUE (TLV/TWA): 1780 MG/M3 ( 750 PPM)

SHORT-TERM EXPOSURE LIMIT (STEL): 2375 MG/M3 ( 1000 PPM)

PERMISSIBLE EXPOSURE LIMIT (PEL): 2400 MG/M3 ( 1000 PPM)

TOXICITY: LD50 (ORAL-RAT) (MG/KG) - 9750  
LD50 (ORAL-MOUSE) (MG/KG) - 3000  
LD50 (IPR-MOUSE) (MG/KG) - 1297  
LD50 (SKN-RABBIT) (G/KG) - 20

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

#### EFFECTS OF OVEREXPOSURE

VAPORS MAY BE IRRITATING TO SKIN, EYES, NOSE AND THROAT.  
INHALATION OF VAPORS MAY CAUSE NAUSEA, VOMITING, HEADACHE, OR LOSS OF CONSCIOUSNESS.  
LIQUID MAY CAUSE PERMANENT EYE DAMAGE.  
CONTACT WITH SKIN HAS A DEFATTING EFFECT, CAUSING DRYING AND IRRITATION.

---



-----  
MSDS for ACETONEPage 4  
-----

VENTILATION: USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV REQUIREMENTS.

RESPIRATORY PROTECTION: RESPIRATORY PROTECTION REQUIRED IF AIRBORNE CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS UP TO 5000 PPM, A GAS MASK WITH ORGANIC VAPOR CANNISTER IS RECOMMENDED. ABOVE THIS LEVEL, A SELF-CONTAINED BREATHING APPARATUS WITH FULL FACE SHIELD IS ADVISED.

EYE/SKIN PROTECTION: SAFETY GLASSES WITH SIDESHIELDS, BUTYL RUBBER GLOVES ARE RECOMMENDED.

-----  
9 - STORAGE AND HANDLING PRECAUTIONS  
-----

SAF-T-DATA(TM) STORAGE COLOR CODE: RED (FLAMMABLE)

## SPECIAL PRECAUTIONS

BOND AND GROUND CONTAINERS WHEN TRANSFERRING LIQUID. KEEP CONTAINER TIGHTLY CLOSED. STORE IN A COOL, DRY, WELL-VENTILATED, FLAMMABLE LIQUID STORAGE AREA.

-----  
10 - TRANSPORTATION DATA AND ADDITIONAL INFORMATION  
-----

## DOMESTIC (D.O.T.)

PROPER SHIPPING NAME	ACETONE
HAZARD CLASS	FLAMMABLE LIQUID
UN/NA	UN1090
LABELS	FLAMMABLE LIQUID
REPORTABLE QUANTITY	5000 LBS.

## INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME	ACETONE
HAZARD CLASS	3.1
UN/NA	UN1090
LABELS	FLAMMABLE LIQUID

**Appendix D**

**California Code of Regulations, Title 22, Section 66261.126, Appendix X -  
List of Chemical Names and Common Names for  
Hazardous Wastes and Hazardous Materials**

## Hazardous Waste List

(California Code of Regulations, Title 22 Section 66261.126)

### Appendix X - List of Chemical Names and Common Names for Hazardous Wastes and Hazardous Materials

(a) This subdivision sets forth a list of chemicals which create a presumption that a waste is a hazardous waste. If a waste consists of or contains a chemical listed in this

subdivision, the waste is presumed to be a hazardous waste Environmental Regulations of CALIFORNIA unless it is determined that the waste is not a hazardous waste pursuant to the procedures set forth in section 66262.11. The hazardous characteristics which serve as a basis for listing the chemicals are indicated in the list as follows:

(X) toxic (C) corrosive (I) ignitable (R) reactive \* =Extremely Hazardous

A chemical denoted with an asterisk is presumed to be an extremely hazardous waste unless it does not exhibit any of the criteria set forth in section 66261.110 and section 66261.113. Trademark chemical names are indicated by all capital letters.

1. Acetaldehyde (X,I)
2. Acetic acid (X,C,I)
3. Acetone, Propanone (I)
4. \*Acetone cyanohydrin (X)
5. Acetonitrile (X,I)
6. \*2-Acetylaminofluorene, 2-AAF (X)
7. Acetyl benzoyl peroxide (X,I,R)
8. \*Acetyl chloride (X,C,R)
9. Acetyl peroxide (X,I,R)
10. Acridine (X)
11. \*Acrolein, Aqualin (X,I)
12. \*Acrylonitrile (X,I)
13. \*Adiponitrile (X)
14. \*Aldrin; 1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-endo-exodimethanonaphthlene



(X)

15. \*Alkyl aluminum chloride (C,I,R)
16. \*Alkyl aluminum compounds (C,I,R)
17. Allyl alcohol, 2-Propen-1-ol (X,I)
18. Allyl bromide, 3-Bromopropene (X,I)
19. Allyl chloride, 3-Chloropropene (X,I)
20. Allyl chlorocarbonate, Allyl chloroformate (X,I)
21. \*Allyl trichlorosilane (X,C,I,R)
22. Aluminum (powder) (I)
- 23A. Aluminum chloride (X,C)
- 23B. \*Aluminum chloride (anhydrous) (X,C,R)
24. Aluminum fluoride (X,C)
25. Aluminum nitrate (X,I)
26. \*Aluminum phosphide, PHOSTOXIN (X,I,R)
27. \*4-Aminodiphenyl, 4-ADP (X)
28. \*2-Aminopyridine (X)
29. \*Ammonium arsenate (X)
30. \*Ammonium bifluoride (X,C)
31. Ammonium chromate (X,I)
32. Ammonium dichromate, Ammonium bichromate (X,C,I)
33. Ammonium fluoride (X,C)
34. Ammonium hydroxide (X,C)
35. Ammonium molybdate (X)
36. Ammonium nitrate (I,R)