
Cost and Performance Summary Report

Air Sparging and Pump and Treat at the Del Norte County Pesticide Storage Area Superfund Site, California

Summary Information [1, 2, 3]

The Del Norte County Pesticide Storage Area Superfund site, located one mile northwest of Crescent City, California, is about one acre in size and is bordered by the Pacific Ocean, State-owned land, residences, and farmland. From 1970 to 1981, Del Norte County operated the storage area as a county-wide collection point for the interim and emergency storage of pesticide containers generated by local industry. This storage area had been approved by the California North Coast Regional Water Quality Board (NCRWQB). The pesticide containers were rinsed on site, with residues and rinse water disposed of in an unlined sump. Site investigations conducted by the NCRWQB and the California Department of Health from 1981 to 1983 found leaking containers and soil and groundwater contamination at the site. About 1,600 containers were removed from the site.

In 1983, the site was placed on the NPL. In 1985, results of a remedial investigation showed the contaminants of concern at the site included 1,2-dichloropropane (DCP), 2,4-dichlorophenoxyacetic (2,4-D) acid, along with elevated levels of chromium, with groundwater contamination extending approximately 170 feet southeast of the site. The Record of Decision (ROD) signed in 1985 specified groundwater pump and treat (P&T) with treatment to include carbon filtration, coagulation, and sand filtration as the groundwater remedy. In 1987, EPA conducted a removal action during which 270 cubic yards of soil were excavated from the suspected source area and disposed of off site.

Following source removal, results of groundwater monitoring indicated that contaminant concentrations had decreased significantly. EPA attributed this reduction to the source removal and biodegradation and/or volatilization of contaminants in the groundwater. By 1989, groundwater concentrations of 2,4-D had decreased to less than 2 µg/L, below the 100 µg/L cleanup goal specified in the ROD. Concentrations of DCP also decreased from 2,000 µg/L to 600 µg/L, but remained above the cleanup goal of 10 µg/L. Results of additional investigations of chromium determined that the elevated levels found at the site were naturally occurring due to the presence of chromium ore in bedrock.

An Explanation of Significant Differences (ESD) was issued in September 1989 documenting that the chromium levels in soil did not require remediation and that levels of 2,4-D were below the cleanup goal and no longer required treatment. In addition, since treatment of chromium and 2,4-D was no longer necessary, the ESD changed the selected groundwater treatment remedy to P&T with aeration (air sparging), rather than carbon filtration, coagulation, and sand filtration. Aeration was initially considered in the ROD, but had not been selected because it would not have been effective in removing 2,4-D and chromium.

From April 1990 to December 1994, P&T was used to treat the DCP-contaminated groundwater. During this time, DCP concentrations decreased, then reached asymptotic levels (between 15 and 40 µg/L in monitoring wells located within the plume). In 1994, air sparging was added and a

program of on/off cycling of the P&T system was implemented in an attempt to enhance treatment. No discernable changes in DCP concentrations were noted after any of these modifications. The air sparging system was turned off in 1996 and the P&T system was shut down in 1997.

Groundwater monitoring data following system shutdown showed that while DCP concentrations continued to slowly decrease, the rate of decrease was the same as when the treatment system was operating. EPA concluded that neither P&T, air sparging, nor any other technology available at the time would be able to treat DCP to below the cleanup levels to restore the groundwater. EPA issued a TI waiver documenting these findings. An analysis performed as part of the TI waiver estimated that 3.75 gallons of DCP had been removed from the groundwater and that 95% of that amount was removed during the first four years of P&T operation.

In August 2000, a ROD Amendment was signed amending the groundwater remedy for the site to include plume containment through natural attenuation, continued monitoring of the groundwater, and institutional controls. Final site cleanup and equipment removal was completed in December 2000. The final close out report, issued in July 2002 indicated that the site had met the requirements for close out specified in the amended ROD, including having institutional controls in place. The site was deleted from the NPL in September 2002.

While the P&T and air sparging technologies were not successful in decreasing the levels of DCP contamination at this site, this report provides information about these technologies for groundwater treatment and lessons learned from this application, focusing on the air sparging system.

CERCLIS ID Number	CAD000626176
Type of Action	Remedial
Lead	EPA
Oversight	California Department of Toxics Substances Control

Timeline [1, 2, 4]

Date	Activity
1983	Site listed on the NPL
1985	ROD signed
1989	ESD signed
4/1990	10/97 – Pump and Treat
3/1994	Start of air sparging operation
7/1995	Additional sparge points added
11/1996	Shut down of air sparging system
8/2000	ROD Amendment issued, including TI Waiver
9/2002	Site deleted from the NPL

Factors that Affected Cost or Performance of Treatment [1]

The site lies on a 1½-mile wide marine terrace shelf, consisting of moderately well sorted fine sands, silts, and clays with generally moderate groundwater permeability. The elevation of the site is approximately 50 ft above mean sea level, and groundwater in the area is relatively shallow, ranging between 3 and 10 feet bgs seasonally. Groundwater flow is to the southeast in the immediate vicinity of both the site and the contaminant plume. The thickness of the uppermost aquifer is approximately 30 feet in the vicinity of the site, and has a hydraulic conductivity of approximately 10^{-3} cm/s.

Matrix Characteristics [1]

Matrix Characteristics	Value
Soil classification	Sands, silts, and clays
Hydraulic conductivity	10^{-3} cm/s
Depth bgs/thickness of zone of interest	30 ft (aquifer thickness)
Presence of NAPLs	Not observed

Treatment Technology Description [1, 4]

The technology used at the Del Norte site included P&T and P&T in conjunction with air sparging. As discussed above, the P&T system was initially operated at the site for about four years, from 1990 to 1994. When DCP concentrations reached asymptotic levels, modifications were made to the system in an attempt to enhance contaminant removal including the addition of an air sparging system and a program of on/off cycling of the P&T system. The P&T system was turned off for about six months in 1995, restarted, and turned off for six months in 1996. No details of the P&T design and operation were provided.

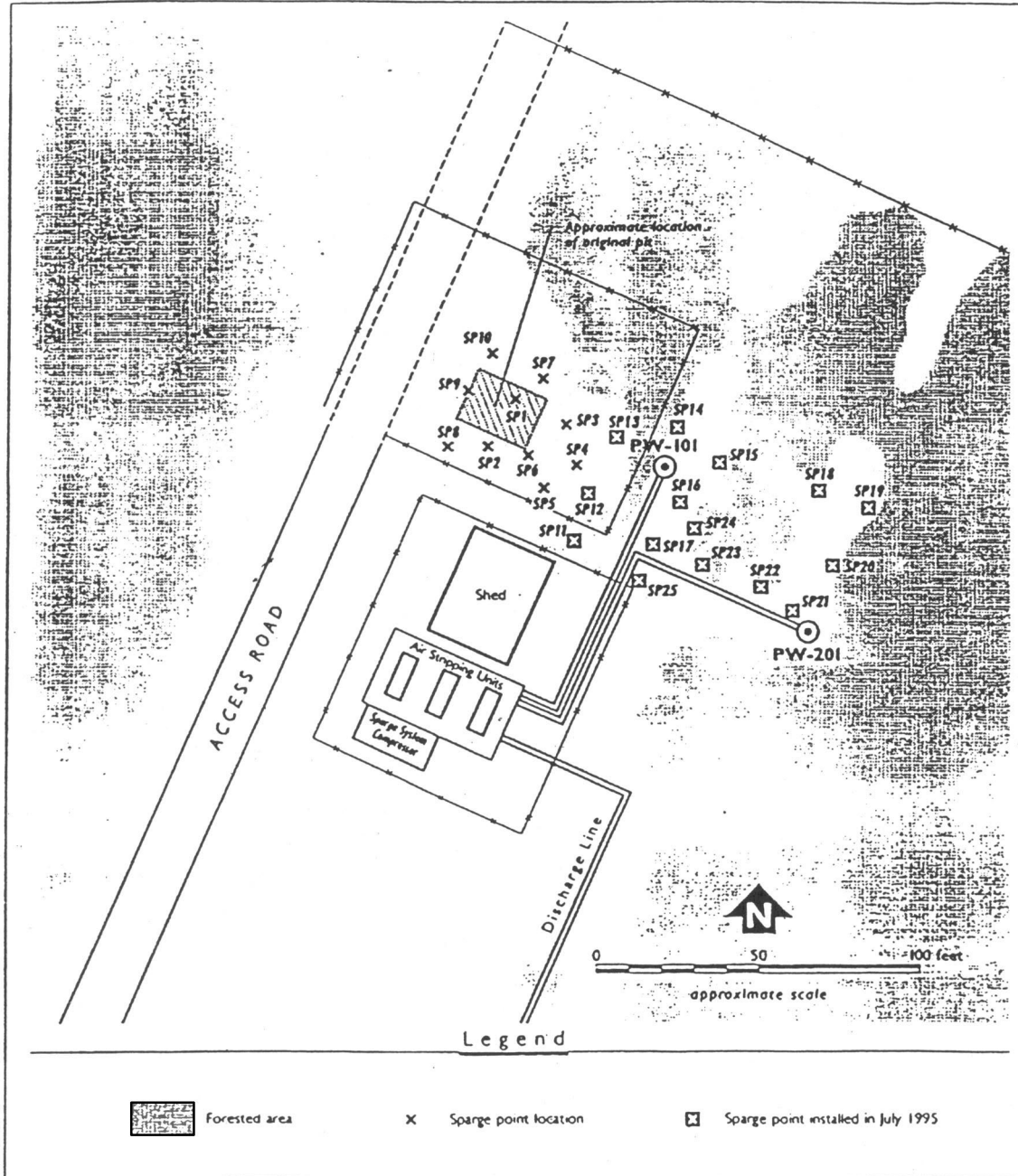
The air sparging system began operating in March 1994. The system included 10 air sparge points, shown in Figure 1, installed within the DCP plume. The points consisted of ½-inch diameter PVC tubes placed to the bottom of the aquifer. The tubes were plumbed to an air compressor, which forced air through the tubes to the bottom of the aquifer. When no discernable differences were noted in contaminant concentrations, 15 additional sparging points were installed in July 1995. No discernable changes were noted in contaminant concentrations after an additional year, and the air sparging system was shut off in November 1996.

The P&T system continued to operate. However, after no additional changes were noted, the P&T system was shut down in 1997.

Operating Parameters [1]

Operating Parameter	Value
Air flow rate	Not available
Operating pressure/vacuum	Not available
Depth of sparging - 30 ft bgs	30 ft bgs

Figure 1. Sparge Point Locations



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Performance Information [1, 2, 3, 4]

The 1985 ROD established a cleanup goal for DCP of 10 µg/L using a health-based standard; no MCL had been established for this contaminant at that time. The 2000 ROD Amendment identified an ARAR of 5 µg/l for DCP based on a new MCL for the contaminant. However, the cleanup goal was waived as an ARAR for the site as part of the TI Waiver. The ROD Amendment also changed the groundwater remedy for the site to include plume containment through natural attenuation, continued monitoring of the groundwater, and institutional controls.

Data on maximum DCP concentrations, shown in Table 1, are available for five periods (1994, 1996, 1999, 2002, and 2003) for three wells. These wells, shown in Figure 2, are located within the DCP plume - well MW-25, located about 90 feet to the southeast of the original source area; well MW-104, located about 50 feet southeast of the original source area; and well MW-105 located about 80 feet south of the original source area (see Figure 2). The data for 1994 and 1996 include the timeframe when the air sparging system was operated in conjunction with the P&T system. The data for the remaining three periods are post-shutdown of the air sparging system (November 1996) and the P&T system (October 1997). Figure 3 shows DCP concentration in the three wells from December 1994 to December 1998.

As shown in Table 1 and in Figure 3, during the operation of the air sparging and P&T systems (1994 and 1996), contaminant concentrations increased in two wells and decreased in one well, with DCP concentrations ranging from 6.9 µg/L to 40 µg/L. According to EPA, no discernable changes in contaminant concentration were noted when the additional sparge points were added in 1995 or when the P&T system was cycled on and off between 1995 and 1996. Data for post-shutdown (2000 to 2003) showed that DCP concentrations continued to decline slowly, with levels ranging from 2.4 to 6.6 µg/L as of 2003. An analysis conducted as part of the TI Waiver estimated that 3.75 gallons of DCP were removed from the groundwater between 1990 and 1997, with 95% of this amount removed between 1990 and 1994 by the P&T system.

In addition, data are available on the areal extent of the DCP plume. As shown in Figure 2, between 1990 and 1998, the areal extent of this plume (greater than 5 µg/L) was reduced from approximately 12,000 ft² to 5,000 ft².

In the September 1990 5-year review, EPA noted that contamination levels at the site continued to decline gradually and were expected to continue to gradually decline. EPA concluded that the remedial actions taken at the site are expected to be protective of human health and the environment. No recommendations or follow-up actions were identified for the site.

In July 2002, the final close out report was issued that indicated that the site had met the requirements for close out specified in the ROD Amendment and the site was deleted from the NPL in September 2002.

Figure 2. Areal Extent of 1,2-DCP Concentrations >5 µg/L

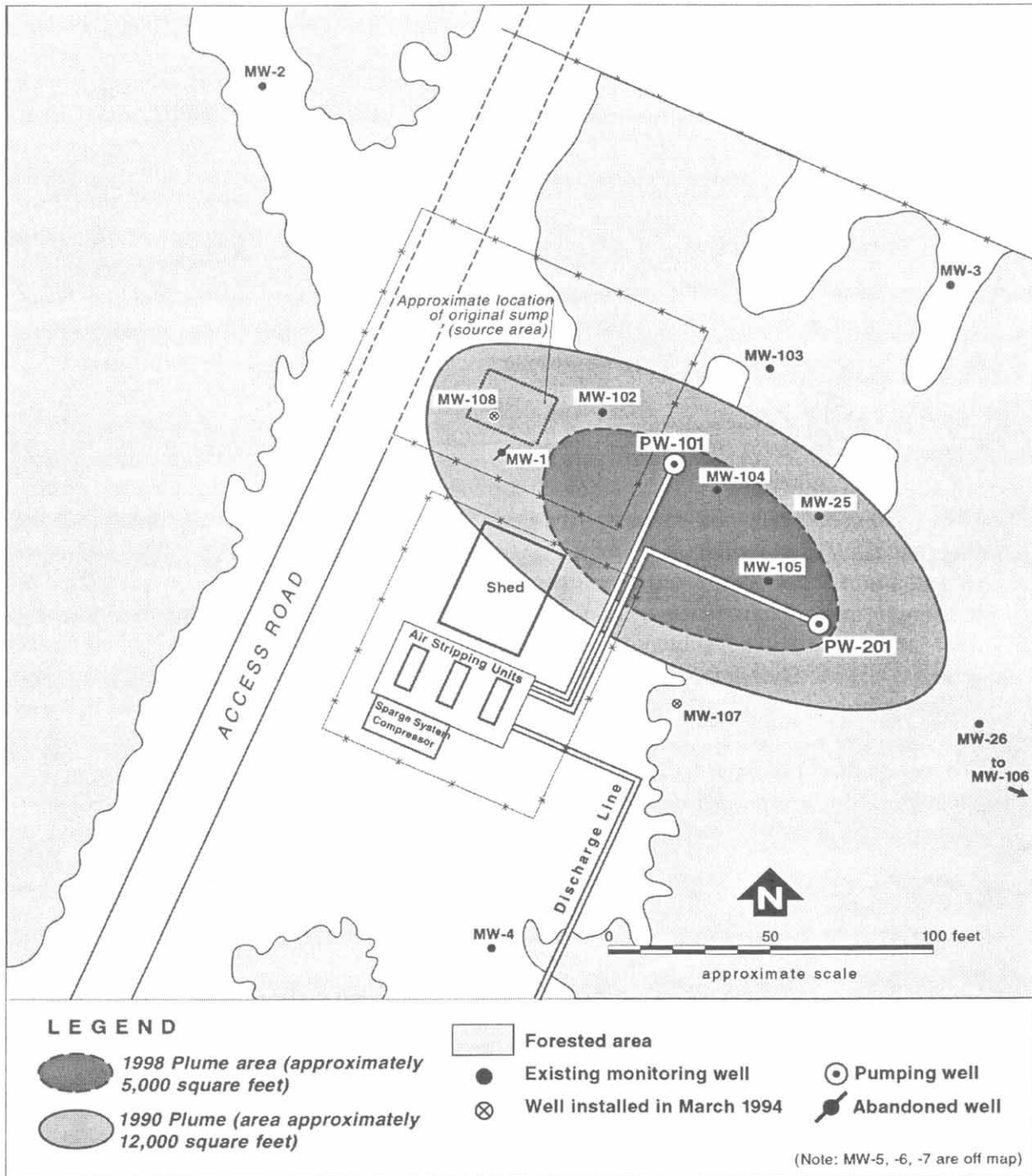


Figure 3. 1,2-DCP Concentrations in Selected Groundwater Monitoring Wells

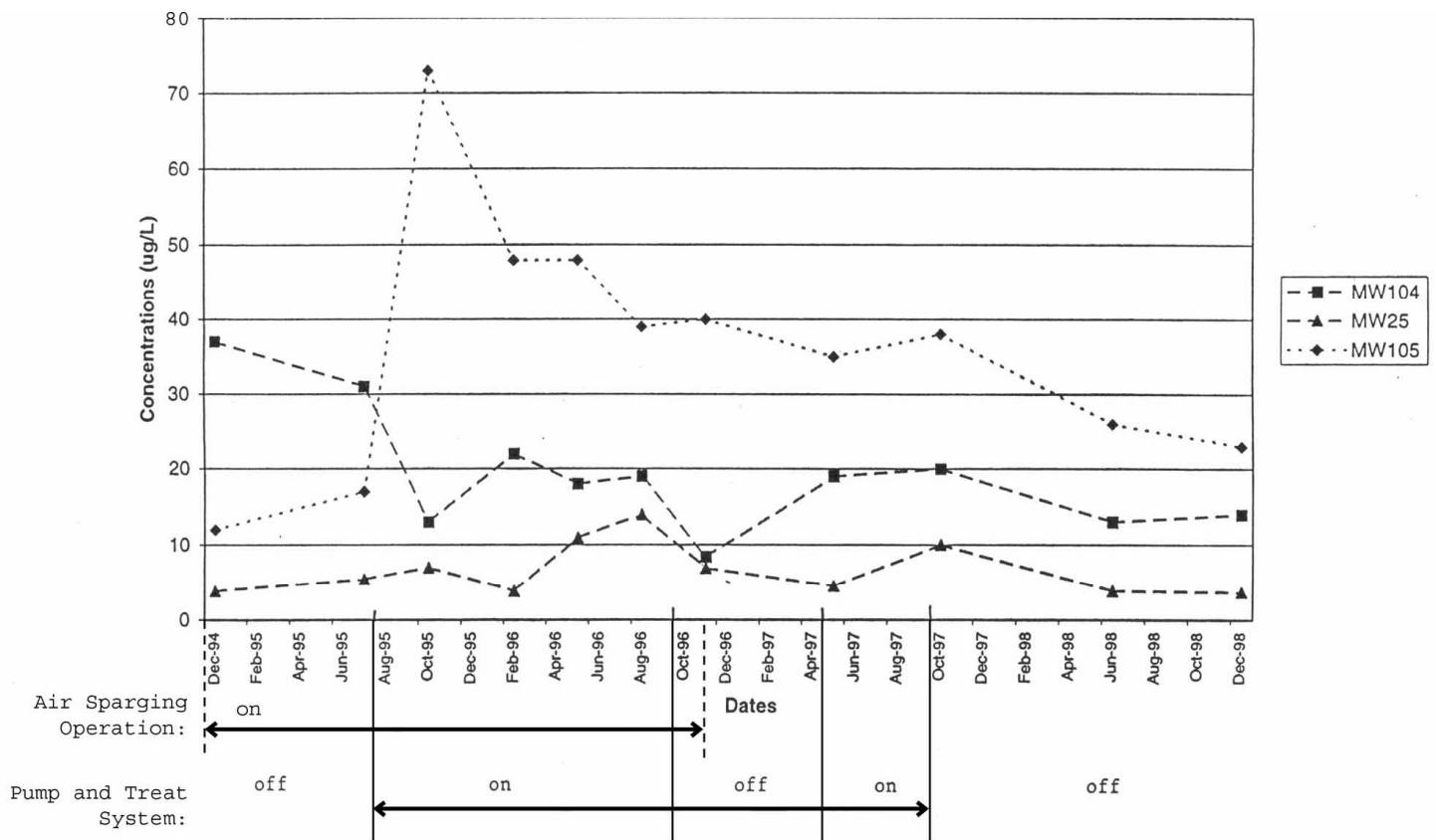


Table 3. Groundwater DCP Concentrations Between 1994 and 2003

Contaminant	Well (MW-)	Maximum Concentration (ug/L) – 12/1994 (Air Sparging startup)	Maximum Concentration (ug/L) – 11/1996 (Air Sparging shutdown)	Maximum Concentration (1999) (ug/L)	Maximum Concentration (2002) (ug/L)	Maximum Concentration (2003) (ug/L)	MCL (ug/L)
DCP	25	3.8	6.9	1.9	N/A	N/A	5
DCP	104	37	8.4	8.2	5	2.4	5
DCP	105	12	40	23	11	6.6	5

N/A – Information not available

Cost Information [3]

EPA provided information about the actual costs for O&M activities at the site. The cost was \$166,518 in 1995, \$106,928 in 1996, and \$84,211 in 1997. No additional information was provided about these costs and no capital cost data were provided.

Observations and Lessons Learned [1, 3]

After seven years of groundwater treatment, including P&T and modifications to the system to add air sparging and cycling the P&T system in an attempt to enhance contaminant removal, EPA determined that neither P&T, air sparging, or any technology available at the time could restore the groundwater plume to meet the cleanup goals for DCP at the site. The systems were shut down and EPA issued a TI Waiver for the site and changed the remedy to monitored natural attenuation and institutional controls.

According to EPA, the properties of DCP likely impacted the remediation of the site. For example, the relatively steady levels of DCP in groundwater may have been due to the relatively high clay and silt content of the soil at the site. Because DCP is a compound with a relatively low octanol/water partitioning coefficient, it may have preferentially adhered to clay and other fine particles, and only desorbed slowly into the groundwater.

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2. Superfund Site Overview. Del Norte Pesticide Storage, California, EPA ID#CAD000626176. Downloaded August, 2003
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4. U.S. EPA. Final Close Out Report, Del Norte County Pesticide Storage Site, Del Norte County, California. July 2002.

Acknowledgments

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